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Figueroa Rada, Juan Carlos
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Socio-formative competencies for non-licensed teachers in technology and informatics: challenges in Colombia*

Competencias socio-formativas para docentes no licenciados en tecnología e informática: desafíos en Colombia

Juan Carlos Figueroa Rada**
https://orcid.org/0009-0008-0640-6358
Ariguaní, Departament of Magdalena / Colombia

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** Student of the Doctoral Program in Education Sciences with an Emphasis on Research, Evaluation, and Formulation of Educational Projects, offered by the Metropolitan University of Education, Science, and Technology (UMECIT), Panama. Master's degree in Educational Technology Management from the University of Santander. Specialist in Educational Informatics Administration from the University of Santander. Systems Engineer from the Autonomous University of Colombia. Teacher in the Technology and Informatics Area at the Liceo Ariguaní Departmental Educational Institution, Ariguaní - Magdalena, Colombia. Email: jcfigueroarada@hotmail.com

Abstract

The objective of the study was to analyze the Socio-Formative Competencies for Non-Licensed Teachers in Technology and Informatics. An interpretative-postpositivist methodology was used, with a phenomenological-interpretative approach to understand the experiences of 8 non-licensed teachers but with training in informatics. A structured interview with 22 open-ended questions was used for data collection. Triangulation was applied to ensure the validity and reliability of the results. Findings revealed categories such as sensation of challenge, awareness of limitations, updated perspective, motivation towards technological careers, innovation in the classroom, and connection with the industry. This leads to the conclusion that there is a need for specific training programs for non-licensed teachers in technological areas, in order to improve their pedagogical practice and their ability to effectively teach topics related to technology and informatics.

Keywords: competencies, socio-formative, non-licensed professionals, technology, informatics.

Resumen

El objetivo del estudio fue analizar las competencias Socio-Formativa para Docentes no Licenciados en Tecnología e Informática. Se utilizó una metodología interpretativo-postpositivista, con un enfoque fenomenológico-interpretativo para comprender las experiencias de 8 docentes no licenciados, pero con formación en informática. Se empleó una entrevista estructurada con 22 preguntas abiertas para la recolección de información. Se aplicó triangulación para garantizar la validez y fiabilidad de los resultados. Los hallazgos revelaron categorías como sensación de desafío, conciencia de limitaciones, perspectiva actualizada, motivación hacia carreras tecnológicas, innovación en el aula y conexión con la industria. Lo que permite concluir que existe la necesidad de programas de formación específicos para docentes no licenciados en áreas tecnológicas, con el fin de mejorar su práctica pedagógica y su capacidad para enseñar eficazmente temas relacionados con la tecnología e informática.

Palabras clave: competencias, socio-formativas, profesionales no linceados, tecnología, informática.

Introduction

The occupation of professionals in various fields who hold pedagogical positions at the primary and secondary education levels is an observed reality that has received little attention. Therefore, to provide a statistical approach to this reality, which stems from the researcher's concern and gave rise to this study, some statistics presented by Unesco (2024) are cited, which state:

Coverage rates range between 63% and 76% for teacher qualification and pre-employment training indicators, while coverage rates for relative salaries and in-service training are substantially lower. The global average coverage rate for all SDG 4 indicators is just over 60%. Indicators reflecting teacher qualifications (4.c.3 and 4.c.4) have the highest coverage rates, at just

over 75%, followed by indicators reflecting teacher training (4.c.1 and 4.c.2), which are slightly above the global SDG 4 average. Other teacher indicators tend to have lower coverage rates. The teacher attrition indicator (4.c.6) has a coverage rate just below 50%, while the coverage rate for recent professional development (4.c.7) is below 30%, and that for teacher salaries relative to others (4.c.5) is below 20% (p.6).

