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Teacher Education

Is a topic of analysis and current discussion; it always poses new challenges related to the adaptation to the diversity of learning styles, the promotion of socio-emotional skills, the use of educational technologies, the instructional design for online modalities, the development of critical thinking, formative evaluation, the promotion of inclusive environments, among others.

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Editorial

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Twenty-first century society requires teacher training adapted to the demands and challenges needed by teachers to receive solid and constantly updated training, focused on the acquisition and development of professional competences that allow an adequate response to the demands of teaching. In this context, both initial and continuous teacher training has evolved towards a competency-based approach, which has meant a reorientation of training plans with the aim of contributing to the improvement of teaching practice and, therefore, to the quality of education.

This competency-based approach, used by different educational institutions worldwide, stands as an integrative training model that involves overcoming traditional models of teaching-learning and moves towards structures that facilitate the effective integration of educational innovation in different educational contexts, enhancing continuous learning, transversality, adaptability, as well as systems that involve moving from learning evaluation to assessment for learning (Pérez Gómez, 2007). In this sense, competencies require that teacher training plans adapt contents, methodologies, and resources to the needs of the new students to guarantee a comprehensive, equitable and quality education.

This monograph presents five works that show a reflective and critical vision of both initial and continuous teacher training, highlighting the key knowledge and competencies that should be part of teacher training.

Acuña, Gringerg and Núñez in "The education of the artisan teacher. Crafts and fabrications to hold the school", present the response of two public high schools in Argentina to their adaptation and responsiveness to the context in which they are located, as well as to the micro-institutional processes implemented in the institutions. The permeability of schools to the social problems of the environment requires the development of pedagogical dynamics and permanent support in teachers, which need a teacher training based on the artisanal foundation of their activity, in such a way that it makes the school as a safe and loved place for students.

Santos-Calero, Zubillaga-Olague and Cañadas, address the "Peer-assessment in physical education of initial teacher education" as an opportunity to facilitate in future teachers the development of essential competencies such as assessment competence. This paper presents a case study in which future teachers had to coevaluate the performance of their peers and give feedback, in the context of two university subjects and through three training workshops. The results show that peer assessment, in addition to developing the aforementioned competence, allows future teachers to internalize, understand and establish knowledge, improving learning and favoring its transfer to other contexts and practices, in addition to developing positive relations between the participants.

De Lima approaches the "Production of a digital game as a mobilizer of initial teacher training" through qualitative research. Their work shows that it is not possible to dissociate material and social aspects in the socio-educational processes and how the production of a digital game allows the creation of new inclusive teaching and learning environments that promote a digital culture.

Inglada Rodríguez, Breda and Sala-Sebastià stress the need for teachers to reflect on their own practice as a fundamental competence. From research that analyzes 119 investigations on functions performed by future high school teachers of mathematics, shortcomings are discovered in the own

reflections of these teachers in training, with consequences that could influence the quality of their teaching processes. The authors propose that these future teachers have a specialized pattern of systemic analysis to overcome this deficiency, allowing a greater analysis in their reflections that would therefore improve their teaching practice.

The fifth paper written by Ledezma, Morales-Maure and Font, from Panama and Spain, presents an "Educational experience on modeling for Panamanian mathematics teachers". From a professional experience carried out in the context of a University Diploma, the procedures for solving three problems were analyzed. Four resolution procedures were identified, which allow raising the possibility of making curricular adaptations in the teaching of mathematics.

The articles that make up this monograph invite a critical and reflective review of teacher training, giving a relevant role to the contexts from which each of the contributions have been generated. It emphasizes the importance of assessing the teaching activity and its impact on educational improvement.

In the Miscellaneous section, the first three articles are related to the use of educational technologies in education. A relevant topic considering the progress in connectivity and access to knowledge, interactivity, and exchange of information; and, above all, the possibility of more student participation, and a more active participation in the learning process.

The article "Ibero-American references in Media Information Literacy (MIL)" constitutes a literature review in WoS and analyzes the theoretical foundation, lines of research and approaches. Romero-Romero, Hernando and Islas argue that Spain is the country that has published the most in the Ibero-American context, these publications expressing different approaches and the great impact on society of the educational, political, economic, and technological fields. As a conclusion, they highlight the need to implement teaching-learning processes supported by Information and Communication Technologies (ICT) to innovate in education.

Flores, Sabag and Martínez, from the experience of the SARS-CoV2 pandemic, analyze the learning-teaching processes in the face-to-face and distance modalities. Although, in the case study, the face-to-face modality with the support of technology is perceived by students as better planned, the authors consider the importance of looking for strategies to improve the quality of instructional designs of the distance modality, which is increasingly used by universities.

The Flipped Learning (FL) is becoming a pedagogical approach that reverses the traditional model of learning. In the third article, Guayasamín and Inga describe the benefits of this model as a methodology for students in seventh grade of basic education to learn English. Among these are the use of multimedia resources, student protagonism and their commitment to the learning process, collaborative work, motivation and improvement of learning outcomes. In this didactic approach considered innovative, teacher is a facilitator and guide during the process.

In view of a more dynamic and meaningful learning, Nunciaroni, Corrêa and Silva, analyze the use of storytelling during the teaching-learning process in nursing degree students, showing that it can be used collectively, as a strategy that puts emotions and feelings into action, which is dynamic, significant, and adaptable to a digital format. The relevance of this research in the nursing area could serve as inspiration for other areas of knowledge.

Academic performance and the factors that influence it have always been topics of educational research. Medranda, Contreras and Obaco analyze the relationship between school conflicts and academic performance in the Ecuadorian context. Although they express that there is an average level of conflict, there is a low academic performance. The article opens up new elements of research, such as poverty, cultural differences, the presence of emotional tensions and aggressive behaviors, among others. The authors conclude that, if not treated in time, they may have a deeper impact on performance.

In the last issues of the journal there is a constant subject addressed in the articles published, specifically the use of educational technologies in the teaching-learning process. This has enormous advantages, such as interactive learning, collaborative work, access to information, the possibilities of adaptation and innovation; but, on the other hand, there are also risks, such as excessive reliance on technology to believe

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that it guarantees the quality of education and distraction in the classroom due to the use of electronic devices for other activities not related to the subject. The key will be to strike the right balance, seeking a more conscious use. Future papers will also discuss topics related to the use of artificial intelligence in education.

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"Formación docente"

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The education of the artisan teacher. Crafts and fabrics to hold schooling

La formación del docente artesano. Artesanías y tejidos para sostener lo escolar

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Abstract

This article addresses teaching work in two public secondary schools; one located on the outskirts of the capital city and the other in the interior of the Chaco Province, in the northern part of Argentina. The students attending these institutions come from families that have been forced to migrate from rural areas to intermediate cities due to the substitution of human labor by agricultural machinery and the consequent uprooting of the rural population in Chaco.

The social, political, and economic changes generated by these processes have modified and affected the daily dynamics and working conditions of teaching in these schools. The discussions presented here arise from in-depth interviews conducted with eight teachers and an educational advisor. The initial results show that teachers employ artisanal strategies to support academic paths that are at pedagogical risk. Thus, the forms that teaching takes result from macro processes resonating in schools but also from micro-institutional processes that come into play through teaching and pedagogical dynamics presenting complex nuances, given the current situation experienced in these institutions.

Keywords: public teaching, high school, teacher education, teaching, crafts, factory.

Resumen

Este artículo aborda el trabajo docente en dos escuelas secundarias públicas; una de ellas ubicada en la periferia de la ciudad capital y la otra en el interior de la provincia del Chaco, al norte de Argentina. Las y los estudiantes que asisten a estas instituciones provienen de familias que se han visto obligadas a migrar desde el campo a *ciudades intermedias*,[1] debido a los procesos de sustitución de la mano de obra humana por maquinaria agrícola y la consecuente desterritorialización del campesinado chaqueño.

Las modificaciones sociales, políticas y económicas que estos procesos generaron, modificaron y afectaron las dinámicas cotidianas y las condiciones de desarrollo del trabajo docente en estas escuelas. Las discusiones que aquí se presentan surgen de la aplicación de entrevistas en profundidad a ocho docentes y una asesora pedagógica. Los primeros resultados arrojan que las y los docentes tejen estrategias artesanales para sostener las trayectorias escolares que se encuentran en riesgo pedagógico. Así, las formas que asume la docencia son el resultado de procesos macro que resuenan en las escuelas, pero también de procesos micro-institucionales que se ponen en juego a través de la enseñanza y de dinámicas pedagógicas que presentan matices complejos, dada la coyuntura que atraviesa la vida en estas instituciones.

Palabras clave: enseñanza pública, escuela secundaria, formación de docentes, enseñanza, artesanía, fábrica.

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1. Introduction

This paper presents the results of a research carried out in two public schools located in urban contexts in the province of Chaco, Argentina. The students at these schools are migrants, coming from families of rural workers who were displaced from their jobs and were replaced by agricultural machinery to collect cotton, among other raw materials (Castilla et al., 2019); situation called by some as deterritorialization of the Chaco peasantry (Sili, 2019; Manzano & Velázquez, 2015). As a result of the migrations, the arrival of this population to the schools modified and affected the daily dynamics and the teaching conditions. In this context, it is essential to conduct research on the pedagogical strategies of teachers to support the schooling of students who are at pedagogical risk (Acuña et al., 2021; Acuña & Grinberg, 2022).

Everyday life and teaching (Acuña & Grinberg, 2018), contribute to the question about teacher training in that they allow thinking about the ways this work takes in "times of crisis and school reconfigurations" (Acuña, 2022). If this applies generally to teachers in all schools, it is even more important in the northeastern region of Argentina, since there are numerous challenges for teachers, who not only must be prepared to take on increasingly complex tasks, but — often — do not have the economic and material resources to carry them out, in a context that conditions their performance (Zabalza Beraza, 2022). Several authors (Muñoz Carril et al., 2023), suggest that focusing on the formative and strategic-pedagogical processes enhances the recognition and analysis of practices, thoughts and emotions that go through it, highlighting the commitment to an innovation that is necessary for change and educational improvement.

This research describes the work done by teachers to keep institutional life moving and to accompany the school trajectories of students in secondary schools. To this end, more than twenty teachers from both schools were interviewed in depth and observations were made inside and outside the classroom. This paper presents the testimony of eight teachers, a pedagogical adviser, and the records of their classes from April 2018 to September 2019.

The paper focuses on the characterization of the daily work of these teachers from a "practical craftsmanship" (Acuña & Grinberg, 2023; Grinberg, 2015). This work unfolds between the managerial logics involved in the constant search for economic resources and collective agencies (Deleuze & Partner, 1997), between the school and the neighborhood to work on the precariousness in the northern Argentina.

The notion of craftsmanship (Sennet, 2009) of teaching practices and school life in general is a way to approach the understanding of teaching (Schwamberger & Grinberg, 2021), as a way of practices that go through training and teaching in their daily development. Arendt (2016) refers to a craft practice that involves skills and development of individuals forms of teachers, often learned through trial and error, to give answers to the complexities and emergencies in these schools. In this way:

> Schools go around the sterile state language and experimental, artisanal, intuitive, collective practices that cannot be said (...). Other languages, whose political quality lies in conferring legitimacy to real existences, as well as in creating conditions for new questions and reinventions. (Duschatzky, 2023, p. 115)

The hypothesis that guides this work suggests that the scenario, product of migrations, resulted in the arrival of new populations in schools (Morzilli, 2021) and in the deepening of inequalities and schooling conditions of students.

In everyday school life, institutions and teachers must seek different forms and modulations that allow them to sustain and accompany in a personalized way the student trajectories that are permanently interrupted by different causes, making the teaching process more complex due to the need to sustain student enrollment and the permanent recovery of school contents each time students return. A teacher says, "We used to talk to Gustavo, because he stopped coming for six months and started to work because he did not have enough to eat. Now he has picked up, looked for the best way and since he is in school, we are working again with the last content he studied."

In the times of crisis (Southwell, 2020a), the concern to look for strategies and practices to hold schooling of students is fundamental for any institution; but when addressing the stories of adolescents and young people who live permanently situations of exclusion, it is also important to prepare teachers to generate strategies that favor more stable schooling.

In the next section, the methodological decisions will be developed, followed by the presentation

of the results with the main categories of analysis emerging from the field work. Finally, some conclusions will be presented that do not seek to be conclusive and closing, but rather encouraging when thinking about the pedagogical strategies that schools and teachers use in high socially vulnerable contexts.

2. Methodology

School life requires meticulous and artisanal teaching practices (Sennett, 2009), which model doing in schools and teaching (Calderón Solís & Loja Tacuri, 2018), strained between optimism and responsibility (Berlant, 2020; McLeod, 2019), which involves the act of educating and the ways of teaching (Grinberg, 2019; Acuña et al., 2023).

Analyzing the daily life of secondary schools considering these details, requires an in-depth analysis found in the qualitative approach with a descriptive view (Barnet-López, 2017; Quecedo & Castaño, 2002). The empirical information was obtained from the work in two public secondary schools in the province of Chaco, Argentina: a school of social management[2] in the capital and a school of state management located in an *intermediate city*. The information was obtained from in-depth interviews that took place between 2018 and 2019, in a work whose dynamics were different, given the characteristics of each institution. In the state management school, the fieldwork was marked by its short duration in time but great intensity (2-3 days *in situ*). However, the school of social management characterizes by longer stays and time-spaced visits.

Additionally, flash interviews[3] and observations of different school spaces were used: socialization as the playground, teaching-learning as the classroom, artistic-pedagogical spaces as school events or community festivals. For this article some of these scenes were taken and, specifically, the interviews conducted with eight teachers and a teacher adviser, were distributed as follows: in the school of the capital four interviews were made to teachers of mathematics, arts, philosophy and literature, 1st and 2nd year of secondary level, while in the school of state management five interviews were done: the teacher adviser and four teachers of the subjects of history, economics, citizenship and music of the last years of the educational level.

Participant observations were made in both institutions (Guber, 2005) in the classrooms of 2nd and 3rd year of the capital's school and 4th and 5th year of the province's school. The teaching strategies used, the contents taught and, above all, the dynamics of linkage between students and teachers were observed from the pedagogical proposals offered. In the observation, it was decided to extract two stories of students that allow to give an empirical support to the article and contextualize, through the field diary, some scenarios that respond to the objective of this investigation.

Participant observation allowed us to record and contextualize the characteristics of everyday school life: student-classroom-teacher interactions and formal and informal encounters typical of school life. These stays in the field brought closer the life scenarios in the classroom to account for the forms of the daily school.

The analysis process consisted, first, in identifying emerging categories of information obtained in the field work from the instruments used, essentially in-depth interviews. The organization of the information was carried out using AtlasTi 8 program. The collection and systematization were possible by using Glaser and Strauss constant comparison method (1967). These analysis tools were instruments for constructing categories that go beyond the empirical dimension of data and the theoretical dimension, understood as central elements that go around the production of knowledge in science. It is pointed out that traditional science privileged two components in the production of knowledge called scientists: or empiricism or theory, which support each other, strengthen or refute, ignoring the experiential component from the perspective of the consciousness assumed by those who narrate their life to a foreigner —researcher— who uses action strategies of understanding and interpreting dialogues: between protagonists, researchers and available scientific knowledge. Hugo Zemelman (1994) refers to a movement, a logic of reasoning that goes beyond scientific rationality and moves towards a dialectical and historical rationality (...). Categorical thinking focuses on experiential categories -not only theoretical-, allowing critical distancing and expanding the understanding and historical awareness of the present (Quintar, 2018, p.18).

After the process of systematization and analysis, this work was organized from three lines: 1) the discussions around the work and the teacher training

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in rural secondary schools; 2) teaching against all odds, accounting for the pedagogical strategies from which institutions, crossed by precariousness and urban poverty (Mantiñán, 2020; Langer & Machado, 2013; Besana et al., 2014), build teaching spaces that allow accompanying and giving schooling answers to students normally excluded from the school system and 3) the circulation of the word and democratization of space. Hence, we propose that teacher training and teaching in the 21st century is a craft that should consider all these aspects, as we will develop below.

3. Results

3.1 Discussions about the work and the teacher training in rural secondary schools

The social and agro-economic crises in the province of Chaco contributed to the emergence of neighborhoods in the outskirts of the cities, expanding their social and urban fragmentation or selective metropolization, as stated by Dafunchio and Grinberg (2013), resulting from the migrations of families and workers residing in rural areas. These processes have had a direct impact on the educational system, schools and teaching, since teachers must teach adolescents and young people who live lives that "resemble those of an adult, either because they work far from home or because they have even moved more than once to get a job," as the teacher adviser narrated.

Facing this context, the daily school places the teacher at a crossroads regarding, on the one hand, the attention of the problems that reach the school as a social resonance box (Southwell, 2020b), and, on the other hand, teaching as a structuring axis of the teaching process. In this work, some interviewed teachers realize this through certain expressions: "How do I make the classes a more heterogeneous and flexible place but interesting enough for the contents to be learned by all children?" (philosophy teacher at the school of the capital, May 2018), or as another teacher wondered: "how to integrate students in learning spaces more enjoyable but not less close to their realities?" (teacher of citizenship at the school of the provincial interior, June 2019).

These and other questions model the daily life of a teaching that is "unembroidered", in search of horizons for its work inside and outside the classroom, as an art teacher from the capital's school said: "Sometimes I come and see that they do not catch on and I feel overwhelmed, but, quickly, I look for other ways and strategies to get them back on board". The overflow here has to do with the imbalance between the components of teaching work, in which they must deal with the "problems that come to schools" but, at the same time, not lose the centrality of learning in their task. For teachers to achieve this, it means "finding their way around so they learn, so they can stay and finish high school," as one music teacher from the state-run school (2019) said.

According to Duschatzky (2023) "a school is not what defines it but what exceeds it, the representations that put everything in place. The school is sketched in its development, in the process of taking shape" (p. 121). Therefore, the school is not yet and will not become; it is in a permanent becoming, it is always being, that is its character, that is its condition and wealth. Wealth and condition assigned by the characteristic of craftsmanship that assumes the teaching work and that labels it as craftsmanship. The institutionality of the school is defined by its craftsmanship in link with other experiences, actors, institutions that weave the plot that allows to sustain the school, in the best of cases, or make it think, in others.

Teachers seek to guide students in their learning, respecting the times and forms of each one, understanding that they are schooling at a pedagogical risk given their living conditions. Thus, what is taught and that goes through teacher training cannot fail to be an activity that has to do with people and their rights, while assuming a heterogeneity that is conditioned by multiple factors (Zabalza Beraza, 2022). This almost artisanal work of searching and finding ways takes on an important value in these schools to achieve permanence. One teacher said:

> Some students are absent for long periods, but they always come back, because they know that we accompany them here. However, when they come back, it is not an easy task, because when we locate them, we must do it considering the last taught content, looking for ways to get them back on track. It is to keep working from where they stopped (...). (in-depth interview, history teacher from the capital's school, May 2019)

For achieving the objective of teaching and that students remain in school, teachers carry out

pedagogical strategies that contemplate an *ecology of feelings* (Osorio, 2017), which are nothing more than dynamics of monitoring and reconfiguration of teaching strategies, considering the characteristics of each trajectory. These are necessary so that once they return to school, they can improve and, above all, learn; as one teacher said, "we are seeing how to work or what we can do to improve and for them to improve, in my subject and in the others as well" (in-depth interview, professor of Economics of the interior school, August 2019).

The pedagogical dynamics and the teaching processes developed by these teachers are part of a collective work, since they know that their training is configured and improves from the work with other colleagues:

> We always meet in the yard, all teachers, and discuss about our students, how to accompany them interdisciplinarily, especially those who return and who need them to stay and value why it is necessary to finish school. (in-depth interview, professor of citizenship at school of the interior, March 2019)

Previous research developed in the region (Delgado et al., 2020), identify secondary school teachers as those who try to provide a school experience that accompanies, listens, contains and prepares for life, prioritizing—above all—presence, since there can be no teaching without presence. The presence is not limited to school attendance as a physical space, but refers to the strategies that each actor, teachers and students, put into action to make something happen, so that the presence becomes a pedagogical and political act:

> There is something that all students know, and it is irrefutable. They know they have to comply with attending school. We know they have problems, and we try to listen and help in everything we can. But for that, they have to be there, hand over the jobs and do their part. (in-depth interview, philosophy teacher from the capital's school, September 2019)

Thus, the school becomes a place that requires presence; without presence there can be no bond, there can be no school, nor can there be school without mediation and teaching.

3.2 Teaching against all odds

The handmade work that teachers do with teaching at the school from the generation of spaces and practices against all odds, does not lose sight of the main objective that is teaching and working with content, as they point out permanently in the interviews obtained (conducted in 2018): "Sometimes I understand that they have had a bad day, so we go out to the playground, we talk but we always come back to work on the content."

The complexity and problems of the contexts and the dynamics in the schools of rural neighborhoods do not escape the training of a teacher who must have the tools to approach the different events. These problems and complexities are something that students bring with them, as a burden, and that, often, teachers are the ones who address them in the classroom. One teacher said:

> Although sometimes they come demotivated, I try to find ways to motivate them in the topic I will present. First, I listen to them, then I improvise: I change a dictation for a book, or we go out for a walk in the neighborhood, but we come back and write (...) We are always looking for other ways. (in-depth interview, philosophy teacher from the capital's school, September 2019)

These search processes often flow indoors into institutions, silently, through *micro-precedents* or *micro-procedures* (Grinberg, 2019; Fallang et al., 2017) that make the school a place where ways of being, living, teaching and learning are created. These micro-procedures result in some teachers looking for their students at home to return to school and, other times, they consist of symbolic searches that are part of those improvisations that the teacher talked about.

It is then a job where teachers have to "juggle", as a pedagogical adviser from the school of the interior (2018) said. On the one hand, this involves taking care of attendance and permanence, attending to the complexities of the lives of students, but, on the other hand, it implies that pedagogical decisions are crossed by constant reconfigurations, to accommodate the times and personal processes of each one. This round trip between students and teachers contributes to the craftsmanship teaching is configured, from a work articulated among colleagues and through the enabling of more democratic communi-

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cation channels to dialog with the problems of students and a horizontal circulation of the word, as we will discuss in the next section.

3.3 Circulation of the word and Democratization of the School

The school as a place of pedagogical encounter, where the school takes place through the word and the encounter with others, assumes a characteristic: the horizontality in the links and a circulation of the word as "possibility of testimony", paraphrasing Armella et al. (2022). The school witnesses the present problems, but also is an opportunity for autonomy, reflection, criticism, and responsibility on the part of the students (Ferreira-Koehler et al., 2021). This is so insofar as it is not a matter of "saying by saying, but of telling what happens to them so that they reflect and can advance on what is best for them and the best is that they study" (in-depth interview, teacher of citizenship of the school of the interior, May 2019).

The artisan teacher fulfills a fundamental role, not only as a witness of the word, but as one who accompanies in the school. To do this, one of the ways the teacher finds is democratic and horizontal communication, as one teacher said:

> Here the word circulates freely (...) we all have a voice in the round table (...), because the word is not forbidden, but, on the contrary, it serves as another tool of participation and learning. (interview with philosophy teacher, capital school, 2019)

In many cases, the school is the only place where students can say, be and belong. However, in dialogue and communication, there must also be a share of responsibility finding balances between democratic spaces and the establishment of agreements on the different components that make up the pedagogical meetings. The mathematics teacher at the capital's school, during an in-depth interview in August 2019, refers to "setting boundaries"[4] so that students understand how far it is possible to negotiate, the words, spaces and ways of learning and the contents taught.

The artisan teacher must find a balance between establishing boundaries and building learning spaces from horizontality. This is not easy, if it is understood that students do not assume a passive role, but, conversely, raise their concerns and desires, as happened in a literature class (August 2019). Here, as the teacher explained the homework to the students, one of them said, "This is boring. When are we going to do something else?" The professor said: "We are going to do something else when you can write a longer text, a more complex text. As long as you cannot do that, we are going to keep doing this" (a field diary note, capital school, 2019). Here the teacher sets boundaries but takes what the student says as a push to give a motivating message "You can, just try to write, for example, what do you see around you?". A student answers, "I see Justin Bieber lives in my neighborhood, or I can say my neighborhood smells rotten." School of the Capital, 2019). Humor is used as an explicit discursive strategy that works as a persuasive resource, resistance, and resilience for these students. Through the words expressed by the student, there is a way of coping with the daily uncertainties and the precariousness of the context (Segado Boj, 2009).

The scene continues: "What else is in the neighborhood?" the teacher inquires. Another student replies, "There are cardboard collectors in the corner." Thus, teachers and students create an argument that brings together experiences close to the context in which school takes place. A story is created through humor and irony about the neighborhood that tries to fulfill the intention of the teacher: the teaching of writing.

Teachers are constantly looking for strategies and designing alternatives beyond the planned ones. About this, one teacher refers:

> I am lying if I tell you that it works for me to plan. It is always going to depend on how the students are that day, what they want. We have to see how to motivate them. They change what you have planned. You may feel more confident about staying on schedule (...) but it actually depends on their times, their desire and how interesting the planned activity is for them (in-depth interview, philosophy teacher from the capital's school, August 2018)

Teaching practices are crossed by resistance and questioning where, from the reconfiguration of what is planned, there are attempts to achieve interpretations of what enables a possible horizon of teaching. Teachers reflect on what motivates young people and that, sometimes, is not what they had

planned, but, nevertheless, they look for ways to be able to motivate them and not miss the opportunity to learn. This translates into negotiations and agreements of times, forms and spaces that allow them to be linked through dialogue. A history teacher said:

> My nature is to always talk to students (...) Children have to know the history contents, but we negotiate a lot the ways in which they like to learn history, I explain, I make them research, I help them, I advise them. I try to address the human, social part, according to what they need, because I understand that school is, perhaps, the only place where they get their attention. (in-depth interview, history teacher at a school of the interior, April 2019).

The teacher chooses the dialogue, where conversations about contents and negotiations about how to approach them are also transformed into learning spaces of other abilities for students as protagonists, from a positioning that, as they know, is not the most comfortable but that, in these schools, is a potential with high educational power.

4. Discussion and conclusions

In the current context characterized by the post-pandemic period, there has been a significant increase in demands related to training and teaching. At the same time, future-oriented education, which goes beyond digital interfaces and virtual environments, faces the daily challenge of determining how to effectively strengthen education. This article has made it possible to problematize about a daily teaching that is reinvented, looking for detailed and handmade ways to accompany the schooling that attend schools and move beyond rigid institutions (Ball & Collet, 2022).

The complexity and craftsmanship of teaching practices account for the socio-educational inequality processes present in the region that affect educational institutions that respond to the schooling of populations that settle in these highly vulnerable territories (Benítez, 2018). In this framework, the work gave an account of the processes and small modulations, inventions and everyday creations that involve new ways that involve schooling and teaching.

Schools become areas of appropriation, experience and habitability (Ramírez & Pertile, 2017) that gradually enable spaces of permanence, meeting and community (Southwell, 2022). Returning to Arendt (2016), a sense of belonging and welcoming of the newcomer emerges, where the school becomes an affective place (Berlant, 2020; Kaplan, 2022; Molano Caro, 2012), an area that welcomes in the middle of the structural situation that characterizes these schools. In these terms, school becomes a place to be safe, a "(...), personal and private territory where ways of doing are invented that acquire a dense, material and affective value (...)" (De Certeau, 2010, p. 149).

Thinking about the training of the artisan teacher shows the strategies and tools that they use to produce more and better educational opportunities, in the "juggling" they perform and the relationship they build between the working universe, the demands of the school space and those coming from the contexts where the schools are located to make them the best place where students can be.

The artisanal character of the teaching activity is crossed by the *presence* of students and teachers in the school space and by the construction of alternatives where word, voice and variety of stories take place. Thus, the craftsmanship of teaching practices involves a set of problematizations linked to the understanding of life in institutions as meeting and reception places (Arendt, 2016), which seek, act and manage so that their students can remain in them.

The school is configured in the coexistence of neoliberal logics (Grinberg, 2019), with "collective agendas" (Deleuze & Partner, 1997), which enable actions, meanings, and affections of those who are there. Thus:

> The school as a body needs to reinvent itself, to stop being the redeeming institution that is sustained by courageous teachers and volunteers and that supposes shared codes between school actors and families (...) It is about finding what Muriel Combes calls "the most intimate of us", i.e., that which, experienced as a singularity, does not belong to a private sphere but to an impersonal terrain and relationships. (Duschatzky, 2023, p. 124)

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Notes

1. Intermediate cities are those that have between fifty thousand and one million inhabitants. They are centers of social, economic and cultural interaction; they offer jobs, services and collective infrastructure to the urban and rural population, and their role is decisive in areas away from the big urban centers (Schweitzer et al., 2018).
2. Social and cooperative management schools are those that are managed by social movements, political organizations, trade unions, cooperatives, popular high schools or other types of civil organizations that are organized collectively/communally and self-managed, with the shared interest of contributing to an educational transformation of the society.
3. Flash interviews are characterized by their brief duration and by being instances of informal conversation within the field (Arroba, 2000).
4. It is part of a regionalism that means setting boundaries, making agreements.

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Peer assessment processes in the initial training of Physical Education teachers

Procesos de coevaluación en la formación inicial del profesorado de Educación Física

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Abstract

Student involvement through peer assessment can have important benefits for the development of competences in initial teacher education. Therefore, the aims of this research are: (i) to study students' perception of the use of the peer-assessment processes for the development of teaching competencies after the peer-assessment experience; and (iii) to study students' perception of the use of peer assessment processes for the development of assessment competence after the peer assessment experience. To this end, a case study was conducted with 10 participants in 2 teacher education subjects. In each subject, three workshops were held in which students had to peer assess the performance of their peers and give them feedback. The information was collected through a semi-structured interview at the end of the subjects. The results show that the students had hardly any experience of this kind, although they valued these processes positively for their learning, although they also encountered difficulties and uncertainties due to their lack of experience. Finally, they also emphasize the importance of carrying out these processes in initial training in order to develop assessment competence and to be able to transfer this learning to their future work context.

Keywords: assessment, teacher education, physical education, peer assessment, competences, students.

Resumen

La implicación del alumnado a través de la coevaluación puede tener importantes beneficios para el desarrollo de las competencias en la formación inicial del profesorado. Por ello, esta investigación se plantea los siguientes objetivos: (i) Conocer las características de los procesos de coevaluación vivenciados por el alumnado durante su formación y la valoración que realizan de dichos procesos; (ii) Valorar la percepción que tienen sobre la utilidad del uso de procesos de coevaluación para el desarrollo de las competencias docentes tras el desarrollo de una experiencia de coevaluación; y (iii) Valorar la percepción que el alumnado tiene sobre la utilidad del empleo de procesos de coevaluación para el desarrollo de la competencia evaluadora tras la experiencia de coevaluación. Para ello, se desarrolló un estudio de caso con diez participantes de dos asignaturas dirigidas a la formación docente. En cada asignatura se realizaron tres talleres donde el alumnado debía coevaluar el desempeño de sus pares y darles retroalimentación. La información se recogió a través de una entrevista semi-estructurada al finalizar las asignaturas. Los resultados muestran que el alumnado apenas ha tenido vivencias de este tipo, aunque valora positivamente estos procesos para su aprendizaje, aunque también encuentran dificultades e inseguridad debido a su falta de experiencia. Finalmente, también destacan la importancia de realizar estos procesos en la formación inicial para desarrollar la competencia evaluativa y poder transferir estos aprendizajes a su futuro contexto laboral.

Palabras clave: evaluación, formación docente, educación física, coevaluación, competencias, estudiantes.

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1. Introduction

For more than a decade University education has been trying to respond to the needs of a competent education, seeking to train professionals capable of solving problems and facing real situations that allow them to enter professional life in a functional way (Barrientos et al., 2019; Gessa-Perera, 2011; Rodríguez-Gómez et al., 2013). In this way, the university becomes a place of reflection, development of critical thinking and share meaningful learning experiences with students (Rodríguez-Revelo et al., 2023). In this context, a pedagogical design is essential to provide students with opportunities to develop their learning and the competences that they will need to use in their professional work at the end of their initial training (Ponce-Aguilar & Marcillo-García, 2020). This is particularly important in teacher education, where students experience teaching and assessment methods that can later use in their professional contexts. Among these methods, the assessment used has been shown as an element to promote the competent learning of future teachers (Barrientos et al., 2019; Cañadas, 2023; Gómez-Ruiz & Quesada-Serra, 2017; Ibarra & Rodríguez, 2011). Formative assessment has been shown to have important benefits in teacher training, such as the development of autonomous, functional, and meaningful learning competences, and promotes metacognitive processes, especially through self-assessment and peer-assessment (Cañadas et al., 2021; López-Pastor et al., 2020; Pascual-Arias et al., 2023). It also increases the motivation and academic performance of the agents involved, achieves greater coherence between the elements of the programme and the assessment, and leads to a renewal of teaching practice (López-Pastor & Sicilia, 2017; Molina-Soria et al., 2020).

One strategy within the assessment process that can benefit students is student participation, especially peer assessment (Panadero et al., 2023). This involves students assessing the quality of their peers' work and providing feedback on their performance (Cañadas, 2022; Rodríguez-Gómez et al., 2013). In this case, the student has a dual role as both evaluator and evaluated, being in the latter case the person who receives the information and decides how to use it to improve the learning process (Cañadas, 2022). Several studies highlight the formative potential of peer assessment to optimize the teaching and learning process (Álvarez-Valdivia, 2008; Barrientos et al., 2019; Gómez-Ruiz & Quesada-Serra, 2017; Pascual-Arias et al., 2023). The implementation of these processes can enhance the self-perceived improvement in learning outcomes and in the acquisition of competencies (Filgueira-Arias & Gherab-Martin, 2020). Furthermore, providing students with the chance to assess their peer´s work also impacts their own learning aiding them in recognising their own performance, comprehending their errors and training requirements, and thus promoting self-regulation (Ponce-Aguilar & Marcillo-García, 2020). Similarly, the peer assessment process provides training for students from experience and practice in assessment practice, which is especially relevant in the case of teacher training because it will be a competence that will be used in the future and that is rarely addressed from the teacher education (Filgueira-Arias & Gherab-Martin, 2020; Gessa-Perera, 2011). Thus, learning about how to assess could be transferred (Cañadas, 2023; Hamodi et al., 2017; Molina & López-Pastor, 2017). Additionally, the development of peer assessment strategies also has benefits for interactions that happen in the classroom, including the relationships between students and the teacher (Álvarez-Valdivia, 2008). When carried out jointly and with mutual agreement, this process enhances communication and promotes the ability to argue, criticize, dialogue, and reflect together with one's partner (Rodríguez-Gómez et al., 2013). In addition, in this way teachers can know the performance of students in both individual and group tasks, allowing them to be aware of whether or not they are working properly.

Although peer assessment has benefits in teacher training, its implementation remains low (Cáceres & Chamoso, 2019; Gómez-Ruiz & Quesada-Serra, 2017). There is a prevailing conception that the teacher is ultimately responsible for establishing the final grade of the subject (Gómez-Ruiz & Quesada-Serra, 2017). On many occasions, these processes are seldom used because university professors lack experience in their implementation, which generates uncertainty (Álvarez-Valdivia, 2008; Rodríguez-Gómez et al., 2013). Therefore, it is essential to continue researching the benefits of these processes and how teachers can integrate them into teacher education.

1.1 Objective

The aim of this research is to analyse future teachers' perceptions of peer assessment processes during their initial training. Specifically, it seeks to:

To know the characteristics of the peer assessment processes experienced by students during their formative stage (Compulsory and University Education), as well as their perception of these processes.

To assess the perception of students about the usefulness of peer assessment processes for the development of teaching competences after the development of a peer-assessment experience.

To assess the perception of students about the usefulness of peer assessment processes for the development of assessment competence after the development of a peer-assessment experience.

2. Methodology

A qualitative research was carried out, specifically a case study (Denzin & Lincoln, 2012; Stake, 2006) developed in the 2020/2021 academic year in two subjects focused on initial teacher training with the aim of knowing the perception of students about the peer-assessment processes during this stage and how its systematic use in these subjects has helped them to develop their competences and, especially, the assessment competence.

To this end, three assessment workshops were conducted in each subject. These were timed according to the contents studied. Out of these, two were individual and one group. In each workshop, the following information was provided to the students through the platform of the subject: (i) Explanation of what they should do in the workshop; and (ii) related files or documents necessary to carry out the workshop. Subsequently, the students were presented with the peer-assessment activity of the workshop. Peer-assessment pairs were anonymous and randomly assigned. In them, the students had to asses their peers following the criteria provided by the teachers, then they received feedback from the teachers, both on the task performed and on the assessment process carried out and the feedback provided to the peers, to finally complete a reflection and self-assessment sheet on the process performed. This included items related to: (a) time spent in performing the peer-assessment; (b) satisfaction with the qualitative assessment performed; (c) satisfaction with the qualitative assessment received; (d) a reflection on the aspects that could be improve after the assessment; (e) elements that will deepen or change in view of the tasks of assessment and qualification of the subject linked to these peer-assessment processes.

2.2 Participants

Ten students participated. Out of these, six women were in the 4th year of the Early childhood and primary education degree and four men were in the 1st year of the Physical Activity and Sport Sciences degree. Participants were selected on the basis that they had completed all the peer assessment activities proposed in the subject, that they had passed the subject and that, once invited, they gave their consent to participate in the study.

2.3 Instrument

A semi-structured interview specifically conducted for this research was used for collecting the information. The interview was conducted to the students once they finished the subject. This included questions related to: (a) peer assessment processes in advance and in other contexts and how these were developed; (b) the advantages of the peer assessment processes used in the subject to improve learning; (c) the importance of assessment criteria and knowledge of content to carry out processes; (d) how this activity has affected their improvement of competence and whether they believe it will serve them in the future to evaluate others. The interview was reviewed by two external researchers prior to its implementation.

2.4 Procedure

Following the completion of the subjects in January 2021, some students who had participated in the experience of the peer assessment processes and who met the criteria indicated above were invited to participate in the research. They were sent an e-mail informing them the aim of the study, as well as the commitments that both parties would make. Once they agreed to participate, a date and time was specified with them, and the interview was conducted online. Prior to the beginning of the interview, consent was requested in order to record the interview for subsequent transcription and, once accepted,

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they were again informed of the conditions of participation, as well as the ways in which the confidentiality and anonymity of the reported information would be ensured, also they were asked to give their verbal consent. The interviews lasted approximately 30 to 40 minutes. Subsequently, the interviews were transcribed and analyzed.

2.5 Analysis of information

To analyze the information collected, we begin with the transcripts of the interview recordings. Subsequently, an inductive coding process was followed. A list of codes was drawn up on the basis of the research topics and the information obtained from a detailed reading of the transcripts of the ten interviews. This step allowed a detailed view of the information collected, which was subsequently analyzed. This was developed on a qualitative basis of coding and categorization of information. The phrases were taken as coding units. Immediately afterwards, the information was organized through an open coding system, setting the codes into categories and sub-topics (Vaismoradi et al., 2013). Nine sub-topics emerged, which fall into three broad topics. The first topic refers to the previous experience of students with peer assessment processes and includes two sub-topics: (i) formal education and initial training; and (ii) qualification. The second category refers to the advantages of peer-assessment processes to improve learning, falling under this category: (i) competency development; (ii) peer learning; and (iii) personal development. Finally, we find the advantages of peer assessment processes to improve the assessment competence itself, dividing this category into: (i) assessment criteria; (ii) perceived competence; (iii) transfer; and (iv) peer learning for the development of assessment competence. Table 1 shows the final structure of the analysis after this process and the number of references in each.

Table 1. *Analysis codes derived from interviews*

Category	Subcategories	Code	No. References	Definition
Past experience of pupils in peer-assessment processes	Formal Education and	EFor_FI	15	Peer evaluation Experiences in Formal Education and During Initial Training
	Initial Training	EFor_FI	15	Peer-assessment experiences in Formal Education and During Initial Training
Advantages of peer-assessment processes for learning and competency development in the subject	Competence development	Des_Comp	14	Development of general and specific competences of the subject
	Peer Learning	Ap_Pairs	10	Benefits of peer learning from Peer-assessment
	Personal Development	DP	15	Personal Development
Advantages of peer evaluation processes for developing and improving competency to evaluate	Evaluation criteria	Ev_CritEv	25	Structure of evaluation processes and importance of evaluation criteria
	Perceived competition	CompPerc	21	Perceived competence to assess from Peer-assessment processes
	Transfer and competence development	Trans_ CompEv	21	Transfer and development of evaluation competencies through peer-assessment processes
	Peer Learning and Competence Development	Ap_ EvPeers	19	Peer Learning and Competence Development to assess

3. Results and discussion

For the presentation of the results, each of the specific aims proposed in the research will be answered. In addition, these results will be discussed simultaneously.

3.1 To know the characteristics of the peer assessment processes experienced by students during their formation (Compulsory and University Education), as well as their perception of these processes

The participants of this research indicate that they have done other peer-assessment processes in high school or at the university, although very punctually, being even more scarce in previous stages such as primary or secondary education. Generally, these processes have been based on the correction of exams or feedback on a work or task. Previous studies on the subject agree with this view on the peer-assessment processes in initial teacher training. It is highlighted, on the one hand, that these are rarely used strategies, predominating in these stages more traditional assessment approaches (Basurto-Mendoza et al., 2021) even though they have shown great benefits for student learning (Ibarra et al., 2012; Ndoye, 2017); and, on the other hand, these are not so frequent in the initial stages, thus observing some examples at the university (Antón-Nuño & Moraza-Herrán, 2010; López-Pastor et al., 2012).

> Yes, I had done it mainly in high school. And then at the university, we have also done some feedback on the peer-assessment level, but it was all done orally. I mean, I do not remember doing any written peer-assessment except in high school. (EFor_FI_Ent1)

> Well, surely as such we have done some, but not really, not like this. Well, maybe we corrected a test that was not too important... (EFor_FI_Ent3)

> Not that I remember. Well, with a teacher. [...] And then we shared the cognitive map that we had done to each other, and we gave them feedback, but it was not like correcting as such, you know, feedback of well, it is clear, it serves me to organize the ideas, you have captured it well the information... (EFor_FI_Ent6)

However, they point out that when these processes have been used, it has been done in such a way that the teacher did not understand the process, intervening only at the end to put a grade without considering the valued by the students. This is one of the main problems reflected in the literature, the lack of a coherent and progressing process that allows to decouple the evaluation from the qualification and that the students acquire strategies to use peer-assessment processes correctly (Liu & Carless, 2006).

> [...] the teacher was in charge, like you, of reviewing what you had done and how they had assessed you, and finally she was the one who graded you, whether you deserved more grade or not. (EFor_FI _Ent10)

> [...] the colleague filled out an Excel form with a score from 0-10, which included bibliography, has clearly explained the agenda, synthesizes the content well, and then we did that feedback, but it is true that we never get to see how the other person graded us, only what they said orally at the end of the presentation. (Coev_Calif_Ent1)

Despite this, the participants value positively not having responsibility about the qualification in these processes, since they consider that their file can be affected and that what really favors learning is the feedback. In this sense, they highlight the need that these processes are not associated with a qualification, as Ponce-Aguilar and Marcillo-García (2020) argue, but should encourage reflection and the development of critical sense of students, to make value judgments about their own work and that of their peers. In this way, assessment processes are developed with greater objectivity and criteria, sharing experiences that lead students to assess their parts without generating conflicts between them.

> I think that, in this case, at least from my point of view, the biggest problem that we have had, which in this case we have been lucky because we have not had that problem, would be the that my correction would represent a grade, because then of course, I would feel more pressure, and then the correction for the person who gets it may be better or worse because it is directly impacting on the grade. (Coev_Calif_Ent9)

> I think that these types of peer-assessment activities at the beginning should at least not be graded, because at the university you are already more focused on achieving your goal which is to get your degree, and you are already thinking about the grade... so separating this from the grade I think is very important to really learn. (Coev_Calif_Ent10)

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> And the thing that I liked the most, and I think that is why we improved the competitive part, was that it was not associated with the mark, so we were honest with the rest of us because we knew that our opinion was not going to have a negative impact on them, and then it was much easier to come up with some specifications or a dialogue that was not fictitious, but was actually real, because it was not going to have an impact on the grade, which is a huge problem, I think. (Coev_Calif_Ent1)

3.2 To assess the perception of students about the advantages of using peer-assessment processes for the development of teaching competences after a peer-assessment experience

Secondly, it is perceived that peer-assessment processes are very useful for their learning and competency development. Participants emphasize that this type of process allows focusing attention on the content, reinforcing the most important elements. This is consistent with previous studies that indicate that these processes allow to improve learning and student outcomes (Cañadas et al., 2021; Gregori-Giralt & Menéndez-Varela, 2017; Vizcaíno-Avendaño et al., 2017).

