Athens Journal of Social Sciences

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The ***Athens Journal of Social Science (AJSS)*** is an Open Access quarterly double-blind peer reviewed journal and considers papers from all areas of social sciences, including papers on sociology, psychology, politics, media, and economics. Many of the papers in this journal have been presented at the various conferences sponsored the Social Sciences Division of **the Athens Institute**. All papers are subject to **Athens Institute**'s Publication Ethical Policy and Statement.

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The current issue is the third of the thirteenth volume of the **Athens Journal of Social Sciences** ***(AJSS),*** *published by the Social Sciences Division of Athens Institute.*

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Gregory T. Papanikos
President
Athens Institute

Athens Institute

A World Association of Academics and Researchers

21st Annual International Conference on Psychology
24-29 May 2027, Athens, Greece

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Academic Members Responsible for the Conference

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Important Dates

- Abstract Submission: **27 October 2026**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **26 April 2027**

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3-8 May 2027, Athens, Greece

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Important Dates

- Abstract Submission: **6 October 2026**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **5 April 2027**

Academic Member Responsible for the Conference

- **Dr. Domenico Maddaloni,** Head, Sociology Research Unit, Athens Institute & Associate Professor, University of Salerno, Italy.
- **Dr. Philip G. Cerny**, Director, Social Sciences Division, Athens Institute & Professor Emeritus, University of Manchester (UK) and Rutgers University (USA).
- **Dr. George S. Tsagaris,** Associate Professor, Cleveland State University, USA.
- **Dr. Sharon Claire Bolton**, Head, Management Research Unit, Athens Institute & Professor, The Management School, University of Stirling, Scotland.

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How Teachers Prepare to Work in Indigenous Education: A Case Study

By Diego Fabián Vizcaíno Arévalo[*], Zaida Mabel Angel Cuervo[±] & Laura Ramirez[○]

This paper presents a case study aimed at investigating the training of teachers within an indigenous education institution. The study conducted semi-structured interviews with 10 teachers from various fields working in an institution situated in the Nasa territory of the Cauca department in Colombia. This institution serves a diverse population including peasants, Nasa indigenous people, and Afro-descendants. The research methodology employed discourse analysis for data interpretation. The primary conclusion drawn from this study underscores a noticeable absence of intercultural training among teachers working within such institutions. Despite this deficiency, the teachers' practical experience and the unique context in which they operate allow for a meaningful exchange of knowledge. This dynamic enables the integration of teaching methods that align with the indigenous education model. Consequently, this exchange of knowledge contributes to the empowerment and cohesion of the Nasa community.

Keywords: *Teaching; quality of the education; intercultural education; teacher training; ethnic education.*

Introduction

Colombia, as enshrined in the Political Constitution of 1991 (Const, 1991), stands as a diverse and multi-ethnic nation (Castro, 2004). This is evidenced by the presence of numerous ethnic groups, composing an estimated population of 1,905,617 individuals (DANE, 2019). This populace is characterized by the coexistence of 64 distinct languages, dispersed across approximately 200 municipalities. Despite this remarkable cultural tapestry, there exists a noticeable dearth of comprehensive studies that delve into the ethnomathematics framework of various indigenous communities (Tabares, 2016).

It is only within recent years that the concept of ethno-education has started to gain prominence. This approach seeks to establish a harmonious and dialogic relationship between cultural heritage and formal schooling, accentuating the significance of traditions, language, and ancestral knowledge (Castillo, 2016; Sánchez, 2018; Jacanamejoy, 2021). Notably, ethnomathematics has been integrated into this discourse, as it provides a conduit for recognizing and appropriating indigenous and cultural mathematical knowledge.

Historically, Blanco (Blanco, 2017; Blanco & Molano, 2021) highlights the emergence of what can be deemed as the embryonic stages of ethnomathematics in Colombia during the 1980s. This period witnessed the collaborative efforts of three pioneering researchers: German Mariño, Víctor Albis, and Guillermo Páramo, who

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amalgamated the realms of mathematics and anthropology. In the words of Blanco, "Ethnomathematics examines cultural practices, which stem from the imperative to solve problems interwoven with mathematical relationships" (Blanco et al, 2014).

Tabares (2016) underscores that Colombia is lagging behind in the realm of ethnomathematics, attributing this disparity to a broader context where the understanding of ancestral cultural identity is overshadowed by the prevailing dominance of Eurocentric knowledge in Latin America (Walsh, 2007). Furthermore, despite the nation's rich cultural diversity and the existence of varying regional knowledge, ethnomathematics remains marginalized in teacher training programs, consequently failing to effectively enrich education for different communities (Aroca, 2016).

Aroca provides an overview of the state of ethnomathematics within mathematics teacher training programs in Colombia, characterizing it as being in an incipient yet growing phase (Aroca, 2016). Through an examination of the curricula in 14 public universities, Aroca finds that only 3 out of these institutions incorporate ethnomathematics as a compulsory course for future mathematics teachers. In 7 universities, the course is offered as an elective, while in 4, it is not provided at all. This scarcity in ethnomathematics training for prospective mathematics teachers exposes a significant gap in their education, reflecting a failure to contribute to the exploration, preservation, and strengthening of ancestral and cultural mathematical knowledge within the country.

Another challenge stems from the epistemological perspective held by both teacher trainees and educators. Gatti (1992) and Ruiz (2018) point out that many universities educators struggle with a dilemma of teaching identity, vacillating between being specialists in their field of expertise or being effective educators. This crisis of teaching identity is perpetuated by passing it down to their trainees, focusing predominantly on discipline-specific knowledge and sidelining the critical nuances essential for 21st-century teaching, such as the promotion of interculturality and its vital role in shaping the education of mathematics teachers. This disregard for the evolving theoretical, societal, and cultural demands over the past four decades is striking (Valero, 2004).

Building on the aforementioned context, this study delves into the training of educators within an indigenous education institution, seeking to characterize their knowledge base and the interconnectedness it shares with the indigenous community where the educational establishment resides.

Understanding Ethnomathematics

Ethnomathematics has emerged as a subject of exploration and engagement for educators, teacher trainers, researchers, and scholars in the field of mathematics. This term possesses a multifaceted nature, encompassing a range of meanings. D'Ambrosio characterizes ethnomathematics as:

> The mathematics practiced by cultural groups, such as urban or rural communities, groups of workers, professional classes, children of a certain age, indigenous societies, and many other groups that identify themselves by common objectives and traditions to the groups" (D'Ambrosio, 2001).

This definition highlights how various communities, including scientific ones, engage with mathematics in diverse ways.

Other researchers have associated ethnomathematics with marginalized groups (Skovmose & Valero, 2012; Bonilla et al., 2018), underscoring the notion that education is a human creation that should be accessible to all individuals, regardless of their language, cultural practices, or economic circumstances. However, numerous communities find themselves excluded from the knowledge, techniques, and structures of mainstream mathematics education. At this juncture, it becomes crucial to acknowledge alternative and ancestral mathematical practices, as they offer pathways for the emergence of group identity, cultural heritage, and historical narratives intricately intertwined with mathematical knowledge.

In Martínez's work (2013), Ascher and Ascher provide a definition of ethnomathematics as "the study of the mathematical ideas of people who are not literate, considering them inferior to those developed by Western culture" (Martínez, 2013). Gerdes (2007, cited by Martínez, 2013) proposes that ethnomathematics emerges at the intersection of cultural anthropology, mathematics, and mathematics education, highlighting the necessity of recognizing the existence of various mathematical systems across diverse cultures, with Western mathematics being just one among them. Meanwhile, in an interview conducted by Blanco, Bishop defines ethnomathematics as "the study of the relationships between mathematics and culture... it is the mathematics of the disadvantaged" (Blanco & Parra, 2009).

Blanco adds another dimension to the concept by asserting that within the realm of ethnomathematics, "different ways of understanding the world are possible, and therefore the claim to truth is not imposed but is understood and validated through consensus" (Blanco & Molano, 2021). Within the scope of this study, ethnomathematics is embraced as the examination of mathematical practices within specific communities, as they are integrated into learning dynamics driven by particular organizational needs.

In light of these perspectives on ethnomathematics, teacher training is deemed crucial for comprehending the ethnoeducational processes inherent to each culture involved. This engagement with the distinct characteristics of mathematical usage in school environments aligns with the concept of mathematization. Mathematization underscores the importance of teachers guiding students towards mathematics through the lens of their cultural context (Freudenthal, 2002; Steiner, 1968), thereby enabling students to connect their cultural realities to society and thereby identifying themselves within specific community practices. Some educators argue that, instead of immersing students solely in a single culture, a more holistic, global approach should be adopted, exposing students to a diverse array of cultural contexts (Tabares, 2016).

Balancing the integration of information and technology tools within mathematics education while preserving cultural traditions is of paramount importance. Jacanamejoy (2021) highlights that over generations, essential aspects of indigenous knowledge, such as customs, language, attire, and myriad traditions, have been gradually eroded. These vanishing traditions must be brought to light, countering an educational paradigm centered on Western knowledge that dismisses alternative forms of knowledge as inferior. Ethnomathematics, in this context, offers a means of embracing knowledge that lies beyond the purview of Western tradition, reclaiming the potential for learning through a cultural lens that reflects the communities' identities.

Blanco's perspective aligns with this notion, asserting that ethnomathematics supports the struggle for and vindication of the mathematical knowledge held by the peoples of the Americas (Blanco, 2021). Fuentes (2019) elaborates on the oppressive dynamics that ethnomathematics aims to disrupt, aiming to revitalize and validate knowledge that was historically disregarded or dismissed (p. 26). This oppression is intertwined with pedagogical practices that neglect the richness of other cultures, propagate a single version of truth, and prescribe a uniform academic approach. The adoption of ethnomathematics challenges these oppressive patterns, fostering a more inclusive and diverse educational environment. Here, mathematics can be used to demystify a society and, from a critical perspective, contribute to a greater awareness of the social world and promote social justice (Brelias, 2014), which is so necessary in working with indigenous peoples.

In Colombia, educational institutions are granted autonomy to develop their own educational projects in accordance with their specific needs. This autonomy extends to educational institutions catering to ethnic groups, allowing them to incorporate indigenous knowledge, such as traditional medicine, dance, language, handicrafts, and agricultural practices, into their curriculum (Ministerio de Educación Nacional, 1994). The framework emphasizes that mathematics education should facilitate students' engagement with elements of their culture and the construction of shared social meanings. This approach, while rooted in indigenous cultures, also acknowledges the importance of universal mathematical knowledge (Ministerio de Educación Nacional, 1998).

While this regulatory landscape provides an avenue for inclusive curricular design based on indigenous cultures, it offers limited guidance on how educators tasked with this responsibility should be prepared. Despite the regulatory framework's potential for recognizing and integrating traditional and community-based education, it lacks specific parameters for the academic training of educators who will be responsible for implementing these approaches. This study aims to shed light on the training of teachers within an indigenous education model within a specific educational institution in the department of Cauca. The primary objective is to characterize the relationship between the teachers' knowledge and that of the Nasa indigenous community. Specifically, the study seeks to explore how teachers, operating within an institution with its own indigenous education model, establish connections and synergies between their own knowledge and the knowledge of the Nasa indigenous people. As an ethical consideration, the name of the institution remains undisclosed.

The research question guiding this work is: how do teachers working in an institution with its own indigenous education model understand the relationship between their knowledge and that of the indigenous community? Through this investigation, we aim to contribute to the broader discourse on ethnomathematics, teacher training, and the meaningful integration of indigenous knowledge within educational contexts. By examining the experiences and perspectives of teachers within this unique educational institution, we hope to uncover valuable insights that can inform future approaches to culturally responsive and inclusive education in Colombia and beyond.

Context

The Nasa people primarily inhabit the territory of Tierradentro in Colombia, situated between the departments of Cauca and Huila. Additionally, some Nasa communities have settled in the Valley region of Tolima, while a smaller population has relocated to Putumayo and Caquetá.

> The ancestral homeland of the Nasa people is characterized as a natural triangle, encompassing the eastern foothills of the Central Andes mountain range and the hydrographic basins of the Páez and La Plata rivers to the south, as well as the Yaguará and Páez rivers to the east. This geographical area holds deep cultural and historical significance for the Nasa community (webpage: Organización Nacional Indígena de Colombia-ONIC, 2021)

According to the most recent Census conducted by the National Administrative Department of Statistics (DANE) in 2019, there are approximately 243,176 individuals who identify themselves as Nasa. The majority of this population, 88.6%, resides in the department of Cauca, specifically amounting to 164,973 people. In the broader context of Colombia, the Nasa people constitute around 13.4% of the total indigenous population.

The history of the Nasa people is marked by their determined resistance against Spanish colonization, even though parcels of their ancestral territory were subjected to colonization and missionization in the mid-16th century. Despite these historical challenges, the Nasa community has managed to maintain and preserve their cultural identity, traditions, and way of life within their territory.

In Nasa culture, profound reverence is directed towards spiritual entities such as Eekayhe', who envelops and bestows life energy, I'khwesx, the spirit responsible for transmitting gifts, and Ksxaw Wala, the guiding presence. The Nasa worldview envisions their reality as a collective household where all beings reside. According to Nasa mythology, the initial grandparents and parents inhabited another land, a singular home. Presently, as life originates on Earth, their current abode, the original ancestors serve as guardians and defenders of the Nasa world.

Central to the Nasa perspective is a complex interplay of symbols and beliefs that offer insights into their surroundings. This intricate framework permeates the community's political, economic, and social structure. The Páez people perceive their world as a layered structure, with "Yu" representing the subsoil, associated with death, cold, and impurity, while "Sek," representing the sun, symbolizes life, warmth, and purity (ONIC, 2021).

Coca holds significant sacred importance within Nasa culture, regarded as an essential element from cultural, religious, medicinal, and nutritional dimensions. The concept of harmony, known as "Wêt Wêt fxi zenxi," also holds great significance for the Nasa community. This harmony, emphasized by Hurtado (2015), underscores the fabric of unity, characterized by equilibrium, collectivity, and the interconnectedness of individuals with nature. This stands in contrast to prevailing trends of globalization and individualism.

Indeed, the fabric woven by the Nasa people's cosmogony is intricately composed of six threads, each representing essential aspects of their cultural identity and worldview, as detailed by Hurtado (2015). These threads, akin to pillars of their

existence, shape their understanding of life and guide their interactions with the world around them.

- *Cultural Practices*: Orality emerges as a prominent feature in this thread, embodying the transmission of ancestral wisdom across generations. This transmission helps avert imbalances, which are communicated through dreams, rainbows, and bodily signs. Preserving these practices ensures the harmony of both individuals and the collective community.
- *Rituals:* Serving as the second thread, rituals play a vital role in purging what disrupts harmony—the "dirty" elements—from the body, family, or community. Traditional healers, endowed with the ability to commune with nature's spirits, conduct these rituals to harmonize energies and offer tributes to Mother Earth.
- *Defense of Mother Earth:* The third thread revolves around safeguarding Mother Earth, regarded not as an inanimate entity but as a living being bestowing life and sustenance. The land and territory intertwine with all life forms, encompassing water, air, natural resources, and the growth that flourishes upon it.
- *Dance Practices:* Woven into the fabric as the fourth thread, dance practices are profound expressions of Nasa life. These dances, often symbolized by the spiral, find resonance in rituals and convey a sense of interconnectedness with nature, ancestors, and spirituality. They are marked by a sense of comfort and a joyful celebration of existence.

It's evident that these threads collectively create a rich tapestry of beliefs, practices, and connections that define the Nasa people's cultural identity and relationship with their surroundings. This intricate fabric weaves together various dimensions of their existence, from ancestral knowledge and healing rituals to their profound connection with the Earth and the joyous expression of life through dance.

The Nasa policy, constituting the fifth thread of the fabric, represents a commitment to preserving their identity, history, and rightful place as an original people. Rooted in their ancestral legacy, this policy is guided by core principles such as unity, territorial integrity, cultural heritage, and autonomy. It is a continuous practice that shapes their social framework and influences their interactions with the world, driving them to defend what rightfully belongs to them.

Health, forming the sixth thread, is intricately linked to the overall balance of the fabric. Cultural practices, symbolized by vegetable fiber ropes, serve to promote this thread. Rituals act as preventive measures, contributing to the well-being of both individuals and the Earth. When health is maintained, the defense of Mother Earth is reinforced. This harmony extends to dance practices, where a sense of ease and well-being is expressed. The Nasa policy further amplifies this cosmogony of harmony, embodying the essence of Nasa culture. In summary, the fabric of Nasa culture is woven from these intricate threads, each representing a distinct aspect of their existence: cultural practices, rituals, defense of Mother Earth, dance practices, Nasa policy, and health. Together, these threads form a comprehensive tapestry that encompasses their identity, values, and interactions with the world, all while navigating the complexities of modern times.

Language plays a pivotal role in the preservation of Nasa culture. Nasa yuwe, their indigenous language, holds profound significance as a carrier of their heritage. Despite its importance, the status of Nasa yuwe is under threat. While approximately 60% of the Nasa community still uses the language daily, its usage has been declining due to various factors. Indigenous education schools have recognized the importance of teaching in the mother tongue, but challenges arise due to a shortage of qualified Nasayuwe-speaking teachers. This discrepancy highlights the struggle to maintain linguistic and cultural continuity in the face of modern challenges.

Over time, Spanish-speaking teachers often acquire proficiency in the Nasayuwe language, learning from peers who are more fluent and through interactions with their students. However, this process is not uniform, and some teachers may only learn basic greetings, phrases, and numbers up to ten. Despite varying language proficiency levels, these teachers may still be involved in teaching indigenous education, especially in areas where the native language has been marginalized or displaced (Ávila, 2018).

In the realm of the economy, the Nasa indigenous people predominantly engage in agriculture and livestock activities to sustain their livelihoods. An interesting cultural practice emerges in their agricultural practices, specifically in the cultivation of corn. The spiral planting pattern for corn is symbolic and practical. Unlike planting in straight rows where one plant overshadows the other, causing an imbalance and potential hunger, the spiral planting represents collective thinking and community benefit. This aligns with the Nasa people's ethos of working collaboratively, known as "minga," where each individual's contribution helps to the well-being of the entire community.

The concept of "trueque," or barter, is deeply ingrained in Nasa culture and serves as a common economic activity. It involves individuals exchanging food items based on their surplus and needs, thus expanding the diversity of their basic food resources. This practice embodies communal support and interdependence, reflecting the Nasa people's commitment to sharing and solidarity within the community.

In essence, both language acquisition and economic practices are integral aspects of Nasa culture, showcasing their adaptability, collective values, and the intricate ways in which their traditions influence various facets of their lives.

Methodology

The research undertaken aimed to provide insight into the training and knowledge of teachers within an educational institution that follows an indigenous education model. This institution is situated in the Departments of Cauca and caters to a diverse student body, including mestizo, Afro-descendant, and indigenous students from the Nasa community. To achieve this goal, the study employed a discourse analysis approach, which involved conducting semi-structured interviews with the teachers working at the institution.

The teachers themselves play a crucial role in shaping the research's theoretical framework. According to van Dijk (2019), participants like the teachers not only contribute to the theoretical definition but also influence the broader context through their discourse. In other words, the contexts in which discourse

occurs are not studied in isolation, as social scientists might typically do, but are instead examined to gain a deeper understanding of the discourse itself.

This research is characterized as qualitative and exploratory. Qualitative research focuses on understanding, describing, and sometimes explaining social phenomena from various perspectives. In this case, the study aims to delve into the nuances of the training and knowledge of teachers in the context of indigenous education, providing a richer and more comprehensive understanding of their experiences and perspectives. This approach allows for a more holistic exploration of the subject matter, capturing the depth and complexity of the teachers' engagement with the indigenous education model and its implications.

By employing discourse analysis and adopting a qualitative and exploratory approach, the research seeks to uncover insights that contribute to a deeper understanding of the interplay between teacher training, indigenous education, and the knowledge dynamics within the Nasa community.

To gather the necessary information, a semi-structured interview approach was employed, involving 10 teachers currently employed at the Educational Institution under study. The interview process followed a set of predefined questions that were organized into categories, focusing on both the characterization of the teachers themselves and their relationship with the knowledge of the Nasa people. One of the key advantages of this approach is its flexibility, allowing for the emergence of new questions during the course of the conversation. This adaptability ensures the collection of reliable qualitative data while accommodating the participants' perspectives, addressing uncertainties, and minimizing rigid formalities in the process (Díaz et al., 2013).

The transcripts of these interviews serve as the primary data source for the study and are subjected to discourse analysis methodology. The central objective of discourse analysis is to uncover, describe, and comprehend the effects and forms through which discourses generate meaning. The focus of this analysis is on the construction of meaning within the discourses, and the examination is carried out within the context of the overarching research goal – characterizing the teachers and elucidating the connections between their knowledge and that of the Nasa people.

By employing discourse analysis, the study aims to explore how meaning is produced, expressed, and shaped through the conversations held during the interviews. This method allows for a comprehensive understanding of the teachers' perspectives, experiences, and interactions with the Nasa knowledge, shedding light on the ways in which their training and engagement with indigenous education influence their perceptions and relationship with the indigenous community's knowledge.

Participants

The study involves a total of 10 participants who are educators at an educational institution situated within the *Pickwe Tha Fiw* indigenous reservation in the Cauca department. The institution's history dates back to its establishment in 2003, initially enrolling students from three distinct indigenous communities and a smaller segment of the local peasant population. However, after a period of twelve years, one of the indigenous communities made the decision to establish its own separate school, resulting in the retention of students solely from two of the original communities.

The participants in this research are drawn from the pool of educators working within this particular educational establishment. They represent a diverse group of professionals who are engaged in the unique educational context of the *Pickwe Tha Fiw* indigenous reservation, and their perspectives and experiences are central to the investigation of the training and knowledge exchange between teachers and the Nasa indigenous people. Through their insights and interactions, the study aims to shed light on the dynamic relationship between the teachers' training and the indigenous community's knowledge.

The teachers who voluntarily participated in this research were assigned a code between 1 and 10, their characterization is presented in Table 1.

Table 1. *Characterization of Participants by training, Language and Length of Service*

Teacher	Teacher training institution	Obtained title	Languages they speak	Time of service
1	Universidad Distrital Francisco José De Caldas	Bachelor of Basic Education with an emphasis in Mathematics	Spanish	3 months
2	Corporación Universitaria del Huila	Environmental engineer	Spanish	3 years
3	Universidad del Cauca	Biologist	Spanish	3 years
4	Servicio Nacional de Aprendizaje Sena (Valle del Cauca)	Environmental control technician	Spanish	11 years
5	Universidad Surcolombiana	English graduate	Spanish - Nasa yuwe	18 years
6	Sena	Environmental control technician	Spanish - Nasa yuwe	11 years
7	Institución educativa agroforestal satwesx zuun	high school graduate	Spanish - Nasa yuwe	8 years
8	Universidad autónoma de Popayán	Professional in sport and physical activity	Spanish	Less than a year
9	Universidad Surcolombiana Neiva	Degree in Literature and Spanish Language	Spanish	Less than a year

10	Normal superior Quiguanas	Normalista[1]	Spanish	4 years

Source: Authors. The gender of all participants is male.