Despite the observation made by this organization and including indicators that are not specifically related to teacher training, it represents a starting point for framing the relevance of this study. In this sense, it is estimated that a considerable number of teachers worldwide lack the necessary pedagogical training. According to the Unesco 2017 Global Teacher Survey, about 16% of primary school teachers and 21% of secondary school teachers do not have the required training. This equates to approximately 60 million students receiving education from teachers without adequate pedagogical preparation.

Additionally, according to Unesco (2021), the World Bank's 2021 World Education Report indicates that 69 million new teachers are needed to achieve Sustainable Development Goal 4 of quality education for all by 2030. Of these, 48 million would be needed to replace teachers who retire or leave the profession, and 21 million to meet the needs of new positions created by population growth. It is likely that a significant portion of these new teachers will not have pedagogical training.

In the case of Mexico, a study by the National Institute of Statistics and Geography (INEGI) conducted in 2020 found that 18% of basic education teachers did not have teaching training. This means that around 1.2 million students in Mexico receive education from teachers without adequate pedagogical preparation (González & Crispín, 2022).

In Colombia, a study by the Ministry of National Education conducted in 2018 found that 10% of teachers did not have a professional degree in education, which equates to about 34,000 students receiving education from teachers without pedagogical training (Albadan, 2020). According to the Labor Observatory for Education Report 2022, in Colombia, 40% of teachers do not have training in pedagogy or didactics, meaning that around 136,000 students are taught by teachers without this specific preparation. On the other hand, an analysis by the Colombian Federation of Educators (FECODE) in 2023 estimates that 50% of teachers in Colombia do not have training in pedagogy or didactics, affecting about 170,000 students in the country (Cabeza *et al.*, 2018).

It is important to note that in Colombia, the situation has arisen where many professionals in informatics and other areas take on teaching roles in primary and secondary education institutions due to the growing demand for professionals in the pedagogical field. Meanwhile, graduates in education specialize in specific areas such as mathematics, language, and social sciences, but are not initially trained in the technological field. This has led the Ministry of National Education to hire engineers in technology and informatics to teach. While this approach meets immediate needs, these professionals often lack pedagogical competencies.

In this context, it is important to highlight that when a technology professional assumes the role of a

teacher in primary and secondary levels without having pedagogical competencies, several significant challenges can arise. Communication becomes an issue, as it can be difficult to explain technical concepts clearly and in a way that is adapted to different levels of maturity and understanding (Figueroa, 2024).

Additionally, teachers who lack pedagogical-communicative competence may face several problems in making themselves understood, including difficulties in explaining concepts clearly and comprehensibly to students, as well as in maintaining their attention and interest in the content. Furthermore, the lack of adequate communicative skills can lead to ineffective classroom communication, making it difficult to effectively transmit knowledge and create a positive learning environment (Cabeza *et al.*, 2018).

On the other hand, the lack of strategies to maintain students' attention and interest, as well as the inability to adapt teaching to individual needs, are also common challenges. Regarding classroom management, there may be difficulty in controlling student behavior, maintaining discipline, and creating a positive and motivating learning environment (Figueroa, 2024).

To maintain students' interest, a teacher needs pedagogical skills that allow them to develop appropriate strategies. Without these competencies, it can be difficult to capture and hold students' attention (Durán et al., 2014). The lack of effective strategies to make content relevant and engaging can result in a boring and demotivating learning environment. Additionally, the inability to adapt teaching to individual needs and learning styles can cause some students to disconnect and lose interest in the subject (Albadan, 2020).

It is also considered that the lack of pedagogical competencies can result in planning and evaluation problems, such as difficulty in designing effective didactic sequences, evaluating learning adequately, and conducting formative and continuous assessment. Despite these challenges, the presence of a technology professional in the classroom can also have advantages, such as providing an updated perspective on the technological world, motivating students towards technological careers, and creating innovative learning experiences (Figueroa, 2024).