> I think there is more, it helps you to go much deeper, to reflect more about the content, even for the final assessment itself, you understand the content a lot better. It has helped me to have much clearer all concepts, all content and reinforce that, and even when doing the tasks, of course (Des_Comp_Ent7)

> Of course, then came the aww, but now I have to assess my peer, so when reading I would realize and say God… here… and here…. I wrote something similar... and I opened mine and started comparing. And based on that, I would assess myself and assess my peer. So, I think that at least in my experience, it has served me to reinforce those contents, not only because when you do peer-assessment you have to read more, because in the end I remembered the first tasks, then I perfected it. (Des_Comp_Ent8)

IIn addition, participants mention that having this type of experience helps them to build knowledge and create spaces with their peers in which they can reflect and debate on the content studied to reach agreements and see other types of proposals and approaches to the same situation. This is a very important perspective, given that participants as future teachers must develop the ability to pass assessments on their work to students, as well as to assume the assessments that are made about their work (Gessa-Perera, 2011; Vizcaíno-Avendaño et al., 2017).

> Yes. [...] I think we improved it a lot the teamwork, the intra and interpersonal competition, and especially the fact that in the end they may have had a more concrete perspective in some area, because they had worked more the frisbee or some aspect in the development of the table, and we had focused more on another. (Des_Comp_Ent1).

> So, I think that part, to me cooperation has served me to learn even more to do the task. That is why, because it no longer only serves you with answering, but knowing if it is right or wrong what the partner has mentioned. (Ap_Pairs_Ent4)

The students agree that through peer-assessment they have been able to detect errors in their own work, being able to improve in subsequent tasks. This shows that the student, despite receiving positive *feedback* and *feedback* of improvement, continues to focus only on the error after the assessmemt received by the peer, almost always with a perspective of improvement.

> Well, in the face of that final work, I did find it quite interesting because I had a first contact, and then I think it helps a lot in the retention of the content that we want to assess because if I have to correct, and I do not have the opportunity to do another job where I am going to apply that correction, two weeks later I will forget it. I found an activity more interesting, I see the error, I try to correct it. In the next one, I see that same mistake if I have managed to correct it and try to correct another one, and that way I am becoming aware of that correction, of that assessment, and of how I am really improving. (Des_Comp_Ent9)

The idea is not only to receive the corrections from the peers, but also to be able to talk to them. These processes helped them to understand the *feed-*

back and to be able to solve doubts, as well as to comment on the differences from the peers. Thus, peer learning favors the exchange of ideas and opinions, opening spaces for reflection, critical analysis and dialogue, hence the students make value judgments both of the work done by their peers, as well as of the work itself, finding different alternatives, diversity of thoughts and arguments to the same situation (Antón-Nuño & Moraza-Herrán, 2010; Gómez-Ruiz & Quesada-Serra, 2017).

> There was a space for dialogue between all of us. This allowed us to talk and understand why they were telling us this. Because so far, I had never had the space to ask why you wrote this on me. And, apart from that, his comments allowed me to understand or approach how we had planned a session from a point of view that I might not have. (Ap_Pairs_Ent1)

> Maybe I had a thought about x, the other person has taken it in another way that has justified it in such a way that, hey, maybe it has given another point of view. (Ap_Pairs_Ent4)

Another element that participants mention is the insecurity they feel when having to asses or being assesed by others. The lack of experience in the assessment processes leads students to think that their peers may not have the necessary skills to perform it, and that what is being transferred to them is not adequate regarding the quality level of the task. The lack of training or instruments with clear evaluation criteria can lead students to distrust these processes, thinking that the subjectivity will have an important weight for not being an expert in the subject (López-Pastor et al., 2016).

> What is going on and what I was going to tell you is that I think that since the task is corrected by another person with the same knowledge you have, then it is not clear for me who is right and who is not. And indeed, you correct or check it later but since it is already a second one, you still do not make a lot of effort. And, it is true that you look at it, because in the end you are also interested in knowing what the peer has said, and more or less, if you agree or not, but you are not sure if what you have said is right, if what he has corrected you is right... and I think that in the end it can come well for that, because you think about it, you correct more to see the mistakes that has indicated and so on. (DP_Ent3)

> Then we see, because of course you also give us feedback on our peer-assessment, if we are improving, if we have done well, if we go well, if there is something we have to change... So well, in the end when you see that you have achieved it... like I felt more proud to say look I have finally made it, I have done it better, but... well, I have been able to do it. And then as I went along, in the second or already in the third task, I felt more prepared, more confident. (DP_Ent4)

Therefore, participation in peer-assessment processes is very useful among students, since they take an active role in their own learning, being aware of the process and the development of competence achieved during and at the end of the process, from a shared evaluation experience. Students emphasize that this type of processes allow to internalize, understand and establish knowledge, favoring the transfer of learning to different contexts and more complex situations.

3.3 To assess the perception students have about the advantages of peer-assessment for the development of assessment competence after a peer-assessment experience

The participants of this research point out that in order to develop the assessment capacity and correctly perform the task requested in the peer-assessment process, having a rubric or evaluation indicators makes it easier to correctly perform the process. Faced with the insecurity and respect generated by this process among students, some highlight that they want to assess the task in the most appropriate and objective way possible, as Rodríguez-Migueles & Hernández-Yulcerán (2014) highlight.

> To know what I have to assess, i.e., to have a rubric, and to know the elements that I have to assess; and therefore, to know what I need to obtain… that we are both clear in the assessment process what are the items or what is the content we are going to assess at the end. (Ev_CritEv_Ent1)

> I think that, maybe, the first part is to realize that you need to have established previously assess-

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> ment criteria... I mean, that is something we have always been told in the theory of assessment, that you need to assess item by item.... But now it is kind of clear to me that, if I did not meet those criteria, it would have been a lot more complicated. So, to live and experience that the criteria to assess are really necessary, no, that it is not only because it is necessary to do it, no. It is just that it is been really useful to me, I could see that it was necessary. (Ev_CritEv_Ent4)

> The criteria make me feel more secure, and I think it is better because in the end you are pending to assess something concrete, it is not a matter of being subjective. Then it would be useful for example to focus more on one thing or another, because in the end I am not an expert on that subject, and if you do not tell me what I have to assess because, I do not know if I am doing well, if I am doing bad... it is better for me (Ev_CritEv_Ent5)

On the other hand, the lack of practice in the application of assessment processes makes the students feel incompetent to act as evaluator. Working on these processes at various times throughout the course helps them gain confidence and improve their competence to assess peers. Students show great respect for participating in this type of process, as they do not consider having sufficient competence to do so and it is a rather complex and demanding task to assume (Álvarez-Valdivia, 2008; Molina et al., 2022). However, they highlight that having experiences in peer-assessment processes generates greater motivation, confidence and security (Álvarez-Valdivia, 2008), seeing improvements in their learning and competence to assess.

> Knowing that you are doing a peer-assessment is already very scary and distressing, first, because you are taking an authority role that you have never had so far, which is that I am responsible for what I am going to tell someone to improve his/her educational practice, which is a big responsibility. (CompPerc_Ent1)

> Well, I did see improvements, and with respect to that at the end it was easier, we were more secure when assessing. (CompPerc_Ent6).

> Yes, when it comes to assessing, I think I have improved, and in fact, just before the interview started, I am taking on the assessment of one of the school subjects, and I think it has helped me because of what I said earlier, to be more objective in what that person really is. Yes, I think it has helped me to be objective (CompPerc_Ent10)

One of the most important aspects of the use of these processes in initial teacher training is the transfer in the educational context at the levels of Primary and Secondary Education. Providing opportunities during initial training to work with the ability to evaluate and give *feedback* will benefit future teachers to be more prepared to use alternative forms of assessment later on, because they feel they control the process and have the capacity to implement it (Cañadas, 2023; Cañadas & Santos-Pastor, 2021; Hamodi et al., 2017).

> Well, I think they are important because from those criteria, we could in the future assess our own criteria— I mean, using those as a basis, in case we are teaching the future, use them as a basis for assessing our students. (Trans_CompEv_Ent2)

> So, they have been very useful to me both to assess my peers, and to build a record to assess my future colleagues if the case it occurs, or my students. So, it did serve me a lot, because I am telling you, at first, I was concern for doing this assessment process, but well, at the end you take it easy, and you see the advantages (Trans_CompEv_Ent6)

> And well, as I said before, it will be useful to assess my students in the future. Or have a guideline about how to assess, even propose this kind of peer-assessment in the future among my students, so that they are assessed. (Trans_CompEv_Ent7)

> But the second one, I think, has been very important because we have had practical work, we have taken a journey and an experience in terms of assessment, because one thing is to know how to do it, and another thing to actually do it. And in the end, there has been a really good balance there, because we have been given tools (Trans_CompEv_Ent9)

Finally, it is essential to positively assess the need for evaluation processes with a formative character and the support of others. When participants felt supported by their peers, both internally in the peer review and externally by the person they were assessing, they indicated that the process had

been more positive and beneficial. As Borjas (2011) indicates, these processes generate great responsibility among students, having to develop cognitive strategies that allow solving certain situations, going beyond a mere opinion and immediate knowledge, and with it, debate and contrast information to create shared learning.

> Yes, especially also because of the fact of doing it among peers. [...] To me personally it did help me, it helped me to be more fair. First, I am very demanding of myself and others, and then many times, I found certain flaws that my peers helped me to understand it in another way or another approach, there was an agreement, so that helped a lot when it came to agreeing on an improvement or agreeing on guidelines to improve as a team, and having a consensus, that I think I improved it a lot. [...] So it did help empathize more. (Ap_PairsEv_Ent1)

> By doing it in a group as well, but by agreeing with my peers was like, I do not know if it was simpler, but more bearable to say it in some way" (Ap_ParesEv_Ent6).

> I think that also doing an evaluation to another group we also helped each other, and I also found very interesting that part of one group evaluating another group, not only me individually. Because in the end, well, we share the ideas [...]. (Ap_ParesEv_Ent7)

4. Conclusions

This study sought to respond three aims: (i) to know the characteristics of the peer-assessment processes experienced by students during their formative stage (Compulsory and University Education), as well as their assessment of these processes; (ii) to analyze the perception that students have about the advantages of peer-assessment processes for the development of teaching competences after a peer-assessment experience; and (iii) to analyze the perception of students about the advantages of peer-assessment processes for the development of evaluating competence after a peer-assessment experience. Regarding the first objective, there are few experiences of peer-assessment processes both in Compulsory Education and in the university, and the few that have been developed sometimes were related with putting a qualification that was subsequently not taken into account in the final qualification. Regarding the second objective, the use of these processes for the development of learning is highly valued, as well as the positive relationships they generate, although they show great insecurity both for their competence to do it correctly and for their peers to assess them properly. Finally, the use of these processes to learn how to evaluate, and as a possibility to transfer and use it in their future work context is positively valued.

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Production of a digital game as a mobilizer of initial teacher training

Producción de un juego digital como movilizador de la formación inicial docente

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Abstract

This paper discusses the digital game object intertwined with the initial training of teachers and aims to discuss mobilizations produced during a curricular internship when the production of an educational digital game was started. Supported by the theoretical-methodological contribution of the Actor-Network Theory, the research has a qualitative character and its empirical field allowed mapping a pedagogical reality from its socio-material aspects. The production of empirical data took place from field observations and the elaboration of reports by teachers in training, which were migrated to the ATLAS.ti program and treated from a focused codification. These procedures made it possible to identify the actants that formed the investigated socio-material network, track the mobilizations undertaken and systematize elements that made up the reality produced by the network. The research reinforces the impossibility of dissociating material aspects from social aspects in socio-formative processes —which are always marked by transience, fluidity, uncertainties and mutations— and shows that the production of a digital game in the initial training of teachers provokes mobilizations that affect the field of action of future teachers and incite the formation of pedagogical meanings.

Keywords: game design, digital game, socio-formative processes, mobilization, initial teacher training, Actor-Network Theory.

Resumen

Este artículo se centra en el objeto del juego digital vinculado a la formación inicial docente y tiene como objetivo discutir las movilizaciones producidas durante una pasantía curricular cuando está en curso la producción de un juego digital educativo. Apoyada en el aporte teórico-metodológico de la Teoría Actor-Red, la investigación tiene un carácter cualitativo y su campo empírico permitió mapear una realidad pedagógica a partir de sus aspectos sociomateriales. La producción de datos empíricos se llevó a cabo mediante observaciones de campo y en la elaboración de informes de profesores en formación. Estos informes se transfirieron al software ATLAS.ti y se procesaron mediante la codificación enfocada. Estos procedimientos permitieron identificar a los actantes que conformaron la red sociomaterial investigada, rastrear las acciones (de movilización) realizadas y sistematizar elementos que constituyeron la realidad producida por la red. La investigación refuerza la imposibilidad de disociar aspectos materiales y sociales en los procesos socio-formativos los cuales siempre están marcados por la fugacidad, la fluidez, la incertidumbre y capacidad de transformación. Asimismo muestra que la producción de un juego en la formación inicial docente provoca movilizaciones que inciden en el ámbito de acción de los futuros docentes y fomenta la formación de significados pedagógicos.

Palabras clave: proyecto de juego, juego digital, procesos socio-formativos, movilización, formación inicial docente, teoría Actor-Red.

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1. Introduction

This article is an excerpt of a postdoctoral research in Education in a Brazilian public university and involved a socio-formative experience based on the development of a digital game during a curricular internship in the initial training of physics teachers. The object '*game*' was linked to the objectives of the internship in order to strengthen links between the curriculum of the career of Physics, the practice of professors in training and the teaching of specific contents in the field of Physics through the collective development of a game. In this context, the main objective of this article is to discuss the mobilizations produced in a network of actors, which was formed during a curricular internship that started the production of a digital educational game.

Although it is possible to find in the literature different papers that explore the game-education relationship in order to provide more ludic and meaningful means of teaching/learning (Alves & Torres, 2018; Cruz & Ramos, 2019; Lobo & Viana, 2020; Ramos & Xavier, 2017), the experiences of developing games during the initial teacher training are scarce (da Cruz et al., 2020). This indicator pointed us out the omission of this idea of pedagogical work during this formative stage and encouraged us to develop a strategy in which a game: 1) was designed and built by teachers in training; 2) constituted a way of mediating the practice of teaching physics; 3) created the internship as a space-time of affectation (Ribeiro & Lima, 2022) and, therefore, of mobilization of teachers in initial training.

Therefore, this work focuses on the mobilization process triggered during the production of a game by undergraduate students in their curricular internship and, for this, it is assumed that a game is a cultural artifact executed in electronic media, constituting an interactive and playful environment with a purpose previously defined in its design (Alves, 2018). In this point, it is important to remember the indicators of Egenfeldt-Nielsen (2009) who addressed three different ways of proceeding in the pedagogical incorporation of games to socio-educational practices with the aim of promoting: 1) learning 'through play', which refers to the inclusion of pedagogical games to promote the teaching of a specific subject in the curriculum; 2) learning 'with games', which considers adaptations of pedagogical practices based on commercial games to explore topics, concepts and curricular methods; and 3) learning "making games", which requires the development of a project and the implementation of a game considering a certain referential subject.

To implement the third aspect pointed out by Egenfeldt-Nielsen (2009), the composition of the planning of pedagogical actions that were part of the curriculum internship of physics students, it was sought to assess and address the recommendations of Schell (2011) in the conduction of a game design that integrates four interdependent elements: 1) 'mechanics' that considers the rules of a game and its execution; 2) 'narrative', circumstance that covers a sequence of events in a game and that provides an experience to the player; 3) 'aesthetics', which stimulates the player's audios senses to foster a meaningful experience; and 4) 'technology', which comprises the materiality that sets the environment of the game and mediates the game.

While there may be prejudices linked to digital games (Oliveira & Santos, 2017) — idleness and sedentarism, for example — the idea of encouraging the production of a game during a curricular internship has a socio-formative intention. Thus, what was set in motion was a proposal that triggered mobilizations that encouraged not only the resignification of undergraduate students regarding the object 'game', but also the reconfiguration of the own period of curricular internship, which transcended the scope of teaching practices mainly expository.

The theoretical-methodological approach developed by Bruno Latour, Michel Callon, John Law, Annemarie Mol, among others, and known academically as Actor-Network Theory (TAR) was considered. Although the objective of this text is not to make an introduction to TAR, it is important to briefly present some of its foundations.

TAR considers the formation of the social from entities that relate to each other and realize realities (Lima, 2022). Referring to the etymology of 'social' — from the Latin *socius* — Latour (2012, p. 24) explains that "[...] in different languages, the historical genealogy of the word 'social' first designates 'following someone'; and then, 'enlisting' and 'alliing with' to finally express 'something in common'." It is from this construct that TAR proposes the mapping of heterogeneous entities as an empirical basis of operation, in association with the purpose of identi-

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fying agencies and the transformations produced in their interactions. In other words, the social begins to be seen from the relationship between humans and non-humans—treated as actors in TAR lexicon—which characterizes the creation of a socio-material network (Figure 1).

Figure 1. *Outline of the Propositions of the Actor-Network Theory*

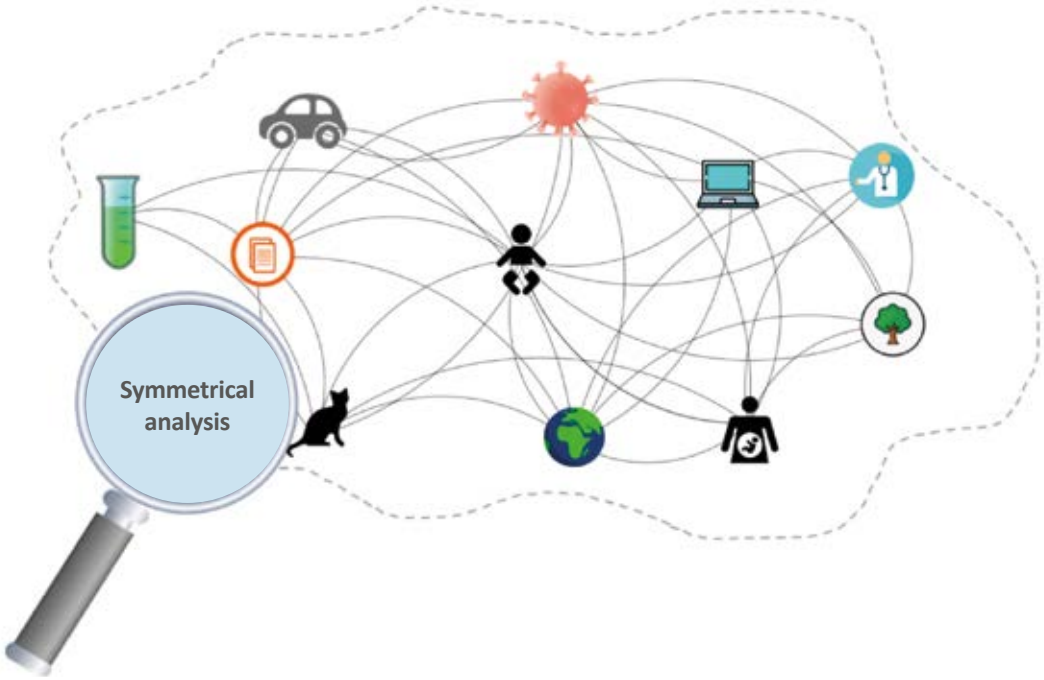

Figure 1 shows a network of heterogeneous associations that is open to movement, therefore, without rigid boundaries that prevent the unexpected association of new participants. The channels of force (Law, 2012) established by associated entities during their interactions shape a given situation and, in doing so, produce agency traces. Hence, the understanding of what gives meaning to the 'effects', i.e., the differences produced by heterogeneous collectives in their interactive relations and that make new configurations in the networks. This implies thinking about considering something that indicates 'mobilization', i.e., something that promotes a break with a condition of inertia and that causes transformations to arise in its context of occurrence. Charlot (2000, pp. 55-56) places this discussion in the educational field and says:

> [...] mobilization involves the idea of movement. Mobilizing is putting you on the move [...] is gathering your forces to use you as a resource. [...] Mobilizing, however, is also participating in an activity originated by mobile phones, because there are "good reasons" for doing so.

Bernard Charlot is supported by Latour (2017) when approaching the term translation, which has a double meaning: that of "translating" from one language to another and that of "transferring" from one place to another. In both cases, the target is the production of a new state of the world (Barad, 2007), i.e., the translations highlight "[...] the work thanks to which the actors modify, move and translate their diverse and contradictory interests (Latour, 2017, p. 367). Thus, this work assumes 'mobilization' as an expression of "[...] something, done together with others in an event, with the specific opportunities provided by the circumstances. These others [... are] non-human entities [...] that have their own logical specifications [...]" (Latour, 2017, p. 341).

Returning to Figure 1, it is possible to note that when thinking from an Actor-Network perspective, it is necessary to keep in mind the premise of a symmetric analysis between people in association, which brings humans and non-humans closer to the same ontological place. To this end, TAR encourages us to turn our attention to scenes for the associations and their translations, always entangled and provisional.

It is worth remembering that this "[...] symmetry is not ethical (things are worth the same as humans), but analytical (things force us to do things and have important implications)" (Lemos, 2014, p. 6).

Considering this contribution, the idea is to contextualize the reality produced during a curricular internship of the Physics career, which involved the collective production of a game by nine teachers in training (three women and six men). This digital product was designed to mediate, in partnership with trainee teachers and internship supervisors, the teaching of Electrostatic content to secondary school students during the coronavirus (COVID-19) pandemic.

2. Methodology

The research carried out is based on the qualitative paradigm (Bogdan & Biklen, 1994; Lüdke & André, 2017; Stake, 2011; Strauss & Corbin, 2008) and it shows an interpretative perspective to the empirical field in order to capture nuances of a socio-formative practice at its moment of execution. In this topic, the apprehension and recording of dynamics that expressed ways of thinking and acting, the (trans-) formation of meanings, emotions, etc., that were part of a given situation of research interest, were assessed. Thus, this article explores a specific part of some of the strategies that were part of a planned intervention in an Action Research (Thiollent, 1996) developed with a group of teachers in training.

The work was carried out in a training course for physics teachers at a Brazilian public university, during a curricular internship in the first academic semester of 2020 and in accordance with the health standards imposed by the COVID-19 pandemic. In addition to the investigator, a research supervisor, and an internship supervisor, nine undergraduate/graduate students were part of the sample. The presence of the researcher in the studied network is intentional, since this association concerns not only specific actions of research, but also the role of a member who was active in the various areas that involved the theoretical classes of the internship and the orientation times to the graduates for developing a game for pedagogical purposes.

If the description of the entities involved in the studied space were limited to the topics already listed, this research would not include the socio-material dimension so appreciated by the actor-network studies (Latour, 2012) and our other 'half-world', which concerns non-humans. In this condition, special attention was also directed to non-human participants, who constituted the socio-material network that carried out (Lima, 2022) the curricular internship of the nine teachers in training and that provided living conditions for the own intervention of physics teachers, which was conducted with secondary students of a Brazilian public school. This is essential, because:

> The human, as seen now, can only be captured and preserved if we give back that other half of itself, that part of things. As long as humanism is created in contrast to the object abandoned to epistemology, we will understand neither the human nor the non-human. (Latour, 1994, p. 134)

It was from this field that the empirical work and data production were oriented, valuing a socio-material vision attentive to humans in an intertwined and mutually constituted way with non-humans (Fenwick, 2014). In relation to the research scope of this work, the analytical corpus was composed of observations and practice reports prepared by teachers in training, which integrated the documentation and evaluation of this formative stage of graduates.

The objective was to map the actions (mobilization) that integrated the planning of intervention in the field of practice and play, as well as those that composed the development by students. Also, to identify the mobilizations that shaped the moment of the curricular internship and that provided conditions for its existence, it was sought:

> 'Follow the actors themselves', i.e., try to understand their innovations [...], to discover what collective existence has become in their hands, what methods they have developed for their adaptation, what definitions would better clarify the new partnerships they were forced to establish. (Latour, 2012, p. 31)

To this end, the empirical data were subjected to a Focalized Coding1 procedure (Thomas, 2006) mediated by the software ATLAS.ti,2 allowing to build thematic groups related to the objective of the research. This orientation also considered the emergence of these thematic groups—or thematic categories—from what the data indicated, i.e.: "[...it was] as if we told the actors: 'We are not going to try

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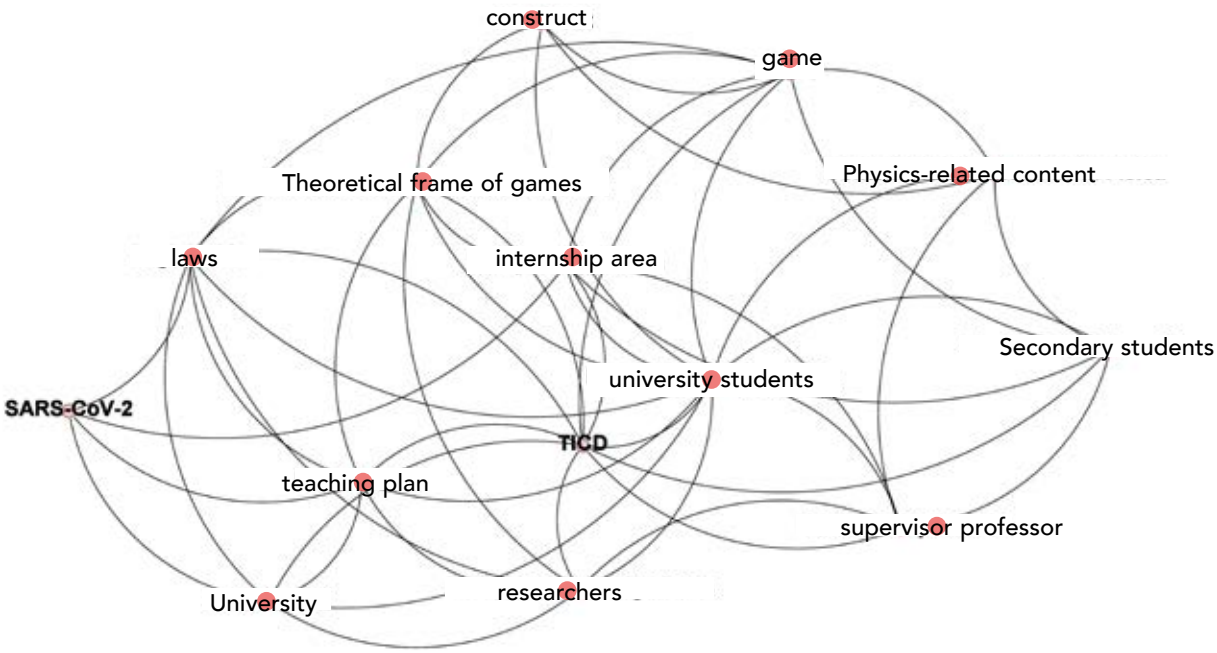
to discipline you, to fit you into our [previous] categories; we will let them be in their own worlds [...]'" (Latour, 2012, p. 44).

These procedures allowed: a) to identify the participants who formed the socio-material network investigated (Figure 2); b) to monitor the mobilizations carried out and their relationships (Figure 3); c) to systematize the reality produced by the network, which includes the effects of this curricular internship (Figure 4).

3. Results

Following Laturian guidelines of "[...] following things through the networks in which they are transported, describing them in their plots [...]" (Latour, 2004, p. 397), a first milestone produced by the methodological work with empirical data is presented in Figure 2.

Figure 2. *Sociomaterial network mapped from empirical data*



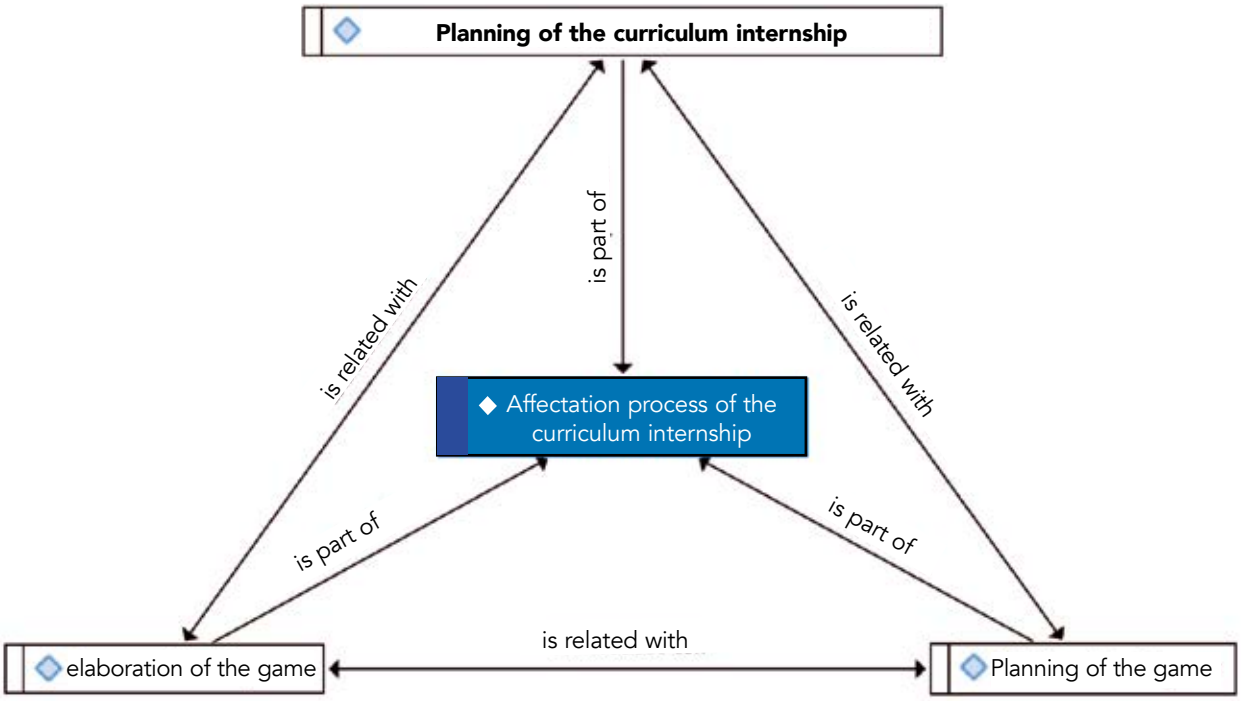
Note. Own elaboration using Gephi software.

Figure 2 represents the participants that make up the studied socio-material network and, initially, it is worth mentioning the Severe Acute Respiratory Syndrome Coronavirus 2 ('SARS-CoV-2'), whose presence and field of action affected the daily life of the university. In network, the coronavirus imposed a procedure of social distancing in teaching, research, extension and administration practices for its transmissive forms and lethality implications by COVID-19. From its agendas, SARS-CoV-2 forced the university to rework its regulations and embody them through 'legislation'. The response to this range of effects was the establishment of an Emergency Remote Education (ERE) regime mediated by Information and Digital Communication Technologies ("TICD"). This also required adaptations to the 'teaching plan' of the curriculum internship and changed the interactions between: 'teacher-researchers' (the author of this article and a research supervisor), 'graduates/undergraduate students', 'teacher-trainee supervisor', 'secondary students' and 'internship field'. As one of the entities associated with the network investigated and in compliance with the ERE standards, I conducted pedagogical conversations with the students covering the 'theoretical framework of digital games' and its educational implications. This set of efforts included theoretical classes, planning moments and the creation of a 'game' by the group of teachers in training on the 'Construct' platform. The curricular internship was accompanied by a supervising teacher who pointed out Electrostatics as a 'referential

content in Physics' to be explored pedagogically with the game with his secondary school students.

Focused Coding (Thomas, 2006) of the corpus, carried out with ATLAS.ti, resulted in the identification of three types of mobilization of graduates. Overall, the work carried out by the initial teachers - which was guided by the teacher-researchers and supervised by the supervising teacher - forged the impact of the curricular internship, as expressed in Figure 3.

Figure 3. *Semantic network of action mobilization that affected the curricular internship*



Note. Own elaboration from the research data in ATLAS.ti

Figure 3 requires the result of focused coding of the corpus in the form of a semantic network linking the thematic clusters identified. It should be noted that the development of the curricular internship was affected by three mobilizations, which included: 1) the moment to plan the intervention of the teachers in training and their teaching practice in the field of the internship; 2) the planning stage of the pedagogical game; and 3) the effective construction of the game that would mediate the teaching practice of graduates/undergraduate students with high school students in the field of the curricular internship.

A final highlight of the results of the methodological procedures carried out with the corpus highlights aspects that were part of the pedagogical reality produced by the hybrid collective during the curricular internship, affecting it (Figure 4).

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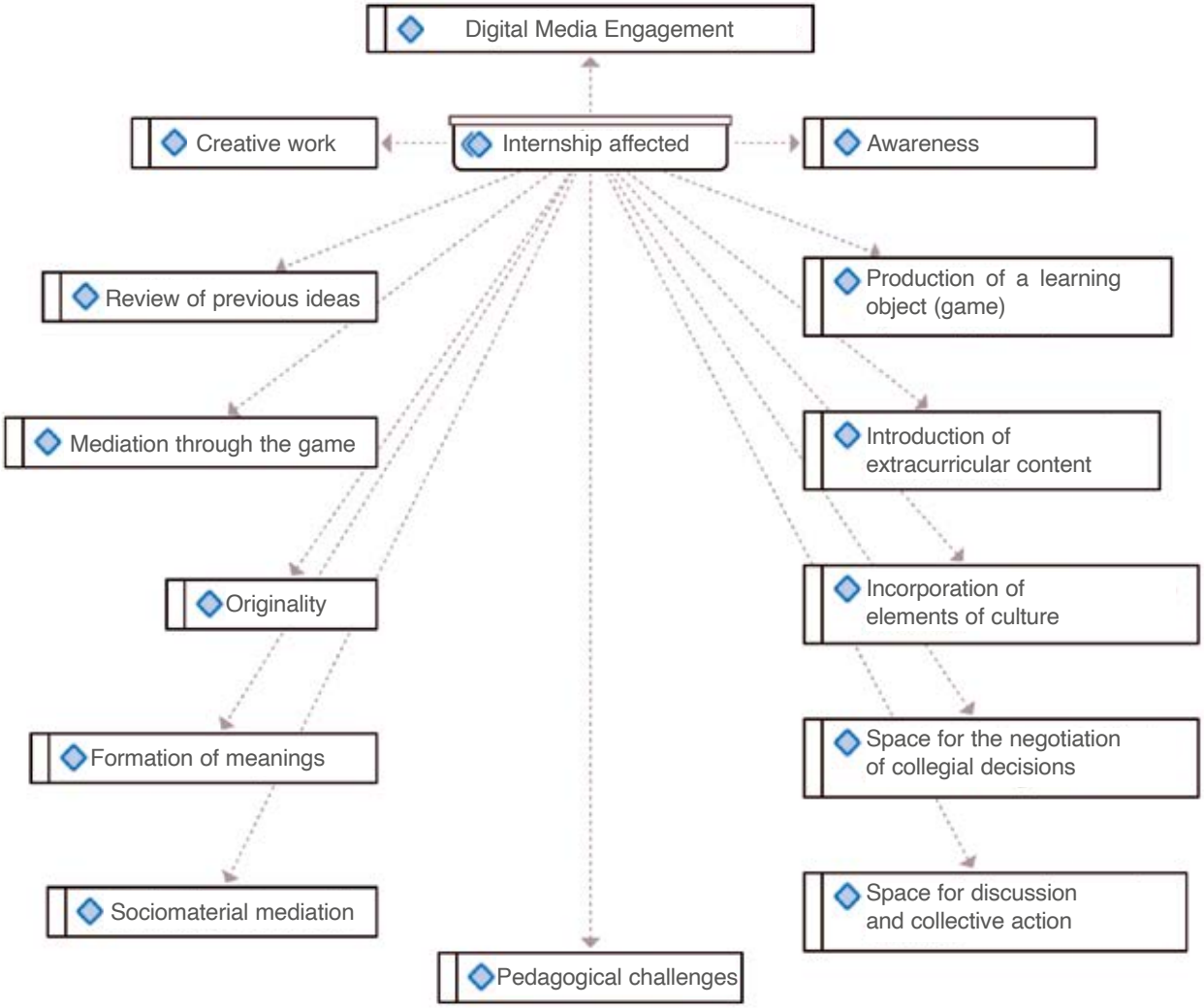
Figure 4. *Internships/curricular practices concerned and their constituent elements*



4. Discussion and conclusions

The first aspect to be highlighted among the results presented in the previous session refers to what appears in the socio-material network of Figure 2, and which shows the impossibility of dissociating the material aspects from the social aspects in the socio-formative processes. By reviewing the mapping present in that network, it is possible to identify numerous associations between the participants who produced the configuration and conditions of existence for the curricular internship in the initial training of physics teachers. In this case, a simple example involves SARS-CoV-2 in the network, which forced to comply with procedures of health surveillance such as the use of masks and social distancing, the reformulation of academic procedures and the own biannual calendar of initial training, the establishment of a teaching modality based on the mediation of information communication technologies, the flexibility of the procedural forms of teaching practices of teachers in training during their performance in the field of internship, etc. However, the heterogeneity of the training course does not end there, because it relates to the other participants, giving rise to pedagogical beings such as: 'graduate-*game*', 'Construct-graduate/undergraduate student', 'teaching-legislation plan', '*game*-high school students', 'teachers-researchers-TICD', 'graduates/undergraduate students-supervising teacher', etc. Therefore, what was underway was the construction of a society that brought together (Latour,

2012) human and non-human materiality in an intertwined way that transcends an anthropocentric conception and makes visible that forms of teaching/learning have a socio-material quality (Coutinho et al., 2 2014; Fenwick, 2014; Lima, 2022; Melo, 2011; Sørensen, 2009). Hence:

> [...] the idea is not to separate people from things, recognizing and emphasizing the participation of non-humans in the course of actions [...] [Thus, non-humans] help to stabilize, mediate, shape, articulate, execute and give meaning to action. They even help us to form identities. In this sense, 'we' (human beings) are a hybrid collective, which does not exist without things. (Coutinho et al., 2016, p. 387)

It is necessary to draw attention to the fact that the conformation of the reality produced and studied did not occur in a linear way. On the contrary, several contingencies were present throughout the curricular internship, which produced 'a social movement' and, therefore, found a place in the translations (Latour, 2017) co-produced by the heterogeneity of the associations. It is also necessary to avoid thoughts that might suggest an illusory stability of the research context, which—as a teacher-researcher—I integrated with other entities of the network. Alternatively, what was found was transience, fluidity, uncertainties and mutations as marks of the socio-material scenario investigated, which characterizes any group (Latour, 2012). In other words, the socio-materialist contribution of TAR allowed us to verify "[...] a multiplicity of heterogeneous materials connected in the form of a network that has multiple inputs, that is always in motion and open to new elements that can be associated in an unprecedented and unexpected way" (Melo, 2011, p. 178).

In this way, it is also worth noting that TAR -as a possible theoretical-methodological route to the field of education- expresses the idea that socio-formative processes are not configured without a non-human materiality, since this is essential to them (laboratories, legislation, textbooks and their reference content, furniture, buildings, etc.). In other words, TAR reveals a "[...] great diversity of things that are at stake in educational environments, provides the identification of non-human agencies, associations between different entities and the effects of these interactions" (Venancio et al., 2020, p. 5). This does not fall into the determinism of the non-human over the human but implies admitting that without non-human materiality it is not possible to produce education.

Another important aspect involves the mobilization that make up Figure 3 and that integrated the assignment of the curricular internship of graduates/undergraduate physics students. The initial traces of translations/transfers (Latour, 2017) associated with the period of the curricular internship date back to the moments of 'intervention planning' that would take place -on the part of the teachers in training and with the support of the teachers-researchers- in a rural school, where the supervising teacher worked in the teaching of physics to secondary students. This phase revealed: 1) a work of accommodation of ideas between peers, since "[...] the activity and the evaluation method of the intervention was discussed" (Graduating A); 2) negotiation and election procedures through which the students decided that they would perform an "[...] intervention that at the same time unites the concepts of Physics [... to be] studied by [the Secondary School...] students and also an initiative [to build a game that explored this] content, providing a different perspective [... of] teaching" (Graduating D); 3) the selection of a subject reference of Physics - in this case Electrostatic - with the aim of "[...] creating material that reflects the planning of the supervising teacher [of the internship]" (Graduating B); and 4) the construction of a list of tasks and its division among the teachers in training.

This first period of definitions triggered the "game planning", which involved a refinement of objectives, all aimed at the construction of that digital object for pedagogical purposes and involving:

> [...] need to bring the important concepts of electricity into a real context and [arouse the] interest of students, since the majority of these concepts are viewed in an abstract way, for example: 'calculate the electrical force in each charge located at the vertices of a triangle'. Exercises like this cause students discomfort, who ask themselves, 'Why do I need to know this? Where will I apply this in my daily life?' [These] questions [...] are extremely valid, after all, no one takes an electron and puts it on the tip of a triangle! So what skills and meanings can a student acquire from such an exercise? (Graduating B)

From this conception, theoretical elements from the references of digital games circulated in the

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network, which focused on: the elaboration of a narrative, the structuring of mechanics, the definition of technology and aesthetic parameters (Schell, 2011) that, when integrated, would consolidate the game. Objectively, the narrative produced presents planet Earth in 2070 and with deep ecological imbalances. With the aim of restoring satisfactory living conditions on the planet, scientists created a clock that gave humans special powers to become '*metamorph*' and, in doing so, save the Earth. To do so, the player would need to acquire the maximum powers available and store them on his watch, and this inventory would allow him to use electrical properties to act in favor of the planet. The game mechanics were created from the immersion and interpretation of contextual information, with the aim of achieving success in the analysis of situations (challenges) that would involve electrical principles present in a certain living being. These electrical skills would be anchored in concepts of Electrostatics presented and discussed previously by the supervising teacher of the internship with secondary students.

The definition of development technology and aesthetic elements of the game considered maximizing interactive possibilities for the player. Initially the project considered structuring:

> [...] a PowerPoint presentation [...] that had a lot of animated things, videos, gifs, among others [, plus a] form of assessment [... based ON] challenges, which would encourage the student to think which [...would be] the best animal to overcome a certain difficulty. (Graduating A)

However, the group of graduates realized:

> [...] that the interactive PowerPoint presentation did not provide all the resources needed for the [... intended] idea, so [... the group opted] to expand the project and migrate it to another digital platform: Construct 2. There it was possible to create and present the content in a real game format, increasing the interaction level of the audience with the project. (Graduate D)

Once again, it is necessary to emphasize the tension that non-human materiality had in the definition of the production of the game and in the directions in which the intervention in the rural school was consolidated. The passage quoted refers to the writings of Law (2012), which introduces the concept of 'proof of force', i.e., situations in which certain elements of a socio-material network are destabilized by other actors equally present in the network, generating a new space-time configuration of established associations. In other words, the limitations inherent to the Power Point environment for the implementation of the game affected the functioning of the project, destabilizing the network. The mobilizations undertaken by the actors to seek a new state of balance caused a kind of deviation from the route (Latour, 2000) in the planned actions, requiring the recruitment of a new actor for the network: the Construct 2. The result was the production of a new reality based on the inter-(actions) forged in the multiple associations between 'graduates-Construct-reference of digital *games*-content of Physics'.

Having reached a new status of provisional stability on the net, what could be seen in the empirical data was the effective "construction of the game" by the graduates. This means that, once again, the actors set themselves in motion, producing a collective and collaborative work that involved: 1) research and selection of content on "[...] an animal with electrical properties [...] with a view to the development of a] text about the animal and that seeks to find the narrative of the game" (Graduating C); 2) analysis and discussion "[...] of texts produced by colleagues to harmonize them better with [the narrative]" (Graduating A); 3) elaboration of challenges to include in the game to articulate the electrical properties of animals and concepts of Physics; 4) "[...] search for images and domain of public" (Grade D); 5) creation of animations and video edits to incorporate them into the phases of the game; 6) encoding of games on the Construct platform; 7) performing "[...] tests and corrections of problems" (Grade D); and 8) hosting and public availability of the game produced.3

For the discussion on the "affected curricular practice", which is outlined in Figure 4, it is worth remembering that the "affectation" is related to:

> [...] that which moves us, that motivates us, that is able to move us from an initial state of passivity to a state of action, of change, of (trans-)formation, of self-knowledge. A state in which we are receiving and producing significant actions, in which we are open to experiencing the new and, from there,

> build new connections with the world around us, signify it or even resignify it, in a process of experience and constitute ourselves through new experiences. (Souza et al., 2022, pp. 5-6)

The indicators presented in Figure 4 were listed by the teachers in training and observed during our presence in the network under investigation. It is argued that the set of elements systematized in the mentioned illustration suggests an 'affected curricular internship', since that space-time (Ribeiro & Lima, 2022) gave rise to an unprecedented experience for the group of graduates. This reinforces the perspective that the mediation of the teaching/learning process with games and/or from the construction of a game in that career was lacking. It also shows the formation of a curricular internship that assumed its identity from socio-material mediations, articulating digital media and other elements of contemporary culture. All this was aimed at stimulating the formation of meanings about teaching and learning from the construction of a game and the countless translations/transfers (Latour, 2017) involved in that dynamic. These aspects corroborate the premise that the formation of a network and the establishment of a collective work denote that the actors undertook movements that involved changes in their ways of action (Sismondo, 2010). In this sense, the creative and collective work that culminated in the construction of the game led to mobilizations that involved review/discussion of ideas and concepts, negotiation processes between peers to decide paths of new actions, awareness about the complexity of the design of games (Prado et al., 2020; Salen & Zimmerman, 2012; Schell, 2011) and the experience of overcoming pedagogical challenges (Lima & Nascimento, 2021).

