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Chilean physics teacher educators' hybrid identities and border crossings as opportunities for agency within school and university

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Abstract

This study examines the sense of agency developed through the hybrid identities of two Chilean educators working across a university physics department (as teacher educators), a secondary school (as part-time teachers), and a self-organized professional community to which they belong. A Freirean conceptualization of agency together with border crossing and hybridity was used as theoretical frameworks. Data were collected through biographical interviews and follow-up conversations. A critical narrative approach was used for analysis. Findings suggest that the two physics educators encountered a hegemonic culture of physics education characterized by different hierarchies and tensions, such as the devaluation of pedagogy, lack of spaces for dialogue, and a punitive view of assessment. Nonetheless, evidence showed that by crossing the borders of different communities, the participants problematise their boundaries. Through their hybrid identities position, the participants enact their agency to contest such boundaries bringing new practices particularly to the physics department, such as offering spaces for collaboration, allowing others to cross boundaries between the school and the university, and across science disciplines. It is argued that such identities can provide new

learning opportunities for their students and their colleagues. Moreover, evidence showed that the community to which participants belong acts as a space for cultivating hope, stressing the need for collective spaces for rethinking our practices. As such, their hybrid identity position offers a counter-narrative to the idea that university physics departments hold only a traditional and banking view of physics teaching and knowledge. Hence, this study offers evidence of how the two physics educators disrupt the boundaries that limit who the teacher educators are and the practices they engage with, highlighting the need for more schoolteachers contributing to initial teacher education. Such a new actor could offer more narratives for future physics teachers to negotiate their ideas about pedagogy and physics.

KEYWORDS

agency, border crossing, identity, physics teachers, teacher educator

The life and work of teacher educators in the context of science education generally (Fu & Clarke, 2019), and in the Latin American context specifically, have both been under-explored (González-Vallejos, 2018). Most post-2010 studies focus, almost exclusively, on the transition between being a school teacher and becoming a teacher educator (Williams et al., 2012). Thus, a primary focus of previous studies has been the complexity of changing from teaching young people to teaching adults (Murray & Kosnik, 2011) and the professional development required to make such a change (Loughran, 2014). Far less attention has been paid to other aspects, such as teacher educators' pedagogical content knowledge (Faikhamta & Clarke, 2013), how they cope with multiple tasks, such as teaching future teachers, researching, and coordinating with schools (Lunenberg et al., 2014; Shagrir, 2015), or how neoliberal policies conflict with their identities and agency for a justice-oriented teacher education (Black et al., 2017).

As Wallace (2018) argues, teacher educators work in the "making [of] science people" (p. 1050), where "each decision, desire, and idea have material outcomes on (and within) the lives of others" (p. 1050) such as preservice teachers and, directly or indirectly, school students. As such, what teacher educators do (or not), and what kind of pedagogies they engage with, are crucial to either reproduce or contest dominant values and practices in teacher education.

An emerging area of research is teacher educators' agentic practices within neoliberal structures, working under different accountability measures, such as quality assurance and accreditation processes (Bourke et al., 2018). However, other structural factors in neoliberal contexts continue to be overlooked. In the context of this study, Chile, structures resulting from neoliberal ideologies and a banking logic of education are strongly embedded in the educational system at all its levels (Sisto, 2020) and are usually overlooked in science education research.

A banking logic is defined as a vertical relationship between a "narrating Subject ... and patient, listening objects" (Freire, 1970, p. 71) with can be seen between people (e.g., teachers/students) and institutions (e.g., universities/schools). In science education, this banking logic is reflected in, for example, the historical tension between universities and schools, where the former are seen as the center of knowledge, the ivory tower, and the latter as the object of the study, "based upon historical notions of the flow of information and knowledge" (Carlone & Webb, 2006, p. 545). The same logic could also be seen between types of knowledges and professions, such as disciplinary and pedagogical knowledge. For example, in a study conducted by Larsson et al. (2021), five assumptions within physics teacher education held by physics lecturers were noted. Those assumptions have to do with a shared view of the participants in their study, such that students in physics departments are seen as future physicists who need to be primarily taught physics content. Two of the other assumptions are: (i) that if students decide to teach physics, it is because they do not have the ability to be physicists, and (ii) that by knowing physics content, you can teach it, which presupposes an epistemic hierarchy in which teaching is seen as being lower than being a scientist. If we put these structural problems into the Chilean context, where university-based educators are commonly assessed on individual "performance" and products, thus failing to consider other dimensions of their profession as teaching quality and professional values (Sisto, 2020), we can see how such banking and neoliberal logic permeates teachers' initial education. As Bazzul (2012) states, "[n]eoliberalism's presence in science education not only has to do with intended conscious decisions but also the formation of individual subjects through discourse" (p. 1010).

In physics education research, such discourse has been shown to privilege banking logics of pedagogy (Larsson et al., 2020) with little attention being paid to the experiences of people living within that culture and navigating such discourses (Larsson & Airey, 2021). Drawing on that perspective, teacher educators thus play a crucial role in contesting or reproducing such culture, and, therefore, knowing who they are is essential. In this study, we explore the agentic experiences of two physics teacher educators in order to focus on such experiences from the perspectives of two actors who work both as schoolteacher and teacher educator.

One study that has addressed a similar topic was conducted by Bakx et al. (2016), who invited school science teachers to conduct part-time doctoral studies. The researchers found that some participants recognized key differences between the school and the university setting. For instance, most of the participants recognized the university as being more flexible regarding curriculum materials but were less engaged—being more of a spectator of the communities they were part of.