The process of selecting teachers to work within the educational institution is a community-driven and multi-step procedure. Prospective teachers submit their resumes to the school secretary, and a collective assembly involving the community members is convened to make the final decision on the selection. Among the criteria considered during the selection process are candidates' familiarity with laws and policies directly relevant to the community, as well as a strong political background and understanding of social processes. If the community provides its endorsement, the applicant proceeds to an evaluation conducted by the Nasa Çxhãçxha association of ancestral territorial authorities. This evaluation encompasses various aspects such as political knowledge, general knowledge, understanding of customs and traditions, pedagogical skills, and the specific educational emphasis they intend to bring. For those who are proficient in the Nasayuwe language, part of the evaluation may be conducted in Nasayuwe.

Once a candidate is chosen for the teaching role, the educational institution is responsible for providing them with an induction process that focuses on their own cultural heritage. Notably, not all teachers are fluent in the Nasayuwe language, and there currently exists no formal program to facilitate their language learning. It's also worth highlighting that there has been a decline in the Nasayuwe-speaking student population, which now constitutes approximately 10% of the institution's total.

In response to these challenges and to promote the revitalization of native languages, the Intercultural Indigenous Autonomous University (AUAIIN) has been active in the region. AUAIIN is working towards preserving and promoting native languages through initiatives such as offering a Bachelor's Degree in *Pedagogy for the Revitalization of Native Languages*. This underscores the broader effort to support linguistic diversity and cultural heritage within the community. Didout (2015), emphasizes the possibility that indigenous people can study at a university that takes their culture into account.

Analysis

The semi-structured interviews conducted with the teachers yielded specific and detailed information. Once these interviews were transcribed, the resulting speech formed the corpus of data to be analyzed. The discourse analysis focused on several key aspects, each providing insights into the teachers' perspectives and experiences within the context of indigenous education. These aspects included:

[1]High school graduate with an emphasis in education.

1. Formation and Relationship with Indigenous Education: The analysis delved into the teachers' educational backgrounds, training, and experiences related to indigenous education. It aimed to understand how their preparation and personal journeys influenced their role within the institution.
2. Research in Education: This aspect explored the teachers' engagement with educational research, particularly as it related to indigenous education. It sought to uncover their involvement in scholarly activities that contribute to the enhancement of teaching practices and the overall educational experience.
3. Appropriate Knowledge of the Nasa Community: The analysis examined the teachers' level of familiarity and understanding of the Nasa community's culture, traditions, and ways of life. It aimed to assess how well their knowledge aligned with the community's values and needs.
4. Doing Mathematics: This aspect focused on the teachers' approaches to teaching mathematics within the indigenous education model. It aimed to uncover their teaching methodologies, strategies, and beliefs about mathematics education.
5. Traditions Permeated by Mathematics: The analysis explored the intersection of traditional Nasa practices and mathematical concepts. It sought to identify instances where mathematics was embedded within cultural traditions and rituals.
6. Importance of Mother Nature in Indigenous Education: This aspect delved into the teachers' perspectives on the role of nature, environment, and sustainability in indigenous education. It aimed to uncover how these concepts were integrated into their teaching and the broader educational philosophy.

By examining these facets of the teachers' discourse, the analysis aimed to provide a comprehensive understanding of their experiences, beliefs, and practices within the context of the indigenous education institution. It sought to reveal both explicit and implicit themes that contribute to the complex tapestry of indigenous education and its relationship with the Nasa community.

Undergraduate training and Relationship with Indigenous Education

In the interview, it was possible to notice that teachers use Western knowledge from their training and relate it to what is offered by the community to generate a new knowledge that is not exclusive between peoples, but rather integrates them and provides new ways of understanding the reality. They adapt them so they can be used in this type of education. For example, Teacher 2 mentions:

> (1) I guide the area, or the learning path that is called bioterritoriality, which is parallel to natural sciences, but applied to the territory, which practically goes from cycle four to cycle six, which would be sixth to ninth grade, and physical chemical transformations and spiritual, which is cycle seven and eight, which would be the tenth and eleventh grade. The training I have, I am a biologist from the University of Cauca (T2),

Although in the Colombian General Education Law of 1994, there is no specific allusion to a subject called "Bioterritoriality", this teacher mentions the link between natural sciences and bioterritoriality, as part of the curriculum of the institution in

which he practices. In this way, Western knowledge of science dialogues with indigenous knowledge about the context and is taught through this subject.

In addition, Teacher 8 (T8) alludes to how their previous knowledge should be transformed in a certain way.

> (2) "that parallel was also made, of how the rainbow is perceived from the scientific explanation and how it is perceived from the Nasa knowledge"(T8),

Here we evidence a process between science and tradition, carried out by this teacher, trained in the city, who has been taught "that the rainbow arises as a result of the sun's rays illuminating small drops of water forming the spectrum of the seven colors" and, upon reaching the community, he finds that the rainbow for the Nasa is much more than that. The indigenous have respect for the rainbow since it can give an invaluable gift, also, it is found within the oral tradition that when the rainbow hits a person, they can die.

Research in Education

The teachers express the importance of educational research in the training processes and in the preservation of the knowledge of the Nasa community. They mention the following difficulties to achieve this: not having a solid training to carry out research, lack of systematization of the knowledge of the elderly. They emphasize how they carry out the dialogue about Western research and Nasa knowledge.

In the interview with Teacher 7, research is evidenced as an aspect for teachers to be updated,

> (3) "one has to find a way to do a lot of research because the training process is really about research" (T7)

Here the teacher has the desire to investigate, he considers that research is important in the training process, however, it seems that during his training process as a teacher, he did not have spaces to carry out this work. Furthermore, he claims that:

> (4) "The knowledge that we have acquired in the big house in this training process has led us to think about different things that should also make a transformation from the community" (T7),

understanding by "Casa Grande" the community in general, which is recognized as a valuable source of information that allows the transformation of the community, even when it is evident that what is desired has not been achieved in terms of changes.

The same teacher talks about the practical exercise

> (5) "As satwesx zuun, we have been leading the way and we continue to carry out different activities, not only from a practical exercise but also from a spiritual one." (T7),

this confirms that they have already begun the path to carry out the transformation referred to in the previous point, only that they lack the bases to develop it. It could be thought that these are related to the investigation of indigenous knowledge, as he himself affirms,

> (6) "something very interesting that the ancestral experts handled in all these activities is that they have a lot of knowledge, but nevertheless, it is still difficult for one to start sitting down with them and start writing. I believe that the greatest difficulty that we indigenous people have is to write" (T7),

within an investigative process, systematization allows the organization and analysis of data, which is what this teacher mentions that is not being done. There is oral tradition, the knowledge of the knowers, however, it is not written, it is not systematized due to a limitation of writing.

According to the previous scenario, the lack of systematization of ancestral knowledge, Teacher 5, mentions that,

> (7) "We can talk, for example, about traditional medicine, the nine points where indigenous doctors feel their signal. The speed with which one jumped here, the speed, the distance, all this has a different meaning that has not been organized, that has not been investigated." (T5),

which implies that valuable knowledge is recognized for the Nasa community, functional, that must be investigated and explored through Western scientific research methodologies, especially in the identification of a disease and/or its cure.

Another participant, Teacher 3, from his knowledge mentions that they should do research to be clear about certain traditions of the community,

> (8) "from the Nasa vision it is important what incidence it has in each one of the people depending on their lunar moment. If the investigative process is carried out to compare at what lunar moment they were born and what is their way of being, of expressing themselves, what abilities they have and their character, how it works, then, it allows us to know that part" (T3),

From the lunar phases, the research for this teacher is related to the comparison and dialogue between astronomical phenomena (Western culture) and the reading that is carried out with the Nasa people with the lunar influence in the construction of the personal characteristics of the subject. As mentioned by Tabares (2016), the Nasa culture takes a holistic and global look, by not staying only with its own knowledge but inquiring about others.

Knowledge apprehended from the Nasa Community

The Nasa worldview has been apprehended by mestizo teachers and strengthened in Nasa teachers. This is evident throughout the interview, when they mention knowledge of this town that explains and characterizes their actions. They talk about how the economy not only responds to the generation of an economic good

but also to the development of cultural practices that are related to the fabric and how the development of personality is associated with the lunar phases.

Some have acquired this knowledge about the Nasa worldview throughout their lives since they are part of this culture, others have gradually acquired it during their time at the institution, for example,

> (9) "It has four fabrics, because of these fabrics we have: 1- ancestral thought and memory, 2- economy territory, 3- spirituality worldview and 4- society and authority" (T9),

For the Nasa people, weaving has had great relevance since for them it is more than a technique to produce hats, ruanas or backpacks, it also means social fabric, from their political and community actions, established in the principle of unity, which can be seen reflected in the mingas (great community work), Hurtado (2015). He also alludes to the importance of weaving within what he called harmony, which is made up of six practices typical of the Nasa people, so that weaving, apart from promoting mathematical thinking, contributes to the strengthening of culture.

Do mathematics

The teachers of the educational center, agree that mathematics is a cultural practice that allows to continue transmitting traditional knowledge from generation to generation, regardless of the formal institutionalization of the discipline. In other words, it does not necessarily have to be formulated under a curriculum, therefore, the community continues to have access to this indigenous mathematical knowledge, not only through the school, but through various activities such as planting, weaving, and native games.

For teachers, doing mathematics is an activity that takes place within a context in which the learners are immersed, as indicated by the teacher 10

> "mathematics is involved within any social or playful context that we represent" (T10)

We can show that for this teacher it is important to take mathematics out of the classroom and take it to a more playful environment in order to enrich the development of mathematical processes in students.

> (10) "If we suddenly take them to my context, which are native games, mathematics is involved at all times" (T10),

Taking into account that students are motivated by the game and that this contributes to strengthen the taste for mathematics, native games such as balance, zumbambico, spiral, arrow, among others are promoted.

They manifest the presence of mathematics not only in places but also in their practices. In this regard they mention:

> (11) "Well, it is in production, in the territory. And since the economy is in the territory, well, there, what we work is in the part of different crops," (T10)

(12) "Also, it is useful knowledge for the economy of comunity, since it allows more efficient sowing and weaving, (T2)
(13) "There are many types of fabrics, the hypogea also have, so one can find many geometric figures of all kinds" (T9).

On the other hand, considering mathematics as an opportunity for the development of thought, stating that it allows developing strategies to solve everyday problems and is not just a compendium of knowledge.

(14) "mathematics is not only numbers, but mathematics is the development of thought, the way I solve situations that give me the same daily environment" (T3),

here mathematics is present in reality, it is a tool for solving situations where they need to measure, count and calculate.

Traditions Permeated by Mathematics

The teachers of this institution mention different ways in which the ancestors used mathematics, Teacher 3 affirms that

(15) "The older ones transform many things to have a tool or an input that they use to transform products, the elaboration of trapiche, the handling of clay or the management of time. An example is the part that has to do with your own measurements such as the fourth, the geme, the fingers, the feet. To measure weight, they were made with weights equivalent to x number of eggs. Time was measured with chew or mambíadas".(T3)

This allows us to understand how science has never been absent from indigenous thinking and feeling. In addition, recognize its origin from the ancestral, contribute to knowing that mathematics is born and develops in response to your needs. For example, ancestral measurement practices, where the human body has played an important role in the creation of measurement patterns (Blanco 2006; Blanco 2017; Carabalí, 2012; Moran & Acosta 2015). Taking into account that the measurements used by the Nasa people are not 100% accurate, it can be said that they work very well for their context, since they are supported by the fabric of trust and are used in activities such as barter, which is an act of collaborating, sharing and community, in which its main purpose is to help another person.

Importance of Mother Nature in the Development of Indigenous Education

For indigenous peoples, Mother Nature is their everything, therefore, for this type of education it is extremely important to be able to transmit that to their students, as the teacher 1 tells us

(16) "One of the areas that this institution focuses on is the conservation of Mother Nature, where students are taught the importance of planting a tree and being protectors of the mountains where the water consumed by the community in general is born." (T1)

Here it is highlighted how for teachers and for the educational community in general the conservation of Mother Nature is paramount. Teacher 2 explains a little about his exercise within the community.

> (17) "What I teach is to make the student understand what our position is as a human species in nature... make them understand that we are not unique nor are we the ones above other species or anything like that, but that we are part of this... it can be seen that here we are talking about a relationship of equal to equal where we have the duty to protect our environment. As the focus of the institution, of the big house, is on the pedagogy of mother earth, which is mother nature, so we work on how it manages in its environment and how it is constituted, how they relate to each other, how they live together and how it is contributed" (T2)

Here the importance of mother nature is reflected from indigenous education and weaving, where we are all important without hierarchical relationships. In addition, the teacher mentions the following

> (18) "here there is also a center that is the spiritual center, and spirituality revolves around that. Western science teaches you that a rock or a specific place has no life, but if you are in the territory, they teach you spirituality... and you realize that everything that lives in the environment has life" (T2).

This is an affirmation that allows us to understand the respect that indigenous peoples have for Mother Nature, since for them everything that lives with her has life and has respect for the peoples.

Results

The insights provided here highlight several critical aspects and challenges within the realm of indigenous education in Colombia. Let's unpack some of these key points:

1. Quality and Training: Indigenous education in Colombia is regulated and emphasizes the importance of quality education for indigenous communities. However, there is a significant gap in the training of teachers to effectively implement the indigenous education model. While there is a willingness among teachers to work with indigenous communities and a strong sense of dedication, the lack of comprehensive training in ethnoeducation and ethnomathematics is evident. This deficiency points to the need for universities to incorporate these crucial components into teacher training programs, thereby equipping educators with the necessary conceptual tools to engage more effectively with indigenous cultures and their knowledge systems.
2. Language and Cultural Knowledge: Language and cultural knowledge are pivotal in indigenous education. The presence of Nasayuwe-speaking teachers and the significance of the Nasayuwe language highlight the importance of preserving and transmitting indigenous languages. The presence of a Nasayuwe-speaking teacher who belongs to the community and has a

background in indigenous education is a positive example of the potential impact of culturally rooted education. It also underscores the value of community-based education in maintaining cultural integrity.

3. Teacher Turnover and Learning Loss: The issue of teacher turnover and the loss of trained human resources is a critical concern. Each time a teacher is replaced, valuable community-specific knowledge and understanding must be relearned, leading to potential learning loss for both teachers and students. This cycle of turnover emphasizes the need for stable, well-trained educators who can establish deeper connections with the community and contribute to a more continuous and consistent educational experience.
4. Role of Indigenous University: The presence of an Indigenous University that aims to train indigenous teachers for community intervention is promising. However, the fact that there are no teachers graduated from this university within the studied institution suggests that there might be barriers or challenges hindering the flow of graduates into the community. Efforts to bridge this gap and increase the enrollment of indigenous teachers from the university into local institutions could contribute significantly to enhancing the quality of indigenous education.
5. Deficient continuous training for teachers: The broader issue of insufficient training for teachers in indigenous education is a systemic challenge that requires comprehensive solutions. The need for greater emphasis on ethno-education within teacher training programs is evident to ensure that educators are equipped to work effectively in culturally diverse settings and engage with indigenous knowledge systems.

These findings shed light on the complex landscape of indigenous education in Colombia, highlighting both the dedication and challenges faced by educators. The recognition of the need for improved training, the preservation of indigenous languages and cultural knowledge, and the importance of stable and culturally competent educators are crucial steps toward creating a more impactful and sustainable indigenous education system. Addressing these challenges requires collaborative efforts among educational institutions, indigenous communities, and policymakers to ensure that quality education is provided while honoring and integrating indigenous cultures and traditions.

Conclusions

The insights gathered from the interviews provide a deep understanding of how the indigenous education model is practiced and embraced within the institution. The following are some key are some key takeaways from this work:

1. Learning Paths vs. Subjects: The indigenous educational model deviates from the curricular structure by subjects, traditional in Western education. Instead, it employs the concept of "learning paths." These learning paths are intricately woven into the fabric of the indigenous education model, representing different aspects of indigenous culture, spirituality, economy, and society.

Each path provides a holistic approach to education that integrates various dimensions of life.

2. Four Fabrics of Education: The educational model is built upon four fundamental fabrics: ancestral thought and memory, worldview and spirituality, territory and economy, and society and authority. These fabrics serve as the foundational elements from which the learning paths emerge. This structure reflects the interconnectedness of different aspects of indigenous life and knowledge.
3. Cultural Appropriation and Transformation: Despite the majority of teachers not being indigenous themselves, they have actively engaged in the process of appropriating and integrating indigenous culture into their pedagogical practices. This appropriation involves a transformation of their existing knowledge and teaching approaches to align with the indigenous education model. The teachers have navigated this transformation by finding a balance between their Western training and the ancestral knowledge of the Nasa people.
4. Learning Journey and Challenges: The teachers' engagement with the indigenous education model is characterized by a learning journey. They have undergone a transition process, acquiring new knowledge and perspectives related to the indigenous worldview, culture, and spirituality. This journey has required them to adapt their teaching methods and approaches, while also respecting and integrating the indigenous knowledge systems. The teachers' experiences highlight the challenges and opportunities inherent in bridging different knowledge systems.
5. Growing Strength of Indigenous Education: The indigenous education model has been gaining prominence and strength in recent years, with more indigenous communities adopting this pedagogical approach. The institution under study has emerged as a significant benchmark for indigenous education within the Department of Cauca. This recognition and influence bring a sense of pride to the entire educational community, validating the efforts put into implementing and advancing indigenous education.

Overall, the insights provided emphasize the complex and dynamic nature of indigenous education within the institution. The teachers' willingness to embrace and adapt to this model, despite challenges, reflects their commitment to fostering a culturally sensitive and holistic educational experience that resonates with the Nasa people's way of life. As indigenous education continues to evolve and expand, it holds the potential to empower future generations and contribute to the preservation and revitalization of indigenous knowledge, culture, and identity.

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Bibliometric Analysis of Research on Cryptocurrency and Volatility

By Ali Köse[*] & Mustafa Okur[±]

In the context of developments in the field of financial technology, cryptocurrencies, emerging as a new asset class, have garnered significant attention in financial markets in recent years, attracting investors, researchers, and regulators, and leading to numerous publications. Bibliometric studies evaluate these publications based on criteria such as the number of publications, their quality, the countries of publication, authors, and journals. This study aims to perform a bibliometric analysis of the academic literature available in the Web of Science (WoS) database, focusing on the volatility of cryptocurrency prices. It analyzes the magnitude and development of academic interest in this field, along with key words, the most cited works, and research trends, in an effort to determine the density of studies, their impact areas, and the academic networks that have emerged in this field. Based on the general findings, it is observed that the number of studies has been on an increasing trend over the years, and that the publications are predominantly in the field of Business Economics. Moreover, it has been found that publications are mainly in finance journals. In terms of network maps, the findings suggest a moderate level of collaboration among authors, with the United Kingdom and the People's Republic of China occupying central positions in international collaboration. In terms of citations, authors such as Lucey, and Katsiampa, Paraskevi, have emerged as prominent figures in the fields of cryptocurrencies and volatility. Regarding key words, terms like 'cryptocurrency', 'cryptocurrencies', 'volatility', and 'bitcoin' are predominantly used in these studies."

Keywords: *cryptocurrencies, bitcoin, volatility, bibliometric analysis*

Introduction

In the realm of financial technology, cryptocurrencies have emerged as a novel asset class that has attracted considerable attention from investors, researchers, and regulators in recent years. The rise of Bitcoin, Ethereum, and other digital currencies has not only underscored the volatility inherent in this market but has also intensified debates regarding the economic, financial, and social implications of cryptocurrencies.

Initially conceptualized as decentralized payment systems, cryptocurrencies have progressively evolved into globally traded financial instruments with increasing market capitalization and liquidity. This transformation has elevated cryptocurrencies from a technological innovation to an integral component of modern financial markets, thereby strengthening the need for academic research.

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The volatility of cryptocurrencies differs from that of traditional financial assets such as equities, bonds, and commodities. While conventional asset prices are primarily influenced by macroeconomic fundamentals, monetary policy, and firm-specific information, cryptocurrency prices are shaped by a broader and more heterogeneous set of factors. Technological developments, regulatory announcements, cybersecurity incidents, market sentiment, and global uncertainty play a particularly prominent role in driving price fluctuations in cryptocurrency markets. As a result, cryptocurrency volatility is often characterized by sudden and extreme price movements that are difficult to predict using standard financial models.

Cryptocurrencies also possess intrinsic characteristics that distinguish them fundamentally from traditional asset classes. Their decentralized architecture, reliance on blockchain technology, and predetermined or algorithmically constrained supply mechanisms introduce unique market dynamics. Although these features enhance transparency and reduce dependence on centralized authorities, they also limit the applicability of conventional valuation frameworks. The absence of cash flows, dividends, or widely accepted intrinsic valuation benchmarks contributes to increased uncertainty and amplifies price volatility. Consequently, cryptocurrencies challenge established financial theories and motivate the development of new analytical perspectives.

Given the rapid expansion and growing relevance of cryptocurrency markets, academic interest in cryptocurrency volatility has increased substantially over the past decade(Alqudah et al., 2023). Studies addressing this topic span multiple disciplines, including finance, economics, computer science, and interdisciplinary research fields. However, the accelerating volume of publications has made it increasingly difficult to obtain a comprehensive overview of how this body of research has evolved, which themes dominate the literature, and which studies or authors have exerted the greatest influence. This fragmentation highlights the need for systematic approaches capable of synthesizing large-scale academic output.

Bibliometric analysis provides a quantitative and objective methodology for examining the structure and evolution of scientific research. By analyzing publication metadata such as citation counts, keywords, authorship patterns, and collaboration networks, bibliometric methods enable researchers to identify influential works, emerging research trends, and intellectual linkages within a given field. In recent years, bibliometric techniques have been increasingly applied in finance and economics to evaluate the development of rapidly growing research areas and to map their underlying knowledge structures.