Considering the insertion of the theme of games and its pedagogical incorporation into teaching/learning practices, it is reasonable to admit that every game includes a goal, and, from this, it can teach something. Symmetrically, the player who enjoys the game can learn something from the experience. From this perspective, the player-game association and its interactions constitute topics of interest (Latour, 2012) for the field of Education, after all: 1) can games be considered as learning objects in a digital school culture? 2) to what extent is it feasible/desirable to incorporate elements of game design -also considered as 'gamification' (Mendes et al., 2021)- in socio-training spaces oriented to motivation? 3) what successful experiences can be found in the scientific literature that provide reliable indicators of the relevance and pedagogical relevance of games? and 4) what are the limits? what does the act of teaching and learning through games entail?

Finally, the arguments presented throughout this article do not intend to delegate formative responsibilities exclusively to games, because it would be a serious mistake. We aim to promote teacher training that recognizes digital materiality - locked in a digital game, for example - as a powerful ally to compose new teaching/learning environments, revealing them and promoting inclusion in digital culture (Lima et al., 2020). This is definitely not a blind substitution of methods that can be seen as an educational panacea (Lima & Andrade, 2018). What is considered is the promotion of training initiatives designed pedagogically that value ethical, aesthetic, historical, curricular dimensions and, fundamentally, that provide opportunities for a better understanding of what it means to be in the world through teaching/learning with digital materiality.

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Notes

1. Due to the limitation of textual space imposed by the publication format of a scientific article, it is not possible to give details on "Focused Coding". However, the work of Thomas (2006) satisfactorily consolidates the understanding of this methodological procedure and is freely accessible at: https://bit.ly/3NpbMT7
2. The author of this article prepared an introduction to working with ATLAS.ti for qualitative data processing and is available in Virtual Communities (2020a, 2020b).
3. The game can be accessed at: https://bit.ly/41jxEFb

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Guideline to reflect on the education functions and improve their teaching

Pauta para reflexionar sobre la enseñanza de las funciones y mejorar su docencia

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Abstract

Teachers should have the competence to reflect on their own practice. The Ontosemiotic Approach offers as a tool for this purpose the "Didactic Suitability Criteria". The objectives of the research are to refine the indicators of epistemic suitability (ES) and to deepen the epistemic dimension of the meta-didactic-mathematical knowledge of secondary school mathematics teachers in initial training. To this end, research on the object function in secondary education has been examined. In a mixed way, we have analysed, in 119 "Master's Dissertation (MD) in Secondary Education Mathematics Teachers in service Training (Catalonia, Spain)" on functions, the reflection that future teachers make on their teaching, from the ES. Based on these analyses, the adequacy of the epistemic suitability for analysing the mathematical object function is designed. Finally, the MDs are reanalysed with this new guideline and it is found that their reflections present important weaknesses that could influence the quality of their instructional processes. It is concluded that if mathematics teachers were provided with a specialised guideline that makes it easier for them to consider all the meanings, representations and processes involved in the complexity of the functions, as well as the mathematical practices in which these emerge, it would improve the quality of the design, implementation, and reflection on their instructional processes.

Keywords: mathematics education, secondary education teachers in service training, initial teacher training, analysis of functions, epistemology, Didactic Suitability Criteria.

Resumen

El profesorado debe tener la competencia de reflexionar sobre su propia práctica. El enfoque ontosemiótico ofrece como herramienta para este propósito los "Criterios de Idoneidad Didáctica". Los objetivos de esta investigación son refinar los indicadores de la Idoneidad Epistémica (IE) y profundizar en la dimensión epistémica del conocimiento meta didáctico-matemático de los profesores de matemáticas de secundaria en formación inicial. Para ello se han examinado las investigaciones sobre el objeto función en la educación secundaria. De forma mixta, se ha analizado, en 119 "Trabajos Finales del Máster (MD) de Formación del Profesorado de Matemáticas de Secundaria (Catalunya, España)" sobre funciones, la reflexión que hacen los futuros profesores sobre su docencia, sobre la ES. A partir de estos estudios se realiza el diseño de la adecuación de la ES para analizar el objeto matemático función. Finalmente se reanalizan los MD con esta nueva pauta y se constata que sus reflexiones presentan importantes carencias que podrían influir en la calidad de sus procesos de instrucción. Se concluye que, si se dotara al profesorado de una pauta especializada que les facilite considerar todos los significados, representaciones y procesos involucrados en la complejidad de las funciones, así como las prácticas matemáticas en las que estos emergen, mejoraría la calidad del diseño, implementación y reflexión sobre sus procesos de instrucción.

Palabras clave: educación matemática, formación de docentes de secundaria, formación preparatoria de docentes, análisis funcional, epistemología, Criterios de Idoneidad Didáctica.

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1. Introduction

Several authors explain through different theoretical models what teachers must do in their profession (Shulman, 1987; Mishra & Koehler, 2006). Amaya de Armas et al. (2016) point out the importance of identifying the knowledge of a mathematics teacher. For this purpose, there is the model "Knowledge and Competence Didactic-Mathematics of the Mathematics Professor" (DMKC) of Juan Godino et al. (2017), which is a refinement of the theoretical model of Deborah Ball et al. (2008).

Regarding the didactic dimension, mathematics teachers must have the competence to reflect on the processes of mathematical instruction carried out, because it is a fundamental strategy for professional growth and enrichment of teaching. In the research about the importance of the reflection of teachers on their teaching practice are the action research of Elliot et al. (1993), Schön's reflective practice (1983) and the study of lessons of Hart et al. (2011). The "Criteria of Didactic Suitability" (CID) offered by the framework Ontosemiotic Approach to Mathematical Knowledge and Instruction (OSA) of Godino et al. (2007), is an instrument designed to order and structure the reflection of teachers articulating different criteria (epistemic, cognitive, interactional, mediational, affective, and ecological) being Didactic-Mathematical Knowledge (DMK) one of the elements proposed by the OSA, called meta didactic-mathematical knowledge (Breda et al., 2017).

It is important to note that CID has been applied in different teacher training processes in various countries, obtaining satisfactory results in terms of the development of teacher reflection to increase the teaching quality: Ecuador and Spain (Font et al., 2023), Chile (Seckel & Font, 2020), Costa Rica (Morales-López & Font, 2019), Panama (Morales-Maure, 2019), Peru (Garcés-Córdova & Font, 2022). The "Interuniversity Master of Secondary Education Teachers of Mathematics in Catalonia" considers the criterion that future teachers must perform teaching practices in educational centers during their initial training, and that it is necessary to reflect on them to obtain the great complexity of teaching and learning processes.

To achieve this objective, the students of the Master's course take a subject called Final Master's Work (MD) in which they analyze the Didactic Unit (DU) developed and implemented by themselves in the pre-professional internship. To perform this analysis, students use DSCs that have studied in another subject. Future teachers, based on analysis, redesign their DU by improving it.

As stated by Font (2011), one of the most important topics in secondary mathematics education is that of functions. They are nuclear because they are present in many modeling processes, and because of their epistemic richness and complexity.

In this paper we analyze the functions of Compulsory Secondary Education (ESO, because of the Spanish acronym) in the MD, and the reflection that teachers in initial training make when they analyze epistemically the DU they have designed.

1.1 Mathematical-didactic knowledge and competency model (DMKC)

In order to improve the training of mathematics teachers, Pino-Fan et al. (2015) propose a DMK model that explains and determines the knowledge of a teacher considering three dimensions: mathematics, didactics and didactic-mathematics goal. In this research we will focus on the third dimension.

Different theoretical constructs have been proposed in OSA to develop this meta-didactic-mathematical dimension, particularly for evaluating instruction processes in mathematics, being its essential tool the notion of didactic suitability. It is said that a teaching and learning process has a certain level of Didactic Suitability if it has certain elements that make it possible to assess it as suitable, in the sense of appropriate or optimal, for students to transform the institutional meanings intended or implemented by the teacher (teaching) into personal meanings (learning), considering the circumstances and means (environment) (Godino et al., 2006a; Godino et al., 2006b). Teaching suitability is defined from the following dimensions or DSC: ES, evaluates the quality of the mathematics taught; Cognitive suitability, evaluates the previous knowledge of the students and if the students have learned; Interactional suitability, evaluates whether interactions between teacher-learners and between learners contribute to the learning of mathematics; Mediational suitability, evaluates the management of time and the suitability of materials and other resources used; Affective suitability, evaluates the degree of motivation and

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interest of students during teaching and learning; Ecological suitability, evaluates the adaptation from the teaching and learning process to the curriculum, to the school's ideology, to the socioeconomic context and to the future (Font et al., 2010). The analysis we present in this paper focuses on ES.

The ES studies the representativeness of the different meanings of mathematical objects present in the instruction process. For example, in the case of teaching the functions of 4th of ESO, the aim is to reduce teaching to the operational aspect and its algebraic representation (low suitability) or to work different meanings of function, such as correspondence, relationship between variables, relationship between magnitudes, and their different representations, verbal, algebraic, tabular, graphical and iconic (high suitability).

Breda et al. (2017) establish a structure of components and indicators that guide and organize the analysis and evaluation of the educational suitability of the study processes of any educational stage. It is important to bear in mind that the components and also the indicators of DSCs have been set considering the principles, trends and results of research in Mathematical Education (Breda et al., 2018). Table 1 presents the components and indicators of ES.

Table 1. *ES components and indicators*

Components	Indicators
Errors	There are no practices considered to be mathematically incorrect. Good practices (without errors) are observed from the mathematical point of view.
Ambiguities	Unambiguous practices are observed... There are no ambiguities that can lead to confusion for students: clear and correctly stated definitions and procedures, adapted to the educational level to which they are directed; adequacy of explanations, checks, demonstrations to the educational level to which they are directed, controlled use of metaphors, etc
Richness of processes	The sequence of tasks includes the performance of relevant processes in mathematical activity (modeling, argumentation, problem solving, connections, etc.).
Representativeness	Partial meanings (definitions, properties, procedures, etc.) are a representative sample of the complexity of the mathematical notion (indicated in the program) Partial meanings (definitions, properties, procedures, etc.) are a representative sample of the complexity of the mathematical notion. For one or more partial meanings, a representative sample of problems. For one or more partial meanings, use of different ways of expression (verbal, graphic, symbolic...), treatments and conversions between them.

Note. Breda et al. (2017, p.1093).

1.2 Research on the notion of function in the framework of OSA

Several studies have been conducted on the concept of function in the theoretical framework of OSA (Amaya de Armas et al., 2016; Flores & Font, 2017; Parra-Urrea & Pino-Fan, 2017; Pino-Fan & Parra-Urrea, 2021; Ramos & Font, 2008; Sánchez et al., 2021). Our research is based on previous works to deepen on the epistemic aspect of the notion of function and the processes involved in its teaching and learning. We collect the lists proposed in these investigations, classifications and characterizations of the processes related with the components of the ES to complete the initiative of Pino-Fan & Parra-Urrea (2021), by designing a tool that adapts the DSCs to analyze, evaluate and improve the instruction processes of functions. This tool will enable the research of teachers' meta didactic-mathematical knowledge.

2. Methodology

This research is mixed, since quantitative, descriptive and qualitative methods are used. Using the strengths of both approaches increases the quality of research (Leite et al., 2021). The quantitative methodology is applied to the selection and quan-

tification of MDs that have developed their DU on ESO functions. However, the qualitative approach centered on the reflection of teachers in initial training predominates in this work. Thus, inductive categories of types of errors, ambiguities, richness of processes and representativeness of the complexity of the object and function worked in the ESO emerge from the analysis of the reflection that future teachers have included in their MD. The study, the comparison, and the generalization of these new categories have allowed us to design a specific tool for the planning, analysis and evaluation of the instruction processes of functions in the ESO.

2.1 Context and participants

The data refer to 119 MD on ESO functions of students coursing the "Interuniversity Training Master of the Mathematics Teacher of Secondary in Catalonia" from 2011-2012 to 2020-2021 academic year. The students of the master's degree carry out two practice phases in secondary schools. The aim of the first is for teachers in initial training to familiarize themselves with the school, the students and start working with the supervisor of the center in the DU that they must design. In the second phase, future teachers implement the DU they have prepared. Then, in the MD, they apply the DSCs to analyze the degree of Didactic Suitability of their own teaching practice and redesign the DU to raise the level of Didactic Suitability. When assessing ES, they reflect on errors, ambiguities, richness of processes and representativeness of the complexity of functions.

2.2 Design of the ES Refining Indicators for Functions (RIEF) tool

To design the RIEF we have adapted the steps of the thematic analysis prepared by Braun and Clarke (2006) structured in six phases. In the first step, a bibliographic study was made and the proposed indicators in Godino et al. (2006a), Pino-Fan & Parra-Urrea (2021) and Sánchez et al. (2021) were considered to make a first analysis of the MD; also, a list of indicators present in the reflections and proposals for improvement of teachers in initial training was elaborated from a triangulation of experts of the DSC tool. In the second step, from the two lists above, we have made a single listing. In a third step, we have classified the indicators by components of the ES criterion (errors, ambiguities, richness of processes and representativeness of the complexity of mathematical objects) and assigned an initial code according to the component to which it belongs (Ei), (Ai), (Pi) and (ROMi). In the fourth step, we have reviewed the indicators within each component. Some indicators were not in line with the assigned component. Some have been eliminated and others have been given a new category (appropriate didactic option (Oi), meanings (Mi), representations and conversions (RCi) and problem situations (Ti)). As seen, the category corresponding to the criterion representativeness of the complexity of mathematical objects has been replaced by three new categories: meanings, representations and conversions and problem situations. In the fifth step, we have worked on defining each of the indicators so that it is clear and operational. We have also reviewed the consistency within each category and globally of the entire tool. Finally, in the sixth step, we have structured the categories of indicators as a specialized guideline to reflect on the teaching of functions in secondary schools.

2.3 Analysis of MD using RIEF

In the first phase, a quantitative analysis of descriptive statistics is carried out. In particular, the absolute and relative frequency of MD is calculated, in which each of the RIEF indicators has been identified. It is distinguished whether it is present in the analysis of the planning and implementation of the DU or in the redesign. In the second phase, a qualitative analysis is performed from a triangulation of experts, which, from the evidence present in the MD, allows us to characterize the meta-didactic mathematical knowledge of its authors. We study how they help them to reflect on the indicators of the ES criterion and how the RIEF guideline facilitates a more guided, and therefore deeper analysis that would make more explicit the weaknesses and achievements of the instructional processes.

3 Results

In this research, three different levels of analysis have been performed. Thus, the results obtained in each of them are different. RIEF has been devel-

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oped first, then MDs are analyzed in a quantitative way and, finally, the MDs are analyzed qualitatively.

3.1 RIEF indicators

We have obtained the following adaptation of the ES in order to facilitate the analysis of the instruction processes in the secondary compulsory about functions.

3.1.1 Errors

(E1) "The error of using continuous curves for discrete functions is avoided" (Pino-Fan & Parra-Urrea, 2021, p.50). (E2) Definition error. (E3) Rendering error. (E4) Resolution or procedure error. (E5) Error in the proposition of a problem. (E6) Argumentation error.

3.1.2 Ambiguities

(A1) Metaphors are used consciously. (A2) Using notation to represent the function and image of a value in the table without specifying the two meanings. (A3) Dynamic function language. (A4) Language inaccuracy. (A5) Using notation to represent a point and a range without specifying the two meanings.

3.1.3 Appropriate didactic option

(O1) "To work with functions is not limited to the use of algebraic representations to avoid them to be perceived only as formulas and regularities" (Pino-Fan & Parra-Urrea, 2021, p. 50). (O2) The "belief that a change in the independent variable necessarily implies a change in the dependent variable" is avoided (Pino-Fan & Parra-Urrea, 2021, p. 50). (O3) "Functional relationships that are not graphable are presented to avoid the belief that every function supports a graphical representation" (Pino-Fan & Parra-Urrea, 2021, p. 50). (O4) "Functional relationships that do not have an algebraic expression associated with them are presented to avoid the belief that every function supports an algebraic representation" (Pino-Fan & Parra-Urrea, 2021, p. 50). (O5) "Functions are presented with explicit domains to avoid the belief that every function has a domain and a natural or real codomain" (Pino-Fan & Parra-Urrea, 2021, p. 50). (O6) 'Irregular' graphs are presented to avoid the belief that any graphically represented function has 'good behavior' (Pino-Fan & Parra-Urrea, 2021, p. 50). (O7) "Definitions and procedures consider arbitrariness and univalence as key features of the notion of function" (Pino-Fan & Parra-Urrea, 2021, p. 50). (O8) "The notions of domain and codomain are presented as inherent elements to the definition of function" (Pino-Fan & Parra-Urrea, 2021, p.50). (O9) "Fundamental statements and procedures relating to the notion of function appropriate to the educational level are presented" (Pino-Fan & Parra-Urrea, 2021, p. 50). (O10) When introducing the Cartesian reference system, account is taken to any confusion that may occur (O11). Students lack prior knowledge that hinders learning.

3.1.4. Richness of processes

(P1) Problem statements are read and interpreted correctly. (P2) Conjectures and propositions are stated. (P3) Argumentation: conjectures and procedures are justified. (P4) Definitions and procedures are institutionalized. (P5) Variables and quantities are identified. (P6) It is identified whether a relationship is functional and if so, the type. (P7) Algorithms, routines or calculations are applied. (P8) Generalization and abstraction processes are carried out.

3.1.5. Meanings

(M1) "Function as correspondence" (Pino-Fan & Parra-Urrea, 2021, p. 47). (M2) The function as a relationship between variables. (M3) "Function as a ratio between magnitudes" (Pino-Fan & Parra-Urrea, 2021, p. 47). (M4) "Function as arbitrary correspondence" (Pino-Fan & Parra-Urrea, 2021, p. 47). (M5) "The function from the theory of sets" (Pino-Fan & Parra-Urrea, 2021, p. 47).

3.1.6. Representations and conversions

Representation is mobilized: (R1) verbal. (R2) algebraic. (R3) tabular. (R4) graphical. (R5) The type is not specified.

Conversions between verbal (R6) and algebraic representation are promoted. (R7) verbal and

tabular. (R8) verbal and graphical. (R9) algebraic and tabular. (R10) algebraic and graphical. (R11) tabular and graphical. (R12) types are not specified.

3.1.7. Problem situations

The proposed problems (T1) activate the different meanings of function. (T2) mobilizes the different function representations and their conversions. (T3) 'in purely mathematical contexts to reinforce learning about functions' (Pino-Fan & Parra-Urrea, 2021, p. 50). (T4) where intramathematical connections are worked. (T5) 'contextualized from everyday life or other sciences' (Pino-Fan & Parra-Urrea, 2021, p. 50). (T6) of modeling. (T7) involving the different types of functions worked.

It is important to mention that the RIEF contains an appropriate *didactic option* category whose indicators do not correspond to ES but to the cognitive, but they are identified as errors or as ambiguities in the ES analysis of MDs; hence, these need to be taken into account in order to correct this trend. As indicated, three categories have emerged from the representativeness component of the complexity of mathematical objects (meanings, representations and conversions and situations) but, on the other hand, no propositions, procedures or arguments have emerged, elements that constitute epistemic configurations along with the three previous ones.

3.2 Results obtained from the quantitative analysis

Reflections on their own practice by authors of MD have been analyzed to identify which of the above indicators are used to propose improvements in their DU.

Table 2 shows the data collected in the analysis of the 119 MD participants in relation to the RIEF components and indicators identified in their reflections. We have counted the number of MD, where we reflect on each of the RIEF indicators (I) and in the aspects they are presented (design and implementation (D) and / or proposal for improvement (M) of the DU). In relation to the MD analyzed, X indicates that no reflection on the component has been found; F refers to the author of the MD, stating that it does not detect errors or ambiguities; V indicates that the will not to make errors or introduce ambiguities or enhance processes is made explicit. The data in column F indicate, for each category of RIEF indicators, the number of MDs that do not show any reflection on that category. The fourth and subsequent columns show the number of MDs where each RIEF indicator has been identified (see details of indicators in section 3.1).

Table 2. *Number of MDs reflecting on each RIEF indicator*

	I	X	F	E1	E2	E3	E4	E5	E6	V			
Errors	D	20	39	12	22	21	17	23	6	---			
	M	99	---	5	2	4	2	5	1	10			
	I	X	F	A1	A2	A3	A4	A5	V				
Ambiguities	D	56	3	30	5	32	27	3	---				
	M	88	---	16	1	5	3	1	12				
	I	X	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11
Didactic options	D	71	1	0	0	0	5	3	2	5	24	6	3
	M	110	0	0	0	0	1	0	0	2	2	3	2
	I	X	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	V		
Richness of processes	D	11	63	99	83	38	17	16	39	15	---		
	M	57	14	51	26	6	4	5	3	4	1		

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I	X	F	E1	E2	E3	E4	E5	E6	V					
Meanings	I	X	S1	S2	S3	S4	S5							
	D	45	19	42	51	13	41							
	M	101	2	6	4	2	4							
Representations	I	X	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
	D	13	63	97	97	99	7	43	45	43	48	49	53	27
	M	44	5	10	4	6	6	8	8	8	9	9	10	6
Problem Situations	I	X	T1	T2	T3	T4	T5	T6	T7					
	D	9	14	10	17	68	63	50	16					
		58	13	16	9	26	27	20	12					

From table 2 it is inferred that many of the RIEF indicators are not considered in the analyzes that have been made by future teachers about their implementations. This is more evident in the redesigns they have proposed.

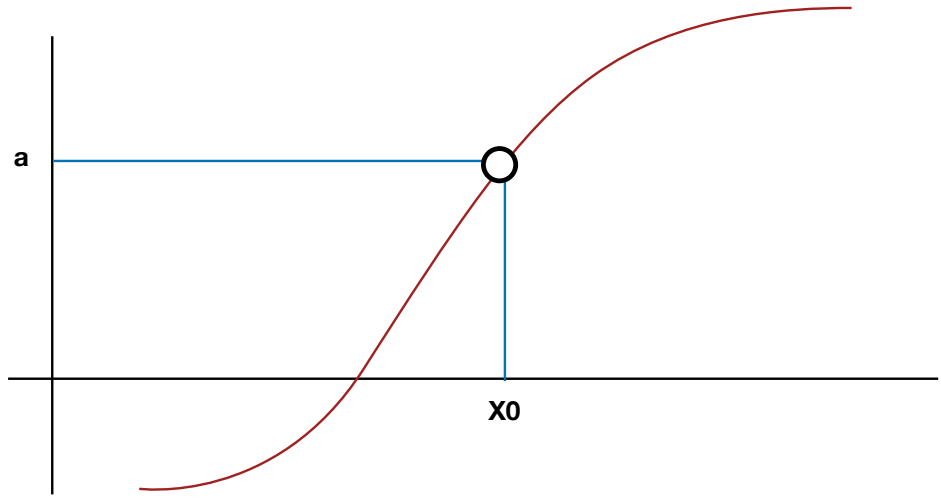
3.3 Results obtained from the qualitative analysis

The analysis of the reflection made by students of the master's degree in MD on ESO functions shows that the types of *errors* on which they reflect are mainly based on problem proposition (19%), definitions (19%) and representations (18%).

The types of *ambiguity* that are most reflected upon are the use of dynamic function language (27%) and the use of metaphors in a conscious way (25%). However, only 4% of future teachers reflect on the use of notation to represent the function and image of a value without specifying the two meanings. MD file 41937 describes the following ambiguity detected by the author in the implementation of DU.

> There was ambiguity in explaining the discontinuous functions, which we defined as those functions whose graph cannot be drawn without lifting the pen from the paper. This definition caused confusion when we drew a discontinuous function in which the point of discontinuity was identified by a circle [...]. Some students said that at no time did the pencil rise to continue drawing the whole function, as they went around the circle, and therefore it was not a discontinuous function.

Figure 1. *Discontinuous function?*



Note. MD file 41937 (Authors' translation).

The most appropriate *didactic option* in the reflection of MD refers to the adequacy to educational level (20%). The most used process is the enunciation of conjectures and propositions (83%), followed by the justification of conjectures and procedures (70%). Most future teachers recognize a lack of this type of process in the design and implementation of their DUs and 52% introduce them in their proposals for improvement. The author of MD file 21708 justifies the presence of these processes. This is how the argument is evidenced in the DU:

> The activity displayed the graph of a function on a few coordinate axes. The goal was to choose which sports (from a list) could be represented with that graph. Students were forced to argue and support their answers (MD file 21708, authors' translation)

The most common *meanings* in the reflections of the MD are the function as relation between magnitudes (43 %), relation between variables (35 %) and the theory of sets (35 %), although only 24 % of the authors who reflect on the meanings when analyzing their DU do so in their proposals for improvement. 89 % of the MD reflect on the representations and conversions component. It is in this component that there is more evidence of a more detailed analysis. Here is the author's reflection on MD file 11402:

Figure 2. *Conversions between representations*

From \ A	Table of values	Verbally	Graphically	Symbolic Expression
Table of values		NO	YES	NO
Verbally	YES		YES	YES
Graphically	YES	NO		NO
Symbolic Expression	NO	YES	YES	

Note. MD file 11402 (translation by the authors).

> As seen in Figure 2, we work on almost all the ways of representation and in all directions. The way we worked the most was to go from the verbal form to the other three forms of representation. And the one that we used the least was the symbolic expression and its conversion to the others, since the students of 1st year of ESO had not studied algebraic expressions. We can say that we work in 6/11 of the possible directions. (MD file 11402, authors' translation)

The *problem situations* component is the most present. 92% of the works contain reflections on some of its indicators. The most studied is the presentation of problems where intramathematical connections are worked (57 %) and it is followed by the presentation of contextualized problems (53 %).

It is very common that the analysis of the mathematical processes worked is limited to indicate which of the described in the following figure 3 have been present in the design and implementation of the DU. Some authors justify citing some activities as an example, but without more concreteness or deepening. The author of MD file 21913 makes a good analysis from the guideline contained in Figure 3, but since this guideline does not consider the mathematical objects being worked, it is generalist, unrefined and is not enough for teachers to verify precisely what kind of processes are promoting and which learning situations make these processes emerge.

> There have been many processes present in the DU, which is why I consider it to be a DU rich DU in processes and suitable for the 2nd level of ESO. (MD file 21913, translation by the authors)

We can also observe that the percentage of MD that reflect on an indicator when assessing the planning and implementation of the DU is higher than those that use it to justify the proposed improvements.

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Figure 3. *Analysis of mathematical processes*

Process and/or Competency	Description	Showed in the DU
Communication	Be able to express learned concepts, ideas, and reasoning.	Yes, from sharing discovery activities and discussions/topic that we did at the beginning of the class to review concepts. We must be more aware of the students who participate and the students who find the topic more difficult.
Exploration	Discover concepts by themselves, exploring the solution possibilities.	Yes, in self-discovery activities.
Formalization	Use the formal language of mathematics.	No. The definitions were created by the students, and while they were corrected and debated, formal language was not used.
Argumentation	Reason and support the statements made.	Yes, it was a key point in most activities.
Problem solving	Solve a non-immediate problem that requires a complex process.	Yes, but not too much. Most of the activities represented small challenges, but they did not become problems. The most intense problems were those of self-knowledge.
Algorithmization	Mechanize a process.	Yes. They were asked to write their own theory, which included the next steps.
Contextualization	Search for the mathematics present in reality.	Yes. Many activities were done in close contexts, such as the institute, hobbies, etc. However not enough importance was given, and it would be good to encourage more the search for mathematical relationships in the reality.
Representation	Use graphs and symbols to express mathematical ideas.	Yes. Especially when working with Cartesian coordinates and function graphs.
Collaborative work	Dialog with colleagues and share ideas to create knowledge.	Yes. Most of the activities were carried out in groups, and much importance was given to collaboration between students.
Modeling	Describe the environment in a mathematical way; model real situations with the mathematics learned.	There was only one exercise in which the students performed the whole modeling process, most of them collected the data and represented it, but they did not come up with any model that would describe it.

Note. MD file 21913 (Authors' translation).

4. Discussion and conclusions

In the initial study of the MD, primary objects, meanings, representations and conversions and situations have emerged from the reflection of teachers in initial training, but, on the other hand, other primary objects, such as propositions, procedures and arguments, also present in the Representativity of Complexity component, have not emerged. Why they have not emerged? Because there is a lack of depth in the reflection of future teachers regarding the propositions, arguments and procedures. The scientific literature contains the following elements that are related to the propositions, procedures, arguments of the notion of function: a) "the procedures consider arbitrariness and univalence as key characteristics of the notion of function"; b) "fundamental statements and procedures related to the notion of function are considered adequate at the educational level" and; c) "situations are promoted in which students must justify their conjectures and procedures" (Pino-Fan & Parra-Urrea, 2021, p. 50). These are not explicit in the MDs we have analyzed.

The fact that only the MD of future teachers is a source of data is one of the limitations of this study. In order to better understand the meta-didactic mathematical knowledge of teachers, it would be necessary to conduct case studies of new teachers and alumni

of the master's degree, when they reflect on their own teaching practice using the RIEF. To do this, we would analyze their reflections, make classroom observations, and interview them to learn more about their meta-didactic mathematical knowledge.

In the analysis of the reflections of the MDs on functions for ESO, it can be stated that evidence has been obtained from almost all the RIEF indicators (Table 2), to a greater or lesser extent. However, by going into detail in each MD, it is observed that, when participants review the DU they have designed and its implementation, the guideline— DSCs (Table 1) and a guideline referring to processes (figure 3) — help them reflect (Esqué de los Ojos & Breda, 2021). However, since this is not a specific guideline for the ES of functions (as is the RIEF), the participants do not take into account in their analysis most of the RIEFs. It is found that their reflections have important shortcomings that could influence the quality of their instructional processes.

Failure to consider some of the RIEF indicators may be due to a lack of extended mathematical knowledge of teachers in training as shown by Batista et al. (2022). The use of RIEFs would help to improve this type of knowledge about functions.

Although the literature review indicates that the work that applies DSC as a theoretical-methodological tool has increased in recent years (Malet, 2022), new contexts of use and refinement of the components are needed to analyze teaching processes of specific mathematical topics (Araya et al., 2021; Breda et al., 2021; García Marimón et al., 2021; Piñero-Charlo et al., 2021). Consequently, if teachers were given with tools such as the RIEF, the reflection on their own practice could be improved, since they would have a specific guideline to carry out a more rigorous, clear and efficient analysis. As indicated by Pino-Fan & Parra-Urrea (2021):

> Proper teaching processes about functions require that teachers understand their historical evolution, i.e., that they understand the holistic meaning of the object (its richness of meanings and how to work and promote them) to have a broader and deeper vision of the notion of function. (p. 48)

Therefore, using the RIEF would not only contribute to improve their teaching practice, but would enable a greater meta-didactic-mathematical knowledge of those who use it.

The results of this research show that as educational levels progress, there are new mathematical notions associated with function analysis (slope, continuity, monotony, concavity, etc.), for which it is also necessary to develop a refined tool.

The training courses of future teachers could be enriched with a module in which the RIEF is taught to improve their knowledge of functions by considering all the meanings, representations, processes involved in the complexity of functions and mathematical practices in which these emerge. And they would also delve into the kind of reflection required to design, implement, and reflect on their instructional processes.

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Educational experience on modelling for Panamanian mathematics teachers

Experiencia educativa en modelización para docentes de matemática en Panamá

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Abstract

Internationally, mathematical modelling has been gaining an important space in educational curricula, this is why the teaching of this process has been included in educational programmes for mathematics teachers. Due to this importance, in this study, an educational experience on modelling for practising secondary education mathematics teachers from the Panamanian school system is reported, whose objective is to analyse the solving procedures of these teachers to modelling problems and classify these solving procedures. The context is the Diploma Course in Mathematics Education Applied to Secondary Education, taught by the University of Panama, which included a submodule on modelling. The "modelling cycle from a cognitive perspective", which was taught in the submodule, was used to analyse the solving procedures for three problems posed to the participating teachers, through the written productions that they uploaded to the virtual platform of the diploma course. Four solving procedures could be identified in the 40 productions analysed, which varied from not totally understanding the wording of the problems to developing a whole modelling cycle. With these results, it is intended to provide a first overview of the teaching and learning of modelling in the Panamanian context and to lay the foundations for possible curricular adaptations to mathematics teaching.

Keywords: diploma, teacher education, mathematical modelling, Panama, mathematics teachers, practising teachers.

Resumen

A nivel internacional, la modelización matemática ha ido ganando un espacio importante en los currículos educativos, razón por la cual la enseñanza de este proceso ha sido incluida en los programas de formación de profesores de matemática. Dada esta importancia, este estudio reporta una experiencia educativa sobre modelización para profesores de matemática de educación secundaria en servicio del sistema escolar panameño, cuyo objetivo es analizar los procedimientos de resolución de estos profesores a problemas de modelización y clasificar dichas resoluciones. El contexto es el Diplomado en Educación Matemática Aplicada a Secundaria, impartido por la Universidad de Panamá, el cual incluyó un submódulo sobre modelización. El "ciclo de modelización desde una perspectiva cognitiva" que se impartió en el submódulo, se utilizó para analizar los procedimientos de resolución a tres problemas planteados a los profesores participantes, mediante las producciones escritas que cargaron a la plataforma virtual del diplomado. Se pudieron identificar cuatro procedimientos de resolución en las 40 producciones analizadas, que fluctuaban desde no comprender totalmente el enunciado de los problemas hasta desarrollar un ciclo completo de modelización. Con estos resultados, se pretende aportar una primera visión general sobre la enseñanza y el aprendizaje de la modelización en el contexto panameño, y sentar las bases para posibles adaptaciones curriculares a la enseñanza de la matemática.

Palabras clave: diplomado, formación de profesores, modelización matemática, Panamá, profesores de matemática, profesores en servicio.

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1. Introduction and state-of-the-art

One of the competencies that allows individuals to be able to link their mathematical knowledge to the needs and demands of the 21st century is mathematical modeling (Maass et al., 2022). In this sense, it is required to prepare teachers with the right competencies for modeling and, thus, educate students in skills to develop this process (Blum & Borromeo Ferri, 2009). While there is a discussion in the literature on how to define *competence in modeling* (see Kaiser & Brand, 2015), on the one hand, this process is considered as one of the axes for problem solving in the international evaluation PISA (Organization for Economic Cooperation and Development, 2019) and, on the other hand, there is a consensus that working with modeling brings a number of benefits for mathematical learning (Blum, 2011).

Given this growing interest in modeling at the international level, this study aims to provide a first overview of a pioneering educational experience on modeling for mathematics teachers at the Panamanian school system. This continuing education program, developed in 2022, recognizes the importance of integrating modeling as a fundamental part of teaching mathematics in Panama. It is necessary that teachers include, among other relevant processes of mathematical activity, modeling in their classes, for which this program decided to incorporate their teaching to active teachers.

1.1 Mathematical modeling

Mathematical modeling briefly describes the translation of a real problem into mathematics and its results back to reality (Pollak, 2007). In the specialized literature, different cycles have been proposed to analyze the modeling process (Borromeo Ferri, 2006) and different perspectives have emerged on its implementation (Preciado et al., 2023). This study uses the "modeling cycle from a cognitive perspective" (see figure 1), proposed by Borromeo Ferri (2018), which is framed in the realistic perspective of working with modeling (Abassian et al., 2020).

The choice of this cycle for this research is justified by (a) the authors' previous experience in theoretical works (see Ledezma et al., 2023) and (b) its use is part of the educational experience reported in this article. To explain the operation of the cycle of Figure 1, the *Problem Sugar Loaf*, which was presented during this educational experience, is used as an example.

> **Sugarloaf:** The Sugarloaf Cable Car takes approximately three minutes to travel from the station in the valley to the foot of Sugarloaf Mountain in Rio de Janeiro. It moves at a speed of 30 km/h and covers a height difference of approximately 180 meters. The chief engineer, Giuseppe Pelligrini, preferred to walk better, as he did in the past, when he was a mountaineer. First, he ran from the valley station across the vast plain to the mountain, and then climbed it in 12 minutes. What is the distance, roughly, that Giuseppe had to run from the valley station to the foot of the mountain? (adapted from Blum & Leiß, 2007, p. 224)

The *real situation* is given by the statement of the *Problem Sugarloaf*, in the form of a text with an image. Through their understanding, there can be a *mental representation of the situation* which involves, for example, establishing relationships with holidays and tourist sites (*extra-mathematical knowledge*), in order to understand what the problem requests (the distance between the valley station and the foot of the mountain). This *mental representation* must be simplified and structured in order to obtain a *real model* that represents the *real situation* posed; in this case you can simplify the mountain and cable as segments, and the cable car as a point, and then structure these simplifications in a drawing. The *mathematical model* takes into account the mathematical objects that allow explaining the *real situation* posed; in this case, the Pythagorean theorem can be applied. From the work with this *mathematical model* are obtained *mathematical results*, which must be interpreted in the context of the *real situation* to obtain real *results*; in this case, approximately 1.49 kilometers are obtained. But does this answer make sense in the context of the *Sugarloaf Problem*? One way to validate these *real results* would be by using a mapping application to measure distances at the actual location of Sugarloaf in Brazil.

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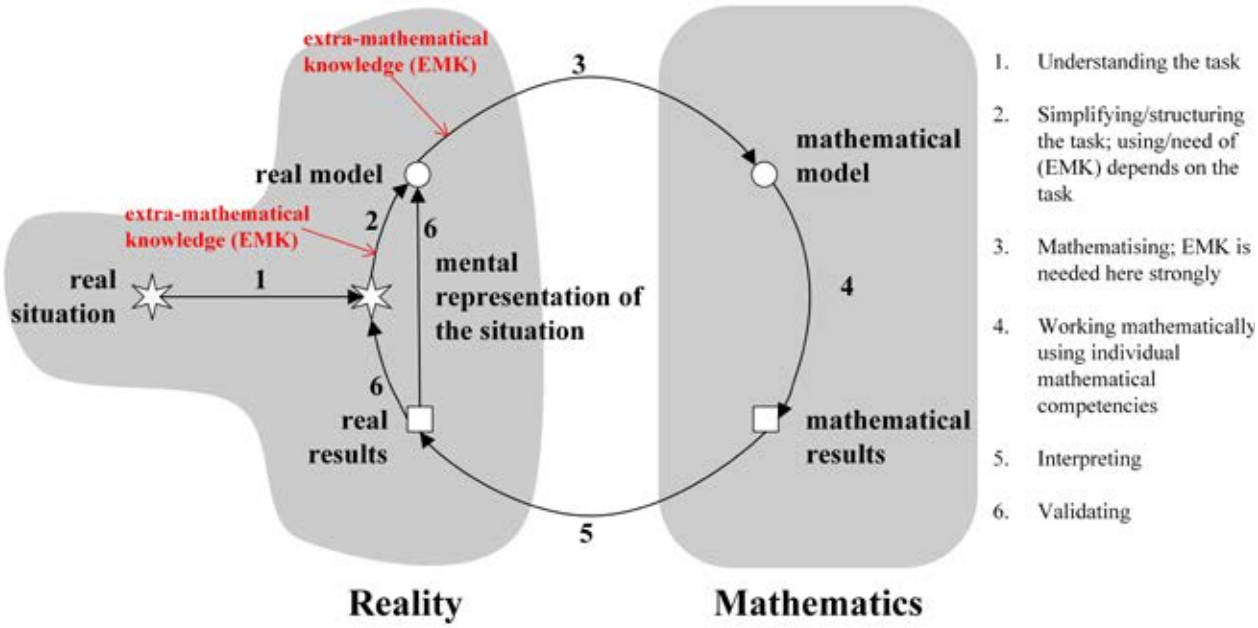
Figure 1. *Modeling cycle from a cognitive perspective*



Note. Adapted from Borromeo Ferri (2018, p. 15).

The modeling process should not be understood in linear terms, but as a cycle, because both the context of the *real situation* and the mathematical aspects involved in its resolution can affect the *mathematical model* and the mathematical work with it (Blomhøj, 2004; Borromeo Ferri, 2007). The work with classroom modeling is usually carried out in small groups of students, who are asked a situation-problem that must be mathematized (Doerr & English, 2003; Shahbari & Tabach, 2019). This problem-situation, known as modeling problem, must meet certain characteristics (Borromeo Ferri, 2018): it must be open and complex, whose resolution is not limited to a specific answer or procedure, and where students must search for the relevant data; it must also be realistic and authentic, adding elements taken from the real world and presenting a situation consistent with an event that has occurred or that can occur in reality (in Palm terms, 2007); finally, it must be a *problem* (in Schoenfeld terms, 1994) that is resolvable through of a modeling cycle, which implies the development of all the phases that make up this cycle. Along with the above, modeling problems tend to have different paths to obtain a plausible and coherent solution in the context of the *actual situation* posed (English, 2003; Lesh & Doerr, 2003).

1.2 Mathematical modeling in teacher education

Given the relevance of this process, several studies have addressed the teaching of modeling for teachers, both in training and active.

One line has focused on the knowledge and competencies of mathematics teachers. In the Austrian context, Kuntze et al. (2013) study teachers' self-perceptions about their *pedagogical content knowledge* (PCK [Shulman, 1986]) related to modeling, considering both the PCK needed to help their students during the modeling process in the classroom, and what they think about their own professional development at the university level. By applying a questionnaire to 38 teachers in training and 48 teachers in service, the results showed a need for professional development that not only covers the PCK on modeling, but also the teaching of strategies for the pedagogical self-efficacy of teachers when implementing this process, for example, using technological tools. Likewise, in the German context, Greefrath et al. (2022) study the facets of professional competences for teaching modeling (see Blum, 2015), specifically those related to knowledge about modeling tasks and classroom interventions. These authors report the results of a 12-session

seminar taught to three groups of future professors from different German universities, in which the improvement of the PCK on modeling of the participating subjects was evidenced. In the Spanish context, Ledezma et al. (2022) study the knowledge and beliefs about modeling of a future teacher from the analysis of the argumentation. In this study, the authors infer these knowledge and beliefs using the model of Knowledge and Didactic-Mathematics Competencies of the Professor of Mathematics (Godino et al., 2017), which they apply to the reflection made by the future teacher in his final work of master (see other studies in this line in Batista et al., 2022).

In the Singaporean context, Ng (2013) tackles the problem of the scarce efforts to incorporate modeling tasks in schools, even though the national curriculum introduced this process in mathematics teaching in 2003. To this end, we compare the results of the implementation of two modeling courses for primary school teachers with no previous experience with this process: one with 48 teachers in service (from a previous study [Ng, 2010]) and another with 57 teachers in training (the current study [Ng, 2013]). In both courses, teachers had to solve the *task Youth Olympic Games* (adapted from English, 2013). The results show the similarities and differences between both groups of teachers when solving the proposed task, suggesting a working method for the Singaporean context, that includes teachers in training and in service when addressing the teaching of modeling.

In the American context, Manouchehri (2017) reports on efforts to assist a group of active mathematics teachers to develop knowledge on modeling and its implementation in the school curriculum. The implementation context was a 25-hour professional development course, where 85 teachers worked on modeling tasks and discussed their implementation. This study reports the results of 25 teachers who participated in the course, where it was evident a growth in their knowledge about modeling from the mathematical challenges (construction and work with the mathematical model), pedagogical (strategies to develop this process in the classroom), and epistemological (obstacles during the modeling process) that they had to face.

In the case of this study, we report a pioneering educational experience with active mathematics teachers in Panama. Panama's school system is formed by the levels of Basic General Education (students aged 4-15 years) and Middle Education (students aged 15-18 years). In this context, the University of Panama, in collaboration with other foreign universities, implemented two diplomas for active professors of both educational levels during 2022: "Didactic Strategies for Teaching Mathematics" (EDEM Diploma) for Basic General Education, and "Mathematics Applied to Secondary Education" (EMAS Diploma) for Secondary Education. The objective of both graduates was to expand the pedagogical skills of mathematics teachers. This research focused on the EMAS Diploma, where one of the topics addressed was mathematical modeling.

1.3 Objective and research question

The approach of the research question on the results of this pioneering educational experience developed in the Panamanian context is the following: What are the procedures for solving modeling problems by active mathematics teachers participating in the EMAS Diploma? To answer this question, the modeling cycle represented in Figure 1 was used to analyze the resolution procedures to three problems posed to teachers during a sub-module of this diploma. These resolutions were classified according to the phases and transitions identified in their written productions. Finally, we reflect on these results and their possible implications for future implementations of this diploma in the Panamanian context.