In this regard, a lack of pedagogical competencies has been observed in non-licensed teachers in educational institutions in Magdalena, Colombia. This translates into communication problems when explaining technical concepts, difficulties in classroom management to maintain discipline and create a positive environment, as well as challenges in teaching planning and evaluation. Meanwhile, students show disinterest in the subject, difficulties in understanding concepts, and potentially low academic results as a result of the teacher's lack of pedagogical competencies in technology. Therefore, the study aimed to analyze Socio-Formative Training for Non-Licensed Teachers in Technology and Informatics.

Methodology

The study methodology adopted the interpretive-postpositivist paradigm, which focuses on understanding and explaining social phenomena from the participants' perspective, recognizing

the subjectivity and complexity of reality. This qualitative approach allowed for an in-depth exploration of the experience of non-licensed teachers in education who teach computer technology (Acosta, 2023).

The method employed was phenomenological-interpretive, which aims to understand the meaning and structure of the experiences lived by the participants. In this case, the goal was to understand how non-licensed teachers in education experience and face the challenges of teaching computer technology in educational institutions (Acosta, 2023).

The sample consisted of 8 non-licensed teachers in education but with training in computer science. The inclusion criteria aimed for them to be IT professionals willing to collaborate by providing information about their experience in teaching this subject. For data collection, a structured interview was used, consisting of an interview guide with 22 open-ended questions designed to address all relevant aspects related to the teaching of computer technology by non-licensed teachers in education.

Regarding ethical considerations, confidentiality of the participants was respected, and their informed consent was obtained before participating in the study. Privacy was ensured, and the identity of the participants was protected in the presentation of the results. Data analysis was conducted using coding-categorization, which helped identify patterns and relationships in the data. Additionally, triangulation was applied, considering empirical, theoretical, and argumentative aspects to ensure the validity and reliability of the results obtained.

Results

The following are the results derived from the triangulation process among the information provided by the informants, the cited theories, and the researcher's argumentation. These results provide a comprehensive and well-founded insight into the socio-formative competencies of non-licensed teachers in technology and informatics. Triangulation enabled the validation and enrichment of the collected data, ensuring the reliability of the findings.

Table 1
Triangulation of the Perception of Technology and Informatics Teachers

Categories	Empirical Moment (direct quotes from key informants)	Theoretical Moment	Argumentative Moment
"Sense of challenge"	"Sometimes it represents a challenge to adapt to the processes involved in planning lessons" (IC1).	According to Echeveste and Martínez (2016), teachers with weaknesses in pedagogical competencies are cognitively affected as they experience stress and feel overwhelmed when planning lessons without the appropriate tools.	Teachers without pedagogical training face both cognitive and emotional challenges when planning lessons and communicating with students. They experience stress, insecurity, and frustration, but some view these challenges as opportunities to improve their skills. This suggests that their experience
	"Personally, it made me feel stressed due to the challenge of teaching without pedagogical training" (IC2).		

Categories	Empirical Moment (direct quotes from key informants)	Theoretical Moment	Argumentative Moment
Awareness of Limitations	"Initially, I felt overwhelmed by the responsibility of educating students without the appropriate tools" (IC3).	According to Figueroa (2024), it is important for teachers to recognize the significance of acquiring pedagogical competencies and to accept the challenge of teaching without specific training. Likewise, it is urgent that they seek support and reflect on their practices to improve, despite facing uncertainty and frustration.	The analysis of teachers' perceptions reveals a complex and challenging reality. On one hand, there is an evident awareness of the need to acquire pedagogical competencies and a willingness to face the challenge of teaching without specific training. However, there is also a sense of stress, overwhelm, insecurity, and frustration in the face of difficulties in effectively communicating and planning lessons. Despite this, teachers strive to improve their skills through daily reflection on their practices and seeking support. Teaching is perceived as an important source of income, reflecting the significance of this work in their
	"This created in me a sense of insecurity about how to approach certain aspects of the educational process" (IC4).		
	"Every day I reflected on my practices and sought ways to improve them" (IC5).		
	"Daily, I faced uncertainty about the appropriate pedagogical strategies" (IC6).		
	"I wanted in-depth courses on how to plan and evaluate" (IC7).		
	"I was frustrated, but it was my source of income" (IC8).		