Although Bakx et al.'s study was conducted with PhD students, who may not necessarily continue in this dual position as a school teacher and as a university academic, the participants' experiences identified an opportunity to narrow the university/school divide by being an actor who crosses the borders of both settings. At the same time, it showed the need to problematise the learning and the relationships within science education for social justice, not only at the school level but also at that of the university, and in particular in teacher education programmes (Morales-Doyle et al., 2021), by creatively looking for opportunities for transformation in daily praxis (Tolbert & Bazzul, 2017). This study, therefore, aims to shed some light on how working at the school and the university informs teachers' agency for educational transformation within both settings. By doing so, this study takes a Freirean approach to education, which means understanding and embracing the socio-political dimension of education and teachers' work. As such, teacher education is a site of contestation, where universities and educators need to frame their praxis in "rigorous, practical, socially just, and democratic teacher

education" (Kincheloe, 2017, p. 503) encouraging critical agency toward a reading of the word and the world, drawing new realities rather than just contemplate it (Freire, 1970).

1 | AIM OF THE STUDY AND THE RESEARCH QUESTIONS

This study aimed to examine the agentic activities of two Chilean physics educators working within the university and school context. In particular, we examine how being both a school teacher and a teacher educator may shape an educator's agency identifying and challenging neoliberal structures within physics education.

The research questions guiding this study are:

1.How does being a teacher and a teacher educator afford opportunities for the participants' sense of agency within the university and school?

2.How does participation in different communities, such as school and university, contribute to a physics educator's transformation (or reproduction) of the practice of science teaching?

2 | THEORETICAL BACKGROUND

This study is grounded in three theoretical constructs to explore the two participants' experiences: agency; border crossing, and hybridity. We begin by introducing the idea of science as culture followed by an explanation of the three constructs.

2.1 | Science education as culture

Teacher education is a complex task that involves working toward encouraging different skills and types of knowledge in the future teachers (Kincheloe, 2017). In the case of science education, that does not mean educating them only in science but about the context where science exists as well as a consideration of *why* and *how* science is taught (Moura, 2019). As such, teacher educators' work involves the shaping of a culture as "a product that is simultaneously capable of conditioning its creator" (Apple, 2014, p. 30). However, we do not exist in the world in deterministic ways. Human agency is essential in terms of production/being produced by dialectical dynamics with such culture (Freire, 1970), where science education could be understood as a subculture (Aikenhead, 1996) and where particular views about teacher education and pedagogy are held. As Osborne (2006) has argued, "science education exists on the 'horns of a dilemma'." On the one hand, we educate students regarding the value of the evidence and, on the other hand, we avoid falling into authoritarian practices as if knowledge is simply to be consumed by students in a banking model, as Freire (1970) would say. In navigating this dilemma, some authors have found that studying and analyzing science education as a cultural world is beneficial, because culture is not a neutral phenomenon and does not exist in a vacuum but, rather, in a system characterized by power dynamics and social stratification (Freire & Macedo, 1987).

As Carlone, Johnson and Eisenhart (2014) have argued, "a cultural lens for science education can be a tool for counter-hegemony" (p. 667) because it can offer possibilities to challenge banking or authoritarian approaches by understanding where they come from and what they look in practice. At the same time, treating science education as a culture means that it has

"norms, values, beliefs, expectations, and conventional actions that are generally shared in various ways by communities" (Aikenhead, 1996, p. 10). In this study, such communities are constituted by the people who contribute to physics initial teacher education—scientists and science educators, among others.

In the context of this study—Chile—such culture is dominated by neoliberal ideologies imposed and reinforced during the dictatorship years. As Mayo (2012) argues, "[t]he Chilean coup d'état brought to an end not only a long democratic tradition in the country but also the idea of education as a human right" (p. 17), imposing a market-driven logic at all levels of education.

Neoliberalism frames education and encourages certain forms of relationships within cultures which frames how we understand ourselves and others (Ball, 2016). A culture identifiable in the Chilean academic context has been described as having a profound productivity logic which creates a "depressing status of teaching" (Muñoz-Garcia, 2019, p. 38), with a focus on measurable products rather than processes "enhancing individual qualities, ignoring the social and contextual dimensions of work" (Fardella et al., 2017, p. 443), with academics with conflicted identities who move between simultaneously wanting a systemic change but at the same time one that is individualized (Fardella et al., 2015). These characteristics have created fragmented environments or what Fardella (2019) has called "golden cages", where the logic of competition, meritocracy, and individualism has colonized academic life and where teaching has been put at the bottom of institutional priorities (Sisto, 2020). The result, which is reinforced by the culture of silence imposed during the dictatorships across the Latin-American region (Freire, 1985), is that a discourse of *apolitical* education has suppressed educators' notions of their work (Cornejo & Insunza, 2013). Science education has not been oblivious to such discourses. The socio-political nature of the field is "the elephant in the room" in the words of Carter (2014), leaving its cultural problems untouched and unknown, and this problem looms even larger in the culture of university physics departments (Larsson & Airey, 2021). As Morales-Doyle et al. (2021) argue, whether conscious or not, "teacher education programs engage in political and ideological education and not simply the decontextualized development of practices" (p. 3). These programmes do not happen in a vacuum, and they occupy a space where ideological and educational projects play a crucial role (Cochran-Smith, 2021). In the context of physics departments in this study, for example, the decisions regarding where to emphasize teacher education continue to be a historical and untouched tension that reflects a prevalent ideological view of the teaching profession (Hernández et al., 2020). These tensions are particularly important to reveal because teacher educators' work involves the "making and unmaking [of] certain kinds of science people" (Wallace, 2018, p. 1055) which could either reproduce the banking dynamics explained before or contest them.