The relevance of this study lies in two areas. On the one hand, it addresses a topic that has not been explored enough in the Panamanian context, such as the education of active mathematics teachers on modeling. Although there are different investigations on education of mathematics teachers in Panama, mainly based on the experience of the EDEM Diploma (see García-Marimón et al., 2021; Morales et al., 2019), these focus on the development of teacher reflection using the construct Criteria of Didactic Suitability (Breda & Lima, 2016). Although the national curriculum documents of Panama do not include a systematic work with modeling for the teaching of mathematics (see Ministry of Education of Panama, 2014a, 2014b, 2014c), the EMAS Diploma does include this process as a relevant subject to teach, since current trends that promote the inclusion of modeling in the processes of teaching and learning mathematics are assumed. On

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the other hand, the University of Panama, responsible for teaching these diplomas, is considered as a reference in teaching and research at the Central American level (García-Marimón, 2023; Morales-Maure, 2019). Therefore, this educational experience can be replicated in other countries of the region due to the existing sociocultural similarities.

2. Methodology

For this study, a qualitative research methodology was followed from an interpretative paradigm (Cohen et al., 2018). This section describes the methodological aspects.

2.1 Context of the investigation

This research was developed in the context of the EMAS Diploma, taught by the University of Panama during the period May-October 2022, with a total duration of 320 hours. The objective of this diploma is to contribute to the continuous professional development of mathematics teachers in Panamanian secondary education, which includes the design, implementation, evaluation, and improvement of mathematical teaching and learning processes, with theoretical support in the construct Didactic Suitability Criteria. In the 2022 EMAS Diploma course, 113 teachers from different areas of the country participated, who were grouped in the four virtual rooms of the online platform designed by the University of Panama by a teacher trainer. This program consisted of six modules taught in hybrid mode: (a) Introduction to Mathematics Education; (b, c, d) Didactics of Mathematics I, II, and III; (e) Social, family, and educational contexts; and (f) Reflection on the own practice. At the end of this program, the participating teachers received a certificate of completion of the course. The EDEM and EMAS Diplomas are pioneering educational experiences in the Panamanian context, which are not only supported by a government research project awarded by the University of Panama, but also by academics from foreign universities (especially from Spain and Hispanic America).

2.2 Sub-module on mathematical modeling and a priori analysis of modeling problems

Within the module "Introduction to Mathematical Education" is the submodule "Mathematical modeling". Due to the hybrid modality of the diploma, the participating professors could access a general explanation on the virtual platform about what modeling is and four problems of this type that they had to solve. The follow-up of this remote work was developed by the teacher trainer in charge of each virtual room. Along with this explanation, a lecture was given at the beginning of this sub-module to the participating teachers and trainers of the diploma, where the explanation on modeling available on the platform was expanded. In this lecture (which lasted 90 minutes), the speaker (the first author) began by explaining what is meant by mathematical modeling, what characterizes these types of problems, what strategies of working with this process are suggested to be followed in the classroom, and how the resolution of a modeling problem (the *Sugar Loaf Problem* in subsection 1.1) can be analyzed using the cycle of Figure 1. These problems are presented in Table 1, together with the *a priori* analysis of each one, in terms of the modeling cycle considered as the theoretical benchmark of the study.

While these modeling problems were discussed during the conference, the participating teachers had to solve them autonomously and upload their resolutions and responses to the virtual platform designed for the EMAS Diploma. Subsequently, the teacher-trainer in each virtual room provided feedback on the resolutions for the three problems.

Table 1. *Modeling issues raised during the EMAS Diploma*

Statements of problems		
Hay bales problem: To the end of summer, you can see mountains of hay bales in the countryside like the ones in the picture. The bales are arranged so that five are placed at the base, four in the next row, then three, two, and finally a ball of hay on the cusp. Try to find the height of the hay-bale mountain. (Adapted from Borromeo Ferri, 2018, p, 14)	Meanders Problem: In the Yamal Peninsula, northwest of Siberia, a series of active and abandoned meanders can be seen from the air in big rivers. The most recent sediments deposited in the convex parts of the meanders are shown in class color. What is the approximate length of the river with sediment? (Authors' Archives)	Boston Light Problem: In Massachusetts Bay there is a lighthouse called Boston Light, which was built in 1716 at a height of 31 meters. Their beacon was intended to warn ships approaching the coast. How far, approximately, was a ship when it first saw the light of the lighthouse? (Adapted from Borromeo Ferri, 2018, p. 106)
A priori analysis		
A *mental representation of the situation* involves, for example, establishing relationships with the field and hay bales (*extra-mathematical knowledge*), in order to understand what the problem requires (the height of the hay bales mountain). To build a *real model,* you can simplify the hay bales as circumferences of 1.5 meters in diameter and the woman as a segment of 1.7 meters straight (both by estimate), and then structure these simplifications in a drawing. In this case it is possible to apply the addition of hay bale heights as a *mathematical model*, which would give the *real result* a mountain of 6.75 meters high.	A *mental representation of the situation* involves evoking images of rivers and their sinuous behavior (*extra-mathematical knowledge*), in order to understand what the problem requires (the approximate length of the river with sediments). To build a *real model,* meanders can be simplified as semi-circumferences on a straight segment that crosses the river image with sediments, estimating a linear length of 30 kilometers (from the observation of maps), and then structuring these simplifications in a drawing. In this case, the addition of semi-circumference perimeters can be applied as a *mathematical model*, which would give as *real result* an approximate length of the river of 47 kilometers.	A *mental representation of the situation* involves, for example, establishing relationships with the coast, the lighthouses, the ships, and the horizon (*extra-mathematical knowledge*), in order to understand what the problem requires (the distance from where a ship first saw the light of the lighthouse). To build a *real model,* you can simplify the Earth as a radius circumference 6,371 kilometers, the lighthouse as a 31-meter segment of line, and the ship as a point, and then structure these simplifications into a drawing. In this case the Pythagorean theorem can be applied as a *mathematical model*, which would give as a *real result* an approximate distance of vision of 20 kilometers.

2.3 Collection and post-hoc analysis of modeling problems

Since the second and third authors of this article are academics involved in the design and coordination of the implementation of the EMAS Diploma, they had full access to the virtual platform where the participating professors uploaded their resolutions and answers to the three applied modeling problems (instruments). To this end, the participating teachers were asked to record, in the most orderly and explicit way possible, all their resolution procedures and not only their responses to these problems (data). In this way, the participating teachers could upload their written productions to the EMAS Diploma virtual platform in the form of scanned documents or prepared with a text processor.

Once the written productions were collected, they were labeled according to the group to which they belonged (G1 to G4) with a number for each one (P01 to P29). For example, production G2.P07 corresponds to number 7 in group 2. Out of these collected productions, two considerations must be taken into account: (a) of the 113 participating teachers, 40 of them uploaded their written productions to the virtual platform; (b) of these 40 participating teachers, not all solved the three modeling problems posed. Therefore, the *ex post* analysis of the resolution procedures of the participating teachers was carried out from the 40 productions collected and consisted of: first, identifying the phases of the modeling process in the resolution procedures to each of the three problems raised, from the *a priori* analyzes of Table 1; second, classifying these productions into four categories that could be established from the resolution procedures identified, based on the phases of the cycle of Figure 1, which are described and exemplified in the following section. Thus, it is possible to have a first general look at the results of this pioneering educational experience in the Panamanian context.

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3. Results

This section presents the results of the study according to the four resolution procedures identified in the productions of the participating teachers.

3.1 Resolution procedure 1 (PR1)

The first resolution procedure identified corresponds to those productions where the participating teachers did not show a complete understanding of the problem statement and/or only provided a description of how it could be solved. The following examples of PR1 are given:

> d = Diameter of the plate. The height of hay piles would be A = 5d. (*Hay Bales Problem*; G1.P22 Production)

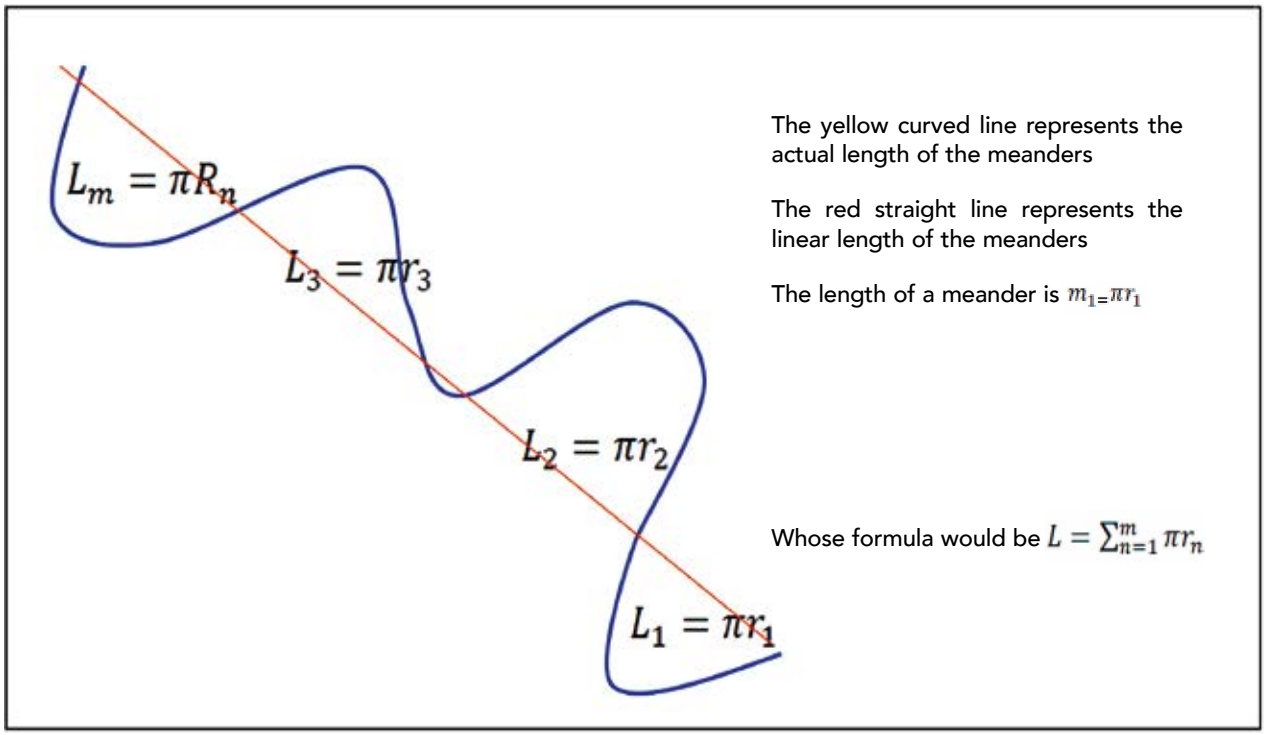
> The distance between two points d = Square root of the first point squared plus the square of the second [*sic*] is calculated with a formula. (*Meanders Problem*; G3.P23)

> The ship must be at a distance from the base of the headlamp equal to the height of the headlamp for the first time, so that the line of sight of the observer, when viewing the headlamp, is at a horizontal angle of 45°, taking into account the curvature of the planet. (*Boston Light Problem*; G2.P09 Production)

3.2 Resolution procedure 2 (PR2)

The second resolution procedure identified corresponds to those productions where the participating teachers developed the phases *real model → mathematical model*. In these productions, it was considered sufficient to formulate a *mathematical model* to solve the problem, without even working mathematically with it; in other words, the problem was mathematized to give an answer. The following example of PR2 for the *Meanders Problem* is presented in Figure 2:

Figure 2. *Production G4.P01 of Meandros Problem (PR2)*

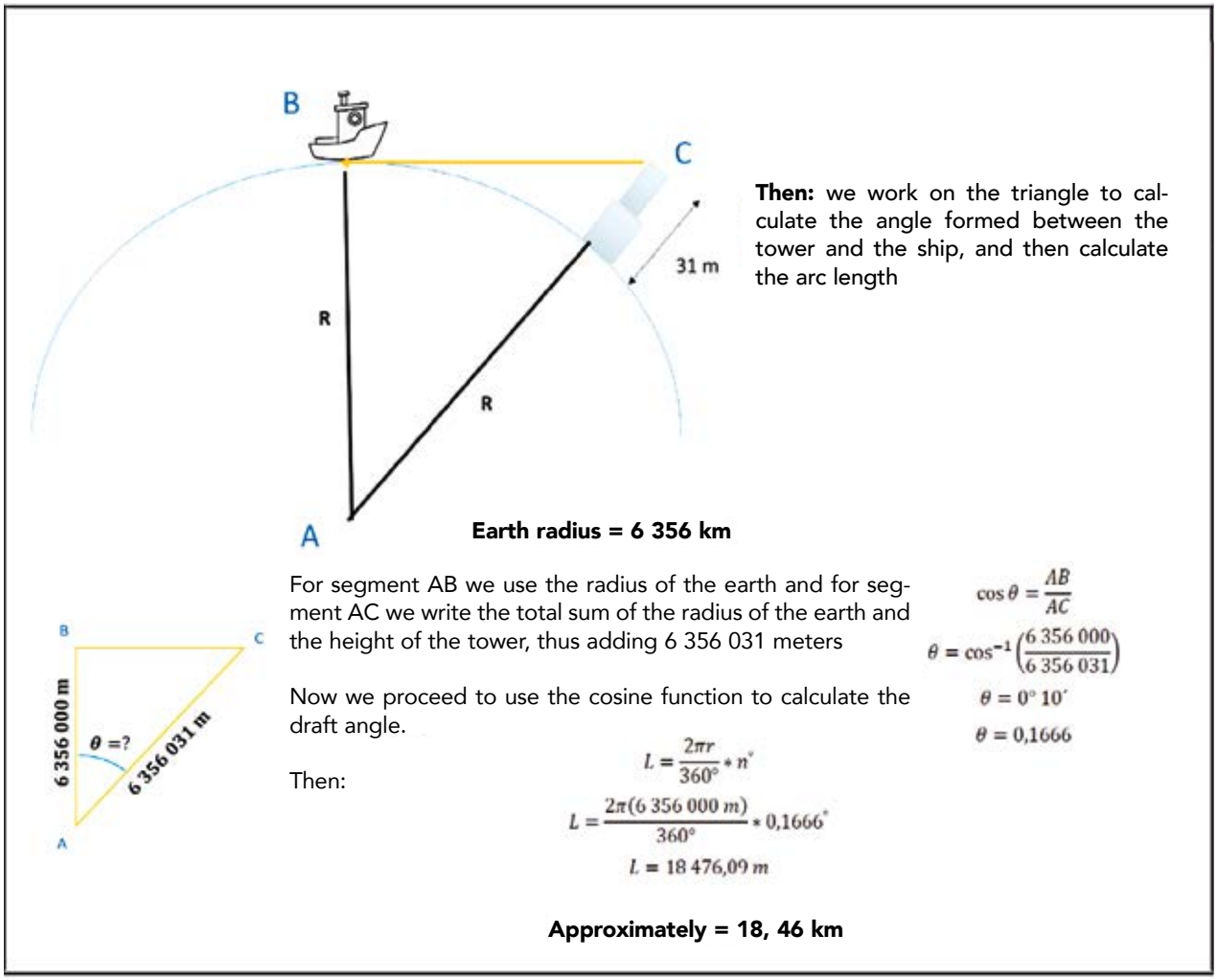


Note. Authors' archives.

3.3 Resolution procedure 3 (PR3)

The third resolution procedure identified corresponds to those productions where the participating teachers developed the phases *real model* → *mathematical model* → *mathematical results*. In these two productions, it was considered sufficient to obtain *mathematical results* from the *mathematical model* to solve the problems, without interpreting them as *real results* and, much less, validate them in the context of the proposed *real situation*; in other words, the problem was worked mathematically to give an answer. The following example of PR3 for the *Boston Light Problem is* in Figure 3:

Figure 3. *G1.P25 Production of the Boston Light Problem (PR3)*



Note. Authors' Archives.

3.4 Resolution procedure 4 (PR4)

The fourth resolution procedure identified corresponds to those productions where the participating teachers developed a complete modeling cycle. In these productions a real model of the real situation was built, a mathematical model was worked with, and the *mathematical results* were interpreted as *real results in the context of the* actual situation from the extra-mathematical considerations made by the resolver. The following example of PR4 for the *Hay Bale Problem* is given in Figure 4:

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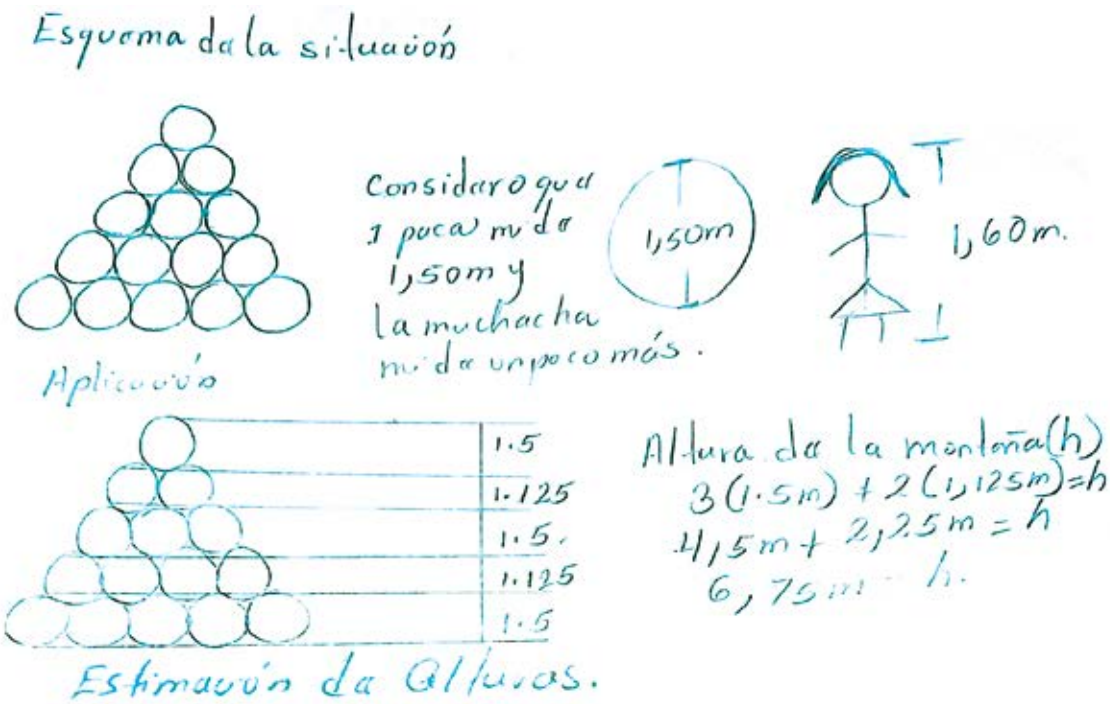
Figure 4. *Production G1.P20 of the Hay Bales Problem (PR4)*



Note. Authors' archives.

3.5 Synthesis of results

Table 2 shows the number of productions by the participating teachers according to the resolution procedures (PR1 to PR4) that they used for each of the three modeling problems raised during the relevant sub-module.

Table 2. *Synthesis of results*

Problems	PR1	PR2	PR3	PR4
Hay Bales	19	5	9	4
Meanders	9	21	5	0
The Light of Boston	5	9	6	1

4. Discussion and conclusions

The results of Table 2 show that most of the resolution procedures that could be evidenced in the productions of the participating teachers were PR1 and PR2. Regarding these results, a plausible conclusion that may explain this situation would be that, for the case of PR1, the participating teachers did not receive modeling training beyond that given in this diploma and, for the case of PR2, the modeling knowledge they may have had could be interpreted as an attempt to mathematize reality instead of developing a complete modeling cycle. As mentioned at the beginning, working with modeling for mathematics teaching is not part of the national curriculum documents of Panama; therefore, it is likely that these teachers have not had a very broad knowledge about the resolution strategies for this type of problems, or experiences of implementing modeling in their educational practice.

The results of Table 2 also show that there were teachers who evidenced PR3, which is consis-

tent with part of the results reported by Ledezma et al. (2023), in which future teachers of mathematics of secondary education were not interested in returning to the "real world" to interpret or validate the results obtained from the *mathematical model* used, focusing their attention on the sub-competences of mathematization and mathematical work with the proposed problems. In addition, there were five productions of the participating teachers that showed the development of a complete modeling cycle (PR4), however, they are not a representative result of the total of collected productions.

These results provide a first overview of the teaching and learning of modeling in the EMAS Diploma and for the authors, as professors involved in this context, allow them to question: What should be improved/modified in the modeling sub-module for future implementations? Based on previous research on this type of educational experiences (see Borromeo Ferri, 2018; Wess et al., 2021) and the results reported here, it can be concluded that:

- First, the time spent on the modeling sub-module is not enough for teachers to acquire modeling competencies themselves and also to think about how they could teach/implement this process in their educational practice. Given this situation, a reformulation is proposed that includes a minimum of ten sessions (similar to Greefrath et al., 2022) to address the teaching of modeling.
- Second, the above conclusion leads to reformulate the didactic aspects of the sub-module, starting from the knowledge and previous competencies of teachers on modeling, dividing this process into sets of phases that form the cycle, and then raising tasks that work specific transitions (or sub-competencies of modeling) (see Maaß, 2010).
- Third, as the final stage of the sub-module, it would be interesting for teachers to design a modeling class, including solving and creating their own problems, that promotes reflection on the practice itself after its implementation (see Ledezma et al., 2022).

Modeling is considered a process that enriches the quality of teaching and learning mathematics, as evidenced in the educational experience of the EMAS Diploma. However, this experience could have an even greater impact if curricular adjustments are implemented in Panama, which should include, among other aspects, the integration of modeling and give it a significant weight in the teaching and learning of mathematics in this country. Finally, it is emphasized that this study is seminal in a line of research on modeling in the Panamanian context for greater professional development of teachers.

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Ibero-American references in Media Information Literacy (MIL)

Referentes iberoamericanos en la Alfabetización Mediática Informacional (AMI)

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Abstract

This review article presents the theoretical basis of contributions, lines of research and approaches that exist from the Ibero-American point of view, with the aim of showing quantitatively the main Ibero-American exponents on Media and Information Literacy [MIL], the results are the product of a search in the WoS, in the category Arts & Humanities Citation Index [AHCI], using Media Literacy and Media and Information Literacy filters; the results are stored in a database that is debugged and then analyzed in the VOSviewer bibliometric software; the types of analysis are co-authored, with the Association Strengh and Ling/Long Modularity methods; the information is presented in tables and bibliometric networks; visualizing the level of association and density given by author and country. The results show Spain with the largest number of researchers with publications in high-impact journals, showing different approaches to MIL and its impact on contemporary society from the educational, political, economic and technological fields; its contribution combines criteria on the need to implement teaching-learning processes supported in ICT to innovate the educational field since digital media do not cause changes by themselves is necessary government collaboration in Latin America; the Ibero-American referents of the MIL are Ignacio Aguaded, Luis Miguel Romero Rodríguez, Rosa García Ruiz, Amor Pérez Rodríguez.

Keywords: MIL, media literacy, VOSviewer, educommunication, bibliometrics, references.

Resumen

Este artículo de revisión muestra el fundamento teórico de aportes, líneas de investigación y enfoques que existen desde el punto de vista Iberoamericano, con el objetivo de mostrar cuantitativamente los principales exponentes iberoamericanos sobre Alfabetización Mediática e Informacional [AMI], los resultados son producto de una búsqueda en la WoS, en la categoría *Arts & Humanities Citation Index* [AHCI], con el uso de filtros *Media Literacy* y Alfabetización Mediática e Informacional, los resultados se almacenan en una base de datos que se depura y luego se analiza en el software bibliométrico *VOSviewer*. Los tipos de análisis son coautoría, con los métodos *Association Strengh y Ling/Long Modularity*, la información se presenta en tablas y redes bibliométricas; y se visualiza el nivel de asociación y densidad que existe por autor y país. Los resultados muestran a España con el mayor número de investigadores con publicaciones en revistas de alto impacto con diferentes enfoques sobre la AMI y la incidencia en la sociedad contemporánea desde el ámbito educativo, político, económico y tecnológico; su contribución aúna criterios sobre la necesidad de implementar procesos de enseñanza-aprendizaje con soporte en TIC para innovar el ámbito educativo, ya que los medios digitales no suscitan cambios por sí mismos, es necesaria la colaboración gubernamental en América Latina; los referentes iberoamericanos de la AMI son Ignacio Aguaded, Luis Miguel Romero Rodríguez, Rosa García Ruiz, Amor Pérez Rodríguez.

Palabras clave: AMI, alfabetización mediática, VOSviewer, educomunicación, bibliometría, referentes.

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1. Introduction

Currently the term Media and Information Literacy [MIL] is in debate, as they are a set of practices that encompass the training of users to use information and communication technologies [ICT], as well as government proposals that standardize access to these elements and use them to create judgments about media and social reality (Garro-Rojas, 2020). The MIL paradigm or "Educommunication" is adopted in Latin America in the 70s, but there are substantial changes that drive their research towards the cultural and ideological power that occurs in the mass media. Different approaches and modalities are adopted that lead to an innovative apex that questions theories and models regarding communication (Castro Lara, 2016).

For this reason, considering digital and media literacy as a broader concept of literacy, it is synthesized in the management of five skills that are related to each other: access, analyze, evaluate, create-collaborate, reflect-act on media (García-Ruiz et al., 2020).

In addition, UNESCO presents documents that define media literacy as:

- A process that allows the acquisition of knowledge about the media managed in society and the operation process, including the use of tools that contribute to the use of these media for effective communication (Fedorov, 2011).
- A process that allows to enhance skills and capabilities in the use of different media, including manipulating writing, graphics and figures, audio, static and animated images through different types of technology; allowing users to expand in current media, produce content and understand the information received in a more critical way (Hinostroza, 2017).

There are researches on media and information literacy that have shown precedents of processes in the field of educommunication in the early sixties -mid-twentieth century- in Latin America, particularly in processes of influence in the so-called communication and development, disintegrating in different facets and political, ideological and cultural aspects on the field of media literacy (Gumucio-Dagron & Tufte, 2008; Trejo-Quintana, 2016; Aguaded et al., 2018; Garro Rojas, 2020).

1.1 Media and Information Literacy

A concept descended to contemporary society mentions that MIL is:

> ... a new conceptual paradigm concerning the capabilities that enable the critical, autonomous, and creative use - by individuals and communities - of any means of information and communication and expression and their specific languages; these capabilities are considered to range from the simplest technical skills for the use of media to the most cognitive skills used in information processing and in the use of languages and reasoning. (Perez, 2015, p. 4)

MIL is a concept not yet formed that refers to the forms of training for users to be able to use ICT, also the proposals of educators who strive to make it a right of the entire population and thus contribute critically and responsibly on the media and social reality in which they exercise citizenship (Garro-Rojas, 2020).

Latin America has made considerable leaps, taking into account the particular case of governments based on genuine democratic processes, since they have instituted the creation of agencies to make decisions on science and technology, which implies new forms of knowledge generation in interaction, conceiving the relationship between science, technology and society, which leads to formulating policies for strengthening collective capacities (Casas, 2020).

Education and communication have generated interdisciplinary and transdisciplinary mergers, being a process based on human and political rights of humanity. Although no government standards are established, the rapid growth and reach of ICTs make this task an urgent challenge for all Latin America (Guerrero & Castillo, 2018).

For many researchers, access to MIL is a matter of justice, since classical literacy standardized by comprehension of written texts is no longer enough in a digitized era. To keep pace with technological progress and take advantage of the opportunities of this new reality, it is necessary to identify the theoretical and practical dimensions of two historically separate teachings [education and communication]

that merge today to provide competitive advantages in all social aspects (López Mondéjar et al., 2016; Torres-Lima, 2017; Garro-Rojas, 2020).

It is necessary to emphasize that MIL emerged worldwide, however, the Anglo-Saxon world has not distinguished the Latin American contributions since many of the emblematic investigations have not been translated, so they have not impacted worldwide. The English language has been conceived as the banner to study education-communication according to powerful organizations of science and knowledge, added to the globalization that has contributed to standardize and expose the Anglo-Saxon model as the ideal to face the subject (Castro-Lara, 2016); currently, there are spaces in Spanish as "Revista Comunicar" that has gained great relevance in Europe and the USA, thanks to its high impact on the MIL world, being a reference for researchers in Latin America.

The concept MIL is relatively new. It arises as a need to respond critically and consciously to digital information available to users in new, novel and globalized media and information channels, evidencing the need for critical thinking as a necessary skill to interpret and analyze the information and increasing disinformation (Duque-Méndez & Sánchez-Obando, 2022).

1.2 Reflections on the MIL

Since its origins, UNESCO has developed different attempts to specify communication and information policies, which allow the merging of these two great fields. Some of these policies have been regulated to the educational environment; for this reason, terms such as educommunication or media literacy respond to the imminent need to update the pedagogy, socio-cultural changes and the hegemony of large media groups (Castro Lara, 2016).

As with the dissemination of new terms such as anglicisms, the words media literacy, educommunication, among others, has had an impact and use; however, in the present century it has been considered as a new expression and as a driving force of the process of change for contemporary society. In 2012, UNESCO published the book *Media and Information Literacy. Curriculum for teachers* showing the correlation between television, radio, Internet, books, print media, digital archives and libraries in a single data warehouse "digital platform"; presented in a holistic way and designed specifically for teachers to initiate an integration process between the formal education system and digital media, which allows reaching thousands of young people and enhancing their abilities (Wilson, 2012).

The EU initiated a series of studies, communications and initiatives that have warned the need to implement ICT in a methodical and adaptive way, presenting itself as a tool developed to improve the digital competences of citizens "DigComp"; later "DigCompEdu" is organized, which is aimed at teachers from the different levels of education from basic to higher education, including adults, considering general and professional training, in addition to training for special needs and non-formal learning contexts (Punie & Brecko, 2014; Redecker, 2017).

ICT is the most significant change that society has experienced since the end of the 20th century, and has also generated significant evolutionary processes in other sectors such as industry, communication and education. It is evident the universality of multimedia devices in contemporary society, reflected in the young generations known as "digital natives" that are interested in new forms and new means of approximation to information, through different options of the interconnected world (López Carballo, 2020).

The premise of media literacy is to teach critical thinking about the media without diminishing its value, but it must always question what they produce. We live in a society run by the *mass media*, therefore, the processes involved in the MIL continue to be unknown in education and in many other segments of society, being Latin America and the Caribbean the most affected. However, there are traces of public policies implemented in this region for their addition in the curricular management of educational systems, but no convincing success has been achieved due to the cultural, economic and digital gap between the different social classes (Lugo & Ithurburu, 2019).

It is necessary to address the issue of educational systems and also consider a curricular restructuring, with emphasis on the analysis of visual culture, and educate in processes of use, adaptation and manipulation of technology, as well as in discerning and interpreting processes of the different media and audiovisual platforms of the hyperconnected society. This level of connectivity has deep social, political

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and economic consequences in our lives, from automobile technology, health systems, labor exchanges, governance systems and any social process sensitive to automation (Martínez Sanz et al., 2016; Reis et al., 2019; Mateus et al., 200 20).

Paredes (2009) promulgated the ideas of involving pedagogical actions in education that use technological means for communication, commit the system to enhance not only skills in use, but to guide processes to rebuild knowledge, and modify the curriculum towards a distribution of social justice and equality. The implementation of educational methodologies based on training in media is a reality, and the aim will always be for students to recode and understand their position in the daily use of such media, to develop processes that enhance skills to interpret, create and actively participate in the information and communication society in which they are involved, interacting with different forms of communication and technological media (Pallarés Piquer, 2014).

The 21st century caused a dizzying rise of Information and Communication Technologies (ICT), which led the different social, economic, political and productive sectors to rethink new strategies and techniques in processes that influence each of their areas of incidence; hence, the Internet and online teaching have become the pioneers in offering digitized resources online, created for various activities that allow to promote education (Quirós-Meneses, 2009).

It is important to consider that—not because they are digital natives—students possess the basic digital competencies and are also not prepared in the best way to elucidate in the digital context of the 21st century. This new environment offers mechanisms, processes and conditions that could lead to real digital and media literacy; however, it is necessary to relate that training is conceived in different spaces and chronological ages, therefore it is necessary the continuity and coherence in learning, either in the school environment and / or family context (Bonilla-del-Río & Aguaded, 2018). For this reason, training in an integral way in the use of media, with the construction of competencies aligned to the curriculum is the challenge of contemporary education, allowing transversal skills to be enhanced in the coexistence of the family and the school, through inter and multidisciplinary collaborations.

If considering the concept of digital competence defined by the Ministry of Education, Culture and Sport of the Spanish Government "...it is the creative, critical and safe use of information and communication technologies to achieve the objectives related to work, employability, learning, the use of free time, inclusion and participation in society" (O. ECD/65; 2015, p. 6994); this leads to deduce that it is not only the fact of knowing the use of technological and digital applications, but "it requires the development of various skills related to access to information, processing and use for communication, content creation, security and problem-solving" (O. ECD/65; 2015, p. 6996).

In the second decade of the 21st century, there are several researchers on digital literacy in education. Cabero-Almenara and Fernández-Robles (2018, p. 2), state the following:

- Multiple Literacies
- Information literacy
- Digital Literacies
- Media literacy
- Transmedia literacy

Likewise, similarities and differences between information literacy and media literacy have been considered, which as for Lee and So (2014) are two fields that are linked and complement each other, since at the beginning of the 21st century, neither information literacy nor media literacy were sufficient to cope with the huge volume of media messages and the abundance of information on platforms that already showed an impressive upturn.

This led to studies on digital literacy, considering it an essential skill for effective performance in society; also, Matamala (2018), states that digital literacy is concretized in the analysis of how to use the information hosted in the "cloud" in precise realities and structures, and achieve explicit educational purposes, depending on the context in which the subject works.

It is important to know that UNESCO is the international organization that leads the momentum for MIL, and recognize that there is a direct relationship with critical thinking and MIL, since the latter consolidates the knowledge, skills, and ethical values of the 21st century for all citizens and all people who actively seek participation in society. On the other hand, the world is conditioned by ICT, that is why online communication, personal expression, quality education and economic development, and of course

the fight against disinformation, are factors that affect the daily life. Therefore, MIL is the instrument that can achieve social cohesion in individual and collective contexts (Perilla-Granados, 2018; Campal-García, 2019).

It is now a decade since UNESCO promotes awareness of media and information literacy [*Media and Information Literacy*-MIL] through World MIL Week. The last six versions were:

- 2018, Lithuania (Kaunas) Media and information literacy cities: voices, powers and change makers.
- 2019, Sweden (Göteborg) Media and information literacy: informed, engaged, empowered.
- 2020, South Korea Resist Disinfodemia: Media and Information Literacy for all.
- 2021, South Africa Media and information literacy for the public good.
- 2022, Nigeria (Abuja) Building Trust: An Imperative of Media and Information Literacy.
- 2023, Jordan (Dead Sea) Media and information literacy in digital spaces: a Collective Global Agenda.

1.3 Ibero-American contributions to MIL

International organizations such as UNESCO, UN, UNICEF, Council of Europe, European Parliament, have expressed concern due to the changes induced by emerging media, due to their interactive ownership in the population; for this reason they have developed guidelines and recommendations to be implemented in different nations, however, is a pending task for Latin American governments, since there are poor results in legislative and public policy projects (López Mondéjar et al., 2016; Hinostroza, 2017; Aguaded et al., 2018; Campal-García, 2019). Paulo Freire [1921-1997] has been one of the most significant pedagogues of the current era, whose theories are so far objects of learning throughout the world: the pedagogy of hope, banking education, the liberating dialogue, literacy as a path of liberation, have cemented in Latin America a benchmark in educational processes.

Spain has been the pioneer in seeking the possibility of adhering to the MIL in teaching and learning processes, since the eighties contributed with their models of *Media Literacy* through educational organizations (Borg & Lauri, 2009); in 2011 and 2014, research was developed to include the concept of media competence in the training plans of communication professionals in their different areas; the main idea was to incorporate new contents and didactic methodologies in specific subjects, and this as a complement to the research of Joan Ferrés (Buitrago et al., 2015). At present, Spain is the country with the highest scientific production concerning MIL at the Hispanic American level.

In Mexico there are academic communities interested in promoting media and digital literacy, but the relationship with the media and its users has been related with tension and subordination (Aguirre Aguilar, 2019); however, the development of technology has facilitated that the actors of the communication process have a different role, generating emerging groups that use media content and the possibilities of the digital world in critical and creative ways (Guerrero & Castillo, 2018).

In Colombia, education for the media in terms of public policies is not so rooted, defined and expedited; but, the importance of the media in the training process has been considered in the basic standards of language from the Ministry of Education, with its amplified and dynamized conception, where the media are used either in the structure of non-verbal language or in the field of the pedagogy of symbolic systems (Aguaded et al., 2016).

A precursor of media training in Brazil is Ismar de Oliveira Soares, leader of the educational research movement in Latin America, with diverse perspectives and approaches. In his works, the author mentions the importance of communication in society after modernism; in addition, he was a precursor in the formation of networks, dynamics and relations with educommunication; with his investigations he has induced different ways of thinking, living, acting and deciding. In addition, the premise considers that educommunication is a possible field from the academia and desirable from the political, being a social need the one that allows the educational space to form communicational and computerized societies, which facilitate the management of horizontal and dialogic knowledge (Oliveira ira Soares, 2012).

In Argentina, there is a democracy expressed as an alternative in power, as well as freedom of the press. Thanks to this, an "Ombudsman's Office"

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was created to attend and regularize the claims of mass hearings and also produce training materials (Cortés-Montalvo et al., 2016; Garro-Rojas, 2020).

Among the research carried out in Chile, the Chilean Ministry of Education (Mineduc) identifies five areas of action: 1. Teaching skills; 2. Leadership; 3. Curriculum and evaluation; 4. Internet and digital resources; 5. Institutional coordination, which shows traces of a resurgence of media education in Chile (Andrada Sola, 2018), which allows MIL to merge with education.

In Ecuador, groups have been organized, and the results of these research networks is *White Paper, Media Competencies in Ecuador* (Rivera-Rogel et al., 2019); in addition, there are several regional and international findings where the behavior of media education in Ecuador is mentioned, which agree that it should work collaboratively in innovative and impactful programs for the training of children and young people to exercise a critical analysis against the media that synchronizes with the political, cultural and social events demanded by society (Torres-Toukoumidis & Mendoza-Zambrano , 2019).

It is clear that some countries converge in lines of research or projects, also, it is true that each country focuses on different aspects of the MIL, and regional cohesion has not been forged due to the particularities of each nation (Trejo-Quintana, 2016); however, efforts have been unified to generate research projects, but the knowledge generated in educational institutions does not affect the public life of the countries. The MIL has been integrating in Latin America and the Caribbean, among its maxims are to provide citizens with basic knowledge about media and technology, so that in some way they can critically evaluate the quality of the content that is transmitted in different media (UNESCO, 2013). When MIL is investigated as an emancipatory process in Latin America there are scenarios of media and information manipulation, which are aimed at conditioning behaviors in time of elections, or merging with the judiciary, serving hegemonic groups, where there is a "late neoliberalism" that tries to manipulate the communicational sense, marketing, change of assumptions and information common society through the media (Pini, 2018).

Nowadays, researchers and organizations are looking for a way to demonstrate the importance of MIL in contemporary society, and they also consider it essential to generate the critical thinking required by today's hyperconnected society. As a final aspect, it is highlighted that digital media do not promote changes or revolutions per se, that is why it is necessary to include them in the teaching-educational process for teaching, even ICT should be used to support pedagogies that promote innovation in the educational field (Howard & Thompson, 2015; Martínez-Olvera and Esquivel-Gámez, 2017; Franco Moreno, 2017; Claro et al., 2018; Cabero-Almenara et al., 2020).

2. Methodology

This article is a mixed research conducted to present a model that allows to spread media literacy and digital competence in higher education in Latin America. The Web of Science [WoS], owned by the company Clarivate Analytics, was used since it is one of the most important collections of databases of bibliographic references and citations of journals in the field of research, made up by the Core Collection, which includes indices in Social Sciences, Arts and Humanities (*Arts and Humanities*). This platform has instruments that allow to develop analysis and evaluation processes on the citation index of different publications , including the JCR.

The databases are refined and worked on the *VOSviewer* bibliometric software [Bibliometric Software] that allows to analyze and visualize the different relationships between the scientific literature; the analyzes developed are co-authored with unit of analysis by author and the *Association Strengh* method, as well as the type of co-authorship analysis with unit of analysis by country and the *Ling/Long Modularity*. The information obtained is presented in organized and graphical tables called maps or bibliometric networks.

3. Results

The main articles found are selected in the database WoS, the category *Arts & Humanities Citation Index* (AHCI) is filtered, with the keywords *Media Literacy*, Media and Information Literacy, Education Communication, Media Skills, Digital Literacy. The result yields a database with 9982 authors; then a debugging of the database, called data cleaning or *scrubbing*, process where incorrect and / or incomplete data, incorrect format or dupli-

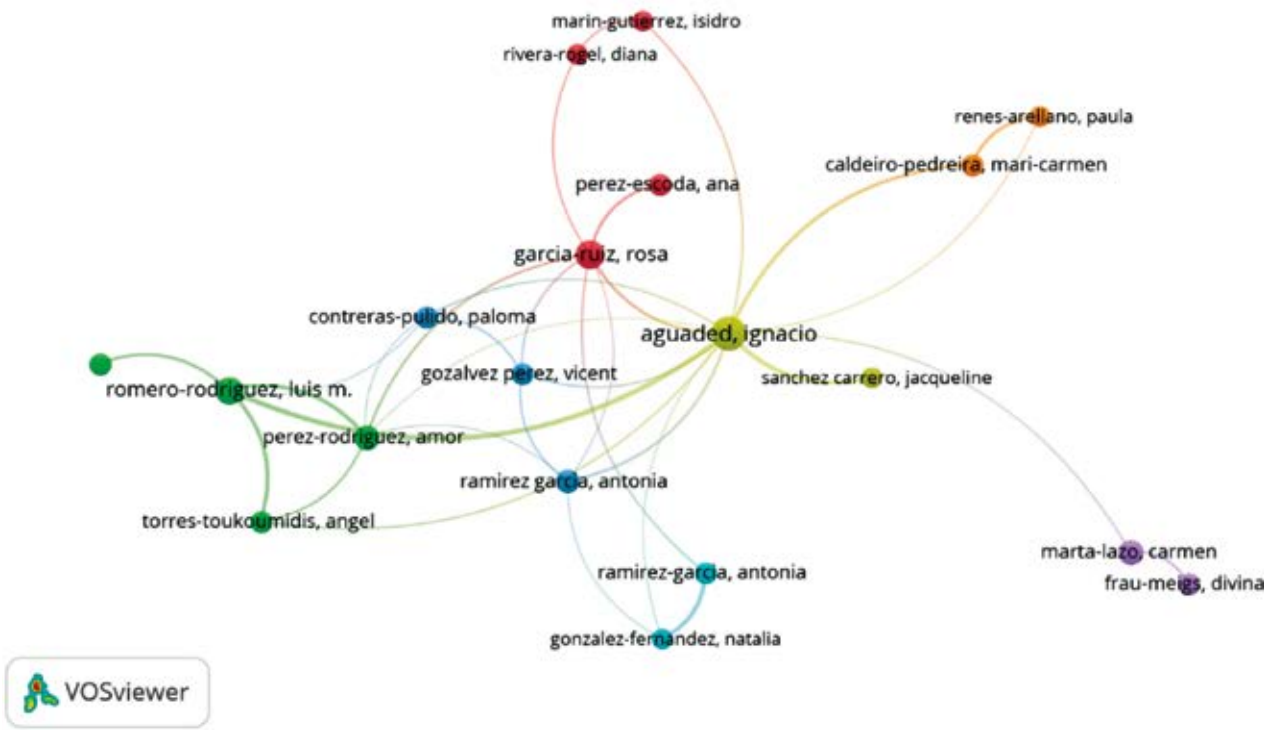
cation of them, is modified and / or deleted, with search and replacement tools.

For the presentation of the results, the graphs generated by *VOSviewer* called bibliometric networks are used. The types of analyzes performed are co-authored, which is one of the most sensitive analyzes and with well-documented scientific foundation, since researchers contribute to obtain visibility, notoriety, complementary skills and access to resources (Olivera Batista et al., 2018).

The first unit of analysis is by author and the *Association Strengh* method; the result shows 139 authors who build and visualize bibliometric networks. Figure 1 shows this existing relationship.

It is noted that among the 20 authors with the most documents, citations and co-authorizations are prestigious researchers from Spain, such as Ignacio Aguaded (1); Luis Miguel Romero Rodríguez (6); Rosa García Ruiz (8); Amor Pérez Rodríguez (14). The number of citations, documents, and co-authoring link relationships are shown in Table 1.

Figure 1. *Analysis of bibliometric networks of co-authorship*



Note. The author from VOSviewer.