Cryptocurrencies and the underlying blockchain technology—by providing transparency, high transaction speed, and the potential to reduce intermediary costs—have emerged as a strategic innovation domain increasingly interacting with traditional financial infrastructures. Within the conventional financial system, crypto-assets exert notable effects on financial stability, regulatory frameworks, and investor behavior. Owing to their relatively high volatility compared to traditional financial instruments, crypto-assets constitute a central research focus in the finance literature, particularly in relation to risk management and market dynamics. Understanding how price fluctuations interact with macroeconomic conditions, market liquidity, investor sentiment, and market structure is therefore essential. Accordingly, this study aims to systematically review the literature on the volatility

structure of crypto-assets and to provide a structured reference for future research, especially in light of ongoing regulatory developments, growing institutional participation, and the gradual maturation of crypto-asset markets.

Within this context, the present study conducts a comprehensive bibliometric analysis of academic literature on cryptocurrency price volatility indexed in the Web of Science (WoS) database. The study aims to assess the magnitude and evolution of scholarly interest in this topic by examining publication trends, highly cited studies, frequently used keywords, and leading journals and authors. Furthermore, it seeks to identify dominant research clusters and emerging themes that characterize the cryptocurrency volatility literature.

Beyond providing a descriptive mapping of existing studies, this research contributes to the literature by offering an integrative perspective on the intellectual structure of cryptocurrency volatility research. By revealing thematic concentrations, research gaps, and evolving academic networks, the study supports future empirical and theoretical research efforts. Moreover, the findings are expected to enhance understanding of how cryptocurrencies are positioned within financial markets and how this emerging asset class interacts with traditional financial systems.

Despite the growing body of research on cryptocurrency volatility, the existing literature remains highly fragmented and methodologically diverse. Studies differ substantially in terms of data frequency, volatility measures, econometric techniques, and the specific cryptocurrencies examined. As a result, drawing generalized conclusions from individual empirical findings has become increasingly challenging. In this context, a systematic assessment of the academic literature is essential to identify dominant research streams, influential contributions, and underexplored areas.

Financial Markets and Volatility in Cryptocurrencies

Financial markets are inherently variable and volatile in nature. However volatility creates uncertainty about future prices (Borawski et al., 2015). This volatility represents both risk and opportunity for market participants. It indicates the extent to which asset prices can fluctuate over time, playing a significant role in investors' portfolio selections and diversifications. Diversification of portfolios is central to strategies aimed at reducing risk and optimizing returns. In portfolio diversification, combining different asset classes is intended to balance the total portfolio risk, leveraging the unique risk and return profiles of each asset class.

Cryptocurrencies like Bitcoin and Ethereum possess characteristics that differ from traditional financial assets. Key differences include:

- ***Decentralization***: Traditional financial assets (such as stocks, bonds, bank deposits) are usually managed by a central authority or institution (e.g., banks, stock exchanges). Cryptocurrencies, on the other hand, operate on blockchain technology without a central authority, fostering a more democratic and transparent system. However, this can also lead to regulatory and legal uncertainties (Nakamoto, 2008, Catalini & Gans 2016, Medellin, 2022).

- ***Volatility***: Cryptocurrencies are generally more volatile than traditional assets, offering high return potential while also implying high risk. Traditional markets usually have more stable asset prices with less severe price fluctuations (Baur & Dimpfl, 2021; Soylu et al., 2020).
- ***Asset Structure as Digital Assets***: Cryptocurrencies are entirely digital with no physical representation. Traditional financial assets are typically backed by physical assets (e.g., real estate) or tangible entities like governments and companies (Yermack, 2013).
- ***Utility and Functionality***: Some cryptocurrencies offer additional functionalities beyond being a store of value or speculative investment, such as smart contracts and decentralized applications (dApps). Traditional financial assets generally lack such technological integrations (Yadav et al., 2022).
- ***Regulation and Security***: Traditional financial markets have established regulations and security measures derived from years of experience and development. Crypto markets, being relatively new and evolving, are still developing their regulatory frameworks and can face security issues (Middlebrook & Hughes, 2014).
- ***Accessibility and Participation***: Cryptocurrency markets are easily accessible to almost anyone with internet access. Investing in traditional financial assets can be subject to more regulations and may require higher capital in some cases (Catalini & Gans, 2016).

Due to these characteristics, it is generally accepted that crypto assets behave differently from traditional assets, particularly in terms of volatility levels. This naturally positions cryptocurrencies as high-risk yet potentially high-return investments. (Sauer, 2015) Despite their high levels of volatility and their bubbly character cryptocurrencies have gained popularity among risk-seeking investors (Dimitriadis et al. 2024). Including crypto assets in optimal portfolio diversification introduces a new dimension to the management of total portfolio risk and return. Modern portfolio theory suggests that diversification can reduce risk. However, the high volatility and low correlation of crypto assets with traditional financial assets create new challenges and opportunities for portfolio managers and individual investors. This result makes cryptocurrencies an attractive option for portfolio diversification, but also necessitates extra caution and more delicate risk management from investors (Ali et al., 2024).

Technological innovations, regulatory developments, and market sentiment can lead to rapid and significant changes, hence volatility, in cryptocurrency prices. This complicates the role of crypto assets in portfolio diversification. For investors, the approach to crypto assets necessitates understanding how to cope with this volatility and integrate this new asset class.

Recently, comprehending the levels and characteristics of volatility in crypto assets has become a crucial part of modern investment strategies and portfolio management. Crypto assets offer unique opportunities and challenges in terms of portfolio diversification and risk management. The role of this new asset class in the future of financial markets continues to be a compelling area of research for both investors and academics. Accordingly, the following section reviews the relevant literature on cryptocurrency volatility, providing the conceptual foundation upon which the subsequent bibliometric analysis is built.

Literature Review

Cryptocurrency markets continue to evolve as an area characterized by high volatility, rapid changes, and dynamics different from other markets. Key publications in the literature related to crypto assets are summarized in the following section.

The 2019 study by Katsiampa et al. utilized Diagonal BEKK and Asymmetric Diagonal BEKK methodologies to examine the conditional volatility dynamics and co-movements of eight cryptocurrencies. The study revealed that investors respond differently to specific cryptocurrencies such as Neo and Dash, with Bitcoin exhibiting the highest level of response to shocks. The study also aimed to assess the strong dependencies among cryptocurrencies and the asymmetric effects of news on the markets.

In their 2019 work, Bouri et al. investigated the relationship between trading volume, returns, and volatility. Utilizing a copula-quantile causality approach, the study analyzed the impact of trading volume on cryptocurrency returns and volatility. The findings indicated that trading volume has a significant effect, especially on extreme negative and positive returns.

Corbet et al.'s 2019 article researched cryptocurrencies as financial assets. The study provided a systematic review of topics such as price increases, regulatory oversight, anonymity, infrastructure issues, and cybercrimes associated with cryptocurrencies. It also aimed to present factors influencing the perception of cryptocurrencies as investment tools.

In their 2020 study, Bouri et al. examined the presence of unexpected movements in the volatilities of cryptocurrencies. Employing the frequency domain test by Bodart and Candelon (2009), the study analyzed causalities related to persistent and transitory shocks among leading cryptocurrencies. The findings suggested that short-term persistent shocks are more effective in explaining causality and that these shocks do not always originate from Bitcoin, while transitory shocks in the long term are more effective in explaining the causality of altcoins.

Another 2020 study by Bouri et al. investigated the volatility relationship between certain cryptocurrencies and stocks as a hedge. The study examined the hedging capabilities and time-varying diversification abilities of Bitcoin, Ethereum, and Litecoin against stocks. The results indicated that cryptocurrencies, especially against Asia-Pacific and Japanese stocks, provide effective protection.

Katsiampa's 2020 research explored the co-movement of volatility between Bitcoin and Ether. The paper analyzed the factors affecting the volatility between Bitcoin and Ether and their responses to news using the Diagonal BEKK model. The findings revealed a high level of volatility linkage between these two significant cryptocurrencies.

In their 2022 study, Elsayed et al. examined the volatility and return relationship between cryptocurrencies and gold. The study used new uncertainty measures, including cryptocurrency policy uncertainty and cryptocurrency price uncertainty indices, to explore the dynamic linkages between cryptocurrencies, gold, and uncertainty measures. The results suggested that cryptocurrency policy uncertainty is one of the primary reasons for decreasing returns compared to other variables.

The 2021 study by Hasan et al. investigated the high instantaneous connectedness among three major cryptocurrencies using 5-minute data. The research identified a

moderate level of realized volatility connectedness, with Bitcoin and Litecoin emerging more as spillover receivers compared to Ripple and Binance Coin. Additionally, the study concluded that there is a time-varying and increasing high instantaneous connectedness in the cryptocurrency market.

Methodology

Bibliometrics is generally described as the measurement of texts and information. Initially, bibliometric methods were applied to track citations in academic journals. However, in recent years, bibliometric analysis has also been used to predict the future in addition to understanding the past. Bibliometrics facilitates the discovery, organization, and analysis of large-scale historical data, thereby unveiling patterns in a subject area that may not have been previously noticed (Güleç, 2023). Bibliometric techniques allow for a systematic, quantitative assessment of research trends, key authors, and influential articles within a specific field (Fantini et al., 2025).

An analysis of the literature performed in this way may help to map and evaluate it, to identify potential research gaps and to highlight the boundaries of knowledge (Olczyk, 2016). Besides, bibliometric research not only allows for the analysis of publications using various methods but also enables the evaluation of scientific works. It also assists in shaping future science policies by assessing the adequacy of publications in their respective fields based on criteria such as the number of publications, the quality of publications, and the choice of indices to which the journals are affiliated (Köse et al., 2017).

Bibliometric analysis provides the ability to elucidate key features such as citations, authors, co-authors, periodicals, and keywords. The stages of bibliometric analysis are addressed in five phases, as seen in Table 1 (Tekin, 2019).

Table 1. *Stages of Bibliometric Analysis*

Determining the purpose of the analysis and selecting the scientific basis of the analysis	(a) Define the scientific and theoretical domains of the study (b) Outline the objectives of the work (c) Select the scientific basis for conducting the article research
Research process	(a) Define search terms (b) Identify engines for advanced search (c) Define search filters
Collection and structuring of data	(a) Identification of reference manager software (b) Identification of bibliometric analysis software (c) Downloading references in reference manager format, bibliometric analysis format, and electronic spreadsheet format (d) Transferring files to the reference manager and bibliometric analysis software
Contextual analysis of scientific outputs related to the sample	(a) Analysis of the temporal volume of selected publications (b) Analysis of citations of selected articles (c) Analysis of journals publishing the selected articles (d) Analysis of the countries of origin of the selected articles (e) Analysis of keywords of the selected articles

Analysis of citation networks based on the sample	(a) Analysis of citations and co-citations of the sample (b) Analysis of the most frequently cited authors (c) Analysis of the main journals"

Bibliometric Analysis Findings of Studies on Cryptocurrency and Volatility in the Web of Scıence (Wos)

Purpose of the Study and Data Set

The aim of this research is to conduct a bibliometric analysis of publications that jointly address cryptocurrencies and volatility. For this purpose, the study utilizes bibliometric analysis methods, including performance analysis and visual mapping. This method of research used a science mapping technique to perform a thorough analysis and visual depiction of a large collection of scientific materials, with a particular focus on the topic of cryptocurrency (Alqudah et al., 2023).

In the implementation of the study, data was sourced from the Web of Science (WoS), a global database. As emphasized in many other bibliometric studies, the selection of keywords is one of the most critical criteria for effective results in bibliometric analyses. Accordingly, the terms 'cryptocurrency/cryptocurrencies' and 'volatility' have been selected as the key words for this study.

Considering the first relevant study in the WoS database was published in 2015, the data set for this study was determined to include publications from the period of 2015-2023. The data set encompasses information obtained from the Web of Science (WoS) database as of the date September 23,2023. Therefore, the data for the year 2023 includes information available in WoS as of September 23,2023.

General performance findings of the data set cover information from the WoS database while network analysis results were obtained using WoS viewer software.

General Performance Findings related to the Data Set

An evaluation of the general information on studies conducted on cryptocurrencies and volatility in the WoS database reveals that, during the study period (2015-2023), there were a total of 331 studies, with publications from 835 researchers on the subject. The average citations per study were approximately 13.76. The data set encompasses information obtained from the Web of Science (WoS) database as of the date September 23, 2023. (Table 2)

Table 2. *General Information on Studies Related to Cryptocurrencies and Volatility in the Web of Science (WoS) Database*

Data Set Period	2015-2023*
Number of Publications (Articles)	331
Number of Authors	835
Average Citations per Publication	13.76

**The data set of the study includes information obtained from the Web of Science (WoS) database as of September 23,2023.*

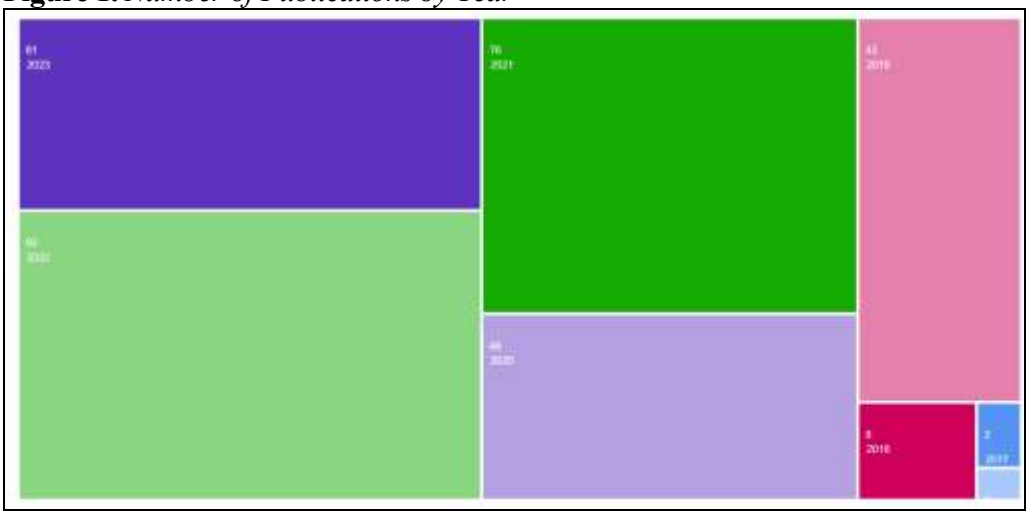
Number of Publications by Year

According to the WoS database, when examining studies on cryptocurrencies and volatility by year and country, it is observed that the first study was published in 2015. Until 2019, there were only a few publications in the database. However, a significant increase was noted in 2019 with 43 publications. The number of publications continued to rise in subsequent years, reaching 48 in 2020, 76 in 2021, and peaking at 92 publications in 2022. In 2023, up to the period covered by the data set, 61 studies were published. See Table 3, Figure 1.

Table 3. *Number of Publicaitons by Year*

Years	**Number of Publicaitons**
2015	1
2017	2
2018	8
2019	43
2020	48
2021	76
2022	92
2023	61

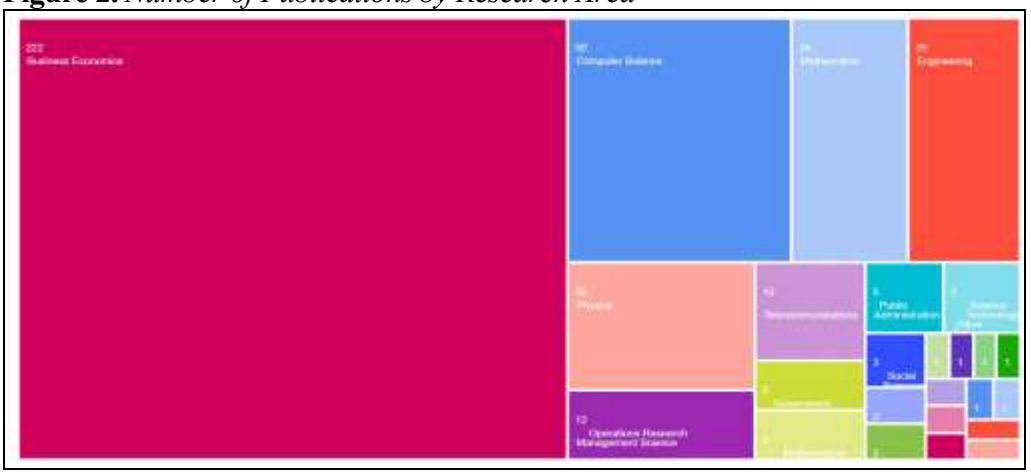
Figure 1. *Number of Publicaitons by Year*



Number of Publications by Research Area

According to the WoS database, studies on cryptocurrencies and volatility across various research areas indicate that Business Economics is at the forefront with 222 publications. It is followed by Computer Science with 50 publications, and then Mathematics and Engineering, which have 26 and 25 publications respectively. Further in the list, significant contributions are observed in Physics, Operations Research & Management Science, Telecommunications, and Government & Law. Additionally, publications in various other disciplines, though in smaller numbers, are also present. See Figure 2.

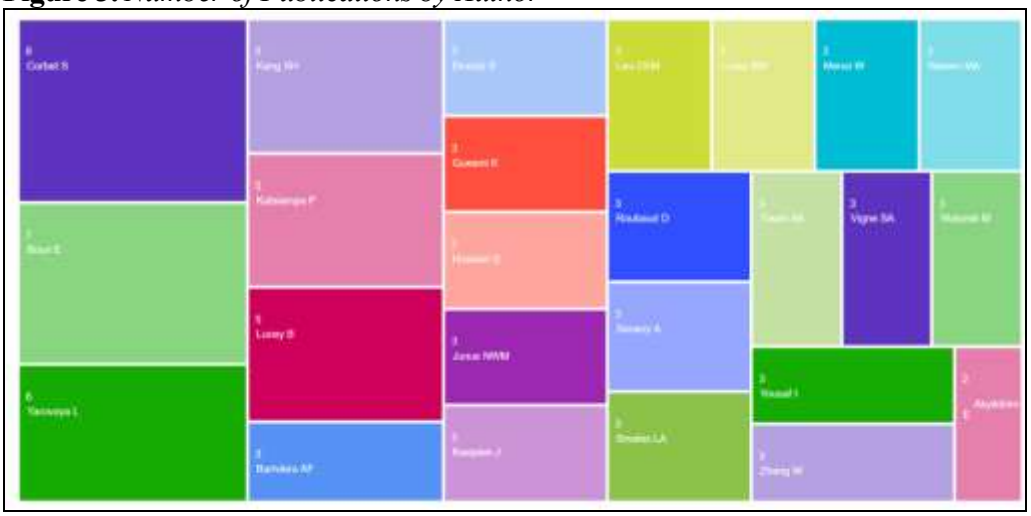
Figure 2. *Number of Publications by Research Area*



Number of Publications by Author

Data from WoS show that, an examination of studies related to cryptocurrencies and volatility from the perspective of authors reveals that Corbet S. stands out with eight publications. Following Corbet S., the authors Bouri E., Yarovaya L., Kang S.H., Katsiampa P., Lucey B. M. et al., have been identified as prominent contributors in this field. See Figure 3

Figure 3. *Number of Publications by Author*



Publication Numbers by Journal Name

In the Web of Science (WoS) database, an analysis of studies on cryptocurrencies and volatility based on journal names reveals that Finance Research Letters leads with 26 publications. This is followed by the Journal of Risk and Financial Management, which has published 15 studies. Subsequent journals include the International Review of Financial Analysis with 12 publications, Research in International Business and Finance with 10, and both IEEE Access and Physica A: Statistical Mechanics and Its Applications with 8 publications each. Other journals also contribute to this body of work. Refer to Figure 4 for further details.