If we engage with a justice-oriented agenda through and within education, then science education's, and particularly physics education's, culture needs to be challenged. A physics education culture that has been shown as having an elite status (Archer et al., 2020), privileging banking pedagogies (Larsson & Arey, 2021), with salient stereotypes such as smartness to belong (Berge et al., 2020), privileging certain identities over others based on gender (Hazari et al., 2010), social class, ethnicity and its different intersections (Avraamidou, 2021). Together with the neoliberal policy scenario of Chile described above (individualistic, meritocratic), the discourses that preservice physics teachers navigate constrain their possibilities for enriching their knowledge toward a justice-oriented pedagogical praxis in their future work—as such, redrawing and rehumanizing the field is an essential task. One of the ways to find spaces for contesting such a culture and to reimagine it, is by learning from the opportunities that teacher

educators identify to exercise their agency that could challenge neoliberal and dehumanized pedagogies and values.

2.2 | Agency as authoring the world in solidarity with others

In this study, we offer a Freirean conceptualization of agency grounded in the concepts of autonomy and hope, as well as authoring ourselves and the world. In general terms, agency is "the personal power to reflect upon one's circumstances and to decide what to do in them or about them" (Archer, 2007, p. 153). Reflexivity is a key dimension of agency, and as Freire (1998) states, it is an imminent characteristic of teachers' work "enable[ing] agents to design and determine their responses" (Archer, 2007, p. 154) in order to act in their material and objective circumstances. This process takes place in a constant dialectical relationship with structures that constrain or enable such responses (Freire, 1970). Thus, reflexivity is not enough, and we need to understand ourselves as capable of transforming oppressive conditions (Freire & Macedo, 1995) being conscious that we live within the world with others (Freire, 1994). Freire calls this process a praxis of reading the word and the world in order to act upon it (Freire & Macedo, 1995). From this perspective, agency is always both individual and collective, since it implies our relationship with others and with the world (Archer, 2007; Freire, 1994) and offers a "critical scrutiny of our own practices and beliefs" (Ball, 2016, p. 1056). In order to examine agency, some authors recommend disaggregating the term into analytical categories to make exploration easier (e.g., Emirbayer & Mische, 1998). In this study, we use the analytical categories of autonomy and hope.

In neoliberal policy contexts, the term autonomy has been co-opted, to frame what teachers can or cannot do, linked to the idea of individual freedom and choice (Davies & Bansel, 2007). Within these contexts, autonomy is usually bounded within a context of competence (Holloway & Brass, 2018). Consequently, people have the unique responsibility for their destiny (Butler, 2009) and are accountable for their success as a result of their good decisions, and their difficulties are interpreted as personal failures (Catanzaro & Wegelin, 2019). In a study conducted in Chile, Fernández et al. (2016) found that teacher autonomy is understood in policy documents as an individual characteristic of teaching which limits space for collaboration and pedagogical reflection. Contrary to this neoliberal view, autonomy is understood in this study as a crucial social dimension of teachers' work, from a Freirean (1998) perspective.

The notion of agency has been used in different studies in education. For example, some researchers have focused on analyzing the close relationship between agency and professional identity (Buchanan, 2015); learning and professional development (Hökkä et al., 2017); social justice (Pantić, 2015); and the context of resisting or implementing educational reforms (Robinson, 2012). In science education, researchers have investigated how to encourage students' agency to empower them to critically analyze scientific problems in their communities (Calabrese-Barton & Tan, 2010), or in terms of learning science out of school (Adams & Gupta, 2017). For science teachers, the focus has been on their response to supporting or rejecting educational reforms (Ryder et al., 2018), and on understanding agency oriented toward social justice (King & Nomikou, 2018; Moore, 2008; Rivera-Maulucci et al., 2015).

In this study, the focus is on two physics educators' agentic moves across educational settings in terms of how they recognize opportunities (and limitations) toward providing meaningful and purposeful learning experiences for all their students, and how their reflections on how their position as both teacher *and* teacher educator may shape these decisions. At the same

time, the intention is to understand how they create a sense of agency, because, in addition to work in the school and university setting, these two teachers are part of a self-organized professional community located outside their workplace. We examine how this collaborative process of making themselves with others, may shape and be shaped by their experiences in other educational settings.

As Moore (2008) argues, agency implies "individuals or groups reflecting, acting, modifying, and giving significance to the teaching of science in purposeful ways, with the aim of empowering and transforming themselves and/or the conditions of their lives, students and others" (p. 591). Using this frame, we may reflect on how to achieve the purposes of science education and how specific structures facilitate or constrain those purposes for our two participants. In addition, we can consider what we might do to transform oppressive conditions within the school or university, such as inequalities reproduced through access, teaching methods, curriculum materials, educational practices, norms, or values within a deep-rooted neoliberal educational system as is the case in Chile.

Identifying opportunities for agency within power structures may illuminate opportunities for all learners. In this case, we examine potential opportunities for pre-service teachers and secondary school students.

2.3 | Border crossing between the school and the university

In being part of different communities, the participants move between them, crossing boundaries (Akkerman & Bakker, 2011). In so doing, they negotiate meaning (Bhabha, 1994) which affords possibilities to enact their agency, transforming, or reproducing different educational structures. However, as Giroux (2011) argues, when we move across settings, it is not simply crossing physical borders: "they are cultural borders historically constructed and socially organised within rules and regulations that limit and enable particular identities, individual capacities, and social forms" (p. 29). The border divides the school and the university, perpetuating the idea of the university as the "ivory tower" where knowledge is produced and the school as the place where knowledge needs to be reproduced (Geduld et al., 2020). However, as Adams and Gupta (2017) point out, different worlds have "porous boundaries, which means that the agency developed in one field could contribute to the agency in another field" (p. 125).