Table 1. *Authors with more documents, quotes and co-authorship*

Author	Documents	Quotes	Total Link Force
Aguaded, Ignacio	28	239	19
Tully, Melissa	16	332	14
Vraga, Emily K	14	333	14
Scharrer, Erika	12	95	14
Hudders, Liselot	17	452	13
Romero-Rodríguez, Luis M.	14	155	12

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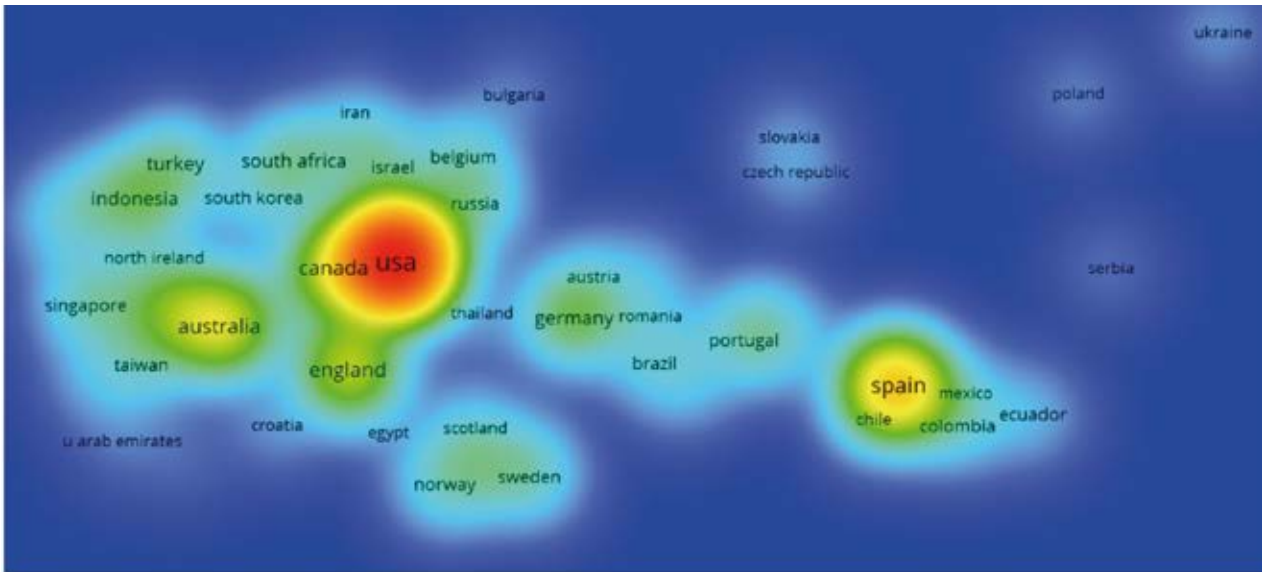
Author	Documents	Quotes	Total Link Force
Cauberghe, Veroline	10	331	10
Garcia-Ruíz, Rosa	15	161	9
Greene, Kathryn	10	152	9
Austin, Erica	12	406	8
De Jans, Steffi	8	188	8
Merchant, Guy	15	306	7
Levistkaya, Anastasia	11	104	7
Perez-Rodriguez, Love	10	115	7
Burner, Cathy	8	183	7
Federov, Alexander	8	101	7
Kupersmidt, Janis B.	7	193	7
Banerjee, Smita C.	7	121	7
Hecht, Michael L.	7	40	7
Jones, Sandra C.	7	38	7

Note. The author from VOSviewer.

The second unit of analysis carried out in the database is by countries with the largest number of publications on the related topics "*Media Literacy*"; "Media and Information Literacy"; "Education Communication". The search method is "*Ling/Long Modularity*". The search results are 54 countries with more than ten related publications in the last seven years [2015-2022]. Figure 2 shows the information, where it is evident that networks with stronger links are main cluster headlines seen in the United States, Spain and Australia.

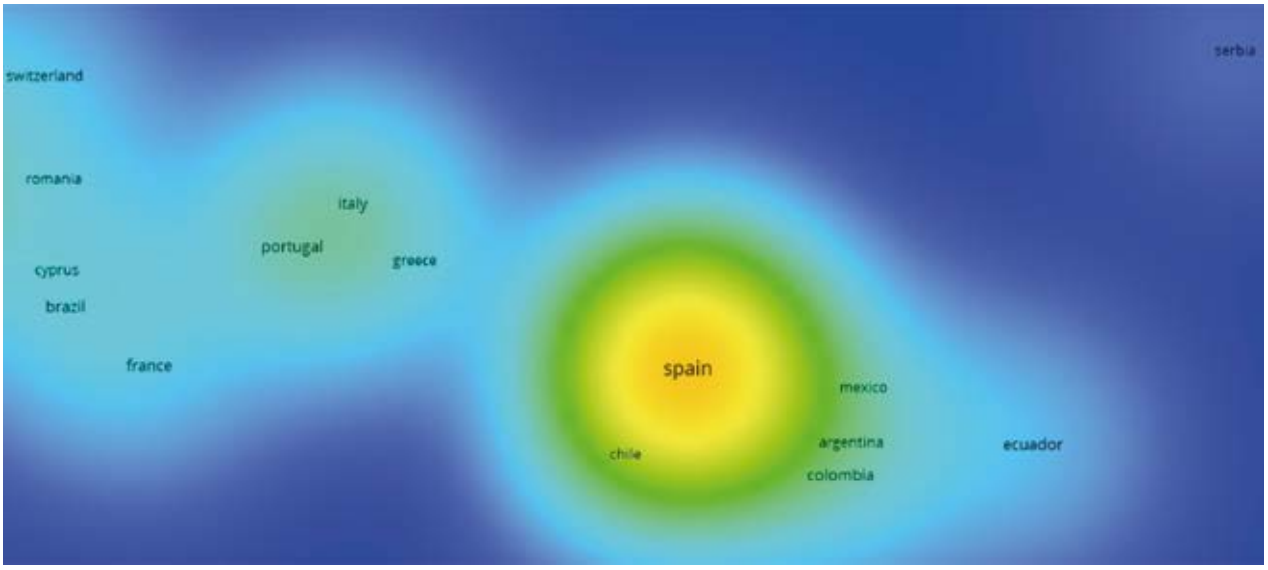
Figure 2. *Countries with the highest number of publications in MIL*



Note. The author from VOSviewer.

When reviewing the Ibero-American context, the analysis is deepened in the cluster "Spain". It is observed that bibliometric networks are generated with countries such as Chile, Mexico, Argentina, Colombia, Ecuador, Greece, Italy, Portugal, France and Brazil. Figure 3 shows the density of the relationship between the mentioned countries, with greater scientific production when the country is located closer to the cluster head.

Figure 3. *MIL Publications Country Networks with Spain*



Nota. The author from VOSviewer.

4. Discussion and conclusions

The purpose of this article is to show the main Ibero-American exponents in Media Information Literacy in a quantitative way, in addition to considering the number of contributions, co-authorships and indexes worldwide of their scientific production.

The search was conducted using articles generated from 2015 to 2022 in the *Arts & Humanities Citation Index* (AHCI), showing that the progress of Ibero-America is outstanding, and Spain is the country with the largest number of researchers with publications in high impact journals with different approaches to study MIL.

UNESCO has strengthened processes and policies that regulate the educational environment, including terminologies such as educommunication or media literacy as part of pedagogical modernization within the current socio-cultural transformations.

Digital media do not produce changes by themselves, it is necessary to include them in teaching-learning processes with ICT support to generate innovation in education.

At the Ibero-American level, names such as Ignacio Aguaded, Luis Miguel Romero Rodríguez, Rosa García Ruiz and Amor Pérez Rodríguez stand out, who have based most of their research in the field of Information Media Literacy and its impact on contemporary society from the educational, political, economic and technological fields.

As other research, this work presents certain limitations, which can be considered opportunities for future research, since only the WoS database is used, which has quality guidelines so that the content is reliable for the scientific community. Comparative studies could be done with databases such as *Scopus* and PubMed.

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Face-to-face and distance learning at Universidad Iberoamericana Torreón

Aprendizaje presencial y a distancia en la Universidad Iberoamericana Torreón

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Abstract

As a result of the SARS-CoV2 pandemic, the incorporation of new technologies for face-to-face and distance learning was even more necessary. Technology represents a way to offer cutting-edge education responding to the needs of the current context. The main objective of this investigation, as a case study, is to analyzes the acquisition of learning by students of different courses at the Universidad Iberoamericana Torreón, México in relation to face-to-face and distance education after the health crisis. The research had a quantitative approach with correlational scope. The sampling was probabilistic by conglomerates and was made up of fifth semester students from 15 courses of the university. The results show that after the pandemic, in particularly context, in the face-to-face modality, the students perceive a better planning by the teachers, which has a consequence a better use of time and the possibility of carrying out diverse activities to strengthen the understanding topics; using digital tools and group work techniques as support. On the other hand, distance classes are described as not very useful and interesting with an excessive academic load. Although the face-to-face learning experience continues to be better evaluated, it is considered important to implement strategies to increase the academic quality of distance classes, as it is a modality that will be used in all universities in the near future, using new technologies and instructional design as support, as well as training programs for teachers and students.

Keywords: learning, distance learning, face to face learning, higher education, COVID-19, instructional design.

Resumen

Como resultado de la pandemia por SARS-CoV2, la incorporación de nuevas tecnologías para la impartición de clases en modalidad presencial y a distancia se hizo aún más necesaria. La tecnología representa una manera de ofrecer educación de vanguardia respondiendo a necesidades del contexto actual. El objetivo de la investigación fue analizar, a través de un estudio de caso, la adquisición de aprendizajes por parte de estudiantes de diferentes licenciaturas de la Universidad Iberoamericana Torreón, en relación con la educación presencial y a distancia después de la crisis sanitaria. La investigación tuvo un enfoque cuantitativo con alcance correlacional. El muestreo se planteó probabilístico por conglomerados y estuvo conformado por estudiantes de quinto semestre en delante de 15 licenciaturas. Los resultados muestran que después de la pandemia, en el contexto particular, la modalidad presencial es percibida por el estudiantado como mejor en la planeación por parte de los docentes, lo que tiene como consecuencia un mejor aprovechamiento del tiempo y la posibilidad de realizar actividades diversas para fortalecer la comprensión de las temáticas; utilizando como apoyo herramientas digitales y técnicas de trabajo grupal. Por el contrario, las clases a distancia son descritas como poco útiles e interesantes y con una carga académica excesiva. Aunque la experiencia de aprendizaje presencial sigue siendo mejor ponderada, se considera importante implementar estrategias que incrementen la calidad académica en las clases a distancia, al ser una modalidad que será utilizada en todas las universidades en un futuro cercano, utilizando como apoyo las nuevas tecnologías y un diseño instruccional adecuado, así como programas de capacitación a docentes y alumnos.

Palabras clave: aprendizaje, enseñanza a distancia, enseñanza presencial, educación superior, COVID- 19, diseño instruccional.

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1. Introduction

The SARS-CoV2 pandemic caused multiple changes as of March 2020, one of the most notorious changes was in education. This situation led to the greatest global challenge for teaching-learning processes in recent decades, arising a problem for the use of technological and communication skills (ICT) by teachers and students.

Although distance education methods as an alternative to face-to-face education have been positioning themselves in recent years, the pandemic has given rise to the emergency of transferring all educational practices to virtual modalities and with a deficient mastery of technologies, due to the impossibility of maintaining physical interaction between people.

In this context, significant gaps were noted in terms of ICT, attitudes, methodologies, infrastructure, as well as physical, psychological, mental and emotional conditions, among others. These factors generated a great diversity of experiences in relation to teaching and learning online to continue with school work.

Although the return to face-to-face is imminent, virtual modalities of teaching are increasingly present in university institutions, so it is essential to understand what are the elements that directly impact the acquisition of meaningful learning for students.

1.1 Learning Process

Learning is mostly understood as a process, in which multiple elements are involved. One of them is the fact that it can take place implicitly or explicitly, as well as be governed by internal or external factors related to learning, among which stand out the environment and learning environments, which include material and human components, as well as motivation and satisfaction of needs (Montenegro, 2014). Likewise, the learning process that generates significant experiences is necessary to acquire knowledge and skills by the student in the 21st century (Sánchez et al., 2022).

The Ministry of Education of the Government of Chile (2017) establishes that learning experiences are understood as a set of knowledge, skills and attitudes, with a sense of what is learned as an experience that is part of the daily life of the student, which should be a model that allows development and training to build tools and knowledge in different environments. Such experiences in diverse environments should be favored by various teaching resources through significant innovative experiences, where students manage their knowledge efficiently (Sandoval, 2020).

There are several pedagogical strategies that can be used to generate learning experiences that result in their being significant. One of them is the learning and service project, which combines the learning of content, ICT, competencies, and values with the tasks of community service (González, 2012). Learning for problem solving takes place, which in turn is linked to enabling students to integrate their learning and use it effectively to meet needs in different situations and contexts. We can also list other alternatives such as gamification, use of platforms, field practices, etc.

1.2 Modalities of classes

Based on the previous context, significant experiences in the different modalities of classes are a challenge to generate methodologies and practices that favor learning in university students. Aguilar et al. (2020) mention that most of the students nowadays are closely related to digital technology, which has changed their way of learning, their skills and their interests. Despite this, it should not be assumed that students can learn with technology; they know how to use it to express themselves, to interact on social networks, but they do not use it as a learning tool.

This is a big challenge in an environment where some of the students found a way to learn with technology, and others have not been able to. Having students increase all the competencies they need according to their level is one of the biggest goals when they return to the classroom.

Virtual classrooms, still designed for this purpose, currently will not be able to replace instruction in the classroom, specifically in groups where class dynamics are essential to the learning process (Contreras et al., 2022). Hybrid or semi-presential modalities are sometimes complex when trying to combine two modalities without mastering the virtuality and all the variables required (Garcia-Peñalvo, 2021).

1.3 Distance education

According to Covarrubias (2021), distance education characterizes by being a method of collective information, which modifies the individual relationship between teachers and students as a preferred learning type, carrying out systematic work of different pedagogical methods and with the technical support to improve learning in students.

Distance learning has changed over time. In its beginnings mainly printed materials that were sent by mail were used, then the radio and television emerged; later the internet expanded it more; finally, the use of apps, which are important tool in classes (Rodríguez et al., 2021).

García (2020) explains the growth of this education, making a semantic map, and makes a memory from distance education by mail, online Learning, open education, virtual education, eLearning to Blended-learning; this must include new technologies such as remote education and hybrid education. Now, online education has grown very fast in both formal and informal environments, relying on various platforms such as YouTube, Facebook, WhatsApp, etc.; as well as tablets, computers, smartphones, cell phones, laptops, among others, which involve a new educational environment in the teaching-learning process (Mishra et al., 2020). Learning through technology and online education cannot be rejected because it is anchored by technological innovation in the educational field (Chaves, 2017; García et al., 2017).

Therefore, the way of education changed in many ways, from common mail to multimedia-based tools, where the flow of information and communication between teachers and students has multiple directions, thus causing gaps in interactive learning and shortages in the generation of meaningful experiences (Montoya et al., 2019).

As an example, many countries have what is called Mobile Learning (m-learning), which consists of teaching using mobile phones where students can access the platforms from anywhere in the world and at any time (Gupta et al., 2021). The existence of a large amount of information leads to increase the skills of research, selection and organization, as well as to increase autonomy and practice in the use of critical thinking. This requires that students are more responsible for their own learning and a new way of relating to their teachers (Aguilar-Romero & Gámez-Suazo, 2023).

Continuing with the paradigm of meaningful experience-based learning, the focus of learning is increasingly moving in the direction of the student, who must learn to learn and that means increasing skills. In a meaningful learning environment, the student structures their learning by selecting the content and learning from the activities they perform.

For this, the teacher must facilitate his/her role as companion and counselor. Additionally, technology also allows individual and social construction at the same time, because it relates the student to a learning community. Another important reason is that it allows to regulate the working time. As long as the materials are on the network, students will be able to access them at any time they want, according to their work system.

The information received will force students to reelaborate and categorize the previous data, forcing them to use the cognitive potential. They are also allowed to investigate by various means, increasing the chances of discovering and finding the motivation they need. The latter is in line with Cantorín (2014), who argues that there is a great connection between educational technology and the follow-up of the meaningful learning approach.

1.4 Face-to-face learning

Learning has evolved over time. It is in the modern age that schooling has raised questions in relation to the teaching-learning process: Who learns? How much do you learn? How does learning happen? Where do you learn? These questions are answered by disciplines such as psychology, sociology, pedagogy, and even philosophy. Many theories emerge from the studies carried out by each discipline, which aim to determine learning. For Alvarado et al. (2022), the face-to-face model is personalized, and it marks a work rhythm of the teacher and there is more contact with the teacher and colleagues, thus preventing isolation.

The teaching-learning process in face-to-face environments provokes to know the diverse realities of educational subjects. Aguilar (2020) considers that disorders that disrupt learning lead to possible motor, mental, maturation, emotional, sociocultural causes that harm students. On the other hand, in a

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face-to-face environment, it is considered that the learning process is appropriate to the student's age and that this process must be mediated by some proposed activities in the classroom and the evaluation on the implementation of these activities (Papalia et al., 2012). Likewise, it has been proven that face-to-face education generates significant experiences, developing comprehensive work, skills and learning in students of different levels (Ojeda-Beltrán et al., 2020; Dasso and Evaristo, 2020).

Another important point is the ability to communicate between teacher and student, so communication improves cooperative work. As the students interact, there is a climate of trust and security that improves the communicative process, in which language confusion must be handled between the sender and receiver, clarifying the main ideas of the subject (Capdet, 2011).

Language in face-to-face areas leads to human contact, not precisely through words but also through bodily expressions, expressed by gestures, movements or poses. Also, it is correct to consider that socialization and social diversity accept the development of social and moral values in the student.

Considering the above, it is necessary to know how the learning achieved and acquired at Universidad Iberoamericana Torreón in the distance modality is evaluated, in contrast to the face-to-face classes.

Finally, it is a priority to identify the factors that influence to promote experiences that allow meaningful learning in the aforementioned modalities, which will enable educational agents to devise and implement strategies that improve learning experiences in the environment, focused on new horizons in the educational field. Therefore, the aim of this research is to evaluate the learning achieved by students of different degrees in relation to face-to-face and distance education after the pandemic, as a strategy to propose improvements to make the teaching-learning processes more efficient towards the fulfillment of the educational quality of the Universidad Iberoamericana Torreón.

2. Methodology

2.1 Population and sample

The research project had a quantitative approach with a correlational or explanatory scope. The application profile of the assessment instrument was the universe of Universidad Iberoamericana Torreón, an academic institution in northern Mexico belonging to the Jesuit University System. The chosen population was 1473 undergraduate students according to the enrollment period August-December 2022.

The sample consisted of students from fifth semester onwards from the following degrees: psychology, law, nutrition, communication, business administration, foreign trade, public accounting, hospitality, marketing, industrial engineering, civil engineering, environmental engineering, architecture and industrial design. Students from those semesters were selected considering they had the experience of having taken classes in the face-to-face and distance modalities at the university during the pandemic. New students were not considered in the study, nor those who were in academic exchange.

Probabilistic sampling was carried out in a random, proportional and stratified way in the three departments that the University is organized (Bracho, 2022). The answers were collected in person and by a QR code that led to a Google form.

2.2 Assessment tool

Nominal variables were gender, career and semester. While for all the items aimed at measuring the central aspects of research, two broad categories were taken: 1) learning and development of competences and 2) modalities of classes. In the first category, aspects were measured on subject domains, research processes, leadership, academic activities, teamwork, etc. For the second category, students were questioned in relation to the usefulness of projects and activities, interpersonal interaction and communication, use of time and rhythm of the subject, teaching resources, infrastructure (internet) among others. Both categories were measured with 69 items in the ratio scale. The objective of the instrument was to evaluate the learning acquired in face-to-face and virtual classes after the pandemic.

The instrument was tested for validity through the evaluation of three experts and reliability was obtained through two pilots, where a final Cronbach alpha of 0.967 was obtained (Hernández and Mendoza, 2018).

2.3 Statistical Analyzes

As a first step, the Kolmogorov-Smirnov normality test was determined to verify the normal distribution of the studied variables. Subsequently, the factor analysis was performed prior to the Kaiser-Meyer-Olkin (KMO) test and the Bartlett sphericity test. The factor test was carried out with the main component extraction method, selecting a varimax and maximum of interactions of 250, a suppression coefficient of absolute values of 0.70 and a α=.95. Finally, the Spearman correlation was analyzed among the variables that measure the aspects most related to the research objectives, with a significance level of 0.05. Correlations were made generally with all responses and by department. Statisticians were performed in the SPSS 28 program.

3. Results

According to the diagnosis made, 58.70% of the respondents were female, 40.89% male and 0.40% preferred not to indicate their gender. As for the ratio of students by departments that make up the university, the Humanities department represented 32.39% of the total answers, the Business department 36.84% and the Department of Engineering, Architecture and Design (DIAD), 30.36% of the students surveyed. Regarding the distribution of respondents by career, the most student participation were law (12.3%), psychology (11.3%), public accounting (10.9%) and business administration (10.3%), followed by industrial design (9.3%), foreign trade (8.9%) and industrial engineering (7.3%).

In the first statistician performed, in the factorial analysis, two main factors were found in the statistical test: 1) transcendental characteristics in distance classes and 2) important characteristics in face-to-face classes.

In relation to the factor related to the transcendental characteristics in distance classes, the variables with the greatest significance indicate that the students of Universidad Iberoamericana Torreón who participated in the research, perform teamwork very often, while showing a deficiency in leadership activities, and their participation in debate and experiences outside the classroom was scarce. Likewise, distance learning was not very interesting to them, which is suggested to be influenced by the perception that they do not obtain a good learning with class activities, which in turn can be influenced by the factor that little diverse resources are used for their teaching. They also point out that the projects are not proportional to the learning obtained and consider them not to be too frequent. Meanwhile, the opinion that these types of classes do not have a good pace in terms of academic load, is an element that may be influencing equally in their unfavorable perception of distance classes. This is also due to the misuse of ICT by teachers and students to ensure learning in the subjects.

Regarding the factor related to the important characteristics in the face-to-face classes, students who are studying the second half of their career in most of the Ibero Torreón's degrees, consider that their face-to-face classes have a good planning, therefore, they use their time wisely, performing activities from which they obtain a good learning and their projects are proportional to the level of learning obtained. In this modality, students often perform teamwork. As for the use of technology, which is related to the development of digital competence, it denotes having a highly significant presence as a resource for the conduction of multiple activities, such as Internet queries, exhibitions using electronic resources, as well as tasks and activities in electronic applications. In addition, they demonstrate a good sense of commitment and responsibility towards their studies by delivering all their tasks and projects with high frequency, which is related to the development of the competence of discernment and responsibility. In this same context, they consider that such classes are the ones that are best planned and in which the time of the session is most used, as well as in which there is a better environment and communication with the teacher.

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Conversely, the results of the correlational analysis are described in Figure 1. These data indicate that the respondents from the different departments of the university continue to favor the face-to-face modality in relation to the main elements studied on learning and competency development. Even when associated with the use of technology, as seen with the use of electronic resources for exhibitions and various activities in this modality.

Likewise, the conduction of projects and activities that they consider useful is a motivation for them to pay attention in class, maintain a positive attitude towards their subjects and in turn deliver them in their entirety, since it allows them to have meaningful learning, coupled with good communication with the teacher and good planning of class sessions.

In addition, the enjoyment of classes in the face-to-face denotes being related to the use of time, interaction with peers and the use of technological resources, which highlights the role of ICTs today as an essential tool in the academic teaching-learning processes in any type of class. Among the multiple tasks they facilitate, the students participating in the research highlight their usefulness for problem solving.

Regarding distance learning, the students surveyed emphasize that the good organization in the development of the subjects and the resources used to teach them are essential aspects for them to be able to carry out the totality of the deliveries of projects and tasks.

Regarding the correlations by departments, the humanities degrees (nutrition, law, psychology and communication) have the most independent correlations, so that the students of this department consider significant a greater number of factors involved in their learning processes and development of competences in relation to the different modalities of classes.

In this sense, for the resolution of problems, students of humanities consider useful in the face-to-face modality the interaction with peers, as well as the performance of activities that allow them to obtain good learning and projects that they perceive useful. Meanwhile, in the distance modality, the resources used for the teaching of the subject show to be a relevant factor for the solution of problems and for the development of projects.

In the face-to-face mode, the use of electronic resources helps them maintain interest in the class. At the same time, in the distance mode, the use of a friendly platform allows them to maintain attention in the class. More specifically, the resources used in this modality are fundamental for the integration of learning. In addition, in this modality, communication with the teacher becomes more relevant to have a positive attitude towards the classes.

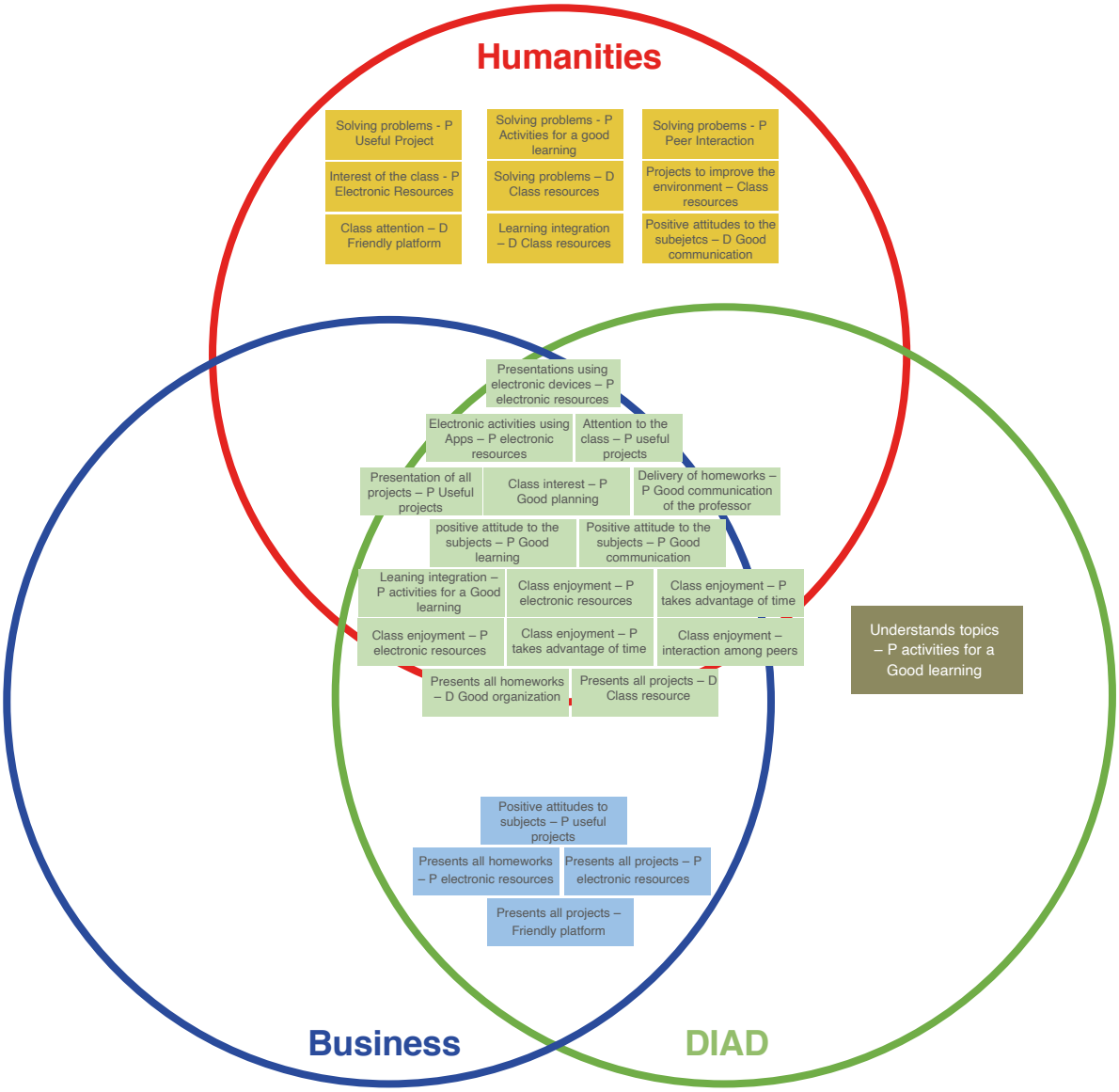
On the other hand, the business departments (business administration, public accounting, marketing, foreign trade and hospitality) and DIAD (civil engineering, environmental engineering, industrial engineering, architecture and industrial design) share some elements that are related to each other, such as the use of electronic resources in a face-to-face class for the delivery of all projects and tasks, which is understood in relation to the profile of the careers they encompass.

The DIAD department characterizes by conducting face-to-face activities, which indicates indicates that, despite technological advances, students of engineering, architecture and design careers consider face-to-face interaction important for the quality of their learning, an aspect that is understood in relation to the practical nature of the activities of such careers.

On the other hand, it is noteworthy that the results do not show correlated variables characteristic only related to the business department. This suggests that the profile of students belonging to this department tends to be neutral in terms of the significance of aspects related to their learning processes in relation to the modalities of classes. Therefore, it can be inferred that

such neutrality would imply a greater willingness to study subjects in alternative modalities, unlike students of humanities and DIAD, who did show more tendency to educational use in this modality.

Figure 1. *Learning in the different classroom modalities of the three departments of Universidad Iberoamericana Torreón*



**DIAD: Department of Engineering, Architecture and Design. Q: Face-to-face. D: Distance mode.*

4. Discussion and conclusions

Students surveyed at Universidad Iberoamericana Torreón tend to prefer face-to-face classes unlike virtual modality following the COVID-19 pandemic. In relation to face-to-face classes, the students of various careers very often perform teamwork. In this regard, Swanson and Swanson (2019) found that university students enjoy performing such activity, highlighting the factor that teams are

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made up of students from other classes. However, the students consider that doing teamwork is not very compatible with the completely online class format.

As for the use of technology, which is related to the development of digital competence, it denotes having a highly significant presence as a resource for conducting multiple activities, such as Internet research, exhibitions using electronic resources, as well as tasks and activities in electronic applications. In this sense, the students participating in the research seem to align with the profile that Aguilar & Chamba (2019) mention of the students of the 21st century, whom they call "technological scholars". However, the presence of technology for the conduction of the *academic activities described contradicts to Aguilar* et al. (2020) who state that the new generation of students does not precisely use technology as a learning tool. Urcid (2023) refers to the idea that technology must be integrated in current educational contexts, to mention that "it is inevitable to incorporate mobile devices as work tools in classes" and establishes that when used appropriately, these can be allies of learning.

Continuing with the face-to-face modality, respondents consider themselves to be in the presence when they tend to pay more attention to their classes, as they find them interesting. At the same time, the activities they carry out in this modality are the ones that most help them to acquire good learning and experiences. In addition, the projects of the face-to-face classes find a greater usefulness. This is similar to what Ruiz et al. (2020) points out, where they mention that the importance in the implementation of digitalization and ICT favor professional development and the improvement of teaching and learning processes.

Likewise, the participants of the research consider that such classes are the ones that are better planned and in which the time of the session is used the most, as well as in which there is a better environment and communication with the teacher. In this sense, de Oliveira et al. (2020) mentioned that virtual classrooms can hardly replace the teaching dynamics in the classroom. Although there is a better infrastructure in the classroom the group dynamics is fundamental to facilitate the development of competences, which could be aimed at verifying the answers of the students participating in the research.

In other sense, in remote classes, the students surveyed report participating infrequently in leadership activities and carrying out projects to improve the environment, as well as providing little support to entrepreneurship and sustainable development projects. Likewise, they show greater difficulty to focus on the class, have less interest, in addition to less interaction with their peers, which is confirmed by Ferri et al. (2020). Such factors, identified as weak, are the ones that students value best as elements that favor the acquisition of learning in various research (Swanson & Swanson, 2019; Chávez et al., 2021; Taveras-Pichardo et al., 2021).

Likewise, the opinion of post-pandemic virtuality indicates an excessive academic load, this is an element that may be influencing the unfavorable perception of distance modality, a factor that is consistent with the findings obtained by Taveras-Pichardo et al. (2021).

In relation to the above, constant feedback and good communication with the teacher in the distance classes, are fundamental aspects so that students can have a good experience as documented by Karkar-Esperat (2018). In this regard, the students participating in this research indicate that these aspects do not occur to a good extent in such classes either, influencing their unfavorable opinion on distance modality.

In summary, from the results obtained through the statistical analysis of the different tests used, a clear orientation to prefer face-to-face modality after the Covid-19 pandemic was found (Berumen et al., 2023). Presence allows to have a good use of their classes for the acquisition of significant learning and the development of professional competences. On the contrary, in the distance modality, they point out significant areas of opportunity for achieving the same aspects (Núñez, 2023).

Also, from the correlations found, the use of ICT in the face-to-face modality for the conduction of activities, tasks and projects becomes relevant, especially for students of the departments of business and engineering, architecture and design; in the case of humanities, they are a valuable element to maintain the interest in the class (Martínez, 2022).

However, it is highlighted that despite technological advances, students of careers such as engineering, architecture and design consider important face-to-face to obtain quality learning (De Oliveira

et al., 2020), aspect that is understood in relation to the practical nature of the activities of such careers. While, regarding distance learning, the factors of a friendly educational platform, the resources used for the teaching of the subject and communication with the teacher are essential for integrating learning.

Likewise, it is emphasized that the business department denotes a neutral profile in its students, which would imply greater susceptibility to study subjects in the various modalities of classes, not preferring in any significant way any of them.

From the above, it is important to implement educational strategies in relation to the use of ICT to increase the quality in distance classes, through training professors on the didactic-pedagogical topic, with emphasis on instructional design, clear and precise guidelines in order to improve meaningful experiences in students and that favors the learning process and development of competences (Murillo-Díaz et al., 2023). These aspects are in line with Albrahim (2020), who mentions six categories in which professors must be trained to provide online classes effectively, which refer to skills in the following areas: pedagogical, content, design, technological, management and social and communicative. In relation to this context, Féliz et al. (2023) state that "we are (re)learning to teach and to learn, including the human and the technological".

In this same context, it is also relevant to guide students who take classes in this modality to improve their study strategies (Aguilar-Romero & Gámez-Suazo, 2023), as well as to change the perspective of online classes generated by the pandemic. Therefore, the challenge of the University is not the infrastructure or technology, but to find the pedagogical mechanism in professors to efficiently provide distance learning, which is consistent with what was mentioned by García-Morales et al. (2021) about the importance for universities to pay special attention to the digitalization of learning processes, offering training to both teachers and students and even the administrative staff of these institutions.

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Flipped Learning as an educational tool for enhancing English language

Aprendizaje invertido como herramienta educativa potenciadora para mejorar la lengua inglesa

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Abstract

This article aims to examine the effectiveness of Flipped Learning (FL) as a methodology for teaching English subjects to seventh-grade students. The study suggests that FL fosters an active and engaging learning environment by encouraging students to take control of their learning process. While the teacher remains the primary facilitator, they guide students and provide continuous, hands-on assessment. Research shows that applying the FL model promotes student participation and interaction with the teacher, thus improving student engagement. The methodology section of this article describes the processes followed to collect data, starting with a bibliometric analysis to build the state of the art, followed by an experimental approach to evaluate the method. A Likert-scale survey was used to measure student perceptions and opinions, proving an effective data collection method. A quantitative approach was used to assess students' perceptions of LF. The results reveal that FL is an effective methodology that improves student engagement, motivation, and learning outcomes. Consequently, the analysis suggests that FL is an innovative didactic approach that can improve student motivation and learning outcomes by designing and implementing innovative pedagogical strategies.

Keywords: flipped learning, education innovation, pedagogical technology integration, active learning, ICT for Education, digital environments.

Resumen

Este artículo pretende examinar la eficacia del Flipped Learning (FL) como metodología para enseñar asignaturas de inglés a alumnos de séptimo curso. El estudio sugiere que el FL fomenta un entorno de aprendizaje activo y atractivo al animar a los estudiantes a tomar el control de su proceso de aprendizaje. Mientras el profesor sigue siendo el principal facilitador, guía a los alumnos y les proporciona una evaluación continua y práctica. La investigación muestra que la aplicación del modelo FL promueve la participación de los estudiantes y la interacción con el profesor, mejorando así el compromiso de los estudiantes. La sección de metodología de este artículo describe los procesos seguidos para recopilar datos, comenzando con un análisis bibliométrico para construir el estado del arte, seguido de un enfoque experimental para evaluar el método. Se utilizó una encuesta de escala Likert para medir las percepciones y opiniones de los estudiantes, demostrando ser un método eficaz de recogida de datos. Se utilizó un enfoque cuantitativo para evaluar las percepciones de los estudiantes sobre la FL. Los resultados revelan que FL es una metodología eficaz que mejora el compromiso, la motivación y los resultados de aprendizaje de los estudiantes. En consecuencia, el análisis sugiere que FL es un enfoque didáctico innovador que puede mejorar la motivación de los estudiantes y los resultados del aprendizaje mediante el diseño y la aplicación de estrategias pedagógicas innovadoras.

Palabras clave: aprendizaje invertido, innovación educativa, integración de la tecnología pedagógica, aprendizaje activo, TIC para la Educación, entornos digitales.

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1. Introduction

The digital age and the advance of knowledge in research characterize the 21st century. Digital technology has profoundly influenced various aspects of life, including the pedagogy of teaching. In recent years, innovative teaching methods such as massive open online courses (MOOCs) and Flipped classrooms (Shaw & Patra, 2022) have emerged. Technology implementation can significantly benefit both in-class and out-of-class learning experiences (Nja et al., 2022). Education plays an essential role in people's lives and future, creating a more humane and inclusive world through education as a tool of accompaniment and human development (Moghadam & Razavi, 2022).

Methodological innovations in the classroom refer to the implementation of novel methodical proposals by teachers to improve teaching of the educational program and the basic curriculum (Chen-Quesada et al., 2020). The COVID-19 pandemic has made it necessary to adopt new methodological strategies in the classroom, leading teachers to review their conceptions to improve the quality of teaching (Rivadeneira & Inga, 2023).

The pandemic has had a significant impact in education, affecting more than 1.3 billion students worldwide and causing a complete transformation of education (Crawford & Cifuentes-Faura, 2022). As students immerse themselves in the digital and technological world, the interactivity of devices opens up new teaching opportunities. The use of complex teaching resources can improve learning effectiveness (Maya et al., 2021).

However, teachers have faced technological challenges during the pandemic and understand that platforms or technological resources alone do not drive change; the pedagogical approach and teacher-student interaction play a crucial role. Educational innovation involves the transition from conventional and ordinary models to emerging concepts based on ICT solutions, as the digital transformation of educational institutions has increased significantly at all educational levels. Traditional teaching methods rely on teachers explaining textbook topics, forcing students to become more actively involved in the classroom (Safapour et al., 2019).

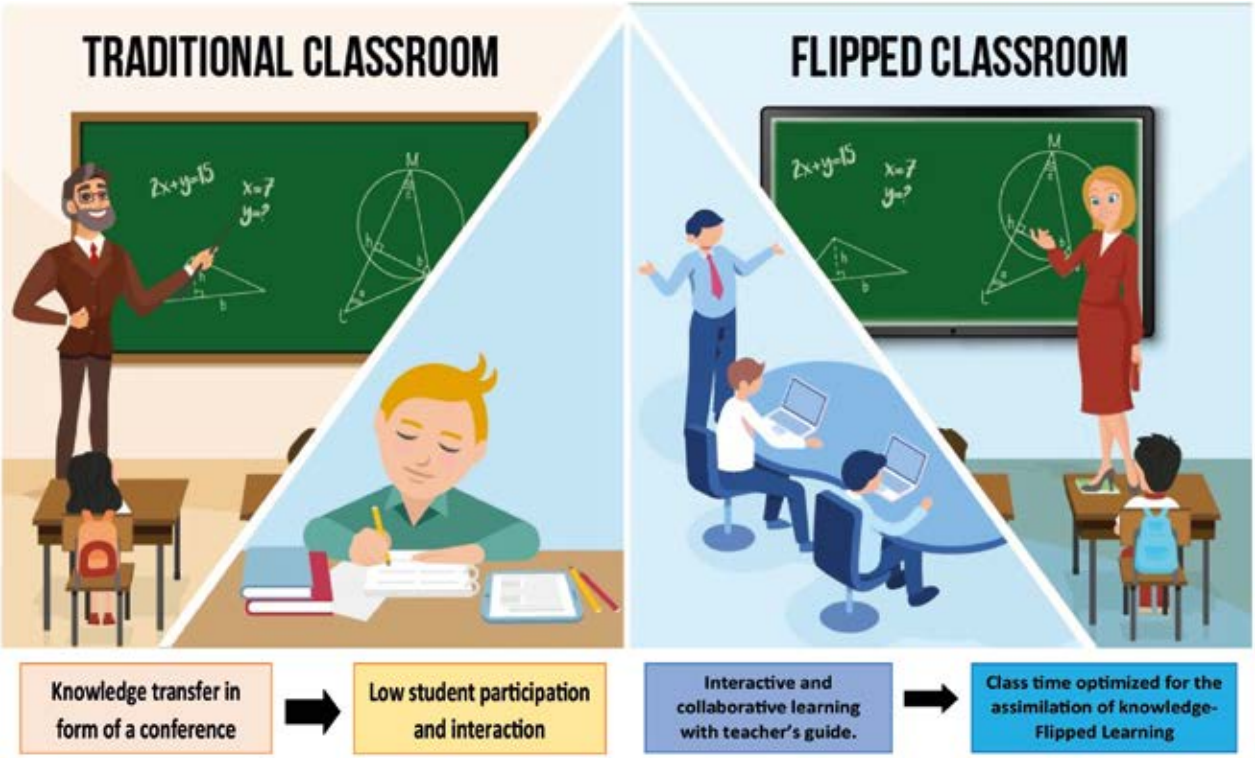
The interaction between teachers and students allows a new curricular innovation, in which the educational community is prepared for changes and works in collaboration to achieve a quality education based on innovation. ICTs provide valuable support for the creation in education, since institutions meet the requirements for undergoing digital transformation. Teachers can leverage their knowledge to improve the classroom environment, as shown in Figure 1. Therefore, it is essential to promote teaching to facilitate the development of educational innovation processes. Consequently, this article aims to demonstrate the applicability of the interactive teaching method based on the Integrated Educational Platform (IEP), using a learning engineering approach to innovate the Academic Support Program (ASP).

Mastery of the English language has become increasingly essential to academic, economic, technical, and social success due to globalization and advances in telecommunications. Updated digital technologies and learning methods are gaining worldwide support to improve traditional English language teaching, including innovative approaches such as the online, mixed and flipped learning paradigms (Fischer & Yang, 2022). Invested learning has gained momentum as educators strive to apply creative techniques that foster greater student engagement and active participation in educational settings (Holm et al., 2022).

Flipped Learning is a pedagogical model that involves instructors sharing predetermined digital resources with students outside the traditional classroom environment, facilitating the asynchronous delivery of related content through online platforms (Ruiz-Jiménez et al., 2022). This approach aims to transfer information to a significant group of students in the classroom, taking advantage of various technologies (Bursa & Cengelci Kose, 2020; Cárdenas & Inga, 2021). The Flipped Learning methodology provides students with more opportunities for problem solving, especially when applying newly acquired knowledge, and students have expressed a higher level of satisfaction compared to traditional teaching approaches (Staddon, 2022). This method helps to obtain a positive result when this model is applied to students in the seventh grade of General Basic Education.

Section 2 describes the research work. Section 3 presents the problem and the methodology. Section 4 presents the results. Finally, section 5 provides some conclusions.

Figure 1. *Flipped classroom as an innovation to traditional teaching*



1.1 Related Jobs

Innovation can be defined as the introduction of something new that has a significant impact on the community. It leads to exploring new forms of active learning, a broad concept that usually encompasses student-centered methods and teacher-led activities. Institutions must be well informed about trends in education in order to anticipate changes. Active methodologies play a vital role in teaching and learning, as they give priority to students, making them protagonists of a functional and constructive approach that distinguishes them from traditional teaching methods. Active learning activities such as peer discussions have been shown to improve students' understanding of the subject (Inga et al., 2021; Jia et al., 2023).

Teachers establish strategies that encourage students to apply their creativity, encouraging a learning approach by making it flexible, playful and attentive to various learning styles. This approach facilitates knowledge acquisition and personal fulfillment and promotes positive interpersonal relationships and social values (Moncayo-Bermúdez & Prieto López Yeimer, 2022; Yangari & Inga, 2021).

The current education system should emphasize the importance of active versus passive learning. Operational strategies focus on learning by doing rather than relying solely on passive activities such as listening, copying and repeating. This active learning approach encourages social interaction, discovery, play, and trial and error for effective learning and development.