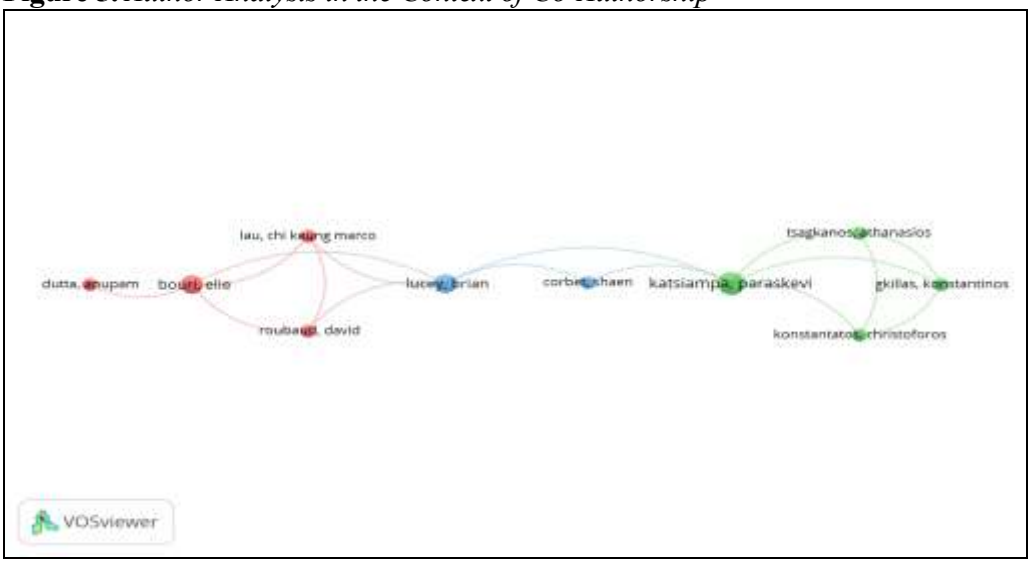
Figure 4. *Publication Numbers by Journal Name*

Findings Related to Network Maps

Author Analysis in the Context of Co-Authorship

Data from WoS show that, while creating an author network map based on co-authors of publications, the analysis included authors with a minimum of one publication and a minimum of zero citations. According to the results obtained, a moderate level of collaboration among authors was observed. Based on these results, several prominent figures emerge in the fields of cryptocurrencies and volatility. Lucey stands out with 2 publications, 241 citations, and a connection strength of 5. He is followed by Katsiampa, Paraskevi, who has 3 publications, 238 citations, and a connection strength of 5. Additionally, Bouri, Elie makes a significant contribution with 2 publications, 129 citations, and a connection strength of 4. (See Figure 5)

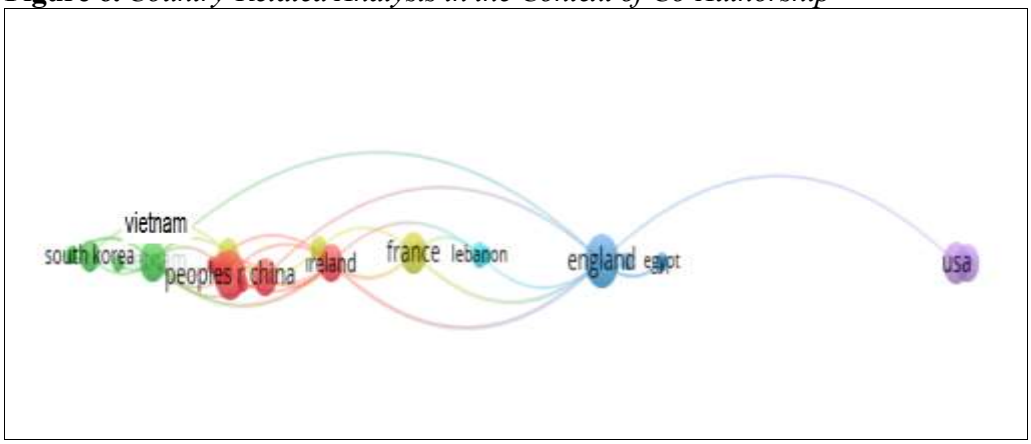
Figure 5. *Author Analysis in the Context of Co-Authorship*



Country-Related Analysis in the Context of Co-Authorship

In the Web of Science (WoS) database, while constructing a network map of countries based on co-authors of publications, the analysis included countries with a minimum of one publication and a minimum of zero citations. According to the results obtained, a strong co-authorship connection was found between the United Kingdom, the People's Republic of China, France, the United States, and Ireland. The United Kingdom and the People's Republic of China appear to hold central positions in terms of collaboration among countries. The most prolific countries in terms of publication output were identified as the United Kingdom with 8 publications, followed by the People's Republic of China with 7, France and Vietnam with 5, and Ireland and Australia with 4. In terms of citation numbers, the United Kingdom, Ireland, France, Vietnam, and Australia were distinguished as leading contributors. (See Figure 6)

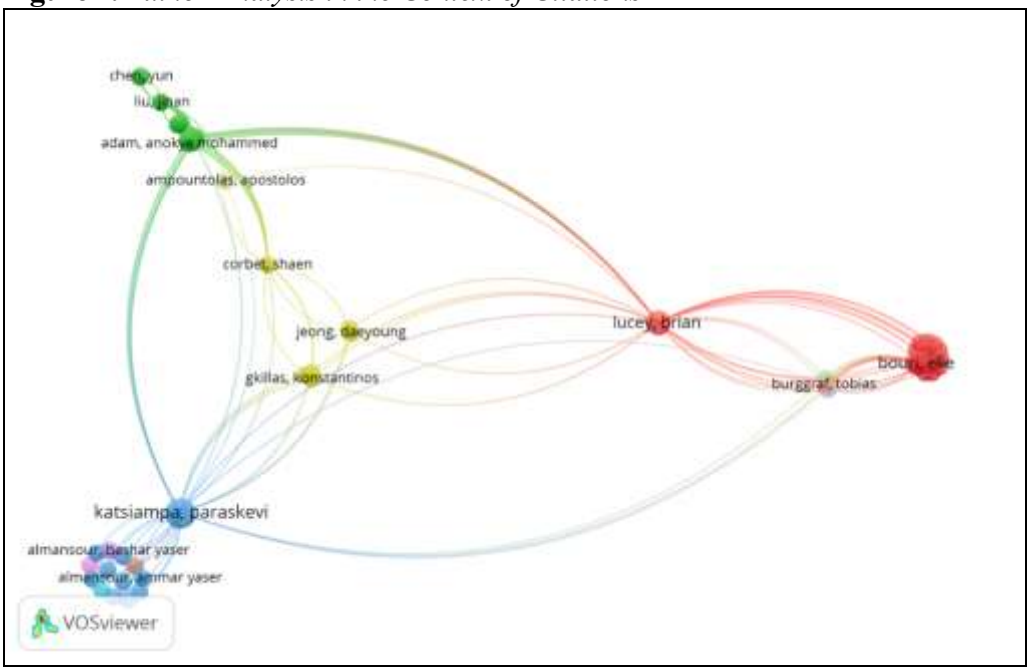
Figure 6. *Country-Related Analysis in the Context of Co-Authorship*



Author Analysis in the Context of Citations

In the Web of Science (WoS) database, while constructing an author network map based on citations, the analysis included authors with a minimum of one publication and at least one citation. According to the results, the most cited authors, thereby the most influential and highly visible in the fields of cryptocurrencies and volatility, are Lucey B. M., with 241 citations, Katsiampa, Paraskevi with 238 citations, Bouri, Elie with 129 citations, and Corbet, Shaen with 121 citations. These authors are prominently positioned in the top four ranks. Additionally, the network map reveals five distinct clusters, particularly around Adam, A. Mohammed. In terms of publication numbers, Katsiampa, Paraskevi leads with 3 publications, followed by Lucey, B. M., Bouri, E., and Yarovaya, L., each with 2 publications. (See Figure 7)

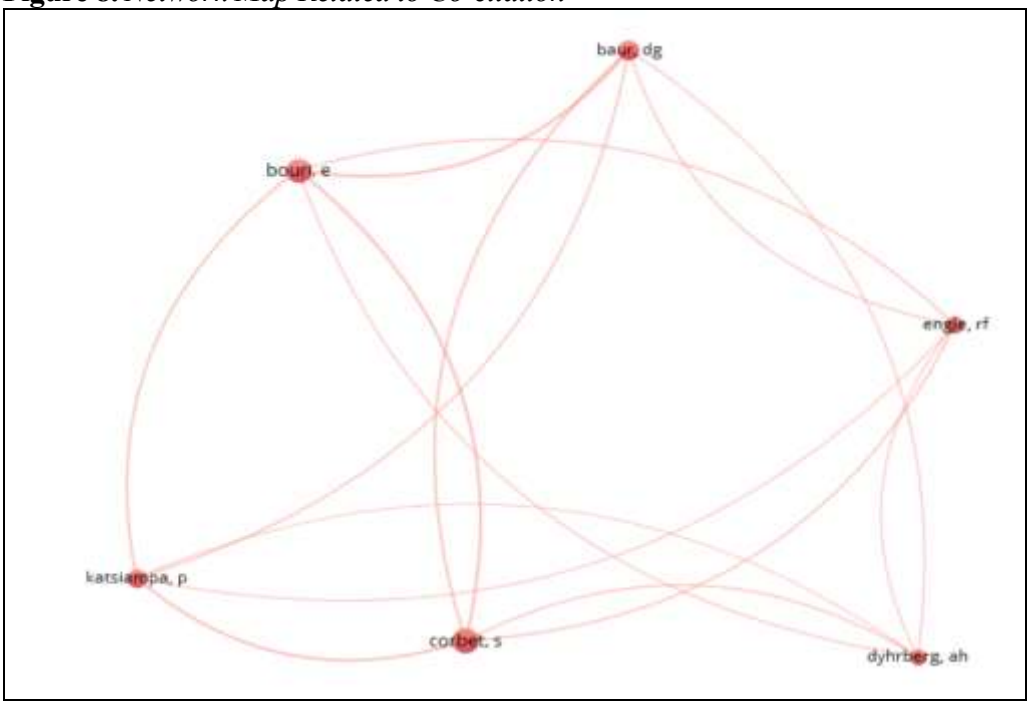
Figure 7. *Author Analysis in the Context of Citations*



Co-citation Analysis

Author-level co-citation analysis allows for the comparison of content similarities between authors by examining how frequently they are cited together in the literature. This approach provides insights into the strength and occurance of intellectual relationships among authors and helps reveal the underlying intellectual structure of the research field (Ulukök, 2022). As a result of the co-citation analysis, a total of 1,161 cited authors were identified in the dataset. To reduce visual complexity and enhance the clarity of the network map, a citation threshold of 20 was applied. This threshold selection resulted in a more simplified and interpretable visualization, with six authors meeting the specified criterion. The findings indicate that, based on co-citation frequencies, the most frequently cited authors in the literature are Corbet, Bouri, Baur, Katsiampa, Engle, and Dyhrberg. (See Figure 8)

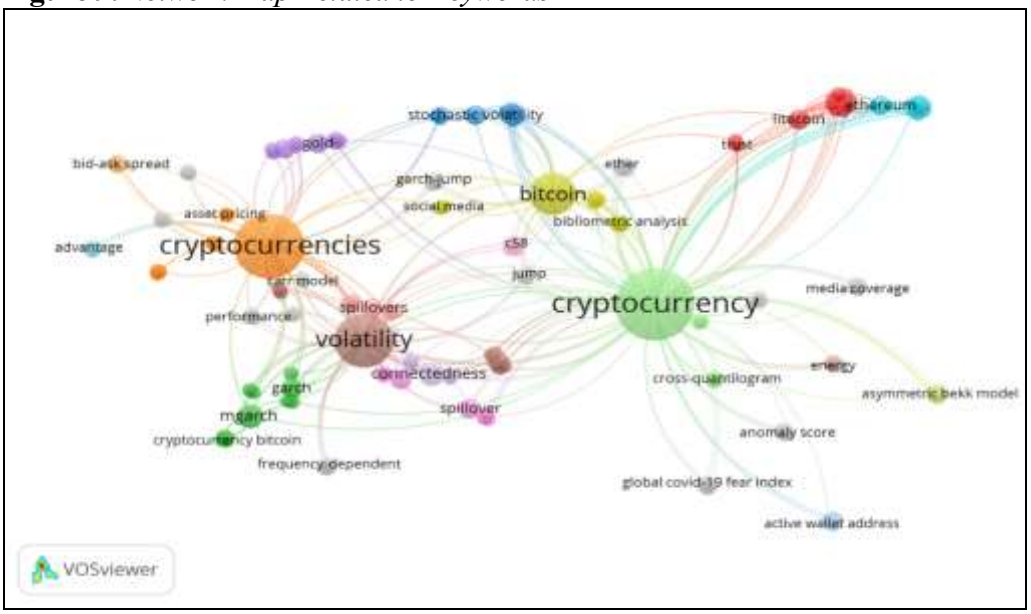
Figure 8. *Network Map Related to Co-citation*



Co-occurrence Analysis of Keywords

A total of 172 keyword were identified in the 331 articles examined in the study. In constricting a network map of co-occurence analysis of keywords for publications in the WoS database, keywords were included in the analysis based on a minimum usage count of one. The results show that studies predominantly revolve around four keywords: cryptocurrency (26 occurrences), cryptocurrencies (21 occurrences), volatility (15 occurrences), and bitcoin (9 occurrences). (See Figure 9)

Figure 9. *Network Map Related to Keywords*



Conclusıon

In line with developments in money markets, the past 10-15 years have seen rapid growth in literature on crypto assets, featuring numerous empirical publications. The issue of volatility, indicating fluctuations in cryptocurrency values, holds distinct importance in money markets. Hence, the recent increase in bibliometric research explaining the current state of crypto assets and illustrating the development of literature is significant. This study encompasses a bibliometric analysis of studies on cryptocurrencies and volatility in the Web of Science (WoS) database, attempting to highlight the dynamic nature of cryptocurrency markets and the diversity of academic work in this field.

From their inception, cryptocurrencies have garnered global interest, prompting researchers to deeply examine this new asset class's role and impact in financial markets. Studies show that crypto markets, characterized by high volatility and rapid changes, are influenced by various factors including technological innovations, regulatory developments, and market sensitivity.

A review of the publications in the WoS database over the years shows an increasing trend, with the highest number of publications, 92, occurring in 2022.

When examining publications in the fields of cryptocurrencies and volatility, it is observed that most publications are in Business Economics, followed by Computer Science, Mathematics and Engineering, Physics, Operations Research Management Science, Telecommunications, Government, etc. Authors such as Katsiampa P., Lucey B. M., Corbet S., Bouri E., Yaravoya L., Kang S.H. have been identified as influential in the areas of cryptocurrencies and volatility.

Journals such as Finance Research Letters, Journal of Risk and Financial Management, International Review of Financial Analysis, and Research in International Business and Finance are prominent in the field of cryptocurrencies and volatility. Given their role in financial markets, these results are as expected.

According to the findings related to network maps, a moderate level of collaboration among authors is observed, with high co-authorship connections found between the United Kingdom, the People's Republic of China, France, the United States, and Ireland Abdeljawad et al. (2025), in their bibliometric analysis of cryptocurrency research, conclude that a substantial proportion of Bitcoin-focused publications have been produced by authors affiliated with Chinese institutions. Consistent with these findings, the results of the present study indicate that the United Kingdom and the People’s Republic of China occupy central positions in international collaboration networks among countries.

In terms of citation counts, the most influential and visible authors in the literature on cryptocurrencies and volatility are Lucey, B. M., with 241 citations, Katsiampa, Paraskevi, with 238 citations, Bouri, Elie, with 129 citations, and Corbet, Shaen. Furthermore, the author-level co-citation analysis indicates that the most frequently co-cited authors are Corbet, Bouri, Baur, Katsiampa, Engle, and Dyhrberg, highlighting their central role in shaping the intellectual structure of the literature.

Chen et al. (2025), in their bibliometric analysis of cryptocurrency research, identify key recurring keywords such as safe haven, market efficiency, blockchain, Bitcoin price, machine learning, realized volatility, and portfolio optimization. In

line with these findings, the present study reveals that the most frequently used keywords in the analyzed publications are cryptocurrency, cryptocurrencies, volatility, and Bitcoin.

It also gives us an understanding of how cryptocurrency research emerged as a domain across various dimensions (Mohapatra et al., 2025). Understanding the position of cryptocurrencies in financial markets and their interaction with traditional financial systems is crucial both academically and practically. This work identifies academic networks and areas of impact in this field and provides a valuable resource for future research. Given the multidisciplinary nature of cryptocurrency markets, encompassing finance, economics, computer science, and law, it is deemed important to undertake new bibliometric studies with multidisciplinary approaches to understand the implications across different disciplines.

Despite its contributions, this study is subject to several limitations that should be acknowledged. First, the analysis is based exclusively on sources indexed in the Web of Science database, which, while ensuring a certain level of academic rigor, may limit the coverage of relevant studies published in other scientific databases such as Scopus and etc. Future research could extend the scope of the analysis by incorporating additional databases, thereby providing a more comprehensive perspective on the evolving literature. Second, this study focuses on a specific time period (up to 2023), which may constrain its ability to fully capture recent developments in the rapidly changing crypto-asset ecosystem. Given the dynamic nature of crypto-asset markets—characterized by high volatility, ongoing regulatory adjustments, increasing institutional participation, and continuous technological innovation—repeating and updating this analysis over time would allow for the inclusion of emerging findings and evolving viewpoints. Such efforts would contribute to a deeper understanding of how crypto-assets may gradually transition toward more integrated and permanent roles within the traditional financial system as alternative investment instruments and components of next-generation financial products.

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Governing Post-Mining Risks: Expertise, Participation, and Knowledge Coproduction in French Post-mining Territories

By Baptiste Lebot, Camille Dumat± & Fenintsoa Andriamasinoro°*

The cessation of mining activities has not eliminated associated nuisances such as pollution and land subsidence. In France, these risks are governed through highly centralized regulatory frameworks relying on standardized forms of scientific expertise. Based on a qualitative, multi-method study conducted in three post-mining territories, this article examines how legitimate knowledge is constructed, negotiated, and hierarchized in post-mining risk governance, and how these processes shape trust in public action. The analysis combines documentary review, interviews with institutional actors, elected officials, residents, and associations, and field observations. The findings show that post-mining governance is structured by an expert-centred epistemic regime grounded in regulatory compliance and technical indicators. While this model ensures legal and procedural coherence, it marginalizes experiential and place-based knowledge and constrains residents' capacity to influence decision-making. Participatory tools primarily operate as informational mechanisms, often generating frustration and mistrust. In response, inhabitants develop forms of "ordinary resilience" through everyday practices that sustain attachments to post-mining landscapes despite technical restrictions. The article argues that central challenge of post-mining governance lies not in participation per se, but in the institutional recognition of plural forms of knowledge, which is essential to enhancing trust and legitimacy in environmental risk management.

Keywords: *Post-mining exploration Territories, risk, plural expertise, controversy, public action*

Introduction

In France, the end of mining activities in the 1990s did not close the chapter of risks and nuisances associated with Post-Mining Extraction Territories (*Territoires Post-Extraction Minière*, TPEM). These territories remain exposed to persistent forms of environmental degradation, including soil and water pollution, the presence of metallic contaminants and mining waste, as well as land instability. Predominantly located in rural or peri-urban contexts, TPEM continue to bear the scars of a

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complex industrial legacy while facing renewed pressures related to land redevelopment and climate adaptation. They face a dual constraint: on one hand, managing the long-term impacts of historical mining activities on landscapes and soil quality, and on the other, reinventing economic, social, and environmental dynamics adapted to contemporary issues such as climate change and the preservation of ecosystems, biodiversity, and associated ecosystem services (Dumat, 2025; ZAN Act, 2023[1]).Thus, TPEM are at the heart of a dual challenge: 1) mitigating the long-term impacts of past mining activities; and 2) reconfiguring these spaces to meet the needs and expectations of contemporary populations, including such as urban agriculture projects (Jules & Dumat, 2022). Within this framework, the management of environmental and health risks emerges as a central concern, particularly regarding decisions that could affect public health (Mottis et al., 2022). Public authorities and experts often play a dominant role in these processes, while the voices of local residents, despite their close familiarity with local conditions and realities, are still scarcely considered. Through their engagement with these environments, residents possess situated empirical knowledge rooted in their daily practices (Mélard & Gramaglia, 2022). While often seen as subjective or anecdotal, this type of knowledge can play a valuable role in risk management, even though decision-making processes are not yet designed to fully equipped to integrate it (Ibid., 2022).

More broadly, this issue is framed within a context of increasing citizen demand for meaningful participation in democratic processes (Gourgue et al., 2021), especially in the realm of public action related to environmental issues (Lascoumes, 2018). Over the past two decades, political and legislative advancements have aimed to foster this process of integration. The declaration of rights (Aarhus Convention, 1998[2]; Environmental Code, 2000[3]) and the creation of institutional mechanisms (Local Information Committees (CLI), 2012; Site Monitoring Commissions, 2012)[4] have been designed to integrate citizens into public action, encouraging participation in various ways and at different stages of decision-making processes. However, these meetings are sometimes perceived by citizens as a way to contain dissent (the famous "Participation, a trap for fools", popularized in May 1968). Such forms of participation are often deemed "insufficient" or "instrumentalized" by citizens, leading to disenchantment and, in some cases, the emergence of counter-movements.

In TPEM, deep tensions surrounding the management of environmental and health risks are observed (Busca *& al.*, 2019), reflecting a growing need for "more democracy" in participation and posing a dual sociological challenge: on one hand, from the perspective of the residents, and on the other, from an institutional

[1]Law No. 2023-630 of 20 July 2023 aimed at facilitating the implementation of objectives for combating land artificialization and strengthening support for local elected officials, Official Journal of the French Republic, 21 July 2023. Available at: https://www.legifrance.gouv.fr/eli/loi/2023/7/20/TREX2306675L/jo/texte

[2]United Nations Economic Commission for Europe (UNECE). (1998). Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention). Done at Aarhus, Denmark, on 25 June 1998. Available at: https://unece.org/environment-policy/public-participation/aarhus-convention/introduction

[3]French Environnemental Code (Code de l'environnement). (2000). Consolidated version available at: https://www.legifrance.gouv.fr/codes/id/LEGITEXT000006074220

[4]See French Environmental Code, cited above.

point of view. Accordingly, this article focuses on the management of environmental and health risks in post-mining extraction territories, with particular on the role of plural forms of expertise in these processes. Adopting a pragmatic sociological perspective, it explores how institutional expertise, regulatory frameworks, and situated, experiential knowledge interact within post-mining governance arrangements. More specifically, the article addresses the following research questions:

> (RQ1) What processes shape, negociate, and order legitimate knowledge in the management of environmental and health risks in post-mining areas?
> (RQ2) What are the consequences for trust in public action?
> (RQ3) Under which conditions certain knowledge claims are recognized as authoritative while others are marginalized?

The article sheds light on the epistemic and political dynamics that shape post-mining risk governance. It further examines emerging controversies in post-mining management and investigates how these dynamics influence both the production of environmental knowledge and the construction of sustainable trust – or persistent mistrust – between public authorities and local stakeholders.

Materials and Methods

Theoretical Background

Drawing on pragmatic sociology and Science and Technology Studies (STS), this research is based on a qualitative, multi-actor investigation that examines post-mining management as a situated and contested set of practices. Rather than approaching post-mining risks as predefined objects of regulation, the study analyzes how they are constituted through institutional arrangements, expert devices, public controversies, and lived experiences. This perspective makes it possible to account for the plurality of actors involved, the heterogeneity of knowledge forms mobilized, and the dynamic processes through which environmental and health risks are framed, debated, and governed in concrete situations.

To identify the range of actors involved in post-mining management and to analyze their differentiated perceptions of environmental and health risks, we adopt Dewey's (1927) conception of publics and Zask's (2008) interpretation of public formation. From this perspective, publics do not pre-exist matters of concern, but emerge through the experience of shared disturbances and the collective inquiry they generate. The post-mining "public" is understood here as the set of actors engaged – directly or indirectly – in the construction of post-mining risks as public problems, through processes of problematization, contestation, and negotiation (Cefaï, 1996).

Terminology

We approach knowledge co-production not as normative ideal, but as an empirically observable, describable, and measurable process. We define it as the joint involvement of institutional experts and non-institutional actors in at least one of the following stages: (1) problem framing (identifying of risks and priorities); (2) knowledge production (data collection, interpretation and/or contextualization); and (3) decision-oriented deliberation (discussion's analysis on management options or land-use planning scenarios). Co-production manifests empirically inpractices such as incorporating residents' field observations into expert reports and establishing deliberative spaces for the joint interrogation of knowledge claims; and adapting technical interventions in response to section, which is organized into four thematic parts: (1) Institutional centralization and the standardization of post-mining risk management; (2) Local knowledge, everyday practices, and the contestation of expertise; (3) Participatory mechanisms and institutional's limits responsiveness; and (4) Emerging forms of knowledge co-production: conditions and constraints.

Within this framework, controversies are approached as specific forms of social interaction structured by argumentative and semantic disagreements among heterogeneous actors. Rather than being reduced to conflicts of opinion, controversies take the form of public trials in which competing definitions of problems, forms of knowledge, and normative frameworks are confronted and put to the test. They render visible the ordinary conditions of democratic functioning by raising questions of legitimacy – who is entitled to speak, on what grounds, and according to which procedures. Following a pragmatic sociological approach, the purpose is not to adjudicate these disputes, but to analyze the regimes of justification, critique, and proof mobilized by actors in order to stabilize or challenge claims (Boltanski & Thévenot, 1991; Barthe & *al.*, 2013; Chateauraynaud, 2011). Finally, this process is nowadays qualified as reflexivity approach and valorized as good practice for young engineers in order to develop sustainable and robust technical solutions (Lehoux et al., 2019; Jacob & Magnani, 2024).