As Giroux (2009) states, "becoming a border crosser engaged in a productive dialogue with others means producing a space in which those dominant relations, ideologies, and practices that erase the specificity of the voice of the other must be challenged" (p. 16). Such space can be explored through the concept of hybridity.

2.4 | Hybridity

Hybridity is a relationship produced by different cultures colliding that produces cracks within structures, transforming them and creating a new space. Such new spaces could enable other positions to emerge (Bhabha, 1990, p. 211) or, as Giroux (2009) argues, become a space where different power dynamics can be contested. Mayo (2019) argues that hybridity is learning to make things dialogue with each other, finding "interstices, spaces for change to occur" (p. 310) which creates tensions which present as opportunities. As such, hybridity is "neither the one nor the other but something else" (Bhabha, 1994, p. 41).

In Roth, (2008) invited science education researchers to see the field through the lens of hybridity as opposed to the idea of pureness, embracing an "ontology of difference" (p. 914). Such an ontology may help to trouble imposed boundaries and categories and embrace the fluidity of practices, experiences, giving way to other possibilities, "destabili[sing] binaries as value-laden and based in often-concealed hegemonic assumptions of the superiority of the first over the second" (Carter, 2004, p. 826). Such an ontology of difference creates tensions that could afford "space for new relationships between politics, science, and education" (Bazzul, 2020, p. 1023). For example, allowing the reconciliation between being a scientist and an educator—a separation that has been shown as problematic (Aydeniz & Hodge, 2011). This process leads to a reshaping of "the practice of science and the practice of science teaching" (Varelas et al., 2005, p. 514) making dialogue happen within the spaces of such practices. Regarding the two participating teachers, we might consider that their border crossings act as opportunities for hybridity, negotiating meaning across settings, impacting their professional decisions, such as at the school and the physics department at the university, or between physics and other sciences.

3 | METHODOLOGY AND METHODS

The research presented here was conducted as part of a wider critical ethnography of the self-organized community to which the two participants belonged. For this study, however, we take a narrative inquiry approach (Riessman, 2008), considering the stories of two participants as an experience of creating meaning through their shared position as school teachers and teacher educators. This process of creating meaning occurs both for participants, as they tell their stories, and for the researchers, when they interpret and recount stories to advance theoretical and analytical points (Rivera-Maulucci, 2012).

3.1 | Context of the study

Teacher education in Chile is only possible through public and private universities (CNA, 2018). Access to these universities is usually regulated by a unique university test. However, some universities have alternative access pathways with a small number of positions available for students who fulfill several specific requirements.

Secondary science teachers' programmes last, on average, 9.2 semesters (Cofré et al., 2015). There are 40 secondary science teacher programmes across the country and 14 short-duration programmes (two or four semesters) for science professionals with a bachelor's degree in science (Cofré et al., 2015). A study conducted by Hernández et al. (2020) found 14 courses across the country leading to a degree in physics teaching. As the authors noted, some of the degrees are conducted in a faculty of science (57%) and others in a faculty of education (43%). The majority of programmes have concurrent instruction (Gaete & Camacho, 2016), which mean that pre-service teachers are trained in science disciplines at the same time as learning how to teach. An important point, noted by Hernández et al., is that when the degree is in a faculty of science, there are more taught units related to the disciplinary subject and more related to pedagogy when in a faculty of education.

There is also a fragmentation between pedagogical and content knowledge (Gaete & Camacho, 2016) with just a few units concerning the history and nature of science (Cofré

et al., 2015) and very few units with opportunities for in-school experiences, such as practicums (Cisternas, 2011). This situation is a function of the neoliberalisation of teacher initial education whose processes and commitments rely primarily on measurable outcomes. In a study conducted by Fernández (2018), exploring how neoliberal policies unfold in teacher initial education in Chile, a "limited understanding of teaching knowledge" (p. 19) was identified within the programmes, with a strong emphasis on content knowledge, leaving other types of knowledge, such as political and pedagogical knowledge, with a lower status.

Regarding teaching practices, although some research groups are working on changing the instructional logic (e.g., Hernández-Silva et al., 2018), in similar ways to other countries (e.g., Larsson et al., 2020), science teacher educators have a tendency to hold a traditional view of science teaching (Vildósola, 2017) which results in a lack of attention to educational context (González-Weil et al., 2014). Typically, the teacher educators are seen as the holder of knowledge (Pedraja et al., 2012) and pre-service teachers the ones receiving it, a positioning which resonates with the banking logic described before.

There are some emerging changes in Chilean science teacher education, mainly involving the restructuring of practices through the implementation of meetings known as 'reflective triadic' where a mentor teacher, preservice teacher, and teacher educator meet at least once per semester in the context of the practicum (Vanegas & Fuentealba, 2017), the implementation of active learning (Hernández-Silva et al., 2018), and the creation and strengthening of teacher communities (González-Weil et al., 2014). In this study, the participants are active in a teacher community that offers a potential space for change by creating dialogic spaces where trust, collaboration, and valuing experiences as a place of professional learning are crucial (González-Weil et al., 2014).

In terms of who can be appointed as a teacher educator, there are national guidelines (which are not mandatory) to be considered by universities (CNA, 2018). In general, these guidelines mention the need for a formal link with local schools as well as the importance of disciplinary experts, such as those with knowledge of the didactics of specific disciplines, since it is valuable for universities' assessment criteria and for trainees to see links between the discipline and how to teach it. However, universities have the autonomy to define how they regulate who they appoint as a teacher educator. So, in contrast to the appointment of school teachers, there are no national requirements or guidelines for teacher educators, and each university has its own regulations for their appointment and evaluation (MINEDUC, 2016).