Note: Own elaboration (2024).

Table 1 presents two main categories, which are derived from the interviews with unlicensed teachers: the sense of challenge and the awareness of limitations. Regarding the sense of challenge, the interviewees expressed that without pedagogical training, they experience stress, insecurity, and frustration when planning lessons and communicating with students. Despite this, some view these challenges as opportunities to improve their skills, suggesting a process of learning and professional growth. In this context, one of the informants stated:

> The sense of challenge in teaching without pedagogical training is very real and constant. At times, adapting to the processes involved in planning lessons can represent a significant challenge. Personally, it has made me feel stressed and overwhelmed, especially in the beginning, when I faced the responsibility of educating students without the appropriate tools. The insecurity about how to approach certain aspects of the educational process and the frustration of facing difficulties in effectively communicating with students have also been part of this experience. However, I try to view these challenges as stimulating and motivating opportunities to improve my skills. It is a complicated and difficult process to manage, but day by day, I strive to learn from my practices and seek ways to improve them. Despite the difficulties, teaching remains an important source of income for me.

In this regard, Gallardo *et al.* (2022) emphasize the importance of training teachers in socio-pedagogical competencies to help them achieve psychological-emotional well-being and gain confidence, which translates into better performance, improved teaching processes, and greater receptivity from students. Similarly, Arteaga *et al.* (2015) believe that pedagogical training pro-

vides teachers with the necessary tools to handle the adaptability required in different educational contexts where they may work.

When interpreting the statements of the teachers and the cited theories, the researcher infers that these professionals (unlicensed) experience a sense of challenge when teaching without pedagogical training. This is important because it highlights the difficulties and pressures that unlicensed teachers face in their educational work. This sense of challenge can serve as a starting point for identifying areas for improvement in the training and support of these teachers, as well as for developing strategies to help them face these challenges more effectively. Additionally, by recognizing and understanding this feeling, it is possible to promote an environment of empathy and support among education professionals, which can contribute to improving the quality of teaching and the well-being of students.

Regarding the awareness of limitations, teachers recognize the importance of acquiring pedagogical competencies and accepting the challenge of teaching without specific training. They seek support and reflect on their practices to improve, despite facing uncertainty and frustration. Teaching is perceived as an important source of income in their lives. In this context, one of the interviewees highlighted that:

As a teacher, awareness of my limitations is fundamental to my professional development. I recognize the importance of acquiring pedagogical competencies and accepting the challenge of teaching without specific training in education. Despite the difficulties and uncertainty I face when communicating with students and planning lessons, I constantly seek to improve my skills. Every day, I reflect on my practices and seek support from colleagues and institutions to continue growing. Although I may feel frustration along the way, I know that this experience is essential for my growth as an educator.

Hence, this analysis reveals a complex and challenging reality for teachers without pedagogical training, who seek to improve their skills despite the difficulties, demonstrating an attitude of overcoming and adapting to the challenges of teaching (Valenzuela et al., 2015). In contrast with Colmenares' theory (2017), teachers must self-evaluate and reflect on their work, strategies, mechanisms, and even their objectives, so that this provides them with information to reorganize and improve the methodologies they implement if necessary.

The information provided by the teachers and the insights from the consulted theory allow the researcher to deduce that the sense of challenge and the awareness of limitations experienced by teachers without pedagogical training when faced with teaching are crucial aspects that influence their learning process and professional growth.

Despite the initial difficulties, many teachers view these challenges as opportunities to improve their skills and actively seek support and reflection to overcome their limitations. These findings highlight the importance of providing continuous support and training to teachers so that they

can successfully face the challenges of teaching and provide quality education to students.