These controversies frequently reveal a gap between publicly articulated problems and institutional capacities to respond to them, a configuration that resonates with the notion of crisis. Crises are characterized by an escalation of complexity resulting from the coexistence of multiple and partially incompatible stakes – health-related, environmental, economic, legal, or symbolic – those standard instruments of public action struggle to articulate coherently. By putting established frameworks of expertise, decision-making, and responsibility to the test, crisis expose their limits and generate renewed forms of contestation. For the sociology of public action, such moments constitute privileged sites for observing the reconfiguration of responsibilities, the renegotiation of legitimate knowledge, and the transformation of coordination among actors (Cefaï & Terzi, 2012; Gilbert, 2014; Lagadec, 1991).

Risk constitutes another central analytical category of this study. Since major industrial disasters of the late twentieth century – such as Seveso (1976), Three Mile Island (1976), Bhopal (1984), and Chernobyl (1986) – trust in scientific expertise and public authorities has been widely challenged. In contrast to substantialist approaches that conceive risk as an objective and measurable reality (Beck, 2001, 1986; Giddens,

1991), constructivist and pragmatic perspectives emphasize its socially situated and processual character. Risk is understood as the outcome of processes of qualification, visibility, and prioritization carried out by actors endowed with differentiated experiences, interests, and forms of knowledge (Gilbert, 2003; Jasanoff, 2004; Peretti-Watel, 2001). Institutional experts and resident-citizens do not evaluate risks in the same way, as their perceptions are embedded in distinct social trajectories, value systems, and territorial attachments. Risk is therefore not merely calculated; it is debated, experienced, and managed through social interaction.

Finally, this study approaches knowledge co-production not as a normative ideal but as an empirically observable, describable, and assessable process. It is defined as the joint involvement of institutional experts and non-institutional actors in at least one of the following stages: (1) problem framing (identification of risks and priorities); (2) knowledge production (data collection, interpretation, or contextualization); and (3) decision-oriented deliberation (discussion of management options or land-use planning scenarios). Empirically, co-production is manifested through practices such as the incorporation of residents' observations into expert reports, the establishment of deliberative arenas enabling the mutual testing of knowledge claims, or the adaptation of technical interventions in response to local concerns (Callon et al, 1999; Chilvers & Kearnes, 2015; Jasanoff, 2004; Wynne, 1996). This analytical framework guides the empirical analysis presented in the following section, which is organized into four thematic parts: (1) institutional centralization and the standardization of post-mining risk management; (2) local knowledge, everyday practices, and the contestation of expertise; (3) participatory mechanisms and the limits of institutional responsiveness; and (4) emerging forms of knowledge co-production, their conditions, and constraints.

Literature Review

a) From latent risks to public problems: processes of environmental problematization

Public policy sociology has extensively demonstrated that public problems do not emerge naturally or self-evidently on political agendas, but are rather constituted through social processes of definition, selection, and public visibility (Cefaï, 1996; Hassenteufel, 2011). Environmental risks, in particular, become public problems through mobilizations, controversies, and competing framings that render certain situations visible and actionable, while others remain unrecognized or marginalized (Lascoumes, 1994; Lascoumes & Le Galès, 2005). These processes involve a wide range of heterogeneous actors – scientists, activists, residents, journalists, and public authorities – who interact within often unstable and conflictual configurations.

This is especially evident in the case of post-mining territories we explore, where the dynamic of public problematization of legacy pollution is marked by a high degree of complexity. Environmental nuisances in these contexts unfold over long temporalities, are often imperceptible – even invisible – and their health effects remain delayed, uncertain, and unevenly documented (Gramaglia, 2023; Wynne, 1993). It is sometimes through triggering events – such as media investigations, scientific publications, health alerts, or local mobilizations – that these latent risks acquire public visibility and prompt forms of institutional recognition or intervention. In these processes, figures such as "whistleblowers" (Chateauraynaud & Torny, 1999)

sometimes play a decisive role by transforming hidden or underestimated risks into publicly acknowledged problems.

b) Perceiving and governing environmental risk in post-mining contexts

The public problematization of environmental risks is closely intertwined with broader transformations in risk governance. As emphasized by Giddens (2000) and Borraz (2008), environmental risk management constitutes a central political issue in contemporary societies, insofar as it entails decision-making under conditions of uncertainty and involves delicate trade-offs between economic imperatives, public health protection, and citizen aspirations. In TPEM, this situation is sometimes aggravated by the absence of robust epidemiological data on long-term impacts, which leaves public authorities with a margin of discretion that is often perceived as enabling the minimization of dangers or the postponement of corrective measures. These situations resonate with the core insights of risk society theory (Beck, 2001, [1986]; Douglas & Wildavsky, 1982), which emphasize the politicization of risk in modern societies, particularly when uncertainties challenge institutional authority and expertise.

In line with the foundational work of Ulrich Beck (2001 [1986]) on the "risk society", several studies have shown that contemporary environmental risks are characterized by their diffuse, often invisible, and uncertain nature, often eluding traditional regulatory instruments (Crivellari, 2024). Persistent metallic pollution and soil instability on former mining sites exemplify this so-called modernity of risks, whose medium and long-term consequences remain uncertain not only for local populations but also for experts themselves. The sociology of risk perception has also highlighted the diversity of social relationships to danger and the existence of social inequalities in exposure and in capacities for protection social (Peretti-Watel, 2001; Le Breton, 2002; Slovic, 2000). The recent work of Busca et al. (2023) in the Orbiel Valley provides an empirical illustration of these dynamics: residents develop situated and experiential forms of knowledge, as well as specific perceptions of danger, based on their daily experiences, spatial practices, and territorial memories. These ordinary knowledge and perceptions, often disqualified by health authorities or state technical services, are constructed through empirical observations, shared narratives, and a sensory and affective relationship to degraded environments. Moreover, residents wish to regain autonomy and the ability to act within their territory.

c) Post-mining territories as contested socio-technical laboratories

This marginalization of ordinary knowledge within institutional risk management frameworks has significant consequences. It fuels distrust toward public authorities and exacerbates controversies surrounding environmental policies, land-use regulations, and monitoring systems. As emphasized in various works, the public management of environmental risks is marked by structural tensions between technical rationality and social legitimacy (Beck, 2001 [1986]; Borraz, 2008; Crivellari, 2024; Gilbert, 2003; Jasanoff, 2004). In TPEM, these tensions are further intensified by the uncertainty surrounding the nature and extent of pollution, making it difficult to establish indisputable evidence and clearly allocate responsibilities. This situation intensifies

conflicts between existing land's uses (agriculture, urban development, gardening) and environmental and health monitoring systems.

Post-mining territories thus emerge as contested socio-technical spaces where multiple actors – residents, associations, experts, local elected officials, and public authorities – engaged in struggle over problem definitions, responsibility allocation, and future land uses (Callon, Lascoumes & Barthe, 2001; Chateauraynaud, 2011). TPEM provide an especially salient setting for these confrontations, particularly around the management of mining residues, site security, and the future use of land (Mottis et al., 2022). Although experts and public institutions retain a relative monopoly over practices (what is, or not, legitimate), local mobilizations increasingly produce alternative forms of knowledge that challenge dominant expertise (Gramaglia, 2023; Busca & *al.*, 2023; Ottinger & Cohen, 2011). Resident practices of reinvesting in wastelands and reclaiming collective memories have thus become both political and symbolic stakes, revealing not only environmental but also social and identity-based dimensions of conflict.

The work of Jules and Dumat (2022) on urban community gardens in Toulouse illustrates how citizen initiatives can simultaneously address social and environmental needs, while confronting rigid institutional systems reluctant to recognize the value of these non-institutional and informal uses of degraded spaces. TPEM's controversies are more shaped on risk's definition than the recognition of local uses and memories, within a context where territorial reconversion encounters the imperatives of land-use sobriety and ecological preservation (ZAN law, 2023). Similar dynamics have been documented in international research on post-industrial and contaminated landscapes, highlighting the transnational dimension of these socio-environmental conflicts (Mah, 2012; De Sousa, 2006).

Recent studies suggest, however, that greater consideration of residents' perceptions and collective memories not only contribute to restoring trust but also enables the construction of context-sensitive and socially acceptable solutions (Busca et al., 2023; Bonincontro, 2024). These dynamics are part of a broader citizen demand for a renewed environmental democracy, capable of recognizing the plurality of forms of knowledge and the social uses of territories. The recent sociological literature on TPEM in France thus shows that these spaces function as complex social laboratories where issues of risk management, territorial reconversion, and citizen participation intersect. It also highlights that the recognition of situated knowledge, the co-construction of problem definitions, and the expansion of deliberative spaces appear as necessary conditions for the elaboration of adapted and legitimate environmental policies. This resonates with global calls for epistemic justice and inclusive governance in environmental decision-making (Fricker, 2007; Jasanoff & Martello, 2004).

Data Collection Method

The analysis draws on a qualitative, multi-method research design aimed at capturing the social and institutional dynamics of post-mining risk governance through the collection of actors' discourses and practices.

Data collection combined documentary analysis, interviews, participant observation, and experimental participatory tools.

The first phase consisted of an extensive documentary review aimed at situating the territorial issues and institutional arrangements of post-mining management. This included the analysis of reports produced by institutions in charge of post-mining management, such as 'health and environmental risk management organizations'[5], in order to examine institutional framings, priorities, and decision-making rationales. Academic literature on risk, expertise, participation, and controversy was also reviewed to inform the analytical framework. In addition, local media sources (newspapers, blogs, websites) were examined to document public controversies and local problem definitions. This phase provided a preliminary mapping of actors and power relations and informed subsequent fieldwork.

The second phase involved qualitative interviews (Blanchet & Gotman, 2015), combining semi-structured interviews with institutional and associative actors and informal, unstructured conversations conducted during field encounters. This approach enabled the collection of more detailed narratives while allowing for a certain degree of flexibility to explore topics deemed relevant by the interviewees themselves (Bertaux, 2010). Interviewees were recruited through institutional contacts, local associations relying on snowball sampling: leading to recruit actors via recommendations. The recruitment of participants relied both on institutional contacts, linked to the framework of the institutional commission, and on outreach efforts directed at local associations and residents of the post-mining territories under study. This approach was complemented by the use of snowball sampling, which enabled the identification of additional participants through referrals. This strategy aimed to assemble a diversified sample encompassing different categories of actors – state representatives, public operators, elected officials, association members, residents, and landowners – and was particularly suited to a context characterized by dense local networks, fragile relations of trust, and, at times, open controversies.

We encountered four types of actors – as illustrated in *Table 1*. presenting also codes used in order to preserve the private information.

1) Institutional actors (deconcentrated state services and specialized agencies) were interviewed due to their central role in France for the production, implementation, and interpretation of the regulatory framework governing contaminated sites and soils. As key actors of environmental expertise, they contribute to the definition of norms, procedures, and risk categories, as well as to the technical and administrative monitoring of contaminated sites. Their accounts make it possible to analyze the concrete modalities of environmental governance, decision-making

[5]These organizations are the French Geological Survey and (BRGM) and the French National Institute for Industrial Environment and Risks (INERIS).

processes, and the tensions between regulatory prescriptions, operational constraints, and scientific uncertainties.

2) Local elected officials were interviewed as mediating actors between regulatory requirements, residents' expectations, and territorial development objectives. Their inclusion is justified by their distinctive position at the intersection of political, administrative, and symbolic registers of action. They are involved in the management of contaminated sites through arbitration processes related to land-use planning, brownfield redevelopment, public health protection, and public communication. Their narratives allow for an examination of how environmental issues are politicized, translated into public problems, and integrated—or not—into territorial development projects.

3) Residents living in the affected territories were interviewed in order to document everyday experiences of pollution, risk perceptions, and situated forms of knowledge emerging from prolonged exposure to degraded environments. Their perspectives are essential for understanding how expert-based management and regulatory tools are received, contested, or appropriated in daily life. These interviews also shed light on the social, health-related, and symbolic effects of pollution on residential trajectories, spatial practices, and relationships with public institutions, highlighting discrepancies between expert risk assessments and lived experiences.

4) Finally, local and national associations, along with their representatives, were interviewed as collective actors playing a structuring role in the public visibility of pollution and in the circulation of controversies. They were selected for their functions as spokespersons, producers of counter-expertise, and intermediaries between residents, experts, and public authorities. Analyzing their practices makes it possible to examine mobilization dynamics, evidentiary strategies, and forms of both critique and cooperation with institutions. These actors actively contribute to the redefinition of public problems related to contaminated sites and soils.

Table 1. *Characteristics of Interview Participants and Reference Numbers used in Citations (Lebot, 2026)*

Status	Role	Interview reference code
Institutional actors	Regulatory and expert authorities responsible for defining, implementing, and monitoring contaminated sites and soils governance	Z
Local elected officials	Political and territorial mediators involved in decision-making, land-use planning, and public communication	E
Local residents	Inhabitants experiencing pollution in everyday life; providers of situated knowledge and risk perceptions	H
Associations and representatives	Collective actors engaged in mobilization, counter-expertise, and mediation between residents, experts, and public authorities	A

To capture non-verbal and interactional dimensions, direct observations were conducted during site visits, public meetings, and inspections (Arborio & Fournier,

2005). These fields observations made it possible to document the dynamics of interactions between actors and their environment, and to understand how knowledge is exchanged or ignored. They also provided an opportunity to observe the power mechanisms underlying participatory processes, including tensions between experts and local residents, such as the forms of resistance developed against governance models perceived as disconnected from their everyday concerns.

Data Analysis Method

All interviews were fully transcribed and analyzed using iterative thematic coding, combining deductive categories from the literature (expertise, trust, participation, co-production) with inductive categories emerging from the data.

The researchers' positionality – at the interface of institutional research mandates and an academic sociological agenda – was reflexively considered throughout the study. The commissioning framework, aimed producing operational knowledge for management institutions, influenced field access and expectations regarding outcomes. During fieldwork, the research relationship was marked by the perception of the researchers as institutional interlocutors, a positioning likely to elicit strategic or normative discourses from local actors; this effect was addressed by explicitly distancing the researchers from the institutions involved.

To uphold a sociological perspective, the researchers situated issues of territorial reconversion, governance, and environmental and social remediation within their broader socio-political contexts, taking considering power relations, regulatory constraints, and local memories associated with mining activity.

The research followed established ethical standards: all participants provided informed consent, interviews were anonymized, and transcripts remain confidential.

Case-study: Three post-mining Territories

The three former mining territories investigated were selected on the basis of a proposal by the management of the Mining Risk Prevention and Safety Department (*Département Prévention et Sécurité Minière*, DPSM) of the BRGM. The selection relied on a combination of institutional, technical, and socio-political criteria.

All three sites are classified as "post-mining" areas (*après-mine*), as they include former mining concessions that have been relinquished or renounced and – in accordance with the French Mining Code – correspond to extractive activities precede to 1810. In addition, each territory has been subject to ongoing or recently completed public interventions led by state agencies or their operators, aimed at preventing or managing risks inherited from past mining activities. From the perspective of post-mining practitioners, these territories present contrasting management situations, both in terms of the advancement of technical measures and the nature of relationships between institutions and local stakeholders. Interventions are perceived as either completed or ongoing, and as having unfolded in a relatively consensual or, conversely, conflictual manner. This diversity of socio-institutional configurations was deliberately sought as a methodological asset, enabling a comparative analysis of post-mining governance arrangements and their associated local dynamics.

Results

1. Institutionalization and centralization of post-mining risk management

An examination of interviews[6] and administrative archives reveals that the TPEM's governance in mainland France became increasingly institutionalized from the 2000s onward, shaped by a combination of European obligations, national standards, and local imperatives for spatial structuring.

In response to environmental disasters in the Lorraine iron-ore mining basin (1996-1999), public authorities initiated a collective reflection by creating the expert body GEODERIS (the Group of Experts from BRGM and INERIS, 1998-2001) to define and disseminate a standardized national methodology.

The 2006 Extractive Waste Directive (Directive 2006/21/EC[7]) marked a decisive turning point: France adopted[8] a regulatory framework mandating a formalized management of mining residues, extending beyond the physical risks of subsidence or collapse to encompass metallic and metalloid pollution, newly recognized as major environmental hazards. A special department – the DPSM (2006) – was created at the BRGM to secure and monitor mining damage (Figure 1). This formalization is part of a broader, incomplete process of politicizing the French subsurface, largely dominated by centralized technocratic logics (Arnauld de Sartre & Chailleux, 2021; Arnauld de Sartre & Chailleux, 2026).

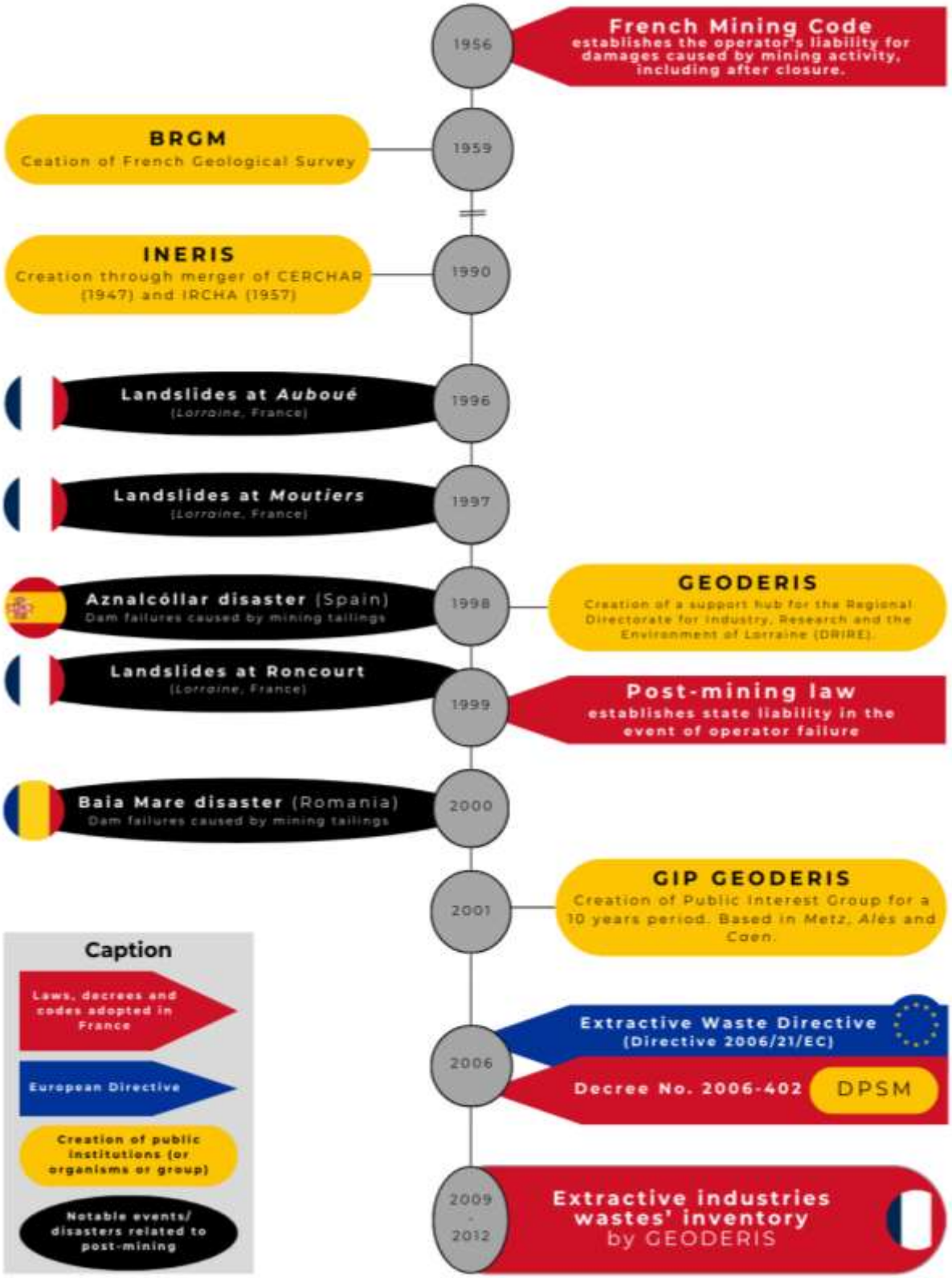
Figure 1 provides a synthetic representation of the governance timeline of post-mining regulation in France. It presents the progressive institutionalization of management bodies (BRGM, INERIS, GEODERIS, DPSM), their embedding within national (French Mining Code, Post-mining law) and European (Extractive Waste Directive) legal frameworks, and the structuring role of disasters in placing post-mining issues on the public agenda and in the gradual formalization of concerns related to mining legacies and risks.

[6]In total, 9 interviews were conducted with agent from health and environmental risk management organization (Institutional actors, Z in *Figure 1.*). 38 interviews were conducted across three post-mining sites (with Local elected official (E), local residents (H) and associations (A).

[7]Directive 2006/21/EC - https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32006L0021

[8]Decree No. 2006-402 of April 4, 2006 amending Decree No. 59-1205 of October 23, 1959 relating to the administrative and financial organization of the BRGM and laying down transitional provisions relating to Charbonnages de France. https://www.legifrance.gouv.fr/loda/id/JORFTEXT000000607316

Figure 1. *Governance Timeline of Post-mining Regulation in France (Lebot, 2026)*



The methodology established by this framework prescribes a three-phase approach: First, identification of physical and chemical risks through quantitative soil and water analyses; Second, implementation of safety measures (including shafts sealing, waste containment, and source-level pollution control); and third post-intervention environmental monitoring to verify regulatory thresholds and sampling rate. This centralized approach ensures strong cohesion in practices nationwide, it simultaneously generates a top-down governance model in which strategic decisions are made at the center and implemented uniformly across affected territories. While this formalization has undeniably produced positive outcomes — clearer allocation of responsibilities, standardized procedures, legal security for public action, and traceability of interventions — it also reinforces a technocratic rationality in which the territory is primarily perceived as an object to be secured according to scientific and administrative criteria, at the expense of the social, historical, or symbolic dimensions associated with the post-mining landscape. Consequently, centralized decision-making frequently overrides localized and nuanced approaches, creating a symbolic distance between the expert state and local populations, as subsequent sections will demonstrate.