Various teaching methods have been developed and implemented to involve students in learning, ensuring that they acquire, expand and practice the competencies required of future leaders (Leão et al., 2022). Active and student-centered learning methods will benefit greatly from these changes. Active learning for teaching has been supported by various political organizations, such as UNESCO, professional associations and accreditation organizations, which recommend incorporating active pedagogy into teaching practices (Hartikainen et al., 2019).

Teachers should create interactive classroom activities that involve group work, active exercises, and critical thinking to improve collaboration.

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High-level student-led discussions, problem solving, discussions, group projects, case studies, student presentations and collaborative problem solving can be employed (Huang et al., 2022).

Active educational methodologies share a common approach to student participation and the connection of content to real-life situations. Although there are different types or classes of active teaching methods, this research focuses mainly on Flipped Learning, which has three essential characteristics: students must be interested in content to participate in class, the teacher must act as a guide and establish a link with students with diverse needs, and the learning process must include planned activities that incorporate technology, motivation and group work.

The authors have observed improvements in students' grades and found that time for additional tasks is associated with deeper and more comprehensive learning. The benefits of this innovative teaching strategy versus more traditional active methodologies have been widely debated (Serrano Pastor & Casanova López, 2018).

The term "Flipped Learning" gained popularity when one of its methodological strategies was to create a podcast about the subject, which students could review on a platform as many times as they wanted. In the classroom, the students moved to lab activities, demonstrations, one-on-one assistance, and small group tutoring. Hence the slogan "Readings at home and homework in class" (Boubih et al., 2020).

According to the Web of Science database at Scopus, Flipped Learning originated in the United States, where there is extensive research on this approach. Over the years, it has spread worldwide. Many teachers have embraced this innovative methodology, expanding its implementation internationally, as shown in Figure 2. The flipped classroom approach, now known as Flipped Learning, continues to be explored, discovering its many benefits. In this approach, students assume the role of active participants in their education, while teachers guide and facilitate their learning process.

Numerous international studies have shown that the application of the Flipped Learning model encourages student participation and interaction with the teacher, as shown in Figure 3. This shift to digital devices in the classroom enhances student engagement. It allows for a range of interactive activities such as discussions, collaborative and cooperative work, Content and Language Integrated Learning (CLIL), collages, infographics and comic book creation.

Flipped Learning has yielded positive results in student achievement and has provided additional time for richer and more complete learning experiences. The shift from traditional active methodologies to this innovative teaching strategy has been widely debated and discussed (Serrano Pastor & Casanova López, 2018).

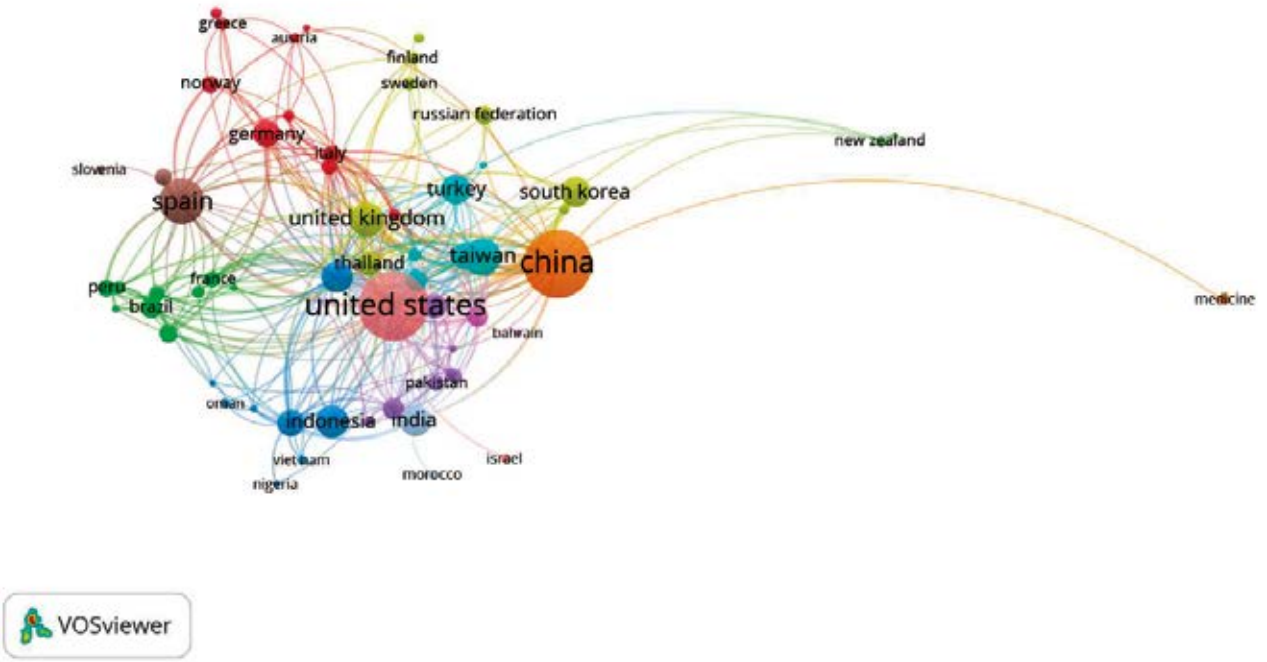
The method gained significant recognition when one of its key strategies consisted of creating podcasts that students could access on a platform at their convenience. It allowed dedicated classroom time exclusively to lab activities, demonstrations, one-on-one assistance, and small-group tutoring. As a result, the slogan "Readings at home and homework in class" was coined (Boubih et al., 2020).

Flipped Learning has spread worldwide. Teachers from several countries have adopted this innovative methodology, recognizing its potential to revolutionize education. As the implementation of Flipped Learning continues to grow, it is essential to highlight the change in the role of students, who are now active participants in their learning journey. Meanwhile, teachers take on the role of facilitators and guides, supporting students with diverse learning needs and fostering an enabling environment for effective learning. In conclusion, active learning, with a particular focus on Flipped Learning, has emerged as a powerful pedagogical approach that prioritizes student participation and the application of knowledge. By incorporating student-centered methods and teacher-led activities, institutions can adapt to the evolving educational landscape, anticipate changes and stay at the forefront of education. As education systems adopt active-learning methodologies, students can develop critical thinking, problem-solving, and collaborative skills needed to thrive as future leaders.

All teachers must possess the skills necessary to achieve technological change in education. The use of information and communication technologies (ICT) is essential in Flipped Learning. It includes training in the use, management and application of technology in the classroom to become 21st century teachers capable of developing the skills, attitudes and knowledge necessary for specific tasks (Yangari & Inga, 2021).

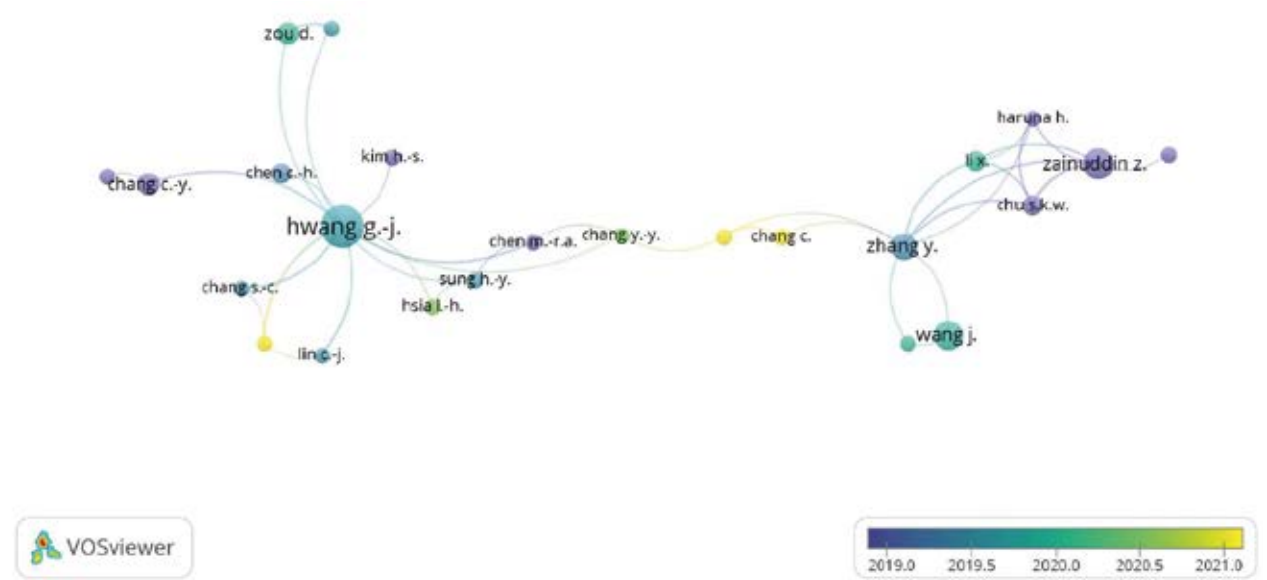
Teachers should receive regular training, especially in the use of technology, as the world was constantly evolving. Institutions should provide continuous ICT training to teachers to effectively teach this new generation of students (Sánchez et al., 2022).

Figure 2. *Bibliometric analysis: Leading countries in Flipped Learning and Education according to research networks — Scopus.*



English is the most widely taught language in different educational levels around the world, making it necessary to develop strategies, needs and approaches in various contexts, such as academic, geographical, social, economic or cultural (González-Urgilés et al., 2020; Xavier et al., 2020).

Figure 3. *The Flipped Learning model and student motivation: A research perspective*



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Motivating students to learn English is crucial; students often need more support and interest to learn the language. It is usually due to ineffective teaching methods and learning approaches. Innovations in the teaching of English through new technological tools can help to improve the generation, transformation, storage and dissemination of tacit knowledge in explicit knowledge (Aguayo Vergara et al., 2018).

Flipped Learning in English teaching allows better time management for students to solve doubts, perform group exercises and participate in collaborative practices, favoring the development of communicative competence. The flipped classroom promotes higher-order thinking, enhances teaching, improves oral expression skills, increases student engagement and develops social interaction and critical thinking skills (Umar & Ko, 2022).

Flipped Learning in English teaching allows better time management for students to solve doubts, perform group exercises and participate in collaborative practices, favoring the development of communicative competence. The flipped classroom promotes higher-order thinking, enhances teaching, improves oral expression skills, increases student engagement and develops social interaction and critical thinking skills (Umar & Ko, 2022).

The Flipped Learning model is based on four critical aspects with different environments and options for students, allowing them to move from a passive role to an active one. The teacher guides them on what they will work independently and what they will practice in class (Colomo-Magaña et al., 2020).

Although there has been much discussion about Flipped learning in recent years, more research is needed to explore how to motivate students to engage in self-study and class discussions and improve student performance. It is recommended to focus on discussions and reduce academic anxiety for high-level cognitive thinking (Li et al., 2022).

Table 1 presents relevant studies on the subject, highlighting the importance and relevance of this research in the context of previous studies.

Table 1. *Summary of jobs related to Flipped Learning*

Work	Problem			Restriction				Proposal		
Author	Student Dissatisfaction	Student Participation	Traditional Teaching	Scenario	Disciplinary Knowledge	Technological Knowledge	Pedagogical Knowledge	Learning Engineering Approach	Interactive Learning	Flipped Learning
(Fernández-Carballo, 2022)	✠	✠	✠						✠	✠
(Ruiz-Jiménez 2022)		✠	✠						✠	✠
(Li et al., 2022)			✠	✠		✠	✠		✠	
(Hernández-Sellés, 2021)	✠		✠	✠					✠	✠
(Mayer et al., 2021)						✠	✠		✠	
(Jia et al., 2023)		✠	✠						✠	✠
(Leão et al., 2022)		✠	✠			✠	✠		✠	
Holm et al., 2022		✠					✠		✠	
(Shaw & Patra, 2022)							✠	✠		
(Umar & Ko, 2022)	✠	✠	✠				✠		✠	
(Huang et al., 2022)	✠	✠								
Proposal by the authors	✠	✠	✠	✠	✠	✠	✠	✠	✠	✠

2. Problem formulation and methodology

Flipped learning is an educational tool to improve the teaching of English, so the methodology is divided into two main stages. The first stage is a bibliometric analysis to determine the impact of this tool on education. The second stage is statistical and consists of developing a survey instrument with Likert scale to measure the incidence of classical methodological processes in foreign language teaching, the motivational aspects of the method and its capacity to generate empathy in students. Finally, the results are analyzed to identify the relevant factors for using the learning model invested in the educational process.

At present, the academic level of students has been significantly improved thanks to the use of modern technology. Consequently, teachers must create innovative pedagogical strategies that go beyond the mere transmission of educational content. Teachers must train students with the skills and knowledge needed to face the challenges of the modern world in an independent, transformative and holistic way.

An innovative pedagogical approach is the Flipped Learning (FL) model, which encourages interactive learning and allows students to build their knowledge. The FL model incorporates inductive-deductive and analytical-synthetic methods, which facilitate the evaluation of students' progress in the framework of FL. This approach represents a shift from passive to active learning, and is gaining popularity as a modern and effective teaching methodology.

Therefore, to evaluate the effectiveness of the FL model, a survey was conducted using the Likert scale to measure the motivation of students to apply this approach during class hours. The results of the survey were analyzed to determine the success of the FL model. Figure 4 provides an overview of the current work, methods and assessments.

The Flipped Learning method is a pedagogical approach that consists of teaching classes outside the classroom while doing homework and other activities in the school. This model promotes an active and attractive learning environment, which motivates students to take ownership of their learning process. In contemporary society, the ubiquity of digital devices such as tablets and mobile phones makes it easier for students to access the materials needed for Flipped Learning, eliminating the need for traditional notebooks.

Figure 4. *Enhancing Evaluation in the Flipped Learning Model: Educational Innovation in Evaluation*

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The teacher continues to be the main facilitator of the learning process, guiding students and providing continuous hands-on assessment. Feedback is provided based on the specific needs of each student, ensuring that all students receive personalized attention and support. Through this approach, students become the protagonists of their education, allowing the identification and grouping of students according to their knowledge and skills.

Then, using the inductive-deductive method, the scientific articles organize the information in a comprehensive and localized way. This approach has a significant potential for the construction of knowledge, especially in the initial phases of research, by adhering to the external laws that govern the object of research. Then, to complement the research study, an exhaustive search of scientific articles was conducted in virtual libraries such as Web of Science and Scopus, covering the period 2018-2022 and using digital object identifiers (DOI) (Inga & Hinemphasis, 2015).

Therefore, to evaluate the long-term impact of this research, a weighted bibliographic analysis of 2000 scientific articles from the Web of Science and Scopus virtual libraries was performed. This analysis allows to understand how Flipped Learning has been developed at an educational level. In addition, the visualization of these data can provide more striking statements about the phenomenon of study.

Table 2 shows the countries with the most documents and citations using the Flipped Learning model. By comparing countries based on the number of studies per database, it can be confirmed that Web of Science contains more documents and information per country than Scopus, suggesting that research on Flipped Learning is more frequent in this database.

Table 2. *Most influential countries in Flipped & Blended Learning strategies*

Bibliometric Analysis					
Web of Science			Scopus		
Country	Documents	Citations	Country	Documents	Citations
U.S.A	569	2505	U.S.A	413	3085
Australia	148	1360	Taiwan	115	1230
China	238	1042	Australia	106	816
England	118	747	Hong Kong	56	801
Spain	200	676	Spain	102	670
Malaysia	55	508	China	113	624
Taiwan	104	478	Turkey	55	514
Belgium	23	451	United Kingdom	70	445
Canada	66	406	South Korea	52	333
Germany	64	352	Belgium	10	225

The use of innovative models in schools responds to the needs of the educational community, which requires the mobilization of resources and collective participation. Such models induce innovation and generate transformations in extracurricular subjects, leading to active learning. However, to achieve this, it is necessary to visualize a change from the traditional to the current pedagogy.

The use of technological and innovative tools can help in the implementation of Flipped Learning, which can be evaluated through this method. An analytical-synthetic process is valuable to analyze research documents and extract crucial elements associated with the object of study. This method helps to observe and verify the causes and effects of innovative learning models. Applied to an evaluation

process, it can determine if the student constructs knowledge successfully.

The subjects of the research were students between 10 and 11 years of age, who are studying the seventh year of Elementary school at the Bilingual Private Academia Militar del Valle (AMV). With technological advances, educational institutions have been remodeled and, due to the pandemic, institutions are better equipped than teachers and students at home. Students and teachers can now connect to the classroom and use the materials teachers share, using the Internet and network devices.

The data for the study was obtained through a survey conducted in Microsoft, and the survey aimed to gather general information on the application of the innovative methodology in English subjects for seventh grade students in the second term. The questions and tools used in the survey were identified by studying other relevant articles. In addition, the survey aimed to examine whether the stated objective of the innovative methodology had been achieved.

Table 3 presents a set of 25 questions designed to be administered to students, using a 5-point Likert scale that includes a neutral midpoint and points of disagreement and agreement. This scale ranges from 1 to 5 and aims to capture the attitudes and opinions of students towards the subject. Specifically, this research aims to know the perceptions of students about the effectiveness of the Flipped Learning model and information and communication technologies (ICT) in the acquisition of knowledge, motivation and communication with teachers, as well as in the overall academic performance in English.

The objective of the survey was to inform students of the research objectives and to know their views on Flipped Learning and ICT. The questionnaire aimed to know the perceptions of students on how Flipped Learning and ICT can influence their acquisition of knowledge, motivation, communication with teachers and their performance in English. The data obtained from the study revealed a considerable variability, since students expressed different levels according to the items presented. In addition, the survey provided valuable insights into how often students use digital tools for academic activities in and outside the classroom.

Table 3. *Invested Learning and ICT for Education - Student Survey*

1. Are you interested in using more digital (technological) resources during school hours?
2. Would you like your teachers to use interactive games more frequently to encourage the teaching content in class?
3. Do you think your knowledge will improve if your teacher uses new technological tools?
4. Can activities like interactive games or videos help you better understand a topic?
5. Would you like your teacher to implement lessons through interactive games?
6. Does your teacher use digital tools in the classroom such as videos, games and virtual environments?
7. Does your teacher motivate you in class when you learn new topics?
8. When you have difficulty learning a topic, does your teacher help you?
9. Does your teacher use innovative technology tools to evaluate in class?
10 The methodology of the teacher in this second semester considers the strengths, weaknesses and interests of the teacher.
11 The methodology allows everyone to participate in the discussion of the issues.
12. Do you work with your teacher on the three stages of the “Learning by Doing” model?
a. Review of the lessons on video at home.
b. Reinforcement with the teacher.
c. Tasks to assimilate knowledge and evaluate the process.
13. The activity of watching interactive videos such as Playpost, Edpuzzle and Youtube helps to understand the content
14. Watching videos at home encourages learning and understanding of concepts before class.
15. Reading before class helped me understand the topic that was going to be discussed.
16. Bringing images to discuss helped me develop communication (speaking) skills.
17. Would you like to have more knowledge about the topic to discuss before the class?
18. Do you find it difficult to do activities at home? Do you get easily distracted?
19. Do you think you could learn on your own (autonomously) using the Internet without a teacher?

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20. Do you think that doing group work among peers favors the understanding of the topic?
21. Completing worksheets in class about the video you watched at home reinforced your knowledge.
22. Reading before class helped us understand the topic being discussed.
23. Did giving oral presentations on the topic improve your English language skills?
24. Would you like your teachers to use a different teaching method in class?
25. Are you interested in the tasks and projects presented by your teacher?

3. Analysis of the results

The results were obtained from a population of 72 students of seventh grade of Elementary School at the the Bilingual Private Academia Militar del Valle.

The opinion of all students who solved the research instrument is known. The following table shows the Likert scale options and the percentages of each question selected by the students surveyed. These percentages will be fundamental to discover if FL is considered an innovative methodology for its application in the teaching of English. Table 4 shows the quantitative survey results.

This data analysis is divided into four parts to discuss the FL model in seventh grade students.

Table 4. *Survey Score: Flipped Learning - Students*

	Q1	Q2	Q3	Q4	Q5
Questions	**Totally agree**	**Agree**	**Undecided**	**Disagree**	**Totally disagree**
	%	%	%	%	%
Q1	43 %	28 %	24 %	1 %	4 %
Q2	69 %	22 %	6 %	1 %	1 %
Q3	42 %	22 %	25 %	7 %	4 %
Q4	61 %	24 %	10 %	3 %	3 %
Q5	58 %	25 %	8 %	6 %	3 %
Q6	60 %	17 %	17 %	4 %	3 %
Q7	67 %	24 %	3 %	3 %	4 %
Q8	75 %	21 %	3 %	1 %	0 %
Q9	44 %	28 %	24 %	3 %	1 %
Q10	43 %	36 %	15 %	4 %	1 %
Q11	63 %	26 %	8 %	1 %	1 %
Q12	65 %	22 %	10 %	0 %	3 %
Q13	58 %	29 %	7 %	6 %	0 %
Q14	46 %	38 %	7 %	7 %	3 %
Q15	64 %	28 %	7 %	0 %	1 %
Q16	61 %	25 %	8 %	6 %	0 %
Q17	60 %	22 %	15 %	3 %	0 %

	Q1	Q2	Q3	Q4	Q5
Questions	**Totally agree**	**Agree**	**Undecided**	**Disagree**	**Totally disagree**
Q18	14 %	11 %	27 %	19 %	29 %
Q19	15 %	13 %	18 %	11 %	43 %
Q20	75 %	17 %	6 %	1 %	1 %
Q21	72 %	22 %	1 %	1 %	3 %
Q22	67 %	26 %	6 %	0 %	1 %
Q23	60 %	17 %	21 %	0 %	6 %
Q24	35 %	11 %	28 %	6 %	21 %
Q25	58 %	26 %	11 %	1 %	3 %

Figure 5 discusses the use of technology in virtual and face-to-face classes. It is observed that 43% would like to implement digital resources during class hours as this would change the traditional methodology of copying by an innovative method where they are the protagonists of their learning.

Seventy percent of students agree that teachers should use interactive games more often to revitalize teaching in the classroom. Sixty percent of them say that activities like interactive games and videos helped them better understand the topic. The same percentage range agrees that teachers use lessons through interactive games and that digital tools such as videos, games and virtual environments are used in the classroom to make this new learning more active and enjoyable.

Figura 5. *Technology in face-to-face and virtual classes*

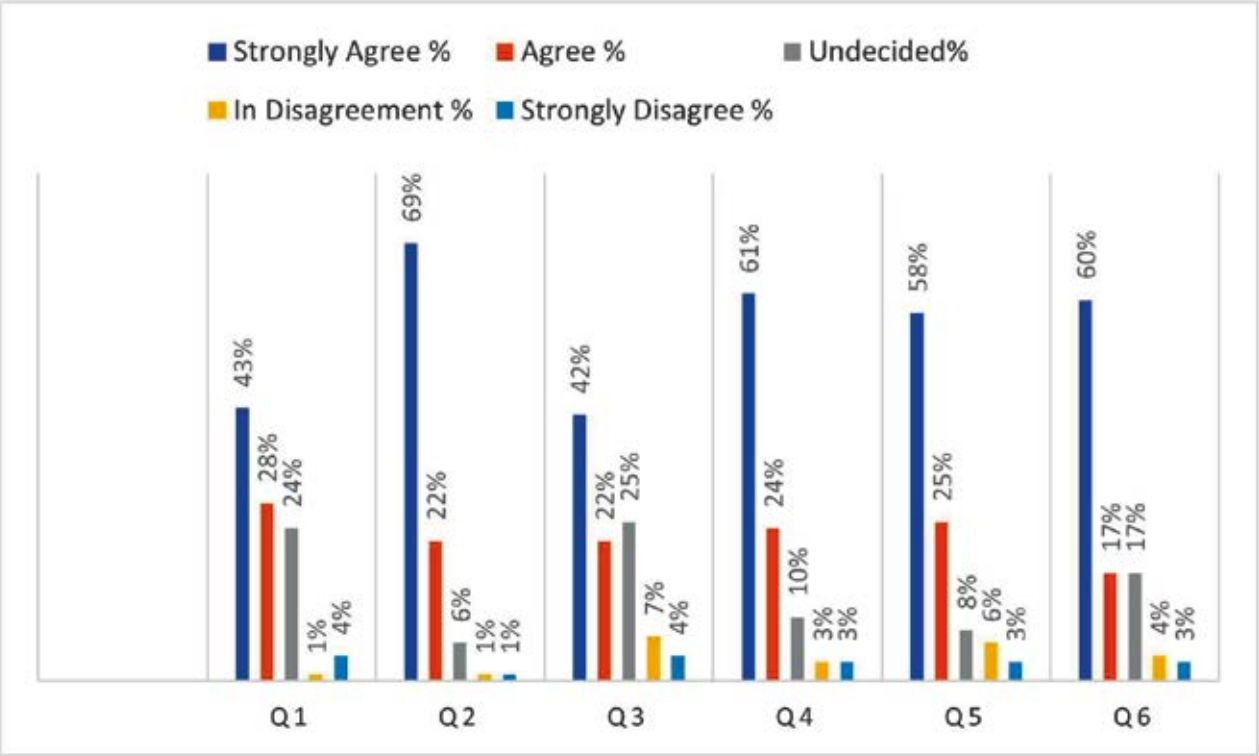

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Figure 6 refers to the methodology used in class and the motivation students receive when they study a subject in English. The visualization of the data in the figure shows that approximately 70% of students feel motivated by the teacher during the class, especially when they learn new topics in English. In addition, students claim to receive support from their teacher when they face learning difficulties. It should be noted that motivation plays a crucial role in the learning process, as it fosters a supportive environment in which students can confidently ask questions and learn from their mistakes.

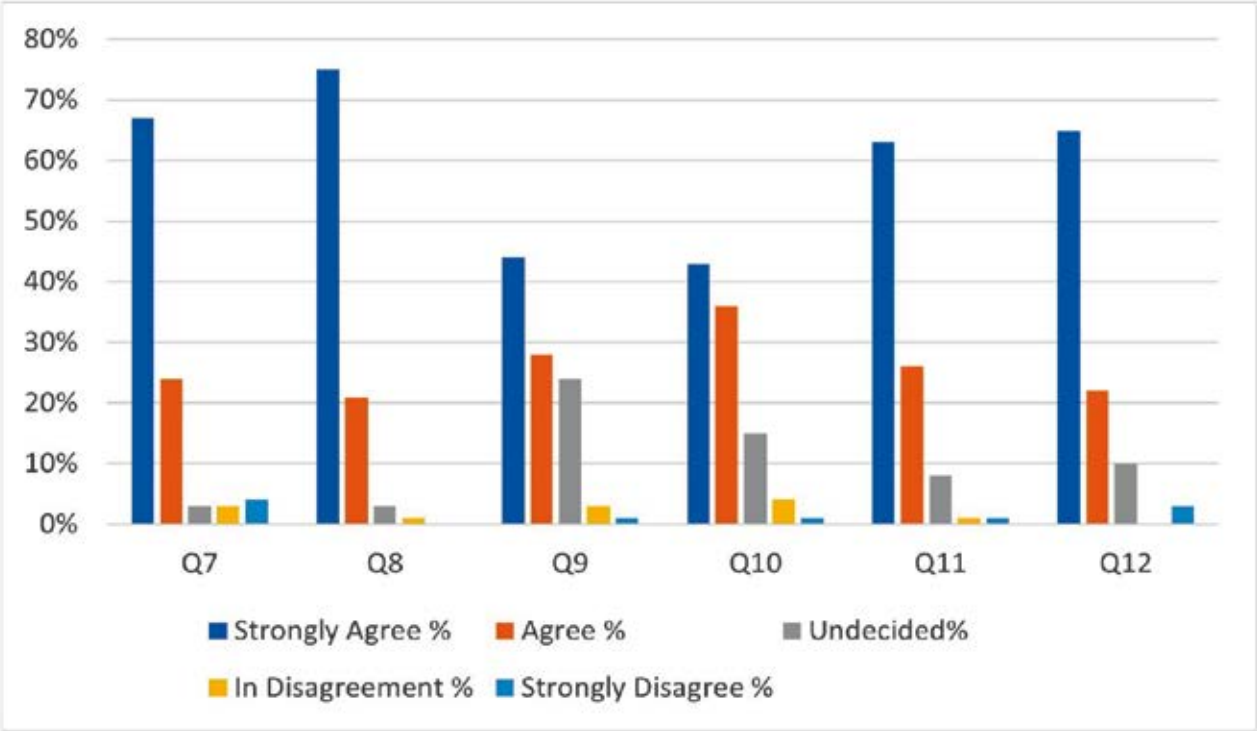
The data presented in the figure also reveals that 63% of students approve the active methodology used by the teacher in the second term. Flipped Learning allows students to be the protagonists of their learning while the teacher guides them. In addition, the graph indicates that 65% of the population approves the teacher's implementation of the three phases of Flipped Learning: reviewing previous lessons on video at home, reinforcing knowledge in class, completing tasks to acquire knowledge and evaluating the learning process.

The next section of the research analysis delves into Flipped Learning and its three stages. Figure 7 compares the conventional teaching methodology and the Flipped Learning model. The traditional approach involves the teacher preparing and delivering the material during the class, while students listen and take notes, followed by homework to test their understanding.

Instead, Flipped Learning puts the student in the foreground and the teacher as a guide. Students receive study material to read and internalize the content beforehand, while the teacher records and shares lessons outside the class. Students then see or hear the lesson before they attend class.

However, the study scenario will be different for Latin America, where there are educational institutions in urban, suburban and rural areas, and where technological resources can be an obstacle to the proper application of Flipped learning. Questions 10, 11 and 12 imply that the students used Flipped Learning in their learning process, thus evaluating the application of the methodology during a certain period, which evidences an experimental approach.

Figure 6. *Class Methodology*



Classroom time is devoted to applied learning activities and individual tasks, reinforcing the knowledge acquired before class. During this time, students discuss the content with their peers and the teacher. In the last stage, students verified and confirmed their understanding by performing additional learning activities and received support from the teacher when needed. After applying this active and innovative methodology, the following results were obtained in understanding how the process works.

Figure 7. *Traditional Learning vs. Flipped learning*

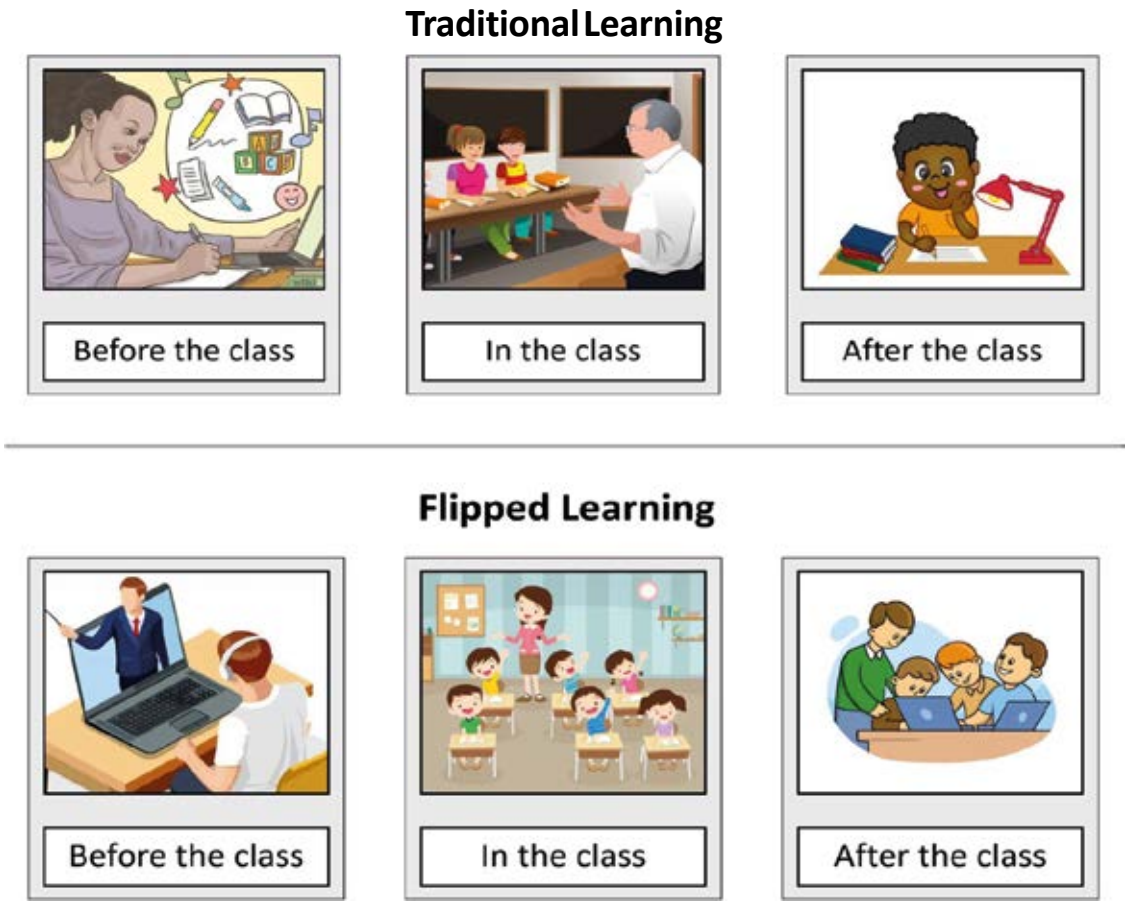


Figure 8 identifies that 70% of students agreed with the previous moment, which consisted of watching interactive videos on Playposit, Edpuzzle, and YouTube. These videos helped to understand the topic before attending class. They said watching videos at home helps them learn and understand concepts, and that reading before class helped them understand a new topic. Therefore, to develop the ability to communicate (speak), presenting images on a subject allowed the student to imagine the topic of the class, to ask questions and imagine what is being discussed; in class, a debate on images is held.

Therefore, the acceptance of this moment was very positive, with more than 60% of the students wanting to acquire more knowledge about the topics to be discussed before attending classes, so they could have a very open dialogue in class, hold discussions and better understand some doubts they may have had the day before. Hence, they stated that it was easy to carry out these previous activities with the mentioned platforms, Playposit and Edpuzzle. Each of these applications is interactive; while watching a video made by the teacher, they have questions within the video, which keeps them active and focused on the information provided. In addition, it is confirmed that 43% of students need the support and direction of the teacher to guide them in the new knowledge, so the teacher directed this moment well.

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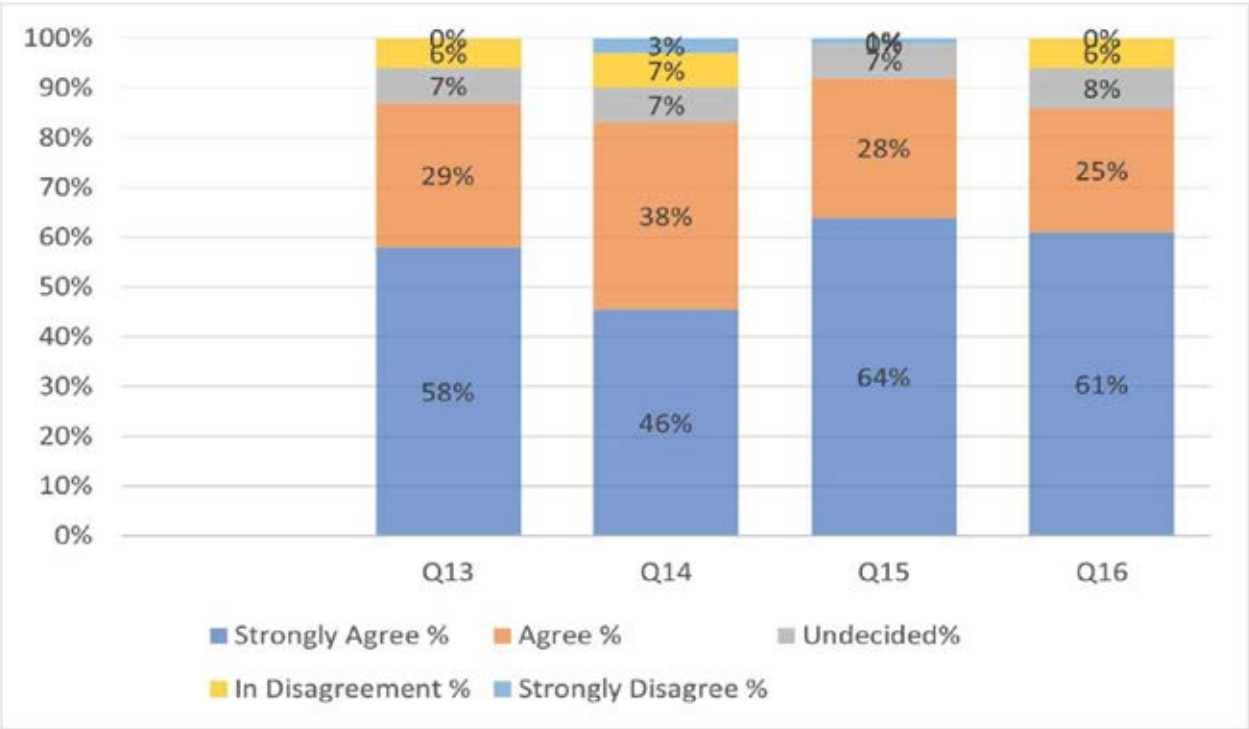
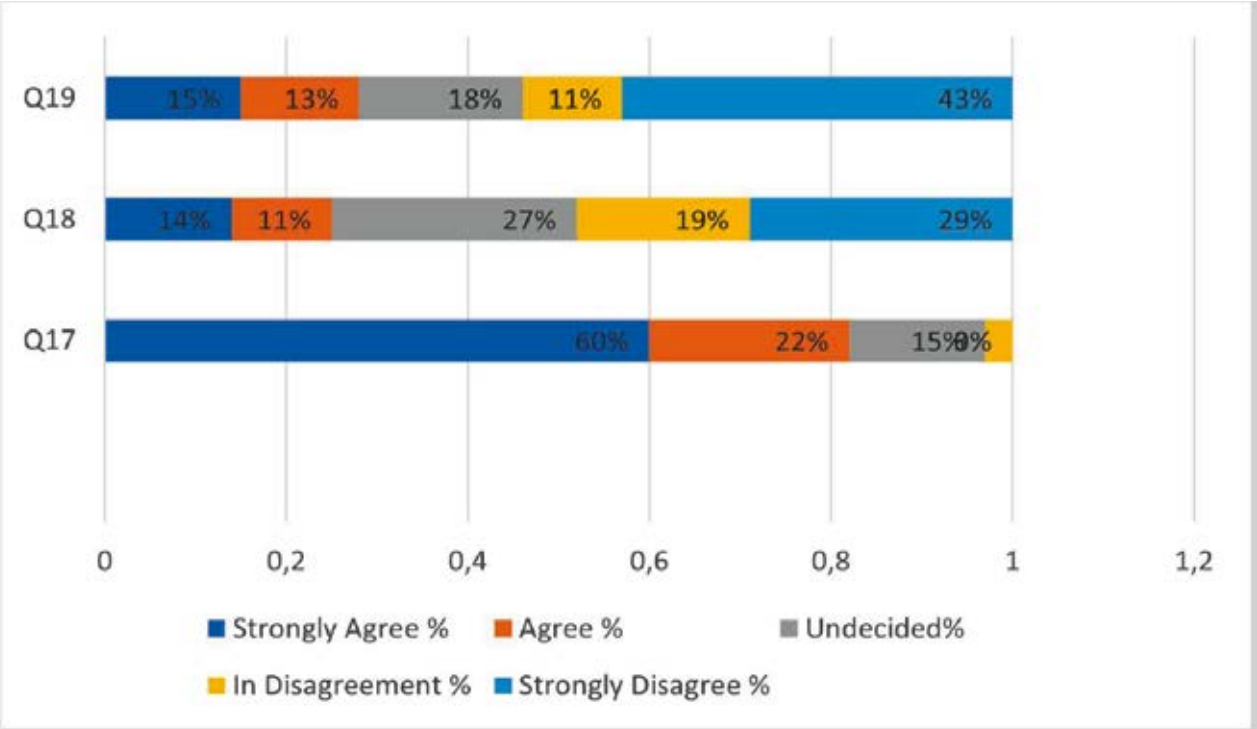
Figure 8. *Teacher survey: a comparative analysis of results. —(a) Application of the moment before (b) Acceptance of the moment before*

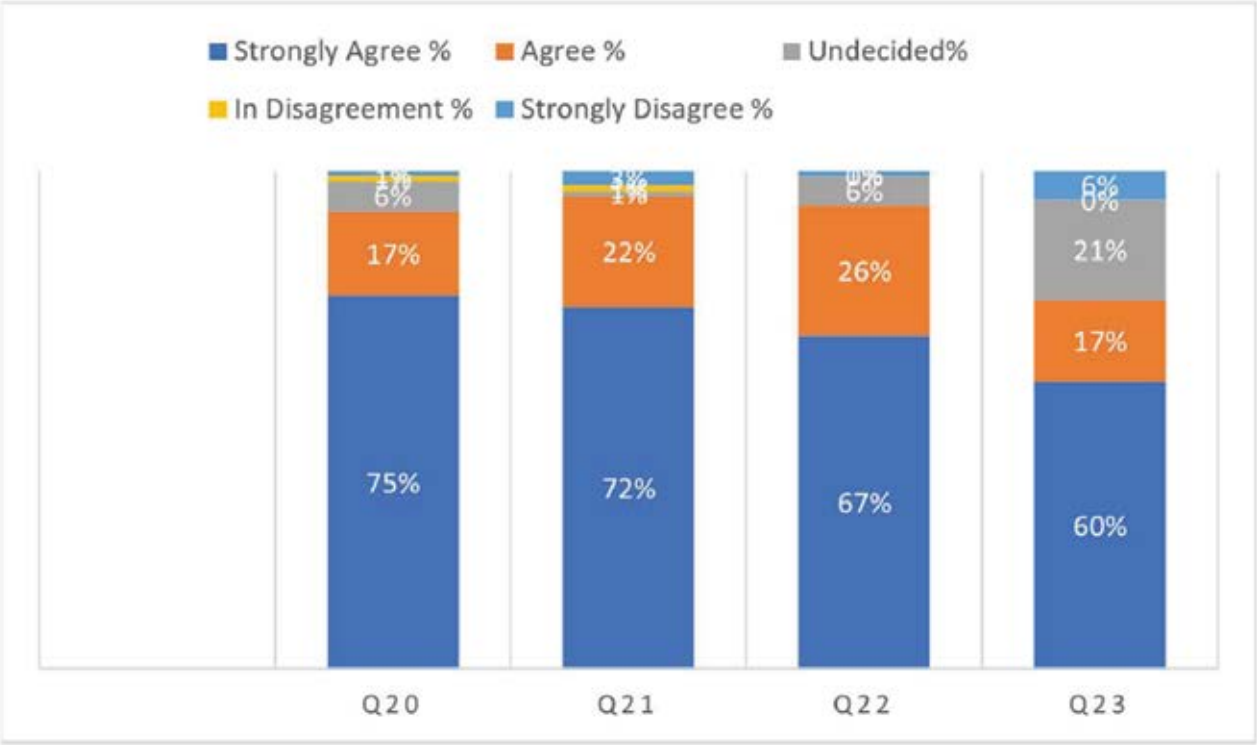


(a) Application of the moment before FL

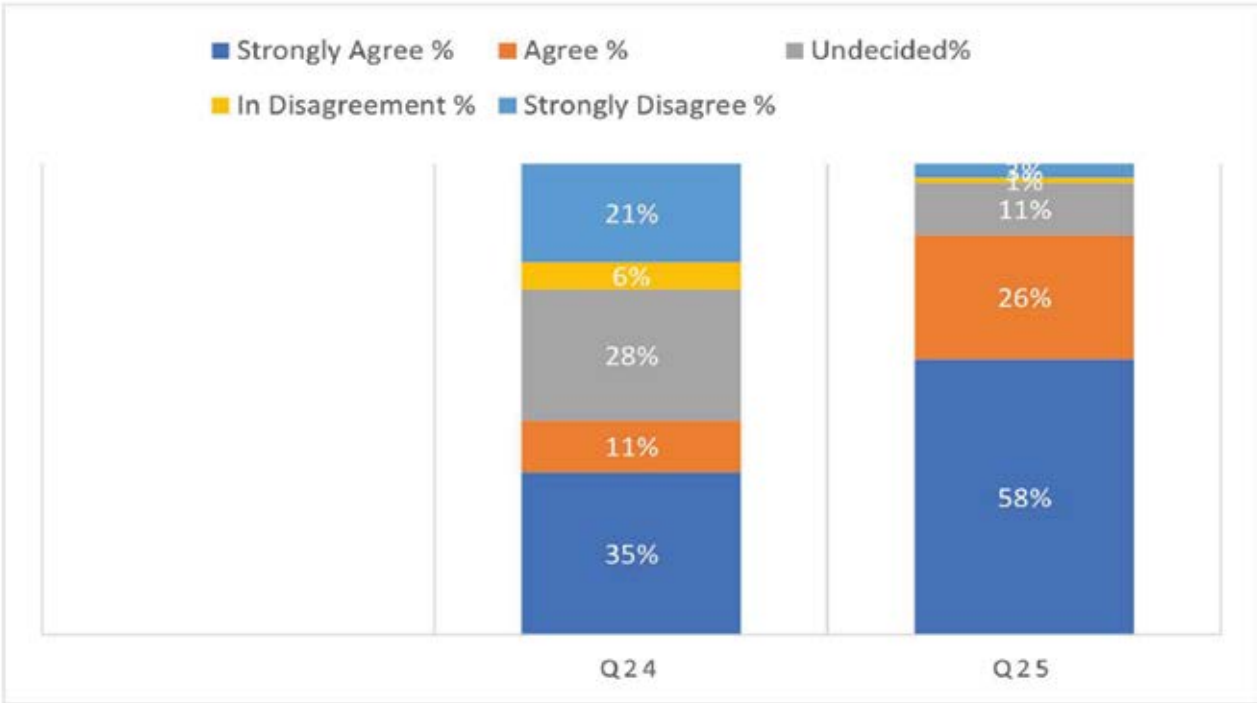


b) Acceptance of the moment before FL

Figure 9. *Teacher survey: a comparative analysis of the results. —(a) Application during and after (b) Acceptance of moments during and after.*



(a) Application of the moments during and after



(b) Acceptance of moments during and after

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Figure 9 shows students' perceptions of the moments during and after Flipped Learning. It is observed that 75% agree with the way they worked in class, since it favors the understanding of the subject and the teamwork strengthened friendship. Completing classroom worksheets on home-watching video reinforced the knowledge gained at home. Reading before class helped them understand the content, and applying it to reading comprehension was very beneficial, as they researched words they did not know. They stated that oral presentations or discussions improved their English language.