Table 2

Triangulation on the Educational Benefits of Information Technology Professionals in Educational Processes

Categories	Empirical Moment (direct quotes from key informants)	Theoretical Moment	Argumentative Moment
Updated Perspective	Technology professionals can offer a fresh and updated perspective on technology and its application in the modern world, which can be especially relevant for students pursuing careers in technology-related fields.	According to Durán *et al.* (2014), it is important to have an updated perspective in educational processes to stay aligned with advancements and changes in society and the world, which allows for providing a relevant education and preparing students for current and future challenges.	Having an updated perspective helps unlicensed teachers improve their teaching practice by staying informed about the latest trends, methods, and educational technologies. This allows them to offer more effective and relevant instruction to their students, which can increase student motivation and engagement in learning. Additionally, staying updated helps them better adapt to changes in the educational system and enhances their job opportunities.
Motivation Towards Technological Careers	Their experience and passion for technology can motivate students to become interested in related careers, thus encouraging participation in STEM fields and the development of technological skills.	Pursuing technological careers is beneficial for students' learning process because it provides them with a sense of purpose and relevance, increases their interest in technology-related subjects, and encourages active exploration and autonomous learning (Valenzuela *et al.*, 2015).	From all this, it can be inferred that teachers become role models, showing enthusiasm and passion for technology and demonstrating how it can be a rewarding and exciting career. By inspiring students in this way, teachers can play a fundamental role in fostering motivation towards technological careers.
Classroom Innovation	Innovation in the classroom can benefit learning by stimulating students' interest and offering them new ways to understand and apply concepts.	Currently, teachers are needed who motivate student participation through innovative strategies (Vera & García, 2010).	Innovation in the classroom is important because it promotes more dynamic, creative, and relevant learning for students, fostering their interest and active participation in the educational process. Additionally, it allows pedagogical practices to be adapted to current needs and contexts, preparing students to face the challenges of the contemporary world.
Connection with the Industry	The connection with the industry allows students to see the practical relevance of what they learn, better preparing them for the workforce.	Today's youth must be educated under the influence of technologies, as they are present in the areas of production and development in the era of globalization (Joyanes, 2017).	Establishing a connection with the industry is important for students because it provides them with the opportunity to apply their knowledge in real-world situations, understand the demands and trends of the job market, and build networks that can be valuable for their future professional careers. This allows them to acquire relevant skills and competencies for their academic and professional development.

Note: Own elaboration (2024)

Table 2 reflects the categories that emerged regarding the advantages of unlicensed IT teachers, showing that the updating of teachers in education is important to ensure that students acquire the necessary skills to succeed in a constantly evolving world.

Furthermore, they expressed that by staying up-to-date with the latest trends and advancements in education, teachers can offer more relevant and meaningful learning experiences. This not only benefits students by better preparing them for the future but also enriches teaching practice by fostering creativity, innovation, and adaptability in the classroom. As one of the interviewees highlighted:

An updated perspective in teaching is essential to keep up with new educational methodologies and technologies. It allows us to adapt to the changing needs of our students and continuously improve our teaching practices to provide a quality education.

In concordance with the interviewees' ideas, Beltrán (2021) emphasizes the need for teachers to receive continuous training that allows them to stay updated on novel strategies, student needs, and institutional guidelines. According to Callealta *et al.* (2020), it is imperative that teachers be innovative and adapt their teaching processes to new technologies to prepare students to face the challenges of this century.

In this sense, the researcher believes that constant updating in education is a fundamental requirement for excellence in teaching. By staying current with the latest trends, methodologies, and educational technologies, teachers can offer more effective and relevant learning experiences for students, better preparing them for future challenges. Hence, an updated perspective not only benefits students but also enriches teaching practice by fostering innovation, creativity, and adaptability in the classroom.