In the absence of effective mechanisms for integrating residents' situated knowledge, many testimonies express frustration: "What we ask is that, before they decide to cover up [the mining remnants], they look into whether other treatment options exist. There are plants capable of absorbing heavy metals… but here, everything has been removed, nothing remains visible. So perhaps one should reflect on the method before ending up in a meeting where we hear, 'See how well we handled it.' Well, no!" pleads one resident (H14), demanding that traditional methods or local knowledge be considered before major interventions. Regional Directorates for the Environment, Development, and Housing (DREAL) act as intermediaries between management agencies and prefectures. Beyond information dissemination, participatory mechanisms are considered time-consuming and incompatible with already saturated institutional agendas, compounded by the perception that this would fall outside their official remit: "Listen, I didn't have time. If a meeting goes badly and it backfires on me, I had other priorities," explains Z9. It illustrates a unilateral communication style that transforms these public meetings into formal exercises devoid of real opportunities for feedback integration – for example, in the formulation of political decisions.

2. Fragmented governance and procedural participation

Despite the technocratic dominance described above, post-mining governance in France is not devoid of participatory arrangements. It relies on a set of formal instruments for information and consultation, including Local Information Commissions (CLIs), Site Monitoring Committees (CSS), public meetings, public inquiries, and complaint registers. These devices are intended to structure the circulation of information between state agencies, local elected officials, and residents. Interview data indicate that responsibilities for communication are distributed across several institutional levels, with specific roles attributed to each.

Several respondents identify the Regional Directorate for the Environment (DREAL) and the prefecture as the primary institutional authorities responsible for communication. As one interviewee put it, "For me it's more DREAL and the

prefecture who are responsible for communication" (Z3). At the same time, state agents describe communication as being partially delegated to mayors: "DREAL doesn't have time to do that. And anyway, it's up to the mayor to communicate. The head of DREAL is the Prefect, so if a meeting goes badly, it falls directly on state agents" (Z9).

According to this same actor, information produced by DREAL is transmitted to local elected officials: "Information from DREAL stops at the mayors. After that, it's up to the mayors to decide if a public meeting is necessary. And when they are organized, nobody comes!" (Z9). In this configuration, mayors are described as the main interface between state services and residents, particularly when it comes to organizing meetings and relaying information at the local level.

Interviews also show that communication follows a strictly hierarchical institutional structure. Several state agents referred to constraints on initiative and on the circulation of information outside formal channels: "If we have the misfortune to bypass the chain of command, we get yelled at!" (Z7). This indicates that exchanges between institutions and residents are expected to pass through predefined administrative pathways.

At the same time, some field agents articulated a positive view of citizen involvement: "It seems very healthy to me that citizens ask to see what's going on in their own territory… The idea is not to abandon people who live in these areas. If there is pollution, they must be supported" (Z6). These statements coexist with accounts emphasizing time constraints, administrative priorities, and the management of institutional risk within state services.

Taken together, the interviews document a system in which communication and participation are formally organized through multiple instruments and distributed across several levels of authority, from the prefecture and DREAL to municipal governments. They also show that responsibility for informing and involving residents is shared between these actors, with information circulating through hierarchical channels and being relayed locally by mayors via meetings or other communication devices. One respondent emphasized that the timing and uneven distribution of information shape the form of exchanges: "If people don't have the same level of information, they can't have a discussion. The problem is that public meetings come too late. So, when discussions do happen, they're usually in 'opposition' mode, in conflict" (Z13).

3. Marginalization of experiential and local knowledge

Residents and local associations sometimes report difficulties in having their observations, proposals, and alternative solutions considered. Experiential knowledge – derived from long-term residence, sensory perception, and everyday practices – was rarely translated into institutional categories recognized as legitimate evidence.

Institutional actors tended to treat local knowledge as anecdotal or emotionally driven, particularly when it contradicted official measurements: "They speak from experience… they're not dead" (Z9), reveals a symbolic downplaying of lived experience and a clear distinction between local observations (the absence of illness among residents) and official expertise (acknowledging significant heavy metal levels as risks to human and environmental health).

This asymmetry was reinforced by time constraints and administrative priorities. As one state agent admitted, participatory engagement was often considered incompatible with institutional workloads and risk management responsibilities.

Across the three sites, interviews reveal that inhabitants maintain strong affective, historical, and identity-based relationships with post-mining landscapes. These attachments frequently conflict with technical framings that define the same spaces primarily as hazardous or degraded.

Residents continue to use former mining sites for walking, gardening, or informal social activities, even when official restrictions apply. One elected official recalled: "I played here as a kid… everyone did." In contrast, institutional discourse tends to focus on exposure thresholds and sanitary risk.

This divergence produces a persistent trust gap between public authorities and local populations. Residents interpret institutional interventions as imposed, opaque, and disconnected from lived reality, while experts perceive local practices as potentially unsafe or irrational.

Rather than open confrontation, this mismatch often results in what can be described as "ordinary resilience": inhabitants quietly maintain their uses and attachments despite regulatory constraints, while institutions continue to apply standardized technical solutions.

Discussions

Interpretations

The analysis of TPEM reveals the persistence of a top-down environmental governance model, in which public agencies produce knowledge according to technical and regulatory frameworks that often fail to capture local perceptions and practices. Environmental and health crises, however, highlight the need for more inclusive, territorially grounded governance. Integrating diverse actors in the governance can enhance policy legitimacy, improve diagnostic quality, and reduce social tensions by acknowledging conflicting collective memories and situated experiences.

a) Reframing post-mining risk governance as an epistemic regime

The results show that post-mining risk management in France is not only a regulatory or technical system, but a structured epistemic regime that defines what counts as valid knowledge, who is authorized to speak, and which realities become governable. The institutionalization of GEODERIS, the DPSM and standardized national methodologies has produced a powerful infrastructure of knowledge production, in which environmental risk is translated into indicators, thresholds, and procedural formats.

This finding refines Beck's "risk society" thesis by showing that the politicization of risk in post-mining territories is not driven only by uncertainty, but by the mismatch between institutionalized ways of knowing and lived ways of experiencing danger. The expert-centered model produces social, cognitive, symbolic, and political effects through the distance it establishes between technical knowledge and empirical

lived experience. The expertise mobilized by management agencies operates within a framework combining scientific knowledge and a normative posture: supervising pollution and geological risk monitoring through standardized indicators and producing formal technical reports according to legal deadlines. This expert-driven process – legitimized by regulatory standards and instrumental rationality (Weber, 1978) – relies on three essential levers: technical mastery of pollution control, centralized financial management (through nationally and regionally targeted budgets) and compliance with regulatory requirements, which underpin credibility in the eyes of public funders. Technical transparency (reports, documents, thresholds) functions as a corollary, intended to strengthen institutional legitimacy. Yet this model presents clear limitations: it tends to narrow alternatives to context-sensitive or innovative solutions, favoring normative rigor and frequently excluding spontaneous local initiatives. While the centralization of expertise effectively imposes a unified strategy, it remains ill-suited to the specific constraints of territories or citizen mobilizations. By constructing legitimacy solely on technical grounds, institutional actors shape a relationship to risk in which local knowledge — based on empirical observations, use-related narratives, and social memory — is largely disregarded, particularly when it does not align with official indicators. This imbalance between technical rationality and social perception fosters mistrust among local actors, whether elected officials or residents, and raises the issue of the compatibility between centralized expertise and locally co-constructed projects.

The reflections of Bessy and Chateauraynaud (1995) on the figures of the expert and the impostor, offer a valuable conceptual framework for analyzing the tensions surrounding the production and credibility of environmental expertise. The authors emphasize that expertise is never fully stabilized, but constantly exposed to public tests of credibility, during which external actors – residents, activists, elected officials – may contest, reinterpret, or replay the technical assessments produced by institutions. In the context of post-mining territories, this dynamic manifests in controversies over risk assessment methods, regulatory thresholds, and intervention priorities. These public tests are not solely matters of political contestation, but also instances of a "sociology of perception" (Bessy & Chateauraynaud, 1995), in which social representations of danger, territory, and industrial history actively dispute the official expertise's claim to objectively describe reality. This observation also echoes Sheila Jasanoff's (2004) work on "civic epistemologies" in risk governance, which demonstrates that the credibility of technoscientific knowledge is closely tied to the social, historical, and political contexts in which it circulates. Applied to French post-mining territories, this invites us to conceive of expertise arrangements not as closed, self-contained systems, but as contested arenas where the contours of public problems and legitimate solutions are continuously negotiated.

In post-mining territories, legitimate knowledge is primarily produced through the progressive institutionalization of risk management, structured by European and national regulatory frameworks (RQ1). The establishment of expert bodies (GEODERIS, the DPSM within the BRGM) and the diffusion of standardized methodologies have consolidated a knowledge regime grounded in scientific expertise, risk quantification, and regulatory compliance. Legitimacy rests on objectified indicators - pollution thresholds, physico-chemical analyses, and technical reporting - produced by central actors and deployed through top-down decision-making. This configuration severely

constrains knowledge negotiation: complex administrative arrangements and saturated institutional agendas leave little room for deliberation or co-production with local actors. As a result, experiential and place-based knowledge is systematically subordinated, as it fails to conform to administratively recognized normative formats.

b) From participation to epistemic asymmetry: Trust and knowledge

Although multiple participatory devices exist (CLIs, CSS, public meetings), the results show that they operate mainly as procedural interfaces rather than epistemic spaces. They organize the circulation of already-produced knowledge but rarely allow residents to participate in the definition of problems, priorities, or acceptable trade-offs.

This pattern is rooted in a long history of top-down governance, in which institutional interlocutors restrict citizen involvement to non-deliberative public information meetings, effectively stripping local actors of any concrete participatory capacity (H14). As a result, participation is formally present but substantively weak, a dynamic that empirically confirms what Blondiaux and Sintomer (2002) have described as the "participation trap". The core deficit is not communicative but epistemic: citizens may be informed, yet their situated knowledge rarely acquires the capacity to shape decision trajectories.

This is crucial: controversies are not simply conflicts of opinion, but tests of legitimacy between competing regimes of knowledge (Boltanski & Thévenot, 1991; Chateauraynaud, 2011). In the post-mining territories studied here, these trials are structurally unequal. Institutional expertise enters public arenas already stabilized by regulatory frameworks, budgetary constraints, and technical protocols, whereas residents' knowledge remains localized, fragile, and readily dismissed as anecdotal or subjective.

Insights from Akrich, Barthe, and Rémy's (2010) work on dynamics of lay mobilizations in response to health and environmental threats help to illuminate this configuration. Their analysis demonstrates how "ordinary" or situated knowledge becomes a critical epistemic resource precisely when institutional actors struggle to produce consensus. In post-mining territories, lay mobilizations extend beyond protest and are embedded in everyday practices of environmental vigilance, risk monitoring, and experiential interpretation of degraded landscapes. Residents and grassroots associations thus position themselves as whistleblowers (Bessy & Chateauraynaud, 1995) and, in some cases, as de facto co-producers of environmental knowledge, challenging the monopolization of epistemic authority by centralized expertise.

The trust deficit observed in all three territories does not primarily stem from hostility toward science or institutions. Rather, it emerges when people cannot recognize their own experiences in the official representations of risk. Residents' attachments to post-mining landscapes – memories, daily uses, emotional bonds – are not merely cultural residues; they are forms of situated knowledge about exposure, habitability, and environmental change. When these are ignored or dismissed, institutional action becomes socially unintelligible, even if it is technically justified. The persistence of "ordinary resilience" – continued informal uses of contaminated spaces – can thus be interpreted as a practical critique of technocratic governance, rather than as mere risk-taking behavior.

Trust, in this sense, is not a psychological variable but a cognitive and political one: it depends on whether people can understand how decisions are

made and see how their own realities are considered. This analysis resonates with Wynne's (2013) seminal work on science and lay publics, which demonstrated – through the case of radioactive contamination in Cumbria – that local knowledge can serve as a valuable resource for refining and contextualizing scientific expertise, provided it is acknowledged and integrated into governance frameworks. In French post-mining territories, the absence of enduring mechanisms to recognize these forms of citizen knowledge tends to ossify roles and reproduce asymmetries of legitimacy, thereby limiting the capacity of affected populations to influence decisions impacting their living environment.

The consequences of this epistemic exclusion are both symbolic and political. Symbolically, post-mining sites tend to be framed primarily as objects to be corrected, secured, or remediated, rather than as lived environments whose collective memories contribute to local identity and territorial narratives (Halbwachs, 1992). Politically, ordinary resilience manifests in informal practices – the use of wastelands, communal gardens, or heritage uses of the site – that often exist in tension with official norms (Busca et al., 2023). These practices reveal residents' capacity to maintain a relationship to place that resists technocratic-administrative logic. They represent both passive forms of contestation and markers of situated, historical, and empirically grounded knowledge that refuse the symbolic erasure of industrial traces.

From this perspective, ordinary resilience should not be interpreted merely as risk-taking or regulatory non-compliance. The tensions between technical legitimacy (institutional expertise) and social legitimacy (local experiences and symbolic practices) expose a structural fault line in the governance of post-mining territories. They underscore the need for an epistemological and political adjustment: for public action to be both legitimate and effective, it must integrate plural expertise capable of reconciling technical knowledge with lived experience (Fischer, 2000).

Ultimately, the central problem is not the absence of participatory arrangements but the persistence of epistemic asymmetry that undermines trust in public action (RQ2). While technocratic governance strengthens legal certainty and procedural standardization, it also produces symbolic distance between institutions and affected populations. Decisions are widely perceived as opaque, imposed, and disconnected from everyday life, particularly when local observations and territorial attachments are subordinated to abstract scientific criteria. Participatory tools, when they exist, remain largely informational and consultative, thereby reinforcing perceptions of exclusion. The resulting dissonance between institutional discourse and lived experience sustains a persistent trust deficit, manifested in frustration, mistrust, and the ongoing practices of ordinary resilience through which inhabitants continue to inhabit, reinterpret, and contest post-mining landscapes despite technical and regulatory constraints.

c) Knowledge co-production forms potential

Accordingly, some territories have begun experimenting with emerging forms of governance and knowledge co-production (*Prior* (Busca et al., 2023); *Eco-citizen Institutes*[9]), illustrating possibilities for distributed expertise (Callon et al., 2001; Chilvers & Kearnes, 2015). In practice, it sometimes occurs that elected officials, residents, and associations succeed in asserting their empirical observations and/or proposing

[9]https://www.iecsea.org/

alternative solutions, landscape valorization or preservation of industrial remnants for memorial or tourism purposes. Such compromises require dual conditions: they must be both socially acceptable and, above all, safe from a public health perspective.

These initiatives often function in an ad hoc, dependent fashion, shaped by local or individual goodwill and the presence of actors open to co-construction. Nonetheless, they demonstrate significant potential benefits: improving institutional trust, enhancing project acceptability, reducing conflict, and producing more precise and contextually grounded diagnoses. Yet these initiatives remain a minority and heavily dependent on organizational conditions: the absence of sustainable institutional procedures, rigid administrative hierarchies, and structural constraints. They illustrate the potential for renewing governance models, while also showing that transforming the expert-centric model would require structural reforms: notably the formal inclusion of citizen knowledge in evaluation processes, training officials in territorial listening, and establishing intermediary deliberative mechanisms endowed with real decision-making power (Blondiaux, 2008; Fung, 2006).

Moreover, the ambition to make this data accessible to lay audiences frequently results in the excessive simplification of scientific knowledge. While popularization is necessary from a democratic participation perspective, it is not without consequences for the nature of the knowledge conveyed. Reducing uncertainties, selecting certain results while omitting others deemed overly technical or anxiety-inducing, and a tendency to produce simplified messages can distort the complexity of the studied phenomena. Such simplification risks concealing internal scientific controversies, methodological limitations, or persistent uncertainties — all essential to a rigorous understanding of environmentally and health-sensitive situations.

Furthermore, this dual process of full public disclosure and excessive simplification risks weakening the legitimacy of expertise by exposing it to criticism based on misunderstandings or 'dangerous' expectations (from a health or environmental perspective). It may also deepen asymmetries between different knowledge registers. If scientific knowledge is simplified for the sake of intelligibility, while empirically situated knowledge struggles to be granted epistemic legitimacy, participatory mechanisms risk perpetuating implicit hierarchies rather than fostering genuine dialogue between knowledge systems. These issues therefore invite reflection on the conditions of knowledge production, dissemination, and debate in health-environment arenas. The challenge is not to limit access to information, but to design mediation and translation mechanisms capable of preserving scientific rigor while enabling critical appropriation by heterogeneous publics.

The attribution of epistemic authority (RQ3) is contingent upon alignment with dominant institutional frameworks and the positional power of the actors involved. Knowledge produced by expert agencies, central administrations, or institutionally embedded actors benefits from strong legitimacy, as it is framed within a regulatory conception of the collective good and public safety. Conversely, knowledge articulated by residents, local associations, or grassroots elected officials is marginalized when perceived as overly situated, affective, or individualized—particularly when it cannot be translated into standardized indicators. This filtering process privileges conformity to expert discourse over contextual relevance, rendering invisible forms

of knowledge that are nonetheless critical to a socially grounded understanding of post-mining territories.

Limits

Nonetheless, this integration faces limits. Full release or oversimplification of technical reports can undermine understanding and credibility. Participatory processes may fall into a "participation trap" (Blondiaux & Sintomer, 2002), where deliberation is largely informational, and residents' empirical proposals are excluded, reinforcing mistrust. These challenges illustrate the difficulty of reconciling institutional expectations with pragmatic engagement of local knowledge.

While this study highlights the fragility and unevenness of knowledge co-production in post-mining territories, it is limited by various aspects. This commissioned study was initially designed to address institutional questions and expectations, which may have influenced the formulation of sociological questions, the selection of participants, and ultimately the interpretation of the results, thereby reflecting, at least in part, the institution's priorities. From a practical and methodological perspective, time constraints and the study's affiliation with administrative bodies contributed to limiting the sample size. The sample could have been broader, for instance by including other TPEM beyond those selected by the commissioning institution, thereby enabling the exploration of territories with potentially different issues that were not anticipated by the institution. Finally, ethical considerations should be highlighted: the funding of the study or the dissemination of its results could be mobilized by the institution to strengthen its legitimacy in areas extending beyond the strict domain of the social sciences and humanities, thus conferring a form of scientific endorsement to the research. Future research could support the management process to observe and act as a mediator between the different actors of TPEM regarding the governance of health-environmental risks.

At the same time, this research also highlights important limitations to reach full co-construction or collective experimentation. While Serious Games appear to be promising mediation and learning tools, the results suggest that promoting an exploratory game to a general citizen audience may be premature. For non-expert publics, the cognitive and informational burden—particularly in complex post-mining contexts—can limit appropriation and meaningful engagement. In contrast, institutional actors or professionals involved in post-mining management may constitute a more appropriate initial target audience, as they already possess baseline knowledge of the actor landscape and regulatory framework.

Recommendations

The analysis of the TPEM case confirms the persistence of a predominantly top-down model of environmental governance, in which public agencies produce and legitimize knowledge through technical and regulatory frameworks. It also reveals the risks and tensions entailed by such openness, particularly concerning the public dissemination and popularization of scientific knowledge. These issues constitute major challenges for implementing truly participatory health-environment governance, which

warrant further clarification. First, the unrestricted public release of technical reports produced by expert bodies raises important questions. While the transparency of public information has become a core principle of environmental policy, the unmediated dissemination of highly specialized documents presents several risks, as they are based on complex methodological protocols and technical concepts often inaccessible to non-specialist audiences. Their raw availability may lead to misunderstandings or unfounded anxieties. In the absence of mechanisms for shared interpretation or socio-technical translation (Callon et al., 1999; Nowotny et al., 2001), such documents risk being appropriated polemically by some actors, fueling public controversies more rooted in partial perceptions than in consolidated analyses. This is particularly sensitive in contexts of environmental and health crises, where public demand for information is often accompanied by distrust toward expert institutions.

This finding is consistent with a large body of literature on environmental risk governance, which highlights the marginalization of local perceptions, lay knowledge, and lived experiences in institutional decision-making processes. The results therefore largely confirm existing theoretical approaches that describe environmental governance as expert-driven and weakly participatory, particularly in post-industrial contexts.

However, the empirical findings also nuance the literature by showing that this top-down model is not only a matter of institutional resistance, but is reinforced by the complexity of actor configurations and knowledge asymmetries in post-mining territories. For citizens, identifying responsibilities, actors, and causal chains related to post-mining risks remains particularly difficult. This helps explain why participatory tools, even when well intentioned, struggle to achieve genuine co-construction.

From a pragmatic sociology perspective, the results support the idea that more inclusive governance requires hybrid mechanisms combining institutional expertise with experiential and situated knowledge. Environmental and health crises act as moments of tension that reveal the limits of technocratic governance and the need for territorially grounded approaches. In this sense, the experimentation carried out in this research confirms theoretical assumptions that risk is not only a technical object but a socially constructed phenomenon shaped by experiences, values, memories, and worldviews.

Based on these findings, several operational recommendations can be formulated, grounded in what this research has empirically demonstrated rather than in normative expectations of participation. These include:

- Formal recognition of citizen-produced or experience-based data as complementary inputs to institutional risk assessments, without assuming immediate co-decision.
- Training public officials and technical experts to interpret, contextualize, and integrate situated knowledge, particularly in conflict-prone territories.
- Development of intermediary deliberative spaces that prioritize dialogue and mutual learning over full co-construction, with clearly defined roles and realistic degrees of influence.
- Gradual and reflexive deployment of participatory tools, such as Serious Games, accompanied by continuous evaluation to avoid symbolic participation and to assess their actual contribution to understanding, mediation, and policy learning.

Overall, the theoretical framework serves here less as a model to be validated or invalidated than as a lens through which the results can be interpreted. The experimentation conducted highlights the conditions and limits for such approaches to become operational and socially meaningful in post-mining environmental governance.

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Analysing Pedagogical Content Knowledge for the Inclusion of Queer Identities: Tertiary Language for Education Lecturers' Perspectives

*By Matthys Uys**

Recognising that the voices of lecturers in higher education remain underexplored and that most research focuses on the lived experiences of queer teachers, learners, and students, this study foregrounds lecturers' perspectives, teaching strategies, and the challenges they face in fostering inclusivity. This article explores how tertiary Language for Education lecturers at a South African university conceptualise and apply pedagogical content knowledge (PCK) – the knowledge of how to teach specific content – to include queer identities in the language classroom. The research question was: What perspectives and suggestions do language lecturers from a university have regarding contextually responsive teaching strategies that support the inclusion of queer identities in language classrooms? This study used a qualitative case-study research design, which was grounded in Mezirow's transformative learning theory. Thematic content analysis was the data analysis strategy, and drew on purposive sampling and questionnaire responses. Eight language lecturers completed the questionnaires. The findings revealed three key themes: (1) contextual responsiveness as the foundation of inclusive PCK, (2) transformative learning fostered through literature and classroom dialogue, and (3) the persistence of resistance and missed opportunities for transformation. While participants acknowledged the importance of contextual awareness, their views ranged from proactive inclusion strategies to open resistance. Ultimately, this study contributed to ongoing discussions – by giving a voice to language lecturers – on reforming language curricula to foster inclusivity concerning queer identities.