In university physics departments, the educators are lecturers with (usually) a postgraduate degree in physics; education lecturers usually have a postgraduate degree in education or science teaching, and other related subject lecturers such as psychologists, have a master's degree or doctorate in their respective subject areas. By no means, all of them are former school physics teachers, as it is not a requirement to become a university educator.

3.2 | Self-organized community

The two participants in this study are part of a self-organized community that has been meeting and interacting regularly since 2012. It was born from the initiative of the members themselves, not from an external agency. As Fenwick (2009) argues, self-organization "depends upon diversity and interaction among diverse parts" (p. 110), and this community involves secondary school physics teachers and teacher educators. By sharing a space where they plan and organize curricular activities together, they are sharing and reframing their educational purposes

through collective meaning-making, contesting the individualistic culture of physics described above.

The community is an example of democratic professionalism, or what Kemmis (1988) calls a "critical community", since they reflect on their pedagogical ideas, creating knowledge in collective dialogue. At the same time, this community is a hybrid place, because both school teachers and teacher educators come together to problematise their praxis in horizontal dialogue, valuing each other's experiences and knowledge.

In this community, nine physics teachers and teacher educators meet for 2 h each month during the first academic semester and twice per month in the second semester. Each year, they plan a curricular unit together that is developed with their classes and is reflected on collectively in order to assess their own learning, and to identify things they could do differently the following year.

3.3 | Participants

The participants are two physics educators who are employed in an initial teacher education programme for physics teachers conducted in a university science faculty. One of them, Andrés,[1] has been working as a physics teacher and teacher educator for more than 20 years. He explains his main concerns as being how physics can be an opportunity to reflect on structural issues (such as the deep individualism in our society or the lack of engagement with environmental problems that deeply affect Chile) hindering or facilitating people's lives. The other participant, Carla, is a physics teacher who has also been a teacher educator for 7 years. Her main concern, as she explained it, is how to offer equal opportunities for learning to everyone by respecting people's interests and diversities, including school students and preservice teachers. Both participants have a degree in physics teaching, and both hold a master's degree. Andrés works in a semi-private secondary school while Carla works in a public (state-funded) school. They both teach pedagogical units in the physics teaching degree as well as physics in another department within the university. They belong and move between three main communities, the university physics department, the school where they work, and the self-organized community. Their experiences contribute to a larger study (reported elsewhere) but for the purposes of this article, the first author interviewed them, again, after the main fieldwork.

3.4 | Data production and analysis

Since the purpose of this study is to explore two educators' experiences and agency within different settings, the data sources were as follows: a personal biographical narrative interview (IV1) (Merrill & West, 2009) which focused on the participants' history in teaching and physics. The interview afforded the opportunity to use an in-depth qualitative approach to explore participants' agency within the different communities they are part of. As Clandinin and Connelly (2000) argue, the personal stories shared through biographical interviews are considered as narratives through which participants "make meaning of their experiences" (p. 154) while recounting them.

The interviews collected both life and work stories, as well as the two participants' experiences working in different communities. Participants were encouraged to share their thoughts and experiences freely, allowing a capturing of the temporality associated with their personal

and professional life courses, in relation to past, present, and future aspirations. Based on the literature on teacher agency and identity, a thematic template was created before the interview, organized around: (a) their stories related to their discipline; (b) their career and professional decisions; (c) their views of the purposes of physics/science education; (d) opportunities and constraints for physics education they have experienced; and (e) their perceptions of role of the communities which relate to their professional decisions. Examples of the questions included the following: *Could you share some stories about what motivated you to become a teacher (and a physics teacher in particular)? Do you feel your workplaces value that you work in different settings? What do you think is your role as a physics teacher and teacher educator in today's world? What can you do or would like to do to achieve that goal? What kind of things constrain/facilitate those goals?*

The interviews lasted approximately 90 min and were audio-recorded. Follow-up online recall conversations (IV2) were also conducted with both participants to more deeply explore certain parts of their stories. Both sets of interviews were conducted in Spanish.

To analyze the data, we took a critical narrative approach (Souto-Manning, 2014) interrogating participants' narratives and using a critical theory lens to understand institutional discourses that may be acquired or resisted by them, for example, when they use a language of critique, conformism, or possibility regarding the place they are referring to. A critical narrative approach "allow[s] us to learn how people create their stories in constant social interactions at both personal and institutional levels, and how institutional discourses influence and are influenced by personal everyday narratives" (Souto-Manning, 2014, pp. 162–163). As such, stories as narratives can also bring new ways for understanding teacher educators' work.

After reading through the interviews, and the recall conversation transcripts several times, we identified distinct 'narratives' within the text relating to the research questions. These were examined in detail to identify their tone and character and how they were communicated, paying attention to structural issues such as tensions or possibilities across the places they belong. We explored Andrés's and Carla's narratives into how they constructed and presented their identity with attention to significant patterns within both participants and how they position themselves in the different communities to which they belong. Excerpts in the data were coded separately, firstly using open coding such as "university culture", "school culture", "learning", "flexibilities", and "collaboration with."

After that first round of analysis, and Using NVivo to organize and code the narratives, we engaged in a constant comparative analysis (Glaser, 1965) that involved memo-writing to record analytical insights across the data. Finally, we identified salient commonalities and categories that were developed into five themes that were enriched by the memos and the theoretical framework informed by the analytical concepts previously disaggregated for agency. For example, "collaboration with" and "learning" were linked to the concept of autonomy, since they involve Andrés' and Carla's relationship with others.

3.5 | Ethics and positionality

Trustworthiness was addressed following different recommendations given by Denzin (2017) such as triangulation in using different methods, thick and rich contextual and methodological description. However, we would like to go in-depth into one of these issues—transparency. Concerning our critical positionality, we should be conscious and transparent about our own political and epistemological alignments with the participants and the study's audience. This

study is focused on two participants who do not necessarily share our views on science education. Thus, we need to be conscious that we are not working with a single story but many, as the participants of our studies.