The acceptance of these two moments of Flipped Learning corresponded to the total. Students want teachers to use a different, active and innovative way of teaching, so they confirm that having applied this methodology, they were very interested in working both outside and inside the classroom. To conclude this section, it can be stated that the students accepted this active methodology.

4. Discussion and conclusions

This article has yet to review the disadvantages of the model, which are evident when technological resources are scarce in urban, suburban or rural areas. Other studies address concerns about the extra time teachers would need to invest in creating technical resources, bandwidth limitations in homes, or limited time after completing various forms inherent to a chaotic education system in Latin America due to the increase in indicators that seek to measure the entire teaching-learning process (Cueva & Inga, 2022).

There are concerns about the time teachers would have to spend in a computer to acquire the learning resources needed for Flipped Learning or the time students forced many teachers to use technology; however, educational innovation must be focused in rural areas without the Internet (Ramirez, 2022).

However, after the pandemic, many have returned to traditional classroom teaching, often experiencing fatigue, frustration and even early retirement by not being updated in competition with digital tools or unable to read updated documents in English.

This work has shown that Flipped Learning is an innovative educational strategy that offers numerous benefits in the teaching-learning process. By shifting the traditional delivery of content in the classroom to pre-study activities, Flipped Learning promotes a more active approach by students, encouraging their participation and engagement. By accessing pre-class learning materials, students can better prepare themselves, delve into concepts and reach the course with a basic level of knowledge, facilitating a more enriching and meaningful discussion environment according to Parra-González et al. (2020).

In addition, Invested Learning allows teachers to devote more time in class to solving problems, carrying out practical activities and providing personalized tutoring, promoting a deeper and lasting learning. However, in spite of the benefits mentioned above, there are also challenges and limitations that must be taken into account in Flipped Learning. First, their implementation requires careful planning and preparation by teachers. Creating pre-study materials and managing classroom activities can be intensive and time consuming, as expressed in Hossein-Mohand et al. (2021).

In addition, some students may need help accessing resources outside the classroom, especially those who need reliable Internet access at home. This can create inequalities in learning and affect the participation of specific students. In addition, Flipped Learning requires more responsibility and self-discipline on the part of students, requiring them to participate independently. Some students may need help organizing their time and keeping up with homework.

Flipped Learning has been widely accepted as an innovative and active method for integrating ICTs within and outside the classroom. This approach has helped students feel more involved in their learning process.

After researching the scientific literature related to the Flipped Learning model, it is possible to affirm that it promotes interaction between teachers and students, especially in the teaching of English. This model has allowed students to interact with technological tools and engage in meaningful discussions about what they have learned in class.

The results of the survey show that Flipped Learning has improved critical thinking, collaborative and cooperative skills, and the ability to create independently in students. These skills prepare them for new realities and facilitate more effective learning outcomes than traditional teaching approaches.

In addition, the students' feedback revealed that they were highly motivated to interact with their teacher in this new way. All the technological tools

used to implement the flipped learning model provided significant support to their learning process, allowing them to adapt to their own pace of learning.

By planning and implementing the Flipped Learning, the teacher was able to renew his/her teaching approach and explore new active methodologies. This approach emphasized the development of students' oral expression in English language teaching, identifying motivation as the key factor for students' continuous acquisition of English language skills.

Flipped Learning is one of the most widely used active teaching methodologies in the world, and this research supports its acceptance and effectiveness among students and teachers. As a result of this study, further research will continue to explore new active teaching methodologies for English subjects.

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Storytelling and the teaching-learning process in the Nursing Major

Storytelling y el proceso de enseñanza-aprendizaje en la carrera de Enfermería

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Abstract

Considering dynamic and meaningful learning, the present study aimed to analyze the use of Storytelling applied remotely as a teaching activity for students of an undergraduate nursing course who participate in an academic association. A cross-sectional analytical and qualitative study was carried out, whose participants were students linked to an academic association at a federal public university, in the city of Rio de Janeiro (RJ), Brazil (BR). Data collection was carried out through an electronic form and remote focus group, demonstrated by descriptive statistics and analysis of the thematic content by category, with the Significance Units identified by colorimetry from the meaning of each Record Unit that gave rise to two categories: 1) Storytelling during the teaching-learning process and 2) Storytelling perceived by students. The stories demonstrate the students' perception in relation to the planning and teaching-learning experience, regarding the use of Storytelling and the collective construction of the story presented, based on the challenges and contributions that this process brought to their training. It was observed that Storytelling can be used as a strategy to mobilize emotions and feelings, dynamic and meaningful, adaptable to the digital format and positively accepted among undergraduate students. Its use is suggested in the teaching-learning process and in research to measure its effectiveness and efficiency.

Keywords: storytelling, nursing service, teaching materials, pedagogical innovation, learning methods, pandemic.

Resumen

Considerando el aprendizaje dinámico y significativo, el presente estudio tuvo como objetivo analizar el uso del *storytelling* (narración de cuentos) aplicado en forma remota como actividad de enseñanza para alumnos de un curso de pregrado en enfermería que participan en una asociación académica. Se llevó a cabo un estudio transversal analítico y cualitativo, cuyos participantes fueron alumnos vinculados a una asociación académica en una universidad pública federal, en la ciudad de Río de Janeiro (RJ), Brasil (BR). La recolección de datos se realizó a través de un formulario electrónico y grupo focal remoto, demostrados por estadística descriptiva y análisis del contenido temático por categoría, siendo las Unidades de Significación identificadas por colorimetría a partir del significado de cada Unidad de Registro que originaron dos categorías: 1) *Storytelling* durante el proceso de enseñanza-aprendizaje y 2) *Storytelling* percibida por los alumnos. Los relatos demuestran la percepción de los alumnos en relación con la planificación y experiencia enseñanza-aprendizaje, mediante el uso del *Storytelling* y la construcción colectiva de la historia presentada, a partir de desafíos y contribuciones que dicho proceso trajo para su formación. Se observó que el *storytelling* puede ser utilizado como una estrategia movilizadora de emociones y sentimientos, dinámica y significativa, adaptable al formato digital y de aceptación positiva entre los alumnos de pregrado. Se sugiere su uso en el proceso de enseñanza-aprendizaje y en la investigación para medir su eficacia y eficiencia.

Palabras clave: storytelling, servicio de enfermería, material didáctico, innovación pedagógica, método de aprendizaje, pandemia.

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1. Introduction

Storytelling can be defined as "the art of telling, developing and adapting stories using specific elements—character, environment, conflict and a message—in events that have a beginning, a development and an end (...)" (Vieira, 2020). Storytelling originated in Hollywood scripts, containing a formula to apply in terms of the development of the characters and their stories. Largely used in marketing, storytelling is also fundamental to the development and conduction of strategies, due to the capacity of human beings to create, transmit and give meaning to the world in a narrative way, which seems to positively impact business (Mills & Key, 2022).

The art of storytelling has been explored from promoting startups to inspiring creativity in the workplace and in entrepreneurial leadership strategy. Neuroscience has used storytelling as a research topic and has observed its capacity for neural mobilization (Suzuki et al., 2018), stimulating and encouraging learning.

A systematic review showed the applicability of a digital version of storytelling used in education, both in Pedagogy and in research and methodological guidance. It should be noted that digital storytelling is understood as "the facilitated production of a short digital story in an educational community... that contains a mixture of digital images, text, recorded narration and/or music" (Wu & Chen, 2020, p. 2). Despite its origin, storytelling has been transposed to other areas of knowledge, specifically nursing, for example.

A Norwegian study, through reflections enabled by storytelling (Petty, 2021), aimed to improve empathy and learning of nursing students by parents of children hospitalized in Neonatal Intensive Care Units. Telling stories as a teaching method to guide women and their families about breastfeeding through storytelling was used as a strategy in a study, as it allows a space to talk about social influences in breastfeeding experiences, in addition to promoting elections, affirmations and catharsis.

The authors also emphasize that storytelling, in the context of clinical practice, can help in the development of individualized care plans, improve communication, and serve as a tool for team development (Lober & Komnenich, 2020).

Involving leaders and keeping them focused on the principles of nursing, as a caring profession, was the focus of a study and, for the authors, storytelling is a multidimensional strategy (Schoenhofer & Boykin, 2022).

Different studies have implemented storytelling as a learning strategy: in a quasi-experimental study to teach about blockages in academic branches compared to traditional classes (Zare et al., 2021); Pharmacology, in a postgraduate course for obstetric nurses (Bano et al., 2020); Ethics, for oncology nurses (Wall, 2021).

The digital version of storytelling has also been used. A Norwegian study aimed to explore the experiences of students from storytelling, with the aim of promoting reflection related to clinical practices (Urstad et al., 2018).

Another characteristic to highlight as positive is to be able to work with topics that sometimes arise from the experience of internships or other practical activities and need to be revisited or even prepare for students in a more proactive way, using as an example the process of death/dying (Moreau et al., 2018).

The change in attitudes towards death of nursing students in their last year in Turkey was identified as a significant effect ($p < 0.05$) resulting from the use of storytelling. The study was conducted with 94 students and data were collected by applying the *Death Attitude Profile-Revised* questionnaire and semi-structured interviews in focus groups. The following aspects were attributed to storytelling: its contribution to learning; its effect on the attitude towards death; reflections on its contribution to knowledge, skills, and attitudes in the provision of care to patients at the end of life (Dorney & Pierangeli, 2021). In terms of palliative care, the strategy can contribute to students' perception of the complexity of care and the importance of the integrality and personalization of care (Price et al., 2015).

Not only in health education, but also in professional education, storytelling can be used. However, a Canadian systematic review showed the need for more solid studies, mainly qualitative, that can assess the impact of digital storytelling on professional education, especially regarding the behavior of professionals. Therefore, the authors included in the review only studies that focused at least on level 2 or 3 of the Kirkpatrick New World model. This model has four levels and measures the evaluation of training, with level 2 focused on the learning of health professionals (degree of acquired knowl-

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edge, ability, attitude, confidence and commitment); and level 3 focused on behavior (degree of behavior change) (Gurney et al., 2023). As a result, learning turned out to be more effective when the storytelling strategy was applied from the co-creation or use of one's own stories.

Storytelling has been used as a strategy not only for nursing students and nurses, but also for patients, due to its impact on the brain (Darby et al., 2022). Storytelling can be seen as a nursing practice, even spread through digital social networks (Fischer, 2019). Storytelling, on the part of patients, also seems to help them with their own experiences, in addition to sharing them with other patients, family members and health professionals. A Brazilian study showed the benefits of storytelling with a group of older people attending a basic health institution to encourage active aging (Costa et al., 2016).

A Swiss qualitative study with six participants, involving COVID-19 patients and survivors, revealed how survivors went from being overwhelmed by symptoms to understanding what was happening to them. The strategy allowed to feed back the caregivers and participants of the study to demonstrate gratitude for the care received, to become aware of a new state of normality, to regain control of their lives and to discover important lessons behind the lived experience (Roig-Vila et al., 2023).

Nursing should be highlighted as an essentially practical profession, which is taught through face-to-face contact between teachers, students and users of the health system, so that storytelling can facilitate the identification of obstacles and opportunities that could impact the student-patient during practical teaching (Timpani et al., 2021). Allowing this learning to be carried out through a dynamic and meaningful strategy is a challenge for teachers and students, in terms of identifying their potential and limitations as an active methodology (Henrickson et al., 2022).

Thus, this study aims to analyze the use of remotely applied storytelling as a teaching activity for undergraduate students in nursing.

2. Methodology

This is a cross-sectional analytical study with a qualitative focus on storytelling as a teaching strategy. The context for its development and implementation was in the first year of the COVID-19 pandemic, in June and July 2020, when the university suspended its academic calendar. Despite this suspension, contact was maintained between students, teachers and the university, promoting, at the time, various teaching activities remotely, due to the need for social distancing. In this context, the method/methodology of storytelling emerged as a way to encourage the active participation of students in their learning process.

The storytelling was planned, developed and presented by participating students of an academic association of cardiology and pneumology and the advisors of the faculty, in the form of a course with four remote meetings open to the internal and external community to the university.

The title of the story was "Alfredo´s Tale". The students were divided in the four meetings, some of them being in charge of narrating the story and, at a certain point, others 'interrupting' it to bring a scientific approach to the topic. For example, in the first episode we see the main character in some risk situations and ends up getting infected with SARS-CoV-2. When signs/symptoms occurred, the narrative was interrupted and the explanation about the disease, forms of contagion, signs/symptoms, and medical diagnostic forms began.

Presentations created on the Canva ® Platform were used, in book format, where each page was part of the story. At the end of each chapter (course day), the "scenes from the next chapter" were presented, with the aim of maintaining the public's interest in the story; it was quickly understood by all participants that screen time should not exceed two hours. Each chapter of the story was structured by the students, under the guidance of the teachers, with remote and synchronous discussions for adjustments, criticism and training. After each chapter, there was a virtual *debriefing* between students and teachers.

Regarding the structure of storytelling, the organization was based on the following elements:

Message: the story included elements that were being widely discussed at the time to promote critical reflection, such as: minimizing the risk of contamination; fake news; use of drugs for the prevention/treatment of COVID-19; use of masks; social distancing; age as a protective factor; and terms that circulated both in memes and social networks, newspapers and in everyday conversation. By showing the contamination of the character (Alfredo), although he was

young and at serious risk of death, it was intended to show not only the damage of the disease, but the structure of SUS (Brazil's Unique Health System) and its benefit for the population of Brazil, which allowed the improvement of Alfredo. It was also emphasized that this could have been avoided through individual and collective educational measures.

Environment: the environments were varied, as the story develops according to the clinical evolution of the character, namely: Primary Health Clinic, Emergency Care Unit (UPA), Hospital. All institutions belonging to the Brazilian Unique Health System (SUS). For each environment, the students presented the contextual structure and function in SUS and how the journey of the character occurred in that area of health care.

Character: his name was Alfredo, alluding to a significant character of the Nursing School; he was defined as a young university student, who had difficulty following public health measures such as social distancing and mask wearing, despite having morbid asthma. Based on the infodemic and the spread of fake news at the start of the COVID-19 pandemic, Alfredo preferred to expose himself to risk, as he did not think it was a serious disease, but rather "a common flu"; moreover, he was young.

Conflict: Alfredo presents the first symptoms of COVID-19 and goes to the Primary Health Clinic where he was treated. As his clinical condition worsens, he progresses to acute respiratory failure and, being treated at the UPA, ends up receiving invasive ventilatory support. He is taken to a hospital, where he remains on mechanical ventilation and, because he remains refractory to measurements, is prone. Finally, Alfredo shows a gradual improvement, with some temporal effects. He is discharged and returns to the Primary Health Clinic to continue his rehabilitation process.

The population of this research was composed by students linked to the academic association belonging to an undergraduate course in Nursing of a public university, located in Rio de Janeiro (RJ), Brazil (BR). The inclusion criteria were: adults over 18 years of age, of both sexes and who had participated in at least two of the four remote meetings.

The data collection was carried out in two stages. Initially, all participants responded to an online tool, through Google Forms®, intended for their characterization, whose link was sent to participants by email available in the course registration form by one of the research assistants. The link presented the Free and Informed Consent Form (FPIC), through which the students gave their consent and, if they participated in the research, they would fill out a questionnaire with the following variables: age, career and undergraduate period, whether the institution of origin was public or private, and whether he/she had participated in the event as speaker, listener or organizing committee. At the end of the questionnaire there was a link to the virtual room where the second part of the data collection would take place, through a remote focus group.

The remote focus group was held in the third week of October 2020, at a date and time agreed with the members of the Academic Association. A virtual meeting was held for the focus group, with a total duration of 50 minutes, led by a researcher linked to this project who, however, did not participate directly in the orientation activities of the Association, nor was present in the course. To support the researcher, a student of Scientific Introduction was in the virtual room.

During the focus group, the independent researcher took written records of the participants' speeches and randomly identified them, when they entered Google Meet®, to ensure anonymity. Therefore, the focus group was not recorded and the researchers linked to the academic association could not identify which research participant had provided each piece of data.

The guiding questions used in the focus group were: How was it for you to experience storytelling? Could you tell me a little bit? Can you tell me the advantages and disadvantages of this methodology? And is it good for your training? What contributions could you refer to? And now? What are the recommendations (positive or negative) regarding the use of storytelling for upcoming events and in the subjects of the Undergraduate Courses in Nursing?

The characterization variables were organized by descriptive statistics and the data obtained through the focus group were subjected to categorical thematic content analysis, using the organization proposed by Oliveira (2008). After elaborating the material produced during the focus group, the reading was developed and sentences were selected from beginning to end, which presented assertions about the object of study, being called Registration Units

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(RU). Each RU was then coded by colorimetry in Units of Meaning (UM) and the percentage frequencies were presented in number of RU, which allowed an accurate description of the characteristics relevant to the content expressed in the text. Subsequently, the UM were grouped according to their common characteristics, expressing the meanings contained in the focus group material and giving rise to two empirical categories, namely: storytelling during the teaching-learning process and storytelling in the perception of students.

The ethical precepts recommended by the Brazilian National Council of Health by Resolution 466/12 and its complementary ones were respected and, therefore, the present study was approved by the Committee of Ethics in Research with opinion number 4.324.164.

3. Results

Seven undergraduate nursing students participated in the study, most of them linked to the public university (n=05/71%). The average age of the participants was 24.6 years old, and all the students were part of at least one academic association when this study was conducted.

Table 1 presents the results regarding the UM and RU for the creation of the categories.

Table 1. *Units of meaning and registration according to the speech of the participants (n=7) - Rio de Janeiro, RJ, Brazil 2020*

Units of meaning	Units of Registration (UR)	Number of US and UR	Categories
Storytelling planning	E1; E1; E1; E1; E1; E1; E1; E3; E3; E3; E4; E5; E1; E1 = 14	22	Storytelling during the teach¬ing-learning process
¿What is Storytelling?	E1; E1; E1; E1; E1; E2; E6; E6 = 8		
Challenges related to Storytelling	E1; E2; E1; E1; E1 = 5	22	Storytelling perceived by students
Students' opinions/perceptions about storytelling	E1; E1; E3; E5; E5; E1; E1; E3; E4; E6; E1 = 11		
Contributions/positive points in the use of storytelling	E7; E1; E1; E1; E6; E1 = 6		
TOTAL	44		

Note. Data collected

The analysis of thematic content categorical focus group allowed the construction of two thematic categories called: "Storytelling during the teaching-learning process" and "Storytelling in the perception of students". These categories describe students' perception of the planning process and the teaching-learning experience using storytelling. These are statements that permeate the experience in the collective construction of the story presented during the course proposed by the academic association and the perception from the challenges, captures and contributions of the process.

Thus, in category 1 it was possible to identify the importance of storytelling planning for participants. Involving students in case planning, which will be illustrated and discussed later, seems to contribute to the participants' commitment, through knowledge sharing and stimulation of creativity: "We had to get together and use creativity" (E5). "... there was a lot of discussion, a lot of exchange and even disagreements" (E3). "When we learn in the classroom, the teacher presents all the content at once, but it does not happen with storytelling" (E1).

Another contribution observed during the data analysis occurred when storytelling was identified during the teaching-learning process as an incentive for critical thinking among those involved. The participants reported that storytelling is a way to bring reality closer to health education in a contextualized way, which not only covers the discussion about health, but also covers political, social and life history aspects, as seen in the following lines: "It was

an update not only of health scenarios, but also of politics, since history had a whole context" (E6). "It looks like we had the COREN1 in our hands and we were going to take care of it. We did it ourselves, we did not call anyone" (E1).

The students referred to the importance of planning this collectively among the participants, as well as describing it as a true story and in chapters. "It is a backstage story. We treat it like a real person" (E1). "It is a series, with chapters" (E2).

Such information highlights some "clues" that can qualify the use of storytelling in different teaching-learning processes, such as: student involvement from case planning to discussion and case continuity in chapters. Such clues seem to compromise the student with the reality of the case and its continuity, based on decision making, which places the student in a "scenario" of responsibility in health care.

When discussing their experiences during storytelling, the students also presented the challenges, their perceptions, and the contributions of the aforementioned health training strategy. Such topics are present in category 2, entitled: storytelling in the perception of students.

The challenges presented by the students refer to the incentive to "solve" the case presented and the relation between theory and practice. See in the RU below: "We had to solve the case" (E2). "Since I joined the Association, we always related theory to practice, we have that concern, telling stories is the same line of thought" (E1).

Challenges such as the motivation to participate in the solution of the case and the ability to relate theory to practice are presented in the discourse of the participants through the desire to carry out more teaching-learning processes using storytelling, demonstrating a positive perception in relation to the experience related. "...participating in storytelling was really great" (E6). "We want to continue and do more activities like this" (E5). "...it was a very enriching experience, despite all the work it required" (E4).

Regarding the contributions of storytelling to health training, participants referred to the interaction between students and the importance of fostering the autonomy and creativity of the participants. As stated in the RU below: "Creativity in creating the story... Learning didactics" (E1). "Interaction between members increased... This was also discussed by the group as a positive point for the group" (E7).

Based on the description of the category on the perceptions of students in the use of storytelling, it is understood that such a strategy, in the experience of the participants, is appreciated as relevant in the teaching-learning process.

4. Discussion and conclusions

Providing critical-reflexive and meaningful learning has been a challenge for teachers and, therefore, using strategies that can involve students in the construction of their knowledge tends to enhance this process. In this context, storytelling seems to be a powerful strategy to stimulate the student through a story, told in the form of text, images or videos; and thus, engage in a way that can follow the beginning, middle and end of a situation (Costa et al., 2016; Bano et al., 2020; Lober and Komnenich, 2020; Wall, 2021; Zare et al., 2021; Schoenhofer and Boykin, 2022).

Regarding the knowledge produced in higher education, it is also clear that the student population is composed of young adults who live a universe in which the required responsibilities are sometimes greater than they can understand and follow. This can lead to a wrong way of seeing learning, making it more difficult than meaningful. Therefore, by using methodological strategies that allow and promote learning in a constructive and non-transmissive way, the teacher can help the student in this transition to adult life and, at the same time, contribute to the formation of a critical-reflective, emotionally intelligent and innovative profession.

Undergraduate students in nursing, participants of an academic association of a public university located in Rio de Janeiro, Brazil (BR), were encouraged and guided by professors not only to teach, but to actively participate in its elaboration, using storytelling as a strategy to address the proposed topic.

Category 1 entitled "Storytelling during the teaching-learning process", showed how the strategy required aspects such as creativity, debates and updating of the public policies in force at that time. In addition, it brought a health reality close to the

1 Nursing professional registration in the Brazilian states.

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students, as observed by statements such as "...it seems that we had COREN in our hands..." and "...we treat it like a real person."

This proximity to reality, through storytelling, was experienced by teachers in an undergraduate course, where they needed to investigate the traits involved in the learning of *disabled children.* The author states that this strategy not only motivates and emotionally engages students but can increase their understanding and correlation with practice (Jarvis et al., 2004). The stimulation of learning of nursing students through storytelling was used to provide a relation between the use of drugs and critical thinking in a significant and creative way, enhancing knowledge on the subject, as observed in a qualitative study (Grady & Bell, 2021).

Digital storytelling, a multimedia recorded story (Moreau et al., 2018), was used to optimize the relationship between nurses and families of critical patients, who identified this strategy as a catalyst to change this interaction. Storytelling can promote understanding of a given health situation and cultivate compassion, as it tends to lead students/professionals to reflect on their beliefs, through emotions and feelings (Beierwaltes et al., 2020). Ensuring Patient Safety (PS) during healthcare is a pressing issue in the training of future professionals and should ideally be addressed in an inter-professional way, which is a major challenge. A study conducted with medical and pharmacy students, through a virtual platform due to COVID-19 in 2020, used an interactive PS program and storytelling about medication errors based on real facts, providing greater empathy, behavior change and attitude and meaning creation (Garwood et al., 2022).

This strategy, considered innovative despite its current use, can be used to help health professionals understand both patients and health systems, potentially generating better care outcomes (Moreau et al., 2018). Digital storytelling, due to its reflective potential, should be used as an educational intervention, also showing the applicability of research results (Beierwaltes et al., 2020).

It can be observed in category 1, situations experienced by students who improve learning, such as "we had to get together and use creativity" and "...there was a lot of discussion, a lot of exchange..." that creativity develops through storytelling because students need to create their own stories. In addition, they learn to search for the topic in face-to-face and/or virtual libraries, develop critical reading of found texts, synthesize readings to support the story, improve communication between them and with the target audience, learn to use digital tools, among other skills (Robin, 2016).

Additionally, storytelling can contribute to the development of fundamental interpersonal skills for health professionals such as teamwork, advocacy and attentive listening. In this way, in addition to learning new knowledge from an active and emancipatory position, they can also develop values and relational skills that will be widely implemented during their professional life (Henrickson et al., 2022). This is positive when thinking about college extension or extracurricular activities, as they are also learning opportunities, as seen in a British study on university dental students. A questionnaire and a focus group were applied to evaluate the results of the sessions with the students at the end of each stage of internship. The potential of storytelling to stimulate reflection, develop teamwork, communication and organization skills, as well as technical skills (Zijlstra-Shaw & Jowett, 2020) was identified.

Category 2, "Storytelling in the perception of students", included the challenges experienced in the process of making the story. It is interesting to note that despite the mobilization required by the use of an active learning methodology, students recognize the positive effects as in the phrases "...participating in storytelling was really great" "We want to continue and do more activities like this" "...it was a very enriching experience, despite all the work it required".

Storytelling was seen in a positive and motivating way by the students of the nursing career, where 90% stated that the strategy improved the acquisition of knowledge and 67.8% indicated it helped in their clinical skills; it is also observed that 91.2% mentioned they could use it in other subjects, which shows the positive aspects highlighted by the students who experienced it (Rodríguez-Almagro et al., 2021). For nursing students in a study that compared teaching academic branch blocks through lectures and storytelling, there were no differences in satisfaction ($p < 0.001$) or learning ($p = 0.20$) (Zare et al., 2021).

A Norwegian study with 37 students from two undergraduate nursing courses showed that digital storytelling allowed more engagement, analysis and

understanding on their part, despite feeling more vulnerable when sharing stories (Urstad et al., 2018). An American study, whose data were also collected through a focus group, presented results discussed by students in the last year of an undergraduate nursing degree. Seeing the health situation from the perspective of patients and their families through digital storytelling and being able to live this memory in every contact with the material, was seen as a positive thing by the students, who also highlighted the use of this strategy throughout their professional career to keep them connected with their patients (Bhana, 2014).

Perhaps, for students involved in creating stories, the experience of sharing their product with other colleagues and the resulting criticism can promote the development of emotional intelligence, as well as collaboration and social learning (Robin, 2016). This was also observed in this research, through the phrases "learning the didactics" and "increased interaction between members... Which was also discussed by the group as a bright spot."

The potential of storytelling, in its classic or digital version, has been gaining ground as a strategy to use in education, especially for the coexistence of different generations at the university. A review published in 2014 already indicated that generation Y, born between the early 1980s and the late 1990s, demanded the development of interpersonal skills, with storytelling being one of the potential strategies (Shorey et al., 2021).

Another review study carried out from six electronic databases based on English productions, between June 2016 and July 2021, corroborates the discussion related to the characteristics of the different generations (Özveren et al., 2020). Generation Z, the so-called digital natives, prefer to learn independently and less passively, and storytelling identifies as an active methodology that can favor theoretical-practical learning and the development of communication skills, so necessary in this generation of students, who despite their technological dependence, have poorly developed face-to-face social skills. However, the authors emphasize that more diverse and culturally mixed qualitative methods or studies are needed to measure the effectiveness of technological integration and digital storytelling in terms of increasing students' learning and confidence in their future careers (Özveren et al., 2020).

Despite its potential benefits, it is necessary to make some considerations regarding storytelling, especially in its digital version. The incorporation of the Internet has worried the scientific community about exposure time, however, paradoxically, Information and Communication Technologies (ICT) have been increasingly used in schools and universities as a way to involve students (Caliari et al., 2017; Roman et al., 2017). A descriptive study with 350 first year students of the teacher training course who responded to a scale developed by Bianchi and Phillips (2005), quoted by Roig-Vila, López-Padrón and Urrea-Solano (2023), whose objective was to identify problems immediately of the general use of smartphones among adults, revealed that academic performance was not affected in 66.6% of the participants; and regarding the need for its use in the face of a ban, 66.6% faced difficulties in complying with this order.

While the potential for innovation associated with storytelling is highlighted, the metaverse reveals as user experiences intensify with technological advances and augmented reality. Virtual information generated by a computer in a real-world scenario has an effect of deepening the experience or broadening the understanding of who is "living" the story, due to its reliability with reality (Yang, 2023). Studies that use virtual realities in teaching-learning processes and methods are still emerging in nursing.

Therefore, storytelling is seen as a strategy mobilizing emotions and feelings, able to bring dynamism and meaning to learning, adaptable to the digital format and positive acceptance among undergraduate students, providing opportunities for the development of technical and non-technical skills (Costa et al., 2016; Bano et al., 2020; Lober and Komnenich, 2020; Wall, 2021; Zare et al., 2021; Schoenhofer and Boykin, 2022; Gurney et al., 2022 3).

The main limitation of this research is that it was conducted with a single population of students participating in an academic association, which demonstrates a previous commitment in the active search for learning. However, it should be mentioned that the members were from different classes and some from other universities. Larger samples with diverse sociocultural characteristics are recommended.

For us professors, following the process of creating the story, guiding the students and observing its evolution was extremely rewarding. The

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experience made possible the relationship between teaching-extension-research, showing the potential to promote participatory and meaningful learning for students and teachers.

Storytelling should be used in the education of students, professionals, and patients, and it should also be extensively researched to measure its effectiveness and efficiency. To this end, professors must update their teaching practices in order to be able to communicate and stimulate the interest and learning of the different generations, either in the classroom or in internships, or in everyday work activities.

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School conflict versus academic performance

Conflicto escolar frente al desempeño académico

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Abstract

School conflicts and low academic performance are a relevant problem within the educational context; these issues have not yet been resolved, making them a necessary topic for research. This study aims to investigate the influence of school conflict on academic performance. A quantitative approach, a deductive method and correlational-descriptive research with a non-experimental-cross-sectional design were used. A population of 1096 subjects, 38 teachers and 1058 students, and a sample of 134 subjects, 38 teachers and 96 students of the tenth year of EGB were determined. For data collection, the school conflict questionnaire CUVE 3-ESO by Álvarez et al. (2013) addressed to teachers was used, and another one addressed to students called Ser Test, developed by the National Institute for Educational Evaluation (INEVAL, 2016). The results reveal that there is a medium level of conflict, where a score of 3.14 points out of 10 was also determined, implying that there is a low level of academic performance; When establishing a relationship between the objects of study, it became evident that statistically there is no significant relationship between them. In conclusion, it was established that academic conflict does not affect academic performance, but, since these conflicts are at a medium level and are not dealt with in time, they tend to have repercussions on school performance.

Keywords: education, violence, school performance, quality of education, learning, interpersonal relationships.

Resumen

Los conflictos escolares y el bajo rendimiento académico son un problema relevante dentro del contexto educativo; estas problemáticas aún no han sido resueltas, tornándolas como un tema necesario de investigar. Este estudio tiene el objetivo de indagar la influencia de la conflictividad escolar en el rendimiento académico. Se utilizó un enfoque de tipo cuantitativo, un método deductivo y una investigación correlacional-descriptiva con diseño no experimental-transversal. Se determinó una población de 1096 sujetos, 38 docentes y 1058 estudiantes, y una muestra de 134 sujetos, 38 docentes y 96 estudiantes del décimo año de EGB. Para la toma de datos se utilizó el cuestionario de conflictividad escolar CUVE 3-ESO de Álvarez et al. (2013) dirigido a docentes, y otro dirigido a estudiantes denominado Prueba Ser, elaborado por el Instituto Nacional de Evaluación Educativa (INEVAL, 2016). Los resultados revelan que existe un nivel medio de conflictividad, donde también, se determinó una puntuación de 3,14 puntos sobre 10, dando a entender que existe un nivel bajo de rendimiento académico; al establecer una relación entre los objetos de estudio, se evidenció que estadísticamente no existe una relación significativa entre las mismas. En conclusión, se estableció que la conflictividad académica no incide sobre el rendimiento académico, pero, dichos conflictos al encontrarse en un nivel medio y al no ser atendidos a tiempo, tienden a repercutir en el desempeño escolar.

Palabras clave: educación, violencia, rendimiento escolar, calidad de la educación, aprendizaje, relaciones interpersonales.

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1. Introduction and state-of-the-art

Educational institutions are a space for learning and coexisting, an aspect that is often interrupted or damaged by school conflicts, which often seriously influence student performance. Because of this, it is important to immerse in this problem to analyze the existing connection between conflict and academic performance. According to Leyton (2020), coexistence is an essential part of the educational process, since it promotes inclusion, participation, democracy, and the solution of problems, becoming a key aspect in academic daily life. Likewise, García et al. (2019) mention that "coexistence is sought to achieve elements that generate well-being, and that allows optimal development" (p. 179).

It is important to know that access to education is a human right, which must be equitable and accessible to all. The educational process intervenes in human well-being and productivity, this must be peaceful and harmonious, free of conflicts that interfere in a good coexistence. It should be noted that this coexistence has been harmed by the social inequality that the country is going through, which according to UNESCO (2020) the causes of inequality are diverse "and among its consequences are differences in access to schooling, permanence and learning".

There are various studies that have aimed to verifying whether school conflict really influences profoundly or superficially on the school performance of students. For Serrano & Sanz (2019), coexisting in educational institutions "requires constant adjustments to resolve the conflicts that are occurring. These adjustments help the child to grow as a person and not to stagnate" (p. 181).

Barreto & Álvarez (2017) state in "School climate and academic performance in high school students" (p. 31), that the educational environment is not considered an element that determines the extent of good grades, thus proving that it has not been possible to find any component that predicts school performance. On the other hand, Franco et al. (2016) mention in their work "School conflict in secondary schools in Guayaquil (Ecuador)" (p. 25), that the way in which students understand their environment of coexistence can be considered as a factor that develops behaviors that favor or damage the formation of their learning, influencing the relationships to the academic environment.

According to the OCDE (2016), in most Latin American countries such as Peru, Colombia, Chile, Argentina, Brazil and Costa Rica, 15-year-old students score low according to the desired level of learning in Reading, Science and Mathematics, as assessed by the PISA Program.

According to INEVAL (2018), the PISA-D test showed that 22.6% of students in Ecuador had high academic performance in at least one competition, but there are 44% of students who have obtained a low performance, i.e., they do not reach any competition. UNESCO (2019), emphasize that school performance is influenced by conflict, violent environments and harassment that can be evidenced in the educational context. Likewise, Cid et al. (2008) indicate that there are factors that cause such learning difficulties, these being the aggressions and conflicts experiences in schools.

In addition, it has been observed in the teaching practice the lack of authority of the teacher, lack of resources and proper management for coexistence that generates appropriate learning environments for developing the educational process. According to Castro (2009), "to speak of quality in education it is necessary to start from the quality of the teachers" (p.137).

Within the school environment, it is very important to know the interpersonal relationships, since these determine the coexistence which originates in the social relations between students; moreover, it must have an equitable, fair, empathetic and respectful approach, although sometimes it turns negative, as conflicts between students often arise in their course, which are often left aside and are not resolved. Araneda & Zuñiga (2021) state that coexistence is not seen as a socialization process between people in school, making it lose its cultural and transversal objective. In this way, coexistence becomes a determining factor to achieve a good school environment and improve academic performance.

The deterioration and difficulties that arise in academic coexistence are not new. Such problems or conflicts are considered as disagreements between educational actors regarding the defense of the own interests of those involved. Cortés (2018) defines educational conflicts as "a social process that includes the most varied forms of aggression and is characterized by having a multiplier and expansive effect that not only affects the victims, but also soci-

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ety as a whole" (p. 138). Although school conflict is a phenomenon that happens occasionally, it affects not only intrinsically and extrinsically students, but also it becomes one of the main obstacles that hinder the social development of the individual and healthy coexistence of both students and teachers, and the scope of the objectives set in the educational process, i.e., school conflicts not only affect coexistence but also academic performance (Pacheco, 2018).

It is important to understand that academic performance is the assessment of learning, skills and efforts that students achieve during their education. These variables are valued at different levels as: high, medium and low; although, Erazo (2012) states that there are four levels: the high level, good, low and educational failure. It is essential to highlight that academic performance in Ecuador is measured from a scale established in the following levels: from 9 to 10 points which correspond to a high level and shows the required learning achieved, from 7 to 8.99 an average level and refer to the required learning achieved, and scores equal to or less than 4 which correspond to a low level and means that the required learning is not achieved.

This performance is normally affected by various factors, one of which is the conflicts that normally occur at schools. "Aggressive and violent behavior modify the school environment with a negative impact on learning" (Cid et al., 2008, p. 22). Likewise, Franco et al. (2019) claim that "the deterioration of relations harms the quality of classes and the academic performance of students" (p. 305). Sometimes, the educational process is damaged by various external factors such as social inequality, since poverty is one of the main factors that prevent access to one of the most important rights of children, such as education (Cárdenas & Coronado, 2017). Hence, the educational system is not fully prepared to face different situations that a student goes through, so UNESCO (2023) "has established a new social contract for education designed to reimagine and shape more peaceful, fair and sustainable societies."

Conflicts are sometimes perceived as constructive or destructive. All of this is reflected in how these conflicts are addressed and how large or small they may become. Carmona et al. (2020) comment that although conflicts generate annoyance, tension or anger, they do not always harm people; in education this can be very true, since sometimes the conflict becomes the initiative to create a solution that benefits the whole group of students, without causing consequences or much more serious aspects. However, sometimes violent behaviors or school conflicts that arise among students are not perceived by other educational actors, making the problem as something common (Rodríguez et al., 2006). Soriano (2009) states that it is necessary that the educational system works on the construction of a harmonious and peaceful coexistence for a good development and training of students, not only in the behavioral aspect but also in academic performance. In addition to this, Arenas (2018) states that promoting the transformation of society is based on "promoting comprehensive training, both in the home and in schools, implementing actions that guarantee change and the reduction of aggressions and further increasing peaceful coexistence to achieve the social transformation desired" (p. 54).

It is necessary to understand conflict as one of the factors that tends to condition the level of academic performance. School conflicts should be perceived as a possibility of learning or as a wake-up call to the fact that something does not work among educational actors, and thus promote a good coexistence between them and, therefore, that school performance is not impaired (Ceballos et al., 2012). In addition, Fierro & Carbajal (2019) say that in "the analysis of the conflict different elements becomes especially relevant, such as origin of the conflict, actors involved, processes followed and proposed alternatives for solution" (p. 4). In other words, the good management of school conflicts allows highlighting possible solutions that may benefit the actors involved, generating harmonious coexistence at the educational, social and, therefore, personal level.

2. Methodology

The approach used for conducting this study was quantitative, since it is based on the statistical analysis and the necessary objective evaluations of the study problem; It is also deductive, since it facilitates the verification of the hypotheses and the representation of the variables. For Rodríguez & Pérez (2017) "through deduction, one moves from a general knowledge to a less general one" (p. 11).

The population consisted of 1096 subjects (38 professors and 1058 students), which according to Ventura (2017), share characteristics that are sought

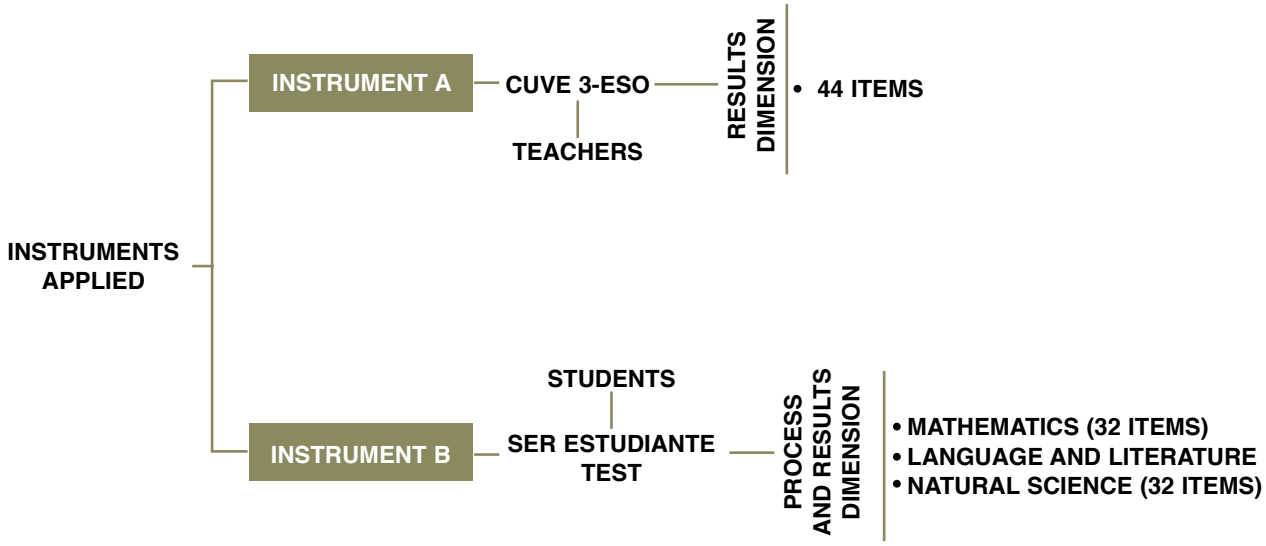
to be analyzed. Also, to study this topic, it was necessary to determine a segment of the population, thus, a sample of 134 subjects was established, divided into 38 professors and 96 students of the tenth year of General Basic Education. It should be noted that in order to select this sample, a non-probabilistic sampling was considered, which allows an arbitrary selection of the number of subjects who will be part of the research (Hernández, 2021). Therefore, this was determined respecting the following criteria: students who are part of the last year of EGB, students who legally belong to the institution, subjects who are willing to provide the necessary information and who are aware of the reality of the investigated context.

To obtain data, the questionnaire was used as an instrument, which according to Blanch et al. (2010) allows examining opinions held by the subjects investigated. In this way, the questionnaire of school conflict CUVE 3-ESO, developed by Álvarez et al. (2013) was used, which is aimed at teachers to measure school conflict. At the same time, the Ser Estudiante tests, conducted by INEVAL (2016) in Ecuador, were used, allowing the evaluation of student performance in the areas of Language and Literature, Natural Sciences and Mathematics.

All the data obtained were analyzed using descriptive statistical techniques, referring to the organization and tabulation of the data obtained, whose results were expressed by measuring central tendency, in frequencies and percentages represented in the form of tables and graphs. Vargas et al. (2018) mention both tables and graphs allow to represent data and information from sources in a clear and organized way. Similarly, inferential statistics were used to determine the correlation between the two variables investigated through the Pearson parametric test. To improve the organization of the information, the SPSS program, Statistical Package for the Social Sciences, version 25 was used.

When the conflict variable scores were added, a global average was obtained that contrasted the results of the academic performance variable. This allowed to obtain the existing correlation between the, yielding in the statistical significance of the phenomenon studied.

Figure 1. *Assembly of applied instruments*



3. Results

This section shows the variables analyzed individually and, in turn, the existing correlation.