Keywords: *inclusion; language classroom; language for education; pedagogical content knowledge; queer identities; tertiary education*

Introduction

Egne (2022) states that the role education plays in a country's overall growth, particularly in higher education, becomes clear due to the fact that higher education is thought to be essential for imparting the information needed to guarantee sustained growth. In agreement, Buli-Holmberg and Kamenopoulou (2017) encourage all countries in the world to strive for inclusive education and concentrate on modifying practices and policies, applying a comprehensive approach to education by including differentiated instruction, organisation, and procedures that address the unique needs of learners while fostering a sense of belonging and engagement. The researchers, however, caution that implementing inclusive education into practice is difficult; it remains feasible, because addressing any disparities that might exist within the educational system is a necessary part of social justice education, as supported by

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Munongi (2023). Therefore, there is a global idea of inclusive education with a focus on queer identity inclusion in language teacher education.

I conducted a recent search on tertiary lecturers' perspectives on and contributions to the inclusion and teaching of queer identities[1], whether it be language or non-language education, in the South African context. According to the studies consulted, many focused on the learning experiences of queer students (Francis, 2017; Mavhandu-Mudzusi & Ganga-Limando, 2014; Nduna et al., 2017; Sithole, 2015; Tanga et al., 2019) and what had been done to create awareness of and engagement with queer identities (Brown, 2020; Jones, 2019; Msibi, 2013), but there was a research gap concerning tertiary education lecturers' perspectives on pedagogical content knowledge (PCK) of queer-themed education.

Lees (2017) and Nzimande (2017) provided responsibilities of educators[2] and teaching methods for training and educating students about sexual diversity within the classroom; Msibi (2018) focused on Black teachers' professional and sexual identities to accommodate and resist structural dictates to be inclusive of queer learners; Brown (2020) explored Life Orientation student teachers' perceptions towards queer individuals and focused on the creation of intergroup dialogue meetings to provide a secure environment to discuss topics related to queering teacher education; Tanga et al. (2019) focused on homosexual students' experiences in a higher education institution in South Africa and commended that social workers and other involved parties have an obligation to inform and train various groups within the population about the diverse characteristics of South African society; and Francis (2017) reviewed 27 studies and indicated that educational institutions – from the perspectives of learners, students, and teachers – promote compulsory heterosexuality and heteronormativity. However, it is noted from the given studies that tertiary lecturers' voices remain absent or unheard (Nduna et al., 2017) – the focus is generally on tertiary education students and secondary education teachers and learners, but not inclusive of tertiary education lecturers.

Lecturers in tertiary education teach pre-service students (who eventually transition to in-service teachers in secondary education). Accordingly, what students are taught at university will be taught to their learners at schools – it is, therefore, the responsibility of lecturers to transfer the necessary PCK to their students to include and engage with queer identities. Krause-Wichmann et al. (2025) affirm that a solid foundation of PCK can then be applied to a variety of pedagogical issues or challenges, which is crucial for student teachers. Brown (2020, 19) states that "teachers need skills to facilitate a learning environment of continuous negotiation and mutual influence". Francis (2017, 15) concurs that "[i]n-service and preservice teacher education […] remains pivotal for the teaching and learning of same-sex desires and sexualities in schools". Fittingly, opportunities can be created for researchers, lecturers, teachers, learners, and students to partake in dialogues of queer-themed literacy and language: the language classroom as a context is a suitable initial point.

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[1]Queer identities in this study refer to a culmination of sexual orientations (e.g., lesbian, gay, and bisexual) and gender identities (e.g., transgender, non-binary, and gender-fluid).

[2]"Lecturers", "teachers", "students", and "learners" were used within different contexts concerning this study. "Lecturers" and "students" were used in the context of tertiary education, whereas "teachers" and "learners" for secondary education. However, to ease reading, when referring both to "lecturers" and "teachers", "educators" was used; when referring both to "students" and "learners", "students" was used.

As a result, the research gap is that only the experiences of queer-inclusive education of secondary and tertiary teachers, learners, and students are available, but the experiences and PCK of lecturers, who teach students and teachers, who ultimately teach learners, need to be explored. When lecturers' voices are heard and included, the teaching and learning of queer inclusive education (i.e., PCK) could be enhanced.

Against this background, the present study addresses the following research question: *What perspectives and suggestions do language lecturers from a university have regarding contextually responsive teaching strategies that support the inclusion of queer identities in language classrooms?* I engaged with tertiary-education language lecturers from a South African university, who teach Language for Education (Afrikaans, English, Setswana, or Sesotho for Education)[3], to provide insight towards the PCK of queer identities[4]. The study followed a qualitative case-study design within Mezirow's transformative learning theory to contribute to the development and change of language in South Africa. Purposive sampling and questionnaires as data-generating methods and content analysis as a data analysis strategy were also utilised to contribute towards the discussions on queer-themed developments in aspects of language education.

The next section focuses on Mezirow's transformative learning theory as a theoretical framework for this study.

Theoretical Framework

Mezirow (2003, 58) defines transformative learning as "the process by which we transform problematic frames of reference (mindsets, habits of mind, meaning perspectives) – sets of assumption and expectation – to make them more inclusive, discriminating, open, reflective and emotionally able to change". O'Sullivan (2003) and Motsisi (2023) further elaborate that transformative learning entails experiencing a profound and fundamental change in the core assumptions regarding thoughts, emotions, and behaviours. This consciousness shifts significantly and permanently transforms one's existence in the world. Such a transformation encompasses one's self-understanding and self-identity, connections with other individuals and the natural environment, comprehension of power dynamics within the interconnected structures of gender and class, bodily awareness, visions for alternate lifestyles, and a sense of potential for peace, personal happiness, and social justice. Fleming (2018) also explains that this process can occur in a deliberate, inadvertent, or subconscious manner, and that each scenario offers a nuanced framework of available interpretations. At times, or during various phases of life or in reaction to significant events, a feeling of discomfort or a realisation that things are misaligned can emerge, indicating a need to reconsider how one interprets meaning. Such experiences catalyse transformative learning by encouraging one to examine what one previously accepted as given truths.

[3]Though South Africa has 12 official languages, Afrikaans, English, Setswana, and Sesotho (at the university in question) are the only available languages students can specialise in when completing their B.Ed. undergraduate degree.

[4]This study was only a subdivision of a larger study – additional information was provided for context when needed.

Hence, the objective of transformative learning is to assist one in altering the assumptions one currently holds – it can be accomplished when one, for example, gains the ability to view things from a different perspective by employing metacognitive reasoning (Christie et al., 2015; Dirkx et al., 2018; Mezirow, 2003; Motsisi, 2023; Rojo et al., 2022). The body of work surrounding transformative learning, thus, provides an opportunity for a more profound, yet logical and intellectual, understanding of self-awareness.

Considering this self-awareness, transformative learning encompasses both the expressive and instrumental aspects of the mind, emphasising the need to adapt to the demands of reality while also strengthening relationships with others and with oneself. The awareness of the several selves that make up one's identity, both as an individual and as a member of a group, is indicated by the self-understanding that results from this coherent approach. One can start to appreciate the complexity of the identities that shape who one is and who one is becoming when imaginative engagement and critical self-reflection are seen as two crucial elements of a wider integrated process of self-understanding (Dirkx et al., 2018).

Regarding education, Fleming (2018) explains that communicative action, which involves social transformation through forms of open democratic dialogue, represents the necessary conditions for transformative learning. Considering educators, transformative learning focuses on the educator's direct involvement in nurturing the skills, insights, and attitudes needed for critical contemplation of assumptions and active engagement in critical-dialectical dialogue. Adult education is crucial for creating the conditions and skills needed for successful adult cognitive processes, as well as the mindset required for transformative learning. Educators, accordingly, become cultural advocates and critical-thinking facilitators who improve the social and political contexts necessary for more widespread, unrestricted participation in thoughtful democratic settings.

However, Taylor (1997) cautions that, despite considerable support for Mezirow's transformative learning, the process of changing one's perspective requires reevaluation. A learning process must acknowledge the importance of context, the diverse nature of the process' catalyst, the diminishment of critical reflection and the augmentation of other modes of knowing and relationships, as well as general expansion of the definitional outcome of a change in perspective. More research is needed, particularly in the areas of cultural diversity, the nature of critical reflection and its connection to other modes of knowing, and promoting transformative learning in the classroom.

As a result, Mezirow's transformative learning theory is a suitable theoretical framework for this study, as Language for Education educators partook in a communicative dialogue to reflect on the inclusion and teaching of queer identities in the language classroom, critically contemplating and being self-aware of the topic in question to promote social justice in the South African context. By offering a prism through which to view how lecturers critically consider and challenge their pre-existing assumptions, attitudes, and practices, transformative learning assists in informing the understanding of their responses. It draws attention to instances in which lecturers exhibit changes in viewpoint, signifying a greater understanding of oneself, of other individuals, and the larger social environment of education. By using

transformative learning, the analysis can find evidence of both professional and personal change that supports inclusive pedagogy and social justice objectives.

Additionally, the conceptual framework for this study was PCK.

Conceptual Framework

Shulman (1987:8) defines pedagogical content knowledge (PCK) as "the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organised, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction". Thus, there is a "special amalgam of content and pedagogy". Shing et al. (2015) agree that PCK is described as the blending or integrating of content and pedagogy, which essentially addresses "the 'what' and 'how' of teaching".

Sarkar et al. (2024) elaborate that PCK can be used to comprehend how educators create educational activities and modify their subject matter to make it relevant, understandable, and developmentally appropriate for students. Thus, PCK creates a strong knowledge base for developing superior teaching competency by connecting teaching and learning knowledge.

Abell (2008) confers and suggests that PCK remains a valuable idea since it can allow educators to engage with the teaching process and produce viable instructional strategies. Moreover, Berry et al. (2008) emphasise that although PCK as teacher professional knowledge is challenging to define, classify, communicate, and document, it is becoming more crucial to do so because it is educators' professional knowledge. Furthermore, the compilation of the effective instruction of knowledgeable and experienced educators from studies on topic-specific PCK can serve as resources in teacher education programmes as well as guidance to improve instruction.

Next, the research design, methodology and methods, and ethical considerations of this study are explained.

Research Design, Methodology and Methods, and Ethical Considerations

Qualitative Case-Study Research

Case study is one of the most employed research designs in qualitative methodological research (Priya, 2021). Cresswell (2014), Ary et al. (2002), and Kekeya (2021) explain that case studies represent a qualitative design – which should not be considered merely as a method for data generation (Yin, 2009) – but be employed to analyse a social unit in which the researcher investigates one or more events, programmes, processes, or activities in depth. Priya (2021) and Kekeya (2021) agree that case-study research involves a thorough examination of the chosen case or cases of analysis within their natural contexts, with single case studies being the most frequently encountered.

In a descriptive case study, the objective is to depict a phenomenon in detail within its real-world context (Kekeya, 2021; Priya, 2021). "Descriptive" refers to the result or outcome of a case study since thick descriptions signify that comprehensive

and authentic data are provided from participants, allowing meanings to be drawn based on that data. However, it should be noted that the qualitative case-study research design is often critiqued for the belief that generalising from a detailed study of a single case is not feasible (Priya, 2021) and that its findings may be overstated or misrepresent the specific phenomenon being examined (Kekeya, 2021). As a result, incorporating queer-themed content in the language classroom in South Africa, along with tertiary language educators' views, constitutes the single qualitative case study for this study.

Purposive Sampling

Stratton (2024) explains that purposive sampling is a method of population sampling whereby a researcher chooses research participants according to their experiences, traits, or membership in a group of interest. Palinkas et al. (2015) concur that purposive sampling is frequently employed in qualitative research to find and choose cases that are rich in information on the topic of interest.

For this study, participants needed to be language educators at this specific university in South Africa who teach within the Senior and Further Education and Training (FET) Phase[5]. There were 15 participants in total: 12 were language lecturers and three pre-service teachers. However, only eight language lecturers answered the relevant part of the questionnaire. Additionally, the pre-service teachers' responses were excluded rather to give a voice to the language lecturers' experience and viewpoints.

Questionnaires

Questionnaires, as a means of a data-generating method, can be employed in qualitative case-study research (Priya, 2021). Tombs and Strange (2024) briefly explain that the questionnaire method asks participants to self-administer and submit their answers on their own, as opposed to requiring direct engagement with the researcher.

Data for this study were gathered through online open-ended questionnaires distributed via Google Forms. The instrument was designed to capture lecturers' experiences, attitudes, and strategies related to teaching and learning about queer identities. Participants were invited to reflect on:

- the importance of contextual awareness in inclusive education;
- ways to introduce queer identities appropriately and respectfully in language classrooms; and

[5]Though not discussed in this study due to its limited scope, these criteria were justified since the language lecturers received sample lessons tailored for the Senior Phase (Grades 7–9, ages 13–15) and FET Phase (Grades 10–12, ages 16–18).

- strategies for addressing queer-related topics in contexts where explicit inclusion may be restricted.

Thematic Content Analysis and Coding

Hsieh and Shannon (2005) define content analysis as a data analysing strategy that uses a systematic categorisation process of coding and theme pattern identification to analyse the content of text data subjectively. Coding, furthermore, involves identifying key elements within the data and subsequently defining and labelling them according to what the data represent – researchers create codes as they engage with and analyse their data (Priya, 2021).

Table 1 outlines an example of thematic content analysis and coding, and its application to this study.

Table 1. *Example of Thematic Content Analysis and Coding*

Name	Response	Coding
Charlie	"We should really trot lightly. One can use newspaper articles for activities, but forcing a curriculum will not, in my opinion, always have the effect we want it to have."	Rejection – no suggestions provided. Uncertainty – no suggestions provided. Positive – suggestions provided. Hesitation – link to uncertainty.
Dakota	"It should not be included."	
Quinn	"I really have no idea."	
Jackey	"I am not sure, especially in a language classroom."	
René	"I do not think it should be included."	
Tatum	"Prescribed literature may incorporate some of these topics, even though they may not be dealt with explicitly. Additionally, additional reading or exposure can be provided to learners who wish to explore such topics."	
Hunter	"I do not think teachers teach only what they like. Be a creative teacher in any situation you find yourself in. History is taught even though some people do not like some topics."	
Jordan	(No answer was provided.)	

Source: Uys 2023.

The codes "Rejection – no suggestions provided", "Uncertainty – no suggestions provided", "Positive – suggestions provided", and "Hesitation – link to uncertainty" emanated from the data. When referring to Table 1, red indicates that two participants rejected the inclusion of queer identities in the language classroom. Yellow shows that two participants were unsure how to include queer identities, and one participant did not provide an answer (possibly due to uncertainty, disinterest, or overlooking the question). Green signifies a positive response and includes examples of including

queer identities into the language classroom, while purple indicates some degree of uncertainty in the response.

By being reflexive and critically analysing my own presumptions, biases, and influence on data interpretation, I was able to ensure researcher validation. To guarantee the accuracy and representativeness of the participant's viewpoints, member checking (i.e., my promoters) confirmed my interpretations.

Ethical Considerations

This study was carried out in South Africa during the Covid-19 pandemic. Therefore, it was recommended that the recruitment process be conducted online since the country was still in lockdown. It was also advised by the scientific and research ethics committees of the university in question that anonymity be ensured due to the sensitive nature of the study. Therefore, a public platform needed to be used for recruitment instead of directly reaching out to potential participants. This public platform was essential to maintain transparency, fairness, and anonymity in the process.

The platform chosen was the university's Learning Management System (LMS) with the assistance of an independent person. The participants could access the instructions for the Google Form questionnaires along with the informed consent form by clicking on the provided link in the advertisement. The informed consent also indicated the awareness of sociocultural risks in researching queer issues in South Africa, and that the participants could leave the study and/or choose not to provide an answer at any time. To accommodate potential religious and cultural sensitivity of the topic, the university's emergency helpline was provided to the participants should they experience any distress or uneasiness.

A total of eight Language for Education tertiary lecturers (who specialise in Afrikaans, English, Setswana, or Sesotho for Education) completed the questionnaires, and pseudonyms were assigned to protect their identities – though the population sample is small, rich data were still gathered, providing me with the opportunity to engage in-depth with the data. Flyvbjerg (2006, 241) explains that "[t]he advantage of large samples is breadth, whereas their problem is one of depth. For the case study, the situation is the reverse". Thus, for this study, the sample is small (i.e., limited breadth), but it has an advantage in data depth.

Approval for the study was granted by the appropriate research ethics committee, with ethics number 01053-21-A2, as well as gatekeeper permission, reference GK-21-081.

The following section focuses on the analysis of the data received.

Analysis of Responses

Acknowledging the Importance of Context

The first question of this subdivision study was: *Why is it essential for educators to understand their context – time constraints, learners' abilities and language skills, available resources, and prior knowledge – when planning and delivering lessons?*

> Charlie shared that it "is the only way that you will be able to meet students and learners where they are and work from there. Without understanding the context, one could include aspects and content that will only hold teaching and learning back. You can only really teach when you understand whom you are teaching".
>
> Jordan stated that the context "influences what and how you will teach learners".
>
> Dakota asserted: "To make work applicable".
>
> Quinn revealed: "So that the appropriate teaching method can be determined to accommodate diverse learning styles of learners".
>
> Jackey reported: "[To] accommodate the linguistic, cognitive, and social needs of students. Also, it acts as a guide for what to teach and how to teach".
>
> René said that "it is important to keep the context in mind when teaching so that the correct real-life applications can be made to the learners or students they are teaching".
>
> Tatum's response to the question was: "It is important to ensure that the lesson is relevant to the learners' personal lives. When content is interesting and meaningful to the learners, they are more engaged and excited to learn".
>
> Hunter said that "language changes with time. People in different places speak and behave differently. So, teaching in rural areas will force you to change as a teacher to accommodate your learners; you consider all these factors when choosing books for learners. The main objective is to see language skills develop: reading, speaking, listening and writing. You teach all the skills in different relevant themes".

Charlie and Jordan highlighted how important it is for a language lecturer to understand their context because it will be hard for them to teach effectively if they do not know who their learners or students are – references are thus made to PCK: "how" to teach "what" (Shulman, 1987:8; Shing et al., 2015). Additionally, Charlie pointed out the prior knowledge that students bring to the language classroom. A language lecturer will be better prepared to expand on their students' existing knowledge if they can determine what they already know about, for example, queer individuals, sexual orientations, gender identities, heteronormative societies, and queerphobia. The language lecturer can, therefore, determine where to begin teaching when students know very little or nothing about these topics. Thus, it is advised that teachings on queer identities are included in pre-service education, as these teachers will teach what they were taught (Francis, 2017). Charlie also mentioned that if one

were unaware of the context, teaching and learning may be hindered. For example, queer-themed topics are frequently seen as controversial and may face strong opposition from religious communities, families, friends, and the general public – Munongi (2023) and Buli-Holmberg and Kamenopoulou (2017) mention that although inclusive education implementation could be challenging, it remains achievable to address existing disparities. Nonetheless, the effectiveness of teaching and learning will be improved if a language lecturer is certain that queer-themed content can be incorporated into their institution's curricula (by alerting the relevant parties), particularly in contrast to circumstances where there is opposition to the content – as a result, there needs to be a strong PCK foundation (Krause-Wicmann et al., 2025).

Dakota employed the term "applicable". This adjective can be connected to the lower-cognitive verb "applying" in Bloom's taxonomy. Educators should consistently inform their students about the relevance of what they are being taught – students must engage with how the material relates to their daily lives, as opposed to focusing solely on abstract thinking – there should be sustained growth (Egne, 2022).

Quinn emphasised several factors that should be considered when it comes to teaching in a particular context: suitability, teaching approach, adjustments, and varied styles of learning. Concerning this study, it is essential to utilise an appropriate (and effective) teaching approach – such as Backward design to lesson planning (Wiggins & McTighe, 2005; Uys et al., 2021) – along with selecting suitable queer-themed resources. The chosen texts (e.g., literature, scenarios, and case studies) should not reinforce any hesitations or insecurities that educators and students may have towards queer-themed content. If they perceive a text as suitable for their age (for instance, one that does not include inappropriate language or explicit scenes), they will be more inclined to engage in teaching and learning about the topic. In this context, Quinn also highlighted the importance of diverse learning styles. Diverse learning styles suggest Gardner's theory of multiple intelligences (Gardner, 2011). The educator can target all the students' primary intelligences by using the Backward design, as this allows them to create instructional strategies and learning activities (such as written or verbal scaffolding activities with or without the use of technology) that aid in reaching the lesson's aims and objectives. Sarkar et al. (2024) and Shulman (1987) agree that PCK assists educators to modify their teaching and learning for it to be relevant, understandable, and appropriate in diverse contexts.

Jackey placed a strong emphasis on teaching the "what", the "how" (Shing et al., 2015), and the "accommodation". They also referred to the needs of the students. For many students, developing queer literacy is essential, regardless of whether they identify as heterosexual or queer, religious or unreligious, and/or part of a certain culture. Developing queer literacy can aid individuals in self-discovery, queerphobia prevention and treatment, and supporting marginalised groups in heteronormative settings.

Though not discussed in this study, René[6] expressed a strong disagreement grounded in personal beliefs. In their response, René referred to "correct real-life applications". Since queerness deviates from Christian[7] principles and the heteronormative norm, they might consider it to be immoral. Rejecting or merely tolerating queer individuals could be viewed, from René's point of view, as the "correct real-life application" to follow,

[6]The reader may consult Uys et al. (2023) and Uys et al. (2025) for additional information on René.
[7]René identified as a Christian.

rather than urging students to accept or celebrate variation in queer identities. However, like Dakota, René linked the experiences of students in the classroom with those outside of it, and they ought to learn things that apply to their everyday lives.

Tatum highlighted the significance of connecting with the students themselves, emphasising that the material presented should hold relevance, interest, meaning, and engagement in their lives. In essence, lessons should have a purpose, such as educating students about queer identities and strategies to combat queerphobia. Buli-Holmberg and Kamenopoulou (2017) reiterate that practices and policies need to be modified to address students' unique needs. Tatum also used "excitement": certain individuals (like queer individuals and their allies) may be more enthusiastic than others (like heterosexual individuals) to learn about queer identities. However, if the educator can creatively introduce queer-themed content to their students, many of them can develop an interest in learning more about queer identities that challenge traditional heteronormative perspectives. Tatum's response aligns with Abell (2008), who states that PCK is valuable, as educators produce sustainable instructional strategies by engaging with the teaching process.