Another important issue for qualitative studies which is relevant to our exploration of the concept of agency is the process of conscientisation as a researcher. This process must involve questioning and reflecting on conventional learned notions of science, learning, education, and theorizing. Reflexivity reminds us that "[the observers] do change the world they observe" (Harding 1993, p. 73). Thus, we need to reflect on our beliefs and biases explicitly and reframe them with others. Those others are our critical friends and our participants. Our participants, through a constant checking process, and our critical friends to encourage the problematisation of our assumptions in the meaning-making process.

Regarding our positionality, we follow Thomson and Gunter's (2011) notion of fluidity of identities, as they say, people position themselves "neither inside nor outside ... but ... engaged in messy continuously shifting relationships" (p. 18) that varied across contexts.

The first author is also a Chilean physics teacher, which gives her more insiderness to the culture of physics in Chile. However, like Andrés and Carla, we both have experience working in schools and in teacher education and are members of numerous different communities. As such, we position ourselves as insider–outsiders to Andrés' and Carla's experiences. Such fluidity, which also impacts our views of science education and its purposes, has affected the analytical work of this study, giving it a richer scope through our dialogic work grounded in an ethics of trust, respect, and solidarity, between us and with Andrés and Carla. From a Freirean positioning of education in the case of Betzabé, and with an environmentalist agenda in the case of Justin, we are both committed to redrawing the field of science education, paraphrasing Apple (2011), engaging in search of spaces of possible action for a more democratic and participatory field.

4 | FINDINGS

The findings are organized into five themes that allow us to answer the two research questions regarding the participants' positioning as school teachers and teacher educators and how their participation in different communities contributed to their practice of science teaching. These five themes are as follows: (1) Andrés and Carla hybrid identities; (2) identifying tensions and hierarchies through hybrid position; (3) offering learning spaces; (4) creating spaces of collegiality reconceptualizing the nature of relationships; and 5) valuing their community as a space for cultivating hope. The quotations presented in the following sections are representative of the experiences that Andrés and Carla shared with us.

4.1 | Andrés's and Carla's hybrid identities

Andrés and Carla acknowledged their multiple roles: "as a school teacher and university educator I can..." (A) and "because I am both" (C), particularly when they talked about their work at the university. Instead of separating or fragmenting who they were with different responsibilities in both settings, they authored themselves as school teachers *and* teacher educators, a perception that opened a space that Andrés acknowledged gave "more scope to act", and Carla highlighted as providing "resources to share." We have called these positionings *hybrid*

identities because they break the boundaries between *one* or *another* by making them both part of who they are and what they can contribute to the faculty of physics. Embracing the multiplicity of who they are, allow them to create and act as bridges of people and practices. To a certain extent, they are creating a new subject, neither just a teacher educator nor just a schoolteacher, but in between and both.

The "scope to act" that Andrés refers to also suggest his interest in using this hybrid identity as an opportunity to read the world, since he also adds that "I feel it gives you a sense of reality" to secondary schools' contexts. Such a sense of reality can contribute to initial teacher education because they are constantly navigating school and university structural constraints and possibilities in real-time rather than a past experience. They agentically decide not to leave their school teacher selves outside the university, but to bring it with them. As such, the enactment of their hybrid identities is a political act because they are creating and occupying a space, acting upon who the teacher educators are.

As Carla argues, they can also reflect with pre-service physics teachers about pedagogical resources, using their experiences in both settings, not in a hierarchical way of one being better than the other, but as a dialogue to advance learning opportunities. Some of these learning opportunities are shared in the following sections. This hybrid identity also allows them to identify some of the (unspoken) tensions within the culture of the university, a progression (seeing or assumed) as moving up the hierarchy, for example, Carla stated that:

> Being a school teacher is usually seen as a lower status in physics departments or an experience you already passed. But when you say, I am a school teacher and a physics lecturer, it gives students the possibility to think about it. (Carla-IV1).

Thus, this is an active awareness of their hybrid identity which they take on as an expression of how they value teachers' work, not as less than a university-based educator, reshaping what is value in the practice of science teaching. As Andrés (IV1) says, school teachers should be seen.

> as a *crucial actor* for initial education because we see the tensions that are present in the school ... what and how students live ... lack of time to work and prepare your materials ... or at the university, lack of spaces for interdisciplinary work.

Such active awareness is an expression of agency—realizing that other ways, other subjects in initial education, are possible and necessary, and that they need a space such as the one that they take. The hybridity also allows them to compare school and university settings from an in-between position, leveraging different aspects of each place when acting in the other, particularly at the university, as shown in the following sections.

4.2 | Identifying tensions and hierarchies through hybrid positions

Andrés and Carla identify hierarchies and tensions *within* the university and *between* university and school as constraints to learning how to be a physics teacher. Both participants identified the power dynamics between pedagogical and scientific knowledge as one of their main constraints.

The power dynamics unfold in different practices embedded in the physics departments' culture and reflect narrow views of assessment, pedagogy, and collaboration. From their shared experiences, both participants felt that the school and their self-organized community experiences differed at this level and that may be the reason why it was easy for them to recognize such practice. Some of their experiences navigating such a culture are reflected in this section. For example, Carla (IV-2) argues that:

> We need to change that logic of dismissing pedagogy. In doing so, we can stop thinking about teaching as a set of techniques ... you need to treat students, preservice teachers and school students, with respect, translate and contextualise ideas to what they live.