According to Table 1, the level of conflict perceived by teachers corresponded to an average of 62.68, reflecting an average level of conflict. In this way, it can be deduced that there is not a good coexistence and a good school environment in the institution; although, it should be emphasized that when the conflict is at an average level and if it is discussed in time there is a tendency to find a solution, thus avoiding major problems.

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Table 1. *Conflict Level*

	Average	%	Conflict Level
Teacher perceived conflict	62.67	67.40	Average

Therefore, to analyze the correlation of the variables studied, it is important to know not only the level of conflict but to establish the level of school performance that the students have as shown in Table 2, since this allows to establish the incidence that one variable has on the other.

According to Table 2, there is an overall academic achievement level of 3.14 out of 10, which is equivalent to a low level, implying that students do not achieve the required learning. At the same time, there is a significant deficit in achieving the minimum learning that students have to obtain to study at the next educational level. It is necessary to emphasize that the greatest problems are recorded in the subjects of Mathematics and Natural Sciences with a score of less than 3 points.

Table 2. *Level of academic achievement*

Variable	M
Academic Performance for Natural Sciences	2,83
Academic Performance for Language and Literature	3,90
Academic Performance for Mathematics	2,70
Overall average academic performance	3,14

According to Table 3, both conflict and school performance have a ratio of 0.123, which explains that there is a low positive correlational force, also it can be observed that there is no statistical significance, since the p-value is equal to 0.240, greater than 0.05. Therefore, it can be mentioned that there is no significant relationship between the objects of study, i.e., school conflict does not necessarily influence the school performance of the students.

Likewise, Table 4 was elaborated with the intention of predicting the relationship between the variables, where the transcendental data of the predictive simulation of the conflict on the academic performance are shown.

Table 3. *Bivariate correlations of academic performance according to teacher conflict*

		1	2	3	4	5
Global Performance of High School Students	Pearson correlation	1	,553**	,715**	,590**	,123
	Sig. (bilateral)		,000	,000	,000	,240
Academic Performance for Natural Sciences	Pearson correlation	,553**	1	,031	,046	- ,060
	Sig. (bilateral)	,000		,771	,663	,568
Academic Performance for Language and Literature	Pearson correlation	,715**	,031	1	,168	,143
	Sig. (bilateral)	,000	,771		,107	,173
Academic Performance for Mathematics	Pearson correlation	,590**	,046	,168	1	,141
	Sig. (bilateral)	,000	,663	,107		,176
Teacher perceived conflict	Pearson correlation	,123	- ,060	,143	,141	1
	Sig. (bilateral)	,240	,568	,173	,176	

**. Correlation is significant at level .01 (bilateral).

According to Table 4, the projected relationship between the variables studied is statistically significant, as the p-value of the areas studied is lower than the significant value (0.05). It should be noted that the correlation force is moderate for the Natural Sciences and the correlation force is low for Language and Literature and Mathematics. Thus, although there is a low positive correlation force, as school conflicts become more severe it tends to influence the academic performance of the student.

Table 4. *Predictive simulation of conflict over academic performance*

Dependent Variable	R^2	ΔR^2	Typical Error	Constant	β	T	Q	Independent variable
Academic performance of Natural Sciences	,004	- ,007	1,035	3,055		7,48	,000	Constant
					- ,060	- ,573	,568	Conflict
Academic performance of Language and Literature	,020	,010	1,244	3,248		6,622	0	Constant
					,143	1,375	,173	Conflict
Academic performance in Mathematics	,020	,009	,924	2,223		6,101	0	Constant
					,141	1,363	,176	Conflict
Overall Academic Performance	,015	,004	2,007	8,525		1 ,774	0	Constant
					,123	1,184	,240	Conflict

4. Discussion and conclusions

According to the results obtained, it can be said that there is an average level of school conflict. Román and Murillo (2011) stated in one of their investigations that 51% of the students in the Ecuadorian State have been victims of attacks and insults, reflecting a high level of conflict in their school environment. Similarly, UNICEF (2017) finds that more than half of students throughout Ecuador (60%) between the ages of 11 and 18 are victims of violence or school conflicts, showing that every 3 out of 5 students are affected by this problem. Conversely, Jordán et al. (2021) show that 37.4% of students have witnessed violence between peers and, according to the investigated institutions, there are countless situations of conflict and aggression, however, depending on the low level determined, these could be resolved without applying complex measures.

However, emphasizing the level of school performance reflected between the students and the students of the studied institution, a low level was determined regarding the performance, showing that they do not achieve the required learning. According to a study conducted by Shapiro (2011) "poor school performance is a frequent problem and has multiple causes; the alterations that characterize it are mainly expressed in the areas of cognitive, academic and behavioral functioning" (p. 218). Likewise, Estrada (2018) states that the presence of a low academic performance originated by psychoeducational factors such as family or social climate and study routines, in addition, the author states that teacher intervention is necessary to address this problem and find early solutions to it.

Finally, and according to the results, a non-significant statistical relationship between the variables is projected, and with it, it is shown that the conflict does not necessarily affect the school performance of the students. This result agrees with Soriano (2009), who indicated that conflicts are not a problem that necessarily affect academic performance, and the author also says that it is important to interpret and prevent them in a harmonious and enriching way.

In contrast to this, UNESCO (2019) mentions that harassment and violence among educational members do have an impact on the academic performance of several schools in the world. Likewise, Araneda & Zuñiga (2021) accept that school conflict does intervene in learning and that it must be solved in a timely way, since it harms good interpersonal coexistence, losing its transversal educational sense and, therefore, education. Likewise, Cid et al. (2008), consider school conflicts as a growing problem that causes harmful effects on students such as school dropout and difficulties in the educational process.

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It is essential to recognize negative emotions in students, since they play a primary role in academic performance (Pulido & Herrera, 2017).

However, focusing on the data investigated, it can be indicated that when there is a violent and conflictive climate in educational institutions, these tend to affect students, causing a low self-esteem, emotional imbalance and lack of communication, which according to Barrios and Frías (2016) are factors that affect school performance, since they do not allow students to develop their skills immediately and effectively. In addition, Bonifaz et al. (2017) mention that the level of school performance is affected by various aspects such as social, personal and their interrelation. In spite of this, Carmona et al. (2020), state that school conflicts generate tensions between the people involved, but sometimes this becomes the initiative of creating solutions that favor and strengthen interpersonal relationships, in this way their effects can be reduced. For this reason, Márquez & Gaeta (2017) argue that schools can prevent aggression and violent behaviors, strengthening conflict resolution management, thus favoring good interpersonal relationships among educational actors.

As mentioned, school conflicts tend to affect academic performance, since there are some types of conflicts, either minor or major, with a number of emotions on both sides which can generate an emotional deterioration in the student, thus lowering their grades. It is important to emphasize that these educational conflicts, if they are attended in time and properly, do not tend to harm students deeply, but rather is a way to solve and learn to generate good school coexistence (Ceballos et al., 2012).

As a conclusion it can be mentioned that there was a low-moderate level presented against the incidence between conflict and academic performance. This, in turn, reveals that despite the fact that conflictive acts are observed in the institution, there is a certain number of students who are not harmed in their school performance. The key point of the research is based on determinants of school conflict in the face of coexistence, the working environment, interpersonal relationships and organization, components that affect academic performance.

It also states that there is not a statistical significance between the conflicts and academic performance, which shows that the conflicts are not always linked to the students' academic performance. However, this relationship could become positive in the future due to certain emotional gaps in the students, i.e., a hostile environment in the school will be projected, in which academic actors are limited only to explain their class, seriously affecting dropout, depression and low academic performance.

Searches should focus on the limitations of the study, highlighting the characteristics of the population and the sample to be selected. Therefore, it is necessary to take into account the magnitude of the data, i.e., since this is a broad problem, it is necessary to consider not only a small part of a set, but also a broader sample that allows to guarantee a more specific representation of the problem. Likewise, future researchers are encouraged to replicate the study, considering determinant criteria to the context of life of both the student and the teacher.

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Publication guidelines

(Normas editoriales)

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Publication Guidelines of «Alteridad»

1. General information

«Alteridad» is a bilingual scientific journal of the Salesian Polytechnic University of Ecuador (UPS), published since January 2006 uninterruptedly, on a semi-annual basis (January-July).

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2. Scope and policies

2.1 Topics

«Alteridad» is a journal specialized in Education and its transdisciplinary topics such as Didactics, School Management, Educommunication, Educational Technology, Social Pedagogy, among others, all related to the main topic.

2.2 Contributions

All manuscripts must be original, and must not have been published in any other journal or must not be in the arbitration or publication process in another journal. Empirical research results are published in Spanish, Portuguese or English, and studies and state-of-the-art are also allowed:

a) **Research:** 5000 to 7500 words, including title, abstracts, descriptors, tables, and references. Assessment will be made of research results, methodological rigor, the relevance of the subject, the quality of scientific discussion, the variety, timeliness, and richness of bibliographic references (preferably publications indexed in JCR and Scopus). At least 35 references must be included.

(b) **Studies and literature reviews**

- Studies: 5000 to 7500 words of text, including tables and references. The debate,

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the relevance of the topic, the originality of the contributions and the bibliographical references (preferably of publications indexed in JCR and Scopus) will be especially valued. Expected 35 references minimum.

- Literature reviews: 6000 to 8500 words of text, including tables and references. An exhaustive review of the state of the art of a current research topic will be considered, with justified and selective references of approximately 70 works (preferably from publications indexed in JCR and Scopus).

2.3 Sections

The journal has a semi-annual periodicity (20 articles per year), published in January and July and has two sections of five articles each by number; the first referring to a **Monographic** topic prepared in advance and with thematic topic and the second, a section of **Miscellaneous**, composed of varied contributions related with educational topics.

3. Editorial process

3.1 Submission of manuscripts

Manuscripts must be submitted only and exclusively through the Open Journal System (OJS), in which all authors must register in advance, although only one will be responsible for the correspondence. No author may submit or review two manuscripts simultaneously, estimating a time of four consecutive numbers (2 years). An article may have a maximum of 3 authors, although if justified depending on the study, there may be up to 5.

«Alteridad» informs by email the reception of the manuscript submitted by the authors. The information related to the acceptance or rejection of the manuscript is sent by email and the platform; and in the case of acceptance, the author is also informed of the editing process.

The Guidelines for the Authors are on the website of the journal, in the Guidelines section, as well as the template for writing the paper (LaTeX/ Overleaf or Word), the cover page and cover letter, the review protocol, the pre-submission list, the evaluation forms by the external reviewers and a guide for submitting the article through OJS. Before the submission, it is strongly recommended that the manuscript be checked with the Pre-Check Protocol. Two files should be sent simultaneously:

a) **Cover page and cover letter** (use the official model), which must include:

- **Cover page** (Title, Abstract and key words provided in the Manuscript).
- **Full name of each of the authors**, organized in priority order; followed by the professional category, institution, email of each author and ORCID number. It is mandatory to indicate if the authors have a PhD academic degree (include Dr. before the name).
- A **Cover letter** will also be included indicating that the manuscript is an original contribution, has not been sent or evaluated in another journal, with the signature of the authors, and acceptance (if applicable) of formal changes to the manuscript compliant with the rules and partial transfer of rights to the publisher.

b) Fully anonymized **manuscrip**t, in accordance with the rules referred to in section 4.

3.2 Review process

Upon having received the document and in a maximum period of 30 days, the correspondence author shall receive a notification, indicating whether the manuscript is considered

or dismissed for the arbitration process by the scientific reviewers. In case that the article has formal problems or does not address the educational subject or has a high similarity percentage to another document(s), the editorial board shall reject the paper without the option to send it back. Conversely, if it has superficial problems, it will be returned to the author for corrections before starting the evaluation process. The submission date of the article will be considered based on the final submission when the article is presented with the corrections.

The articles will be scientifically evaluated by an average of three experts of the topic. Reports will indicate the following recommendations: Accept the Submission, Publishable with Modifications, Sent the manuscript back for its Review, Not Publishable. The acceptance or rejection of the manuscript for its publication will be decided from the analysis of external reports. In the case of dissenting results, it shall be forwarded to a new opinion, which shall be final. The protocol used by reviewers is public (researches; studies and state-of-the-art).

In general, once the external scientific reviews are taken into view, the criteria justifying the decision on the acceptance/rejection of the manuscript by the Editorial board are:

- Current and novelty.
- Relevance and significance: advancement of scientific knowledge.
- Originality.
- Reliability and scientific validity: proven methodological quality.
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- Presentation: good writing.

The timeline for the scientific evaluation of manuscripts after the previous estimation procedures by the Editorial Board is up to 100 days. As for the manuscripts sent for Calls for papers, their scientific review dates begin once the call finishes. Manuscripts that are positively evaluated and require modifications must be sent with the changes within the next 15 days.

3.3 Editing and publishing of the manuscript

The edition and layout processes of the accepted articles is performed by the Technical Board of the journal along with the Abya-Yala Editorial. «Alteridad» reserves the right to make style corrections and editorial changes if necessary to improve the manuscript. A proof of printing in PDF format will be sent to the authors for correcting typography and spelling, and its review and comments must be sent within three days. The Editorial provides authors a free professional translation of the final version of the manuscript into English (or Spanish, according to the original version), guaranteeing its international consultation and dissemination. Articles will be published on the journal's platform in both versions (Spanish and English) and in the following formats: PDF, HTML, EPUB and XML-Jats.

4. Structure of the manuscripts

The manuscripts shall be submitted in typeface Arial 10, simple spacing, fully justified and without tabs or white space between paragraphs. Only large blocks (title, authors, abstracts, key words, credits, and captions) will be separated with white space. The page must be two centimeters in all its margins. Manuscripts must be submitted in Microsoft Word document (.doc or .docx), (https://alteridad.ups.edu.ec/pdf/alteridad/Microsoft_Word_Template.docx) o LaTeX/ Overleaf (.tex) (https://www.overleaf.com/latex/templates/revista-alteridad-ecuador/svvjcbgmcrrv), requiring the file to be anonymi-

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zed in File Properties to avoid the information related to the identification of the author/s.

4.1 Cover page

Title (Spanish and English): Concise but informative, in Spanish in the first line and in English in the second, consisting of as many significant terms as possible. The title is not only the responsibility of the authors, hence changes can be proposed by the Editorial Board. A maximum of 80 characters with space are accepted.

Abstract (Spanish and English): It must be concise and must follow this order: justification, objectives, methodology used (approach and scope), more relevant results, discussion, and main conclusions. It must be written impersonally "The present work analyzes...". In the case of the Abstract (in the other language), the use of automatic translators will not be accepted. It will be between 220/230 words.

Key words (Spanish and English): 6 keywords must be presented for each language, and must be directly related to the topic of the manuscript. The use of the keywords presented in UNESCO's Thesaurus is recommended (http://bit.ly/2kIgn8I). New terms would be accepted only in exceptional cases if they present a standardized scientific nature.

4.2 IMRDC Structure

For those works involving empirical research, the manuscripts will strictly respect the IMRDC structure, with the headings of Economic Supports and Notes being optional. Literature Studies and Reviews may be more flexible under their headings, especially in Methodology, Results and Discussion. In all types of works, bibliographic references are mandatory.

1. **Introduction:** It should include the theoretical foundations and purpose of the study, using bibliographic citations, as well as the review of the most significant literature of the topic at the national and international level. The use of high-impact references (JCR and Scopus) will be positively valued.
2. **Methodology:** The approach and methodology used must be written in a way that the reader can easily understand the development of the research. It should contain the explanation on the approach (quantitative, qualitative or mixed) and the scope (exploratory, descriptive, correlational or explanatory). When appropriate, it shall describe the sample and the sampling form, and it must refer to the type of statistical analysis applied. If it is an original methodology, it is necessary to set out the reasons that have led to its use and describe the possible limitations.
3. **Results:** Efforts will be made to highlight the most relevant results and observations of the investigation, describing, without making judgments, the material and methods used for the analysis. The results will be presented in figures and/or tables according to the journal's standards (See section 4.4). They will appear in a logical sequence in the text, tables or figures, avoiding data redundancy.
4. **Discussion and conclusions:** It will summarize the most important findings, relating the observations with interesting studies, pointing to contributions and limitations, without resulting in data already commented in other sections. In addition, this section should include deductions and lines for future research.

4.3 Economic support and notes

Economic support (optional): Council Science Editors recommends that authors specify the source of funding for the research. Works on the endorsement of competitive national and

international projects will be considered a priority. In any case, for the scientific assessment of the manuscript, it must be anonymized with XXXX only for its initial evaluation, in order not to identify authors and research teams, which must be set out in the Cover Letter and subsequently in the final manuscript.

Notes: if necessary, notes will be at the end of the article (before references). They should be used to clarify terms or make marginal annotations. Note numbers are placed in superscript, both in the text and in the final note. Notes collecting simple bibliographic citations (without comments) are not allowed, as these should be in the references. If it contains a cite, the reference must also be found in the Bibliography section.

4.4 Bibliography

Bibliographical citations should be reviewed in the form of references to the text. Bibliography that is not cited should not be included in the text. Its number must be sufficient and necessary to contextualize the theoretical framework, methodology used and research results in an international research space: minimum 35 for empirical research manuscripts, and around 70 for literature studies and reviews.

They will be presented alphabetically by the author's first last name (adding the second one only in case the first one is very commonly used). The quote should be extracted from the original documents, preferably journals and to a lesser extent books. Given the significance of citation indixes and impact factor calculations, the use of references from indexed publications in JCR and/or Scopus and the correct citation following APA 7 norms is valued (http://bit.ly/35FNGvN).

It is mandatory that references with DOI (Digital Object Identifier System) be written in the References (can be obtained on https://search.crossref.org/). All journals and books without DOI must contain a link (in its online version, if applicable, and in a shorten version using Bitly: https://bitly.com/), and the websites must include the consultation date using the format provided.

Journal articles must be presented in English, with the exception of those in Spanish and English, in which case they will be presented in both languages using square brackets.

Norms for the references

a) Periodic publications

- **Journal article (one author):** Ochoa, A. (2019). The type of participation promoted in schools is a constraint factor for inclusive education. [El tipo de participación que promueve la escuela, una limitante para la inclusión]. *Alteridad, 14*(2), 184-194. https://doi.org/10.17163/alt.v14n2.2019.03
- **Manuscript from a journal (until twenty authors):** Guarderas, P., Larrea, M., Cuvi, J., Vega, C., Reyes, C., Bichara, T., Ramírez, G., Paula, Ch., Pesantez, L., Íñiguez, A., Ullauri, K., Aguirre, A., Almeida, M., & Arteaga, E. (2018). Sexual harassment in Ecuadorian universities: content validation for instrument development. [Acoso sexual en las universidades ecuatorianas: validez de contenido de un instrumento de medición]. *Alteridad, 13*(2), 214-226. https://doi.org/10.17163/alt.v13n2.2018.05
- **Manuscript from a journal (without DOI): López, L., &** Ramírez-García, A. (2014). Medidas disciplinarias en los centros educativos: ¿Suficientes contra el acoso escolar? *Perfiles Educativos, 36*(145), 32-50. *https://bit.ly/37Xd5mw*

b) Books and chapters of books

- **Complete books:** Cuéllar, J.C., & Moncada-Paredes, M.C. (2014). *El peso de la deuda externa ecuatoriana*. Abya-Yala.

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- **Chapter of books:** Padilla-Verdugo, J. (2014). La Historia de la Educación desde los enfoques del conocimiento. In E. Loyola (Ed.), *Ciencia, Tecnología y Sociedad (CTS). Miradas desde la Educación Superior en Ecuador* (pp. 107-128). Abya-Yala. https://bit.ly/3etRnZH

c) **PhD or Master dissertations**

- Llorent, M. (2019). *Las políticas educativas TIC en el plano autonómico: el caso de Andalucía* [Tesis doctoral, Universidad de Sevilla]. Depósito de Investigación Universidad de Sevilla. https://bit.ly/3YRTRr5

Guidelines for Headings, Tables and Figures

The headings of the article shall be numbered in Arabic, without full case of capital letters, no underscores, no bold ones. The numbering must be at most three levels: 1. / 1.1. / 1.1.1. A carriage return will be established at the end of each numbered heading.

Tables and figures must be presented in the text in Word or LaTeX located in the place selected by the authors. They shall be used only when necessary and suitable, and must be up to 6 between tables and figures (more only under extraordinary cases if justified). Both must be listed in Arabic and titled with the description of their content. If the source of the table or figure corresponds to another author, the authors must incorporate the source consulted below the table [for example, Source: Romero-Rodríguez (2016, p. 32)].

Tables must be elaborated in document, thus tables cut and pasted from other documents that cannot be edited in the diagramming process will not be accepted. The figures, in addition to being incorporated in the document, must be sent as supplementary material when submitting to «Alteridad» OJS, with a quality greater than 600 dpi, in TIFF, JPEG or PNG files.

In the case of LaTeX/Overleaf, figures must be loaded in the template in original PDF format in order to maintain its quality, since conversion from other formats can lower the quality of the figure. In the case of Word, in addition to being incorporated in the document, figures must be sent as complementary material when submitting the file on the OJS of "Alteridad", having a quality higher than 600 dpi in TIFF, JPEG or PNG.

5. Fees and APC

«Alteridad» is an Open Access journal, included in the Directory of Open Access Journals (DOAJ) that offers all its production online for the scientific community. There are not fees throughout the editorial process for the publishing articles, including scientific review, layout and translation thereof. There is no publication fee, no Article Processing Charge (APC) associated with this publication, neither for authors nor for readers. The journal is also licensed by Creative-Commons Attribution-Non-Commercial-Share Equal (RoMEO blue journal), which allows free access, download and archive of published articles. All expenses and financing of «Alteridad» derive from the contributions made by the Salesian Polytechnic University.

6. Ethical responsibilities

Each author shall submit a responsible statement of authorship and originality, as well as their ethical responsibilities.

- **Originality:** The works must be original and should not be evaluated simultaneously in another publication; hence, the authors are responsible to comply with this standard. The opinions expressed in the published articles are the responsibility of the author/s «Alteridad» as CrossRef®›s international partner, uses the

CrossCheck® and iThenticate® anti-plagiarism tool to ensure the originality of the manuscripts.

- **Authorship:** The list of signatory authors should include only those who have contributed intellectually to the development of the work. Collaborating in data collection is not sufficient criteria of authorship. «Alteridad» rejects any responsibility for possible conflicts arising from the authorship of the manuscripts published.
- **Use of Artificial Intelligence:** authors should indicate clearly and specifically whether they used Artificial Intelligence tools for preparing their manuscript and analysis, indicating to what extent and which Large Language Model (LLM) or tool was used. They must include it as a note at the end of the manuscript as for section 4.3.
- **Transmission of copyright:** the transfer of rights of the manuscript published in «Alteridad» will be included in the cover letter. The Salesian Polytechnic University (the publisher) has the copyright of published articles; it favors and allows the reuse of these under the license indicated above.

7. Promotion and dissemination of the published article

The authors commit to disseminate their published article as well as to the whole journal using the link of the website of "Alteridad" (https://alteridad.ups.edu.ec/index.php/alteridad/). In addition, they are encouraged to share their published article in academic networks (Academia.edu, ResearchGate, Mendeley, Kudos, ...), social networks (Twitter, Facebook, LinkedIn, ..., also publishing the DOI in these), institutional repositories, Google Scholar, ORCID, web or personal blog, among others. Authors are also encouraged to share the published article through email lists, research groups, and personal contacts.

«Alteridad» has a Metric Measurement System (PlumX) that allows verifying the compliance with this commitment. The impact of previous works will be considered for submitting future articles in «Alteridad».

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Normas de publicación en «Alteridad»

1. Información general

«Alteridad» es una publicación científica bilingüe de la Universidad Politécnica Salesiana de Ecuador (UPS), editada desde enero de 2006 de forma ininterrumpida, con periodicidad fija semestral (enero-julio).

Es una revista científica arbitrada, que utiliza el sistema de evaluación externa por expertos (*peer-review*), bajo metodología de pares ciegos (*doble-blind review*), conforme a las normas de publicación de la *American Psychological Association* (APA). El cumplimiento de este sistema permite garantizar a los autores un proceso de revisión objetivo, imparcial y transparente, lo que facilita a la publicación su inclusión en bases de datos, repositorios e indexaciones internacionales de referencia.

«Alteridad» se encuentra indexada en el *Emerging Sources Citation Index* (ESCI) de *Web of Science*, en la *Scientific Electronic Library Online* (SciELO), en el Sistema de Información Científica REDALYC, en el directorio y catálogo selectivo del Sistema Regional de Información en Línea para Revistas Científicas de América Latina, el Caribe, España y Portugal (Latindex), en el *Directory of Open Access Journals* (DOAJ), en el *European Reference Index for the Humanities and Social Sciences* (ERIHPLUS), en el Portal Dialnet; está evaluada en la Matriz de Información para el Análisis de Revistas (MIAR), en la Clasificación Integrada de Revistas Científicas (CIRC), y en el sistema Qualis de revisión de revistas de CAPES. Además, se encuentra en repositorios, bibliotecas y catálogos especializados de todo el mundo.

La revista se edita en doble versión: electrónica (e-ISSN: 1390-8642) e impresa (ISSN: 1390-325X) en español e inglés; siendo identificado cada trabajo con un *Digital Object Identifier System* (DOI). Todos los artículos publicados en «Alteridad» tienen licencia Creative Commons Reconocimiento-No-Comercial-Compartir igual (RoMEO blue journal).

2. Alcance y política

2.1 Temática

«Alteridad» es una revista especializada en Educación y sus líneas transdisciplinares como Didáctica, Gestión de Centros Escolares, Educomunicación, tecnología educativa, Pedagogía Social, entre otras; y todas aquellas disciplinas conexas interdisciplinarmente con la línea temática central.

2.2 Aportaciones

Todos los trabajos deben ser originales, no haber sido publicados en ningún medio ni estar en proceso de arbitraje o publicación. Se editan preferentemente resultados de investigación empírica, redactados en español, portugués o inglés, siendo también admisibles estudios y selectas revisiones de la literatura (*state-of-the-art*):

a) **Investigaciones:** 5000 a 7500 palabras de texto, incluyendo título, resúmenes, descriptores, tablas y referencias. Se valorarán especialmente los resultados de la investigación, el rigor metodológico, la relevancia de la temática, la calidad de la discusión científica, la variedad, actualidad y riqueza de las referencias bibliográficas (preferiblemente de publicaciones indexadas en JCR y Scopus). Se esperan mínimo 35 referencias.

b) **Estudios y revisiones de la literatura**

- **Estudios:** 5000 a 7500 palabras de texto, incluidas tablas y referencias. Se valorará especialmente el debate generado, la relevancia de la temática, la originalidad de las aportaciones y riqueza de las referencias bibliográficas

(preferiblemente de publicaciones indexadas en JCR y Scopus). Se esperan mínimo 35 referencias.

- **Revisiones de la literatura:** 6000 a 8500 palabras de texto, incluidas tablas y referencias. Se valorará la revisión exhaustiva del estado de la cuestión de un tema de investigación actual con referencias justificadas y selectivas de alrededor de 70 obras (preferiblemente de publicaciones indexadas en JCR y Scopus).

2.3 Secciones

La revista tiene periodicidad semestral (20 artículos por año), publicada en los meses de enero y julio y cuenta por número con dos secciones de cinco artículos cada una, la primera referida a un tema **Monográfico** preparado con antelación y con editores temáticos y la segunda, una sección de **Misceláneas**, compuesta por aportaciones variadas que traten temas educativos de forma prioritaria.

3. Proceso editorial

3.1 Envío de manuscritos

Los manuscritos deben ser enviados única y exclusivamente a través del *Open Journal System* (OJS), en el cual todos los autores deben darse de alta previamente, si bien uno solo de ellos será el responsable de correspondencia. Ningún autor podrá enviar o tener en revisión dos manuscritos de forma simultánea, estimándose una carencia de cuatro números consecutivos (2 años). Un artículo podrá tener como máximo 3 autores, aunque si se justifica en función del tamaño del estudio, podrán ser hasta 5.

«Alteridad» acusa recepción de los trabajos enviados por los autores e informa por email y mediante la plataforma del proceso de aceptación o rechazo; y en el caso de aceptación, del proceso de edición.

En el Portal oficial de la revista, en la sección Normativas, están las Normas para Autores, las plantillas para la redacción de los manuscritos (LaTeX/Overleaf o Word), la Portada y Carta de presentación, el Protocolo de chequeo previo al envío, los formularios de evaluación por parte de los revisores externos y una guía para el envío del artículo a través de OJS. Antes de su envío se recomienda encarecidamente que se compruebe el manuscrito con el Protocolo de chequeo previo. Deben remitirse simultáneamente dos archivos:

a) **Portada y Carta de presentación** (usar el modelo oficial), en la que aparecerán:

- **Portada** (Título, Resumen y Descriptores previstos en el Manuscrito).
- **Nombre y apellidos completos** de cada uno de los autores, organizados por orden de prelación; seguido por la categoría profesional, centro de trabajo, correo electrónico de cada autor y número de ORCID. Es obligatorio indicar si se posee el grado académico de doctor (incluir Dr./Dra. antes del nombre).
- Se incluirá además una **declaración** (Cover letter) de que el manuscrito se trata de una aportación original, no enviada ni en proceso de evaluación en otra revista, confirmación de las autorías firmantes, aceptación (si procede) de cambios formales en el manuscrito conforme a las normas y cesión parcial de derechos a la editorial.
- **Manuscrito** totalmente anonimizado, conforme a las normas referidas en el epígrafe 4.

3.2 Proceso de revisión

En un plazo máximo de 30 días, a partir de la recepción del documento, el autor de correspondencia recibirá una notificación, indicando preliminarmente si se estima o desestima para el arbitraje por los revisores científicos. En el caso de que el artículo presente deficiencias formales, no trate el tema educativo o tenga un elevado porcentaje de similitud con otro(s) documento(s), el Consejo editorial desestimará el trabajo sin opción de vuelta. Por el contrario, si presenta carencias superficiales de forma, se devolverá al autor para su corrección antes de comenzar del proceso de evaluación. La fecha de recepción del artículo no computará hasta la recepción correcta del mismo.

Los artículos serán evaluados científicamente por una media de tres expertos en el tema. Los informes indicarán las siguientes recomendaciones: Aceptar el envío, Publicable con modificaciones, Reenviar para revisión, No publicable. A partir del análisis de los informes externos, se decidirá la aceptación o rechazo de los artículos para su publicación. En el caso de resultados discrepantes se remitirá a un

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nuevo dictamen, el cual será definitivo. El protocolo utilizado por los revisores es público (Investigaciones; Estudios y revisiones de la literatura).

En general, una vez vistas las revisiones científicas externas, los criterios que justifican la decisión sobre la aceptación/rechazo de los trabajos por parte del Consejo Editor son los siguientes:

- Actualidad y novedad.
- Relevancia y significación: avance del conocimiento científico.
- Originalidad.
- Fiabilidad y validez científica: calidad metodológica contrastada.
- Organización (coherencia lógica y presentación formal).
- Apoyos externos y financiación pública/privada.
- Coautorías y grado de internacionalización de la propuesta y del equipo.
- Presentación: buena redacción.

El plazo de evaluación científica de manuscritos, superados los trámites previos de estimación por el Consejo Editor, es de 100 días como máximo; los remitidos para *Calls for papers*, sus fechas de revisión científica se inician al cierre de los mismos. Los trabajos que sean evaluados positivamente y requieran modificaciones, deberán ser reenviados con los cambios, dentro de los siguientes 15 días.

3.3 Edición y publicación del manuscrito

El proceso de corrección de estilo y maquetación de los artículos aceptados es realizado por el Consejo Técnico de la Revista en coordinación con la Editorial Abya-Yala. «Alteridad» se reserva el derecho de hacer corrección de estilo y cambios editoriales que considere necesarios para mejorar el trabajo. A los autores de artículos se enviará una prueba de imprenta en formato PDF para su corrección únicamente de tipografía y ortografía, mismo que deberán reenviar en un máximo de tres días. La Editorial realizará, gratuitamente para los autores, la traducción profesional de la versión final del manuscrito al idioma inglés (o español, según la versión original), lo que garantizará su consulta y difusión internacional. Los artículos serán publicados en la plataforma de la revista en sus dos versiones idiomáticas (español e inglés) y en los siguientes formatos: PDF, HTML, EPUB y XML-Jats.

4. Estructura de los manuscritos

Los trabajos se presentarán en tipo de letra Arial 10, interlineado simple, justificado completo y sin tabuladores ni espacios en blanco entre párrafos. Solo se separarán con un espacio en blanco los grandes bloques (título, autores, resúmenes, descriptores, créditos y epígrafes). La página debe tener dos centímetros en todos sus márgenes. Los trabajos deben presentarse en formato de Microsoft Word (.doc o .docx) (https://alteridad.ups.edu.ec/pdf/alteridad/Plantilla Microsoft Word.docx) o LaTeX/ Overleaf (.tex) (https://www.overleaf.com/latex/templates/revista-alteridad-ecuador/svvjcbgmcrrv), siendo necesario que el archivo esté anonimizado en Propiedades de Archivo, de forma que no aparezca la identificación de autor/es.

4.1 Portada

Título (español) / Title (inglés): Conciso pero informativo, en castellano en primera línea y en inglés en segunda, conformado por el mayor número de términos significativos posibles. El título no solo es responsabilidad de los autores, pudiéndose proponer cambios por parte del Consejo Editorial. Se aceptan como máximo 80 caracteres con espacio.

Resumen (español) / Abstract (inglés): Se describirán de forma concisa y en este orden: justificación del tema, objetivos, metodología empleada (enfoque y alcance), resultados más relevantes, discusión y principales conclusiones. Ha de estar escrito de manera impersonal "El presente trabajo analiza…". En el caso del *Abstract* no se admitirá el empleo de traductores automáticos. Tendrá como extensión entre 220/230 palabras.

Descriptores (español) / Keywords (inglés): Se deben exponer 6 descriptores por cada versión idiomática relacionados directamente con el tema del trabajo. Será valorado positivamente el uso de las palabras claves expuestas en el Thesaurus de la UNESCO (http://bit.ly/2kIgn8I). Solo en casos excepcionales se aceptarán términos nuevos, siempre que tengan un carácter científico estandarizado.

4.2 Estructura IMRDC

Para aquellos trabajos que se traten de Investigaciones de carácter empírico, los manuscritos respetarán rigurosamente la estructura IMRDC, siendo opcionales los epígrafes de Apoyos y Notas. Los trabajos que se traten de Estudios y revisiones de la literatura podrán ser más flexibles en sus epígrafes, especialmente en Metodología, Resultados y Discusión. En todas las tipologías de trabajos son obligatorias las Referencias bibliográficas.

1 **Introducción:** Debe incluir los fundamentos teóricos y el propósito del estudio, utilizando citas bibliográficas, así como la revisión de la literatura o los trabajos relacionados más significativos del tema a nivel nacional e internacional. Se valorará positivamente el uso de referencias de alto impacto (JCR y Scopus).

2 **Metodología:** El enfoque, alcance y diseño metodológico deben ser redactados de forma que el lector pueda comprender con facilidad el desarrollo de la investigación. En su caso, describirá la muestra y la forma de muestreo, así como se hará referencia al tipo de análisis estadístico aplicado. Si se trata de una metodología original, es necesario exponer las razones que han conducido a su empleo y describir sus posibles limitaciones.

3. **Resultados:** Se procurará resaltar los resultados y las observaciones más relevantes de la investigación, describiéndose, sin hacer juicios de valor, el material y métodos empleados para el análisis. Los resultados se expondrán en figuras o/y tablas según las normas de la revista (Ver epígrafe 4.4). Aparecerán en una secuencia lógica en el texto, las tablas o figuras imprescindibles, evitando la redundancia de datos.

4. **Discusión y conclusiones:** Resumirá los hallazgos más importantes, relacionando las propias observaciones con estudios de interés, señalando aportaciones y limitaciones, sin redundar datos ya comentados en otros apartados. Asimismo, el apartado de discusión y conclusiones debe incluir las deducciones y líneas para futuras investigaciones.

4.3 Apoyos y Notas

Apoyos (opcionales): El *Council Science Editors* recomienda a los autor/es especificar la fuente de financiación de la investigación. Se considerarán prioritarios los trabajos con aval de proyectos competitivos nacionales e internacionales. En todo caso, para la valoración científica del manuscrito, este debe ir anonimizado con XXXX solo para su evaluación inicial, a fin de no identificar autores y equipos de investigación, que deben ser explicitados en la Carta de Presentación y posteriormente en el manuscrito final.

Las notas: En caso necesario, irán al final del artículo (antes de las referencias). Deben ser utilizadas para aclarar términos, hacer anotaciones marginales o indicar el posible uso de herramientas de Inteligencia Artificial. Los números de notas se colocan en superíndice, tanto en el texto como en la nota final. No se permiten notas que recojan citas bibliográficas simples (sin comentarios), pues éstas deben ir en las referencias. En caso de contener alguna cita, su referencia deberá encontrarse también en la sección de Referencias bibliográficas.

4.4 Referencias bibliográficas

Las citas bibliográficas deben reseñarse en forma de referencias al texto. No debe incluirse bibliografía no citada en el texto. Su número ha de ser suficiente y necesario para contextualizar el marco teórico, la metodología usada y los resultados de investigación en un espacio de investigación internacional: mínimo 35 para los manuscritos de investigaciones de carácter empírico, y alrededor de 70 para los estudios y revisiones de literatura.

Se presentarán alfabéticamente por el primer apellido del autor (agregando el segundo solo en caso de que el primero sea de uso muy común). Las citas deberán extraerse de los documentos originales preferentemente revistas y en menor medida libros. Dada la trascendencia para los índices de citas y los cálculos de los factores de impacto, se valorarán positivamente el uso de referencias provenientes de publicaciones indexadas en JCR y/o Scopus y la correcta citación conforme a la Norma APA 7 (http://bit.ly/35FNGvN).

Es prescriptivo que todas las citas que cuenten con DOI (Digital Object Identifier System) estén

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reflejadas en las Referencias (pueden obtenerse en https://search.crossref.org/). Todas las revistas y libros que no tengan DOI deben aparecer con su link (en su versión on-line, en caso de que la tengan, acortada, mediante Bitly: https://bitly.com/), y de los sitios web además la fecha de consulta en el formato indicado.

Normas para las referencias

a) Publicaciones periódicas

- **Artículo de revista (un autor):** Ochoa, A. (2019). The type of participation promoted in schools is a constraint factor for inclusive education. *Alteridad, 14*(2), 184-194. https://doi.org/10.17163/alt.v14n2.2019.03
- **Artículo de revista (hasta veinte autores):** Guarderas, P., Larrea, M., Cuvi, J., Vega, C., Reyes, C., Bichara, T., Ramírez, G., Paula, Ch., Pesantez, L., Íñiguez, A., Ullauri, K., Aguirre, A., Almeida, M., & Arteaga, E. (2018). Acoso sexual en las universidades ecuatorianas: validez de contenido de un instrumento de medición. *Alteridad, 13*(2), 214-226. https://doi.org/10.17163/alt.v13n2.2018.05
- **Artículo de revista (sin DOI):** López, L., & Ramírez-García, A. (2014). Medidas disciplinarias en los centros educativos: ¿Suficientes contra el acoso escolar? *Perfiles Educativos, 36*(145), 32-50. https://bit.ly/37Xd5mw

b) Libros y capítulos de libro

- **Libros completos:** Cuéllar, J.C., & Moncada-Paredes, M.C. (2014). *El peso de la deuda externa ecuatoriana*. Abya-Yala.
- **Capítulos de libro:** Padilla-Verdugo, J. (2014). La Historia de la Educación desde los enfoques del conocimiento. In E. Loyola (Ed.), *Ciencia, Tecnología y Sociedad (CTS). Miradas desde la Educación Superior en Ecuador* (pp. 107-128). Abya-Yala. https://bit.ly/3etRnZH

c) Tesis doctorales y de maestría

- Llorent, M. (2019). *Las políticas educativas TIC en el plano autonómico: el caso de Andalucía* [Tesis doctoral, Universidad de Sevilla]. Depósito de Investigación Universidad de Sevilla. https://bit.ly/3YRTRr5

d) Medios electrónicos

- Aunión, J. (2011, marzo 12). La pérdida de autoridad es un problema de toda la sociedad, no es específico del aula. *El País*. https://bit.ly/2NlM9Dp

Normas para epígrafes, tablas y figuras

Los epígrafes del cuerpo del artículo se numerarán en arábigo. Irán sin caja completa de mayúsculas, ni subrayados, ni negritas. La numeración ha de ser como máximo de tres niveles: 1. / 1.1. / 1.1.1. Al final de cada epígrafe numerado se establecerá un retorno de carro.

Las tablas y figuras deben presentarse incorporadas en el texto en Word o LaTeX ubicadas en el sitio en el que los autores consideren que deben estar. Se emplearán únicamente cuando sean necesarias e idóneas, debiendo limitarse su uso por cuestiones de espacios a seis entre tablas y figuras (salvo casos excepcionalmente justificados). Ambas deben ser enumeradas en arábigo y tituladas con la descripción de su contenido. Si la fuente de la tabla o figura no fuera de elaboración propia, los autores deberán incorporar al pie de la tabla o la figura la fuente de la que se extrae [por ejemplo, Fuente: Romero-Rodríguez (2016, p. 32)].

Las tablas deben estar elaboradas en el propio documento por lo que no se aceptarán tablas cortadas y pegadas de otros documentos que no puedan ser editados en el proceso de diagramación.

Para mantener la calidad de las figuras, en el caso de LaTeX/Overleaf, deben ser cargadas en la plantilla en formato original PDF, puesto que la conversión desde otros formatos puede disminuir la calidad de la figura. En el caso de Word, además de ser incorporadas en el documento, deberán ser enviadas como material complementario al momento del envío en el OJS de «Alteridad», debiendo tener una calidad superior a 600 dpi, en archivos de tipo TIFF, JPEG o PNG.

5. Tasas y APC

«Alteridad» es una revista *Open Access*, incluida en el *Directory of Open Access Journals* (DOAJ) que oferta toda su producción de forma íntegra online en abierto para toda la comunidad científica. Asimismo, no establece ninguna tasa económica durante todo el proceso editorial para la publicación de los artículos,

incluyendo la revisión científica, la maquetación y la traducción de los mismos. No existe ningún *publication fee, ni Article Processing Charge* (APC) vinculados con esta publicación, ni para autores ni para lectores. Asimismo, la revista tiene licencia *Creative-Commons* Reconocimiento-No-Comercial-Compartir igual (RoMEO blue journal), lo que permite libre acceso, descarga y archivo de los artículos publicados. Todos los gastos, insumos y financiamiento de «Alteridad» provienen de los aportes realizados por la Universidad Politécnica Salesiana.

6. Responsabilidades éticas

Cada autor/es presentará una declaración responsable de autoría y originalidad, así como sus responsabilidades éticas contraídas.

- **Originalidad**: Los trabajos deben ser originales y no deben estar siendo evaluados simultáneamente en otra publicación, siendo responsabilidad de los autores el cumplimiento de esta norma. Las opiniones expresadas en los artículos publicados son responsabilidad del autor/es. «Alteridad», como socio internacional de CrossRef®, emplea la herramienta antiplagio CrossCheck® y iThenticate® para garantizar la originalidad de los manuscritos.
- **Autoría**: En la lista de autores firmantes deben figurar únicamente aquellas personas que han contribuido intelectualmente al desarrollo del trabajo. Haber colaborado en la recolección de datos no es, por sí mismo, criterio suficiente de autoría. «Alteridad» declina cualquier responsabilidad sobre posibles conflictos derivados de la autoría de los trabajos que se publiquen.
- **Uso de Inteligencia Artificial**: Los autores deberán indicar de manera clara y específica si utilizaron herramientas de Inteligencia Artificial en la preparación de su manuscrito y análisis, evidenciando en qué medida y qué *Large Language Model* (LLM) o herramienta fue usada. De ser el caso, incluirlo como nota al final del manuscrito de acuerdo a lo indicado en la sección 4.3.
- **Transmisión de los derechos de autor**: se incluirá en la carta de presentación la cesión de derechos del trabajo para su publicación en «Alteridad». La Universidad Politécnica Salesiana (la editorial) conserva los derechos patrimoniales (copyright) de los artículos publicados; favorece y permite la reutilización de las mismas bajo la licencia de uso indicada en *ut supra*.

7. Promoción y difusión del artículo publicado

Los autores se comprometen a darle la máxima difusión a su artículo publicado, así como a toda la revista, utilizando el link a la página web de «Alteridad» (https://alteridad.ups.edu.ec/index.php/alteridad/). Además, se les exhorta a compartir y archivar su artículo publicado en las redes académicas (Academia.edu, ResearchGate, Mendeley, Kudos, …), sociales (Twitter, Facebook, LinkedIn, … , publicando en estos también el DOI), repositorios institucionales, Google Scholar, ORCID, web o blog personal, entre otras. Asimismo, se anima a los autores a compartir el artículo publicado a través de listas de correo electrónico, grupos de investigación y contactos personales.

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