Hunter's insight emphasised the evolution of language. For example, we currently use Late Modern English. Early Modern English, Middle English, and Old English were spoken several centuries ago. Although the future of English remains uncertain, it is obvious that language is changing quickly. Similarly, queer topics were and are still taboo for many individuals, but there have been notable developments in the opposite direction over time (i.e., a change in perspective due to transformative learning – Mezirow, 2003; O'Sullivan, 2003; Motsisi, 2023; Fleming, 2018). Perceptions change along with language, and even if one disagrees with a shift, it is important to recognise it. The saying "knowledge is power" stands in stark contrast to the saying "ignorance is bliss", since knowledge enables people to make decisions that are advantageous to society as a whole. Hunter also highlighted diversity, pointing out that many individuals were unique because of their identities, races, faiths, civilisations, societies, languages, and more. This uniqueness implies that Hunter wanted to emphasise that individuals should not be forced to fit into society and conform to heterosexuality and heteronormativity (Francis, 2017). There will be individuals who oppose change and generate strife should they be forced to be someone they are not. Rather, inclusiveness depends on fostering variety.

Hunter also skillfully highlighted the difficulties in rural regions. It can be more challenging to include or teach queer-themed topics in rural areas as opposed to semi-rural or urban ones. Hunter seemed to imply that rural communities are typically smaller and less diverse. Although this might be true, Sharp and Lee (2017) observe that diversity levels are steadily rising in rural areas, but this may be the case when compared to urban areas. Hunter, therefore, thought that if a language lecturer wanted to include queer-themed topics in their lessons, it was advised that they modify their strategy to suit the needs of their students. This modification is in line with Mezirow's "perspective transformation", which is a change in perspective that affects not just the language lecturer, but also the students, parents, guardians, and the community at large.

Like Quinn, Hunter addressed the appropriateness of queer-themed topics, emphasising that knowing the context would help language lecturers to choose

relevant resources for their classrooms – Taylor (1997) emphasises that students' contexts must be acknowledged in the learning process. Hunter also mentioned the importance of language in developing speaking, writing, reading, and listening abilities. To accomplish this development, a variety of themes may be used to meet the goals related to language education. To accomplish educational goals successfully, it is advised that language lecturers consider the wider implications (such as preparing students for the reality and its future challenges) regarding language education and the complementary materials accessible.

Introducing Queer Identities Suitably and Respectably

The second question was: *How can queer identities be introduced respectfully to students with limited knowledge of the topic?*

> Charlie answered that "this [a literature or context approach] is an approach across disciplines. In Life Skills, learners and students are learning about these identities. If they still do not know anything, I think that it is important to do it from the literature that you are working with. Talking about these identities without the text's context will seem like a lesson, but discussing it from the particular characters opens the door to exploring it with the students. Talk about what 'Jim' is feeling. However, I do not think that we should give a sex lesson within the language classroom. I would approach the issue from the characters in the text just like I would do with all social issues".
>
> Tatum answered as follows: "I think providing them with objective definitions of queer identities is the best start, as media and other resources provide subjective views, which may not be the best approach for such controversial topics".
>
> Jackey stated, "I think one can approach this [queer-themed content] through open dialogue. There may also be suitable and age-appropriate videos, films, or texts to share with the learners".
>
> Quinn suggested that "one can use colours to orientate learners about the reasons which were used for gender association".
>
> Hunter stated: "Start by letting them tell you what they already know from their homes and families".
>
> Dakota stated that "this [the teaching and learning of queer identities] should happen at home and not at school".
>
> René corresponded that "this is a personal matter that must be taught by parents in a personal setting at home".

Charlie noted that students who lack or ignore knowledge of particular topics are present in many fields of education, not only language studies. Nevertheless, language lecturers can use literature and its literary elements to teach queer-themed topics to students who do not know enough about them. Charlie also highlighted that when a subject was related to a literary work and its characters, students may get more

interested in it. Classrooms can encourage active participation through conversations rather than a teacher-centred approach. Charlie's suggestion of implementing open dialogue links to Fleming's (2018) communicative action (i.e., open democratic dialogue), resulting in transformative learning. Charlie further emphasised that teaching students about sex itself should not take place in a language classroom. Sexual issues are directly addressed in subjects like Life Sciences and Life Orientation. For example, a needs assessment called comprehensive sexuality education is conducted in Life Orientation to help students clear up any misunderstandings they may have about sex, sexual orientation, and gender identities (Department of Basic Education, 2021); another example is creating intergroup dialogue meetings to provide safe spaces to engage with queer-related topics (Brown, 2020). Structured lesson plans are also provided to service teachers to assist them in navigating this sensitive topic. Lees (2017) and Nzimande (2017) additionally provide educators with responsibilities when teaching sexual diversity in the classroom.

Tatum distinguished between objectivity and subjectivity, arguing that impartiality and fairness should be prioritised over potentially biased or prejudiced viewpoints when discussing contentious issues. Combining dictionary meanings with queer identities developed through scholarly study to provide definitions that are understandable for students is one method of reaching the recommended objectivity Accordingly, Tatum has used her PCK as a resource to improve instruction in teacher education programmes (Berry et al., 2008). Importantly, Tatum additionally alerted educators about subjective materials and media – incorrect, vague, or discriminatory information could be shared and absorbed, which could challenge or hinder a transformative mindset.

Hunter emphasised how crucial it was to comprehend students' prior knowledge. To determine the students' current understanding of queer identities and to create a strategy for the future, the language lecturer can give a baseline assessment (such as multiple-choice or short-answer questions). Language lecturers can, therefore, determine – by evaluating prior knowledge – whether students have received queer identity instruction at home, whether there is a knowledge gap, and, if pertinent, whether their viewpoints are objective or subjective. Educators can utilise Backward Design to Lesson Planning (Wiggins & McTighe, 2005; Uys et al., 2021, which follows a constructivist approach, addressing the importance of students' prior knowledge.

Jackey discussed the importance of open conversations involving educators and students (i.e., Fleming's (2018) communicative action). In addition to these discussions, sample lessons can serve as models for educators when creating their queer-themed lessons (see Uys, 2023). Like Tatum, Jackey highlighted the use of multimedia as a resource. However, caution was advised when it came to videos, films, and texts that could be found online. If someone searches for content incorrectly, they might unintentionally land on a pornographic site or sources that contain explicit content, which could expose students to inappropriate material that is also illegal for individuals under 18 years old.

Quinn favoured a creative approach to presenting queer identities to students. Quinn proposed using colours to educate about different queer identities – many individuals confuse sex with gender and sexual orientations with gender identities, or vice versa, believing these terms can be used synonymously. Additionally, concerning the definitions of queer identities, colour will aid students, particularly the spatial-

visual intelligence (Gardner, 2011), in distinguishing among these identities. Thus, Quinn's PCK could also aid her in creating her own resource to improve inclusive instruction in teacher education programmes (Berry et al., 2008).

Dakota and René concurred that queer education should not be part of school curricula but should instead be imparted by parents and guardians at home. One cannot help but question whether this information will be communicated correctly in an open and unbiased manner and in a way that disparages any divergence from heteronormativity (if shared at all). Moreover, while an educator's role is to educate, parents also have a teaching role (e.g., informal daily activities such as dental hygiene and instilling respect), but their lessons differ from an educator's content-specific trained teachings (like English, Mathematics, and Life Orientation). Additionally, it is the right of every parent or guardian to express their perspectives – whether positive or negative – on varying queer identities. However, to stop violence against those who are viewed as different, parents or guardians have an obligation to society to instil in their children a sense of tolerance, acceptance, or celebration from a young age. It is advised that people's identities accommodate queer individuals and resist structural dictates (Msibi, 2018).

As a result, prescribed literature (e.g., videos, films, texts), open dialogue, self-directed scholarly study, scaffolding and assessments, to name a few, are illustrated as inclusive practices by the participants.

Including Queer Identities in the Language Classroom with Obstacles in Mind

The third question was: *How can queer-related topics be meaningfully integrated into the curriculum when an educator is unable or prohibited from explicitly introducing queer-themed lessons in the classroom?*

> Charlie thought that "we should really trot lightly. One can use newspaper articles for activities, but forcing a curriculum will not, in my opinion, always have the effect we want it to have".
>
> Tatum thought that "prescribed literature may incorporate some of these topics, even though they may not be dealt with explicitly. Additionally, additional reading or exposure can be provided to learners who wish to explore such topics".
>
> Hunter said: "I do not think teachers teach only what they like. Be a creative teacher in any situation you find yourself in. History is taught even though some people do not like some topics".
>
> Quinn said: "I really have no idea".
>
> Jackey said, "I am not sure, especially in a language classroom".
>
> René, contrastingly, said, "I do not think it should be included".
>
> Dakota agreed that "[i]t should not be included".

Instead of evaluating students on queer-themed topics directly, Charlie might be approaching the problem indirectly (that is, through the lens of the

hidden curriculum – Rossouw, 2024). For example, there might be an authentic newspaper article about violence or discrimination against queer individuals, or even about a pride event. A literary text with an explicit queer-themed topic may elicit strong reactions from parents, guardians, or society at large, but an article or two with queer-themed topics may elicit other responses. Charlie argued against imposing a particular curriculum because there was the possibility that the outcomes would not meet one's expectations. Regarding the current study, queer-themed topics ought to be seen as an enrichment of the current curriculum rather than as a compulsory inclusion. However, a language lecturer should handle queer-themed issues carefully if there is any resistance.

Tatum advocated for the indirect teaching of queer-themed content – Geer and Brown (2023) affirm that direct instruction-based methodologies can be limiting to student interaction and, therefore, propose an indirect approach. These topics are not confronted directly but approached from a subtle perspective. Tatum also recommended that students interested in delving into queer-themed content should be given supplementary reading materials to facilitate their exploration. This suggestion indicates a choice available to those who want to teach or learn more about queer identities. However, it should be noted that there is some uncertainty from Tatum's side, as they do not want to teach the content explicitly[8].

Hunter addressed language educators. Given the breadth of the curriculum, it is logical to assume that not all topics will be approached with the same zeal; educators' comfort levels with queer-themed matters are crucial. For example, because of South Africa's history of apartheid, white South African language lecturers and students may feel uncomfortable when racism is discussed in the language classroom; similarly, men may feel uncomfortable when feminism-related themes arise. These topics are still covered in the teaching and learning process, though. Thus, language lecturers and students may not be enthusiastic about studying queer-themed topics, but these issues remain pertinent to modern society and need to be addressed to solve the persistent problem of queerphobia. Supporting Graff's (1992) suggestion that "the conflicts" be taught, Kissack (2001) argues that if there is a commitment to social justice that aims to stop discriminatory acts in the future, then texts that convey pessimistic, sexist, or racist viewpoints should not be disregarded.

Quinn's reply could be viewed from various angles. It could be seen as a hesitation to propose an idea, an indication that the concept is too strange to contemplate, or a lack of the requisite PCK to think about incorporating queer-themed content. Jackey, like Quinn, was also uncertain about how queer-themed content could be incorporated into the language classroom. One might wonder whether they mean that queer-themed content should rather be addressed in alternative subjects (e.g., Life Sciences or Life Orientation), or if they have simply not considered the possibility of including such content. The role of Language for Education educators in language classrooms often entails promoting the expression of diverse perspectives, challenging widely accepted views, and encouraging strong personal reactions. Tanga et al. (2019) agree that all involved

[8]Though not discussed in this study, Tatum had a tolerable view towards queer identities, as the most prominent obstacle was their Christian beliefs and values.

parties have the obligation to teach and learn about South African diversity; Francis (2017) additionally mentions that the promotion or enforcement of compulsory heteronormativity and heterosexuality should be further avoided. This was why Jackey's statement seems limited, as the language classroom can provide multiple opportunities for different topics and themes to be explored and discussed.

It is alarming, though, that Quinn and Jackey were unsure about queer-themed content, not being able to offer any recommendations for its inclusion in the language classroom – this can be considered a sign of inexperience and a failure to imagine the possible integration of queer-themed content. This insecurity could also be the result of insufficient professional development in undergraduate inclusive pedagogy. Thus, Brown (2020) expresses that educators need skills (i.e., PCK) to facilitate a learning environment and to negotiate a mutual influence.

Rene and Dakota differed slightly from each other. Although both participants had negative opinions, Dakota seemed to be more determined to reject the inclusion of queer-themed content, while René was hesitant and implied doubt. Nevertheless, neither participant made recommendations on how to include queer-themed content in environments that do not accept them. Unfortunately, René and Dakota were against queer-themed content being taught in educational institutions – this rejection could be an indication that they believe their viewpoints are unquestionable and correct.

Findings and Discussion

There were three categories in the analysis section: (1) *Acknowledging the Importance of Context*, (2) *Introducing Queer Identities Suitably and Respectably*, and (3) *Including Queer Identities in the Language Classroom with Obstacles in Mind*. The findings collectively highlight the crucial role of contextual awareness, pedagogical sensitivity, and educator preparedness in fostering inclusive language education that addresses queer identities.

The theme *Acknowledging the Importance of Context* illustrates that an educator must be aware of their context to determine the requisite PCK accurately to fulfil the lesson's aims and objectives. Additionally, this awareness is essential for real-world applications beyond the classroom to support or enhance social justice. The acknowledgement that teaching and learning ought to be "meaningful", "relevant", and "applicable" is prominent in the participants' responses. Additionally, the participants mentioned that understanding one's context will improve one's capacity to accommodate the various intelligences of all learners or students, thereby mitigating constraints and crafting existing knowledge among educators and students, promoting a deeper understanding of a language and its associated skills.

In *Introducing Queer Identities Suitably and Respectably*, outside some participants who hold the view that discussions about queer identities should begin at home, the other participants suggested utilising queer-identity definitions, multimedia resources and forms of literature, existing knowledge, open conversations, and gender-related contexts that suitably tackle the subject matter for its introduction.

In *Including Queer Identities in the Language Classroom with Obstacles in Mind*, it does not go unnoticed that only three Language for Education lecturers were able to provide suggestions for including queer-themed content in the language classroom. As previously mentioned, lecturers teach pre-service students in tertiary education who eventually become in-service teachers who teach learners in secondary education. Consequently, when the lecturers themselves have limited or no experience, pre-service students will not be educated on queer identities, which influences learners being educated on queer-themed content. Many programmes seek to increase knowledge of queer identities and queer concerns (e.g., sexuality and gender-focused programmes that provide advisory services, professional training, and a supportive environment within communities confronting discrimination, stereotypes, and queerphobia). Even though these initiatives are admirable and could successfully raise awareness of the difficulties encountered by students with alternative queer identities, learning about queer characters in the language classroom, who experience rejection and marginalisation in texts, offers a more relatable and intimate viewpoint on these topics than conventional teaching techniques in alternative subjects. Accordingly, language lecturers and service teachers need training regarding queer identities to have the necessary PCK for the language classroom; otherwise, queer-themed content could remain absent, neglected, or avoided.

The analysis of the responses revealed three major points of connection: (1) contextual responsiveness as a foundation for inclusive PCK, (2) transformative learning through literature and dialogue, and (3) the reality of resistance and missed transformative opportunities.

Contextual Responsiveness as a Foundation for Inclusive PCK

Mezirow's (2003) emphasis on self-awareness and meaning-making is reflected in how lecturers (Charie, Jordan, Quinn, and Hunter) stress the importance of understanding the teaching context (including learners' backgrounds, readiness, and sensitivities) before introducing queer themes. This affirms Mezirow's claim that transformation begins when educators reflect on their frames of reference, an act many participants perform by acknowledging religious, cultural, and rural constraints that shape teaching decisions. This claim corresponds with the assertion that inclusive pedagogy cannot be implemented meaningfully without adapting to contextual realities.

Transformative Learning Through Literature and Dialogue

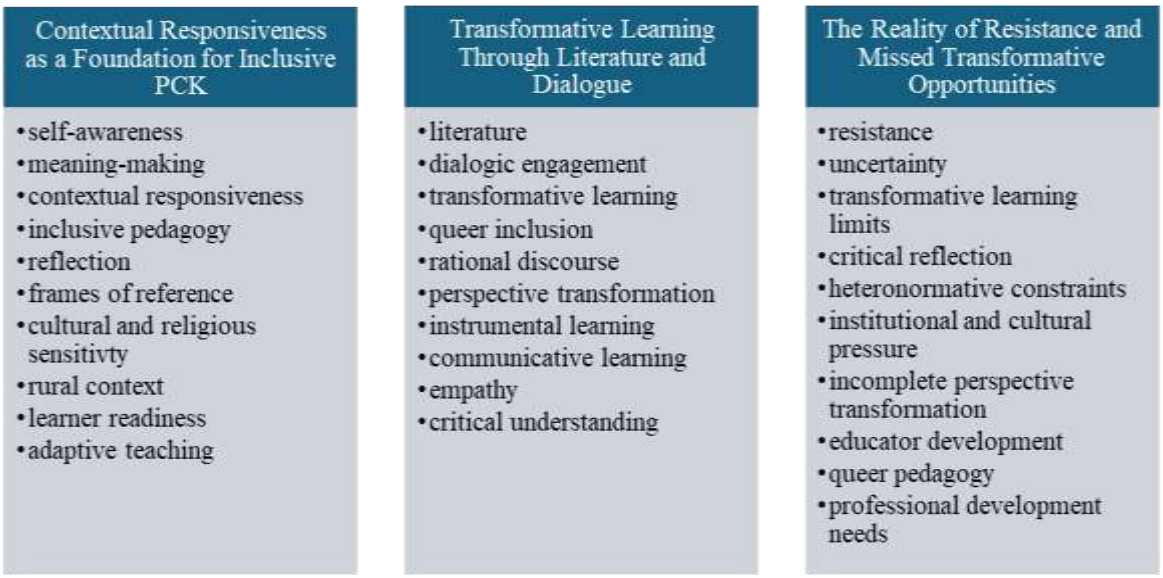
The literature review posits literature and dialogic engagement as gateways to transformative learning. Charlie and Jackey mirror this by advocating for the use of literary texts and open conversations as indirect yet effective means to introduce queer identities. Tatum adds by proposing objective, knowledge-based approaches to counteract biased or misinformed views, aligning with Mezirow's (2003) idea of rational discourse and perspective transformation. These lecturers exemplify instrumental and communicative learning as they seek to equip learners with both conceptual knowledge and empathic understanding.

The Reality of Resistance and Missed Transformative Opportunities

Where the literature review envisions the educator as a critical facilitator of social change, some lecturers (René, Dakota, Quinn, and Jackey) reveal that they do not yet demonstrate full engagement with the transformative processes. Their responses show either explicit resistance or uncertainty in integrating queer-themed topics, especially under institutional or cultural pressure. These moments illustrate the limits of transformative learning in practice when educators themselves have not undergone sufficient reflection or development to teach beyond dominant heteronormative ideologies. Mezirow (2003) warns that without critical reflection, habits of mind remain unchanged. Here, resistance or silence suggests a failure to engage with such reflection, highlighting the urgent need for lecturer professional development on queer pedagogies.

The three major points of connection are summarised in Figure 1:

Figure 1. *Summarised Major Points of Connection*



It is possible to directly connect the lecturers' differing levels of contextual responsiveness, participation in transformational discourse, and resistance manifestations to Mezirow's (2003) key dimensions of transformative learning. Lecturers' awareness of confusing quandaries when they cope with conflicts between inclusive pedagogical principles and contextual limitations (e.g., religious, cultural, or rural sensitivities) is reflected in contextual responsiveness. Reflection on ingrained presumptions and frames of reference is prompted by this realisation. The process of logical discourse through which lecturers and students analyse and negotiate meaning is embodied by transformative conversation, which is supported by literary texts and open classroom discussions. These transformative discussions promote deeper reflection and possible understanding shifts. Alternatively, resistance identifies times when discomfort or institutional pressure preclude critical thinking, causing the transformative process to pause before real perspective change takes place. When considered as a whole, these

dimensions show how transformative learning proceeds unevenly: resistance indicates the limits of transformation, dialogue facilitates reflection, and contextual awareness causes dissonance. Accordingly, the necessity of ongoing reflective and dialogic practices is emphasised to support inclusive pedagogical change.

The discussion confirms that while some lecturers embody the potential for transformation, others remain constrained by personal beliefs, inadequate training, or institutional silence. Therefore, it is necessary to construct inclusive, justice-orientated language classrooms through intentional, theory-informed professional development to equip educators with the tools, confidence, and critical awareness to engage with queer identities meaningfully.

Limitations and Recommendations

Limitations that stem from this study were the small number of Language for Education lecturers who participated in this study and the limited answers that were provided at times – thus, I acknowledge that the use of questionnaires (without interviews) limited interpretive depth. Thus, a future recommendation would be to triangulate data by having face-to-face discussions, group discussions, or interviews to ask for elaborations and the provision of more opportunities for tertiary educators to voice their opinions about teaching and learning queer-themed content.

Conclusion

The introduction and theoretical framework of this study established the necessity of addressing queer inclusion in tertiary language education by foregrounding a research gap: the lack of focus on lecturers' perspectives regarding PCK for queer-themed education. It positions language lecturers as key agents in shaping future in-service teachers' readiness to engage with queer identities in South African schools. Drawing on Mezirow's transformative learning theory, the study proposes that lecturers who engage critically with their assumptions and pedagogical strategies can promote broader social justice and inclusivity. The analysis of responses operationalised this conceptual foundation by demonstrating how lecturers' reflections align with, or resist, transformative learning and contextually responsive PCK.

The participants' insights established a lens for introducing queer identities suitably and respectably to students, outlining what could be covered, the reasons for addressing it, and the methods of exploration. As a result, the perspectives from the university language lecturers contained insightful suggestions about context-aware teaching strategies that support the inclusive and respectful integration of queer themes in language classrooms, policy, and practice – thus, there is a need for updating courses for teachers of all levels. Though not always positive, this study still gave a voice to tertiary language lecturers about including queer curricula and transforming the language classroom.

It is crucial to recognise that, despite this paper's setting in South African tertiary language education, the concepts it emphasises (i.e., contextual responsiveness,

transformative engagement, and careful consideration of learners' preparedness) have wider applicability when considering the ethical and cultural transferability of these findings. Ethically, the focus on considerate, knowledgeable, and tactful methods of teacher queer-themed curricula highlights universal concerns about equity, inclusivity, and preventing harm when introducing potentially sensitive material. Culturally, what is seen as appropriate or successful in one environment might need to be adapted in another to take into consideration local conventions, societal attitudes, and institutional limits. A useful model for educators worldwide, who seek to incorporate queer-inclusive content while navigating various cultural and ethical landscapes, this paper, nevertheless, provides transferable insights into how lecturers' reflective practices and pedagogical strategies can foster inclusive learning environments.

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