Here Carla shares a broad diagnosis of physics teachers' initial education. Pedagogy is dismissed, considered as simply a set of techniques, a view which creates an epistemological hierarchy between types of knowledge necessary to become a physics teacher. This view resonates with Andrés's experiences and views on the tensions that pedagogy encounters within their department. This is a tension not only at the level of how pedagogy is understood as part of the knowledge that preservice teachers need to develop, but also as part of how initial education is framed under measurable outcomes, Andrés (IV-1) argues:

> Teachers' work requires a lot of decisions, reflection, collegiality; things that are not easily learnt because, where? how? It's not easy to even justify it because it is not concrete or numbered. When you are educated with a strong emphasis only on the discipline, you miss vital dimensions of your future work ... I try to change that, sharing with students things like "this happens to me in school", "what would you do if in a physics class if X happens...?" and then my school expertise is transferred to the university, to a place that sometimes is too closed to see what is happening outside ... Being a teacher is political, it is contextual, its engagement, how to bring those ideas to initial education is my constant struggle.

The participants have been trying to challenge such tensions through their agency, reading the world when naming such struggles and tensions, and then acting on what they uncover. How is it possible, as Carla says, to put pedagogy at the same epistemological status as physics content knowledge? They have some ideas, for example, recognizing their position as hybrid physics teachers as a contribution, and acknowledging that teaching has more dimensions that just knowing content knowledge. As Andrés (IV-2) argues:

> We are an anchor with the outside reality and its tensions, with who the students are at the school, but also at the university where sometimes they are thought of as a static amalgam of the same.

and as Carla (IV-2) argues:

> We need to overcome that idea that being a physics teacher is less than a physicist. You can be both, like me, or you can be one or the other. Just mentioning, I think, is a bit of change, a bit of saying "Hey, I am no less for deciding to work at school."

Andrés and Carla identify that their very existence is an opportunity to recognize that differences do not need to be hierarchised but instead assumed and acknowledge. On many occasions, they reflected on concrete practices for breaking the hierarchy between pedagogy and content knowledge. From their view, if they could have spaces for dialogue within their universities, they might share and discuss the value they give to different knowledges and practices. For example, they could discuss how different professions, such as scientists and pedagogues, and educational settings, such as schools, communities, and universities, contribute to preservice teachers' learning. They could also discuss and problematise the importance of developing a body of knowledge that considers pedagogical, subject-matter, political, contextual knowledge as part of initial teacher education.

Those conversations are political and philosophical, and themes that have been avoided within physics faculties. As such, Andrés and Carla mentioned all these points as problematic and keys to change hierarchies and tensions within physics. Such points are important to encourage border crossings beyond people but also to include practices and values. However, spaces for dialogue within the university, in their view, are absent, or if they do exist, they are more for talking about convergences instead of divergences, as Andrés (IV-2) suggests:

> There isn't space for dialogue and there is a [staff] meeting now and then, but it is per institute, so physicists talk with physicists, biologists with biologists. That is problematic because the future teacher needs to work with other teachers in the school. If educators, independent of if they are scientists or teachers, are not talking to each other, they will maintain a view about science that is created *within that box.*

They both share how this situation differs from a school culture where they have a [staff] meeting for all teachers every week, and their community culture where teacher educators and schoolteachers revise their pedagogical practices together in the recognition of the other as an actor valid to dialogue with.

It is crucial for educators and scientists in initial teacher education to have space for discussions since they offer perspectives regarding who the pre-service teachers are, their socioeconomic realities, their interest, and regarding their future work. Such spaces could be opportunities to work toward a community agenda or formulate projects oriented to something collectively defined. However, as Andrés says, "community discussions are avoided because dissent is avoided because it is seen as bad" (IV2). Such tensions in dissent could be opportunities for new relationships and understandings of their role. It could also help to challenge discourses they find problematic such as teaching as a set of techniques—something they both noted, or as Carla argues, assessment as something punitive. However, it is not impossible to encourage these spaces to exist, as Carla (IV-2) suggests:

> I have experience working in other faculties ... there is more sense of community in biological sciences. I think that is because they have spaces for talking – students, and lecturers from different units ... which impacts students' sense of belonging because they see a community. We have a debt in the physics faculty, and not just here. I worked in another physics faculty and it was similar – zero communication between the people in education and the people in charge of the physics units.

Having spaces for dialogue could be an opportunity to cross the borders of the fragmented learning environment of the faculty and develop transdisciplinary views of the world rather than disciplinary frames which create, as Andrés argues, "narrow views of their profession" and few opportunities to negotiate such views. However, as Carla argues, there is a space for change at the micro-level within their teaching practice, and they both have been using such space. For example, Andrés (IV-1) notes that:

> I have been working with colleagues in other [science] departments who have a similar diagnosis to me regarding the status of pedagogy. With these people, we have been creating community out of the context of our fields, working with school teachers, organising projects that incorporate schools.

In a similar vein, Carla (IV-2) noted:

> Sometimes I feel that I can't act at the level of colleagues' assumptions, but I can work at the level of my classes and handbooks. I incorporated formative assessment, which is usually absent at the university but common practice at school. I also included school visits before their placement, so they know one more school experience, and I share my experiences in the school and how different they are.

Carla and Andrés identified ways and spaces to bring new practices to the university. Their practices are informed by their work at school, their community experience and how they imagine that science teacher initial education needs to be. The community logic and the need for projects are present in their shared stories on different occasions. Such community logic that may be developed through the various communities they belong to is expanded to the places where they see it does not exist, which in this case is the university. As such, their hopes are held in the possibility of change that, from their view, starts by working at the level of who they are and what they do as educators in their work with students and creating spaces with other educators. It is driven by a sense of a collective agency or, as Carla calls it, a sense of community to which to belong.