Regarding the emerging category of motivation towards technological careers, the interviewees highlighted the idea that the good performance and skills (knowledge) of the teacher can motivate students towards technological careers and encourage them to implement these skills in other subjects to obtain information, create concept maps, and mental maps by recognizing the programs for these tasks. Hence, one of the interviewees considers that:

> In my experience, motivating students towards technological careers involves showing them the relevance and positive impact they can have on the world. Through practical activities and interesting projects, I help them see the exciting potential and opportunities for personal and professional growth in the technology field.

This aligns with social cognitive theory, as noted in Castillo's (2020) research, which posits that motivation towards technological careers can be promoted through exposure to successful models in the field, the creation of an enriched learning environment, and the appreciation of students' technical and creative skills.

All this suggests that motivation towards technological careers can be fostered through educational programs that integrate emerging technologies and innovative pedagogical approaches. The research indicates that early exposure to technology, combined with practical experiences and collaboration with the industry, can significantly increase students' interest in these areas.

Another category that emerges from the informants' discourse is Innovation in the Classroom, highlighting that a teacher with extensive knowledge in their field has the ability to adapt content with novel strategies that capture student interest, thereby facilitating the practical aspect. In this sense, one of the teachers stated:

Innovation in the classroom involves not only using new technologies but also developing creative pedagogical approaches that stimulate critical thinking and problem-solving. For me, it is important to stay informed about the latest educational trends and adapt them to the specific needs of my students.

According to Cedeño (2021), from the perspective of educational innovation theory, classroom innovation refers to the implementation of novel practices and methods that significantly improve the teaching and learning process. According to Cruz (2019), this can include the use of technology, the design of interactive activities, and the promotion of a collaborative learning environment.

From the researcher's perspective, classroom innovation can improve the quality of education by increasing student motivation and engagement, as well as fostering the development of 21st-century skills such as creativity, collaboration, and problem-solving. Research shows that innovative teachers tend to achieve better academic results and higher student satisfaction.

Finally, the category of Connection with the Industry emerged, where the interviewees highlighted the importance of a teacher with technological training because it prepares students in this highly demanded field in the labor market. One of the interviewees stated that:

Establishing a connection with the industry is fundamental to staying updated on the demands of the job market and ensuring that my students acquire the necessary skills to succeed in the workforce. Through collaborations with companies and professionals in the field, I can enrich my curricula and provide practical learning opportunities.

In contrast to Aristizábal (2022), who considers that according to competency-based education theory, the connection with the industry is important to ensure that students acquire relevant and up-to-date skills for the job market. Collaboration with companies allows aligning the educational curriculum with the needs and expectations of the productive sector.

All this leads the researcher to infer that the connection with the industry can benefit students by providing them with practical experiences, authentic learning opportunities, and the possibility of establishing professional contacts. Research suggests that collaborations between edu-

cational institutions and companies can improve graduates' employability and contribute to local economic development.

Conclusions

The analysis of the interviewees' discourse, coupled with the consulted theories, highlights the urgency of strengthening the pedagogical training of unlicensed technology and informatics teachers in Colombia. It is essential that training programs address not only the technical aspects of technology and informatics but also the necessary pedagogical strategies for effective teaching in these areas. The integration of innovative and participatory educational methods, as well as the development of skills for managing diversity and inclusion, are key aspects that must be considered in the training of these teachers.

Additionally, special attention must be given to the continuous updating of pedagogical knowledge and skills, in line with technological advancements and the changing needs of society. Continuous professional development and access to updated educational resources are fundamental for teachers to stay current in an increasingly digitalized and dynamic educational environment. It is also important to promote a culture of collaborative learning among teachers, where they can share experiences, best practices, and resources, thereby enriching their educational work.

Finally, it is necessary for educational policies and teacher training programs to recognize and value the importance of pedagogical training in the teaching of technology and informatics. This involves ensuring adequate resources, both material and human, for the development of quality training programs. Additionally, it is crucial to establish monitoring and evaluation mechanisms to verify the impact of these actions on improving educational quality and developing competencies in technology and informatics among students.

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