Carla and Andrés are creating opportunities for cultural border-crossings. They break the border between fields and set new conditions for pedagogy as part of a body of knowledge (rather than techniques), and for pedagogical practices as in Carla's case, by practising a new approach to assessment for instance. In the same vein, by working with colleagues in other science departments, they offer pre-service teachers a broader view of physics because, in the future, they will work in multidisciplinary science departments. Through what they practice, physics education becomes part of a net with other sciences, with other actors, rather than an isolated bounded space.

4.3 | Offering learning experiences

Even though they have experienced tensions, this hybrid identity gives professional knowledge to Andrés and Carla allowing them to provide learning opportunities for school students, future physics teachers, and scientists. They try to make the possibilities of their position a collective one, opening more spaces for dialogue that they identified as lacking in their department.

At the level of school students, they can offer richer educational opportunities with physics, for example, by bringing them to the university, thus crossing a physical border to the higher education environment. Andrés (IV-1) provided some insight into the limitations and affordances of his position:

> From my position I have more scope to act ... I can literally, open the doors of the university to my students ... the university is not a sacred place anymore, so it is possible to dream of going there for students who maybe wouldn't think it possible otherwise. It allows the university to fulfil its social commitment by being a public place for learning ... we can use the labs to gain experiences that we couldn't get at school because we don't have a science lab.

The university understood as a golden cage is not fulfilling its social commitments because it became a sacred strongly bounded place rather than a public one, as Andrés says. However, by crossing a physical border, bringing their students to the university, they are disrupting the logic of the golden cage for a moment. In Chile, universities usually have an imposing physical entrance where you need to present yourself in order to get access that might be denied. Thus, by opening the door and crossing this physical border with students, not only could they influence students' perceptions of the university but also change the internal environment, creating a new space, because Andrés and Carla also invite scientists, mainly physicists, to teach school students. As Andrés (IV-2) shares:

> When Simón presented his research to my students it was good for students, but also good for him to learn about the richness of teaching young people. Those experiences help to put the teaching profession where it should be, as a profession with different complexities, not as just techniques. We had the opportunity to talk about that. It also offers the community here (the physics department) challenges of how to make their ideas understandable for secondary school students.

In such a learning space, scientists can learn from the differences between teaching university and school students and the different types of knowledge required to work at different educational levels. By doing this, they are inviting a change to the epistemological status of pedagogy from a series of techniques to a form of knowledge that invites us to reflect on context and translation as stated by Andrés and Carla. These are also opportunities for interactions between Andrés and Carla and other science colleagues. At least for a moment, dialogue happens within the space that the hybrid position of Andrés and Carla facilitate to create. Andrés (IV-1) continues:

> These are meaningful experiences also for me as a teacher and for the physicists ... opening their labs in my classes and breaking those boundaries. I try to create a bidirectional relationship between school and university since they both need each other, which also humanises who the physicists are.

Such a bidirectional relationship is possible because Andrés and Carla find interstices in the boundaries to cross, redrawing the idea of what the university is for, as Andrés says, as a "public space" rather than an institution in a vacuum formed by a set of compartments with strong close borders. At the same time, it humanizes who the scientists are – they are there, in the

same physical space as their students and are willing to share part of their work with a different subject when Andrés and Carla offer opportunities to do it. Andrés and Carla invite others to engage with a border crossing which may be an opportunity to rethink how the teaching profession is conceptualized, to new relationships to be created. In a similar vein, Carla (IV-1) explains:

> We have this annual event [with the self-organised community]. Since last year's event, we are inviting pre-service physics teachers to contribute to the activity where we go out of the school with students so they can interact with school students and with in-service teachers. They [preservice teachers] are contributing by facilitating a learning experience because we consider them as a key actor, not just someone who is learning, but someone who can also contribute.

In both experiences, Andrés and Carla included other actors, such as scientists, in-service teachers, and pre-service teachers, in educational experiences and boundary-crossing. Including these other actors acknowledges how their positions and knowledge contribute to physics education—scientists contributing with their content knowledge and in-service teachers with their pedagogical content knowledge, for instance. This recognition, in turn, may mean two things for pre-service physics teachers learning. Firstly, that they can develop a sense of belonging to a professional community and, with that, a sense of agency in relation to this community. Secondly, in-service teachers are recognized as actors who also contribute with their knowledge in an out of school activity, developing their identities and sense of agency within the field of science education rather than framed as empty vessels to be filled. Moreover, they value the local territory as a place for learning science, which could be the opportunity for a hybrid setting. It is neither in the school nor in the university but somewhere else where both settings can encounter. Thus, the border crossing is physical and cultural because two different settings, the school and the university, come together through a pedagogical science experience, and the local territory becomes a space for new relationships to happen.

4.4 | Creating spaces of collegiality reconceptualizing the nature of relationships

Andrés and Carla have had other type of experiences working together with school teachers and teacher educators in a more democratic way within their self-organized community. Thus, cultural resources can be borrowed across communities to challenge the nature of the relationships across spaces as a way of crossing borders with practices and values:

> With colleagues in biology and chemistry from initial teacher education programmes, we had a project where we went to a school to research with teachers. I provided access to the school, and the experience was rich for everyone. For school teachers doing research, we managed to have some time that the school gave us to do it. For academics, since you change the logic of research, it is not about working *on* teachers but *with* teachers. And for pre-service teachers, because we invited them to do their thesis in the context of this project. (Andrés-IV2).

This is an example of the access that Carla and Andrés provide, not just by opening the doors of physics faculties but also by encouraging relations among people by taking a position that values both school and university as meaningful to each other. This process means school teachers are not the objects of study but essential actors with an active role and voice. For academics, it means they can have easier access to schools and problematise how they conduct research, considering school teachers also as knowledge producers and as valid others to reflect with. The experience also provided opportunities for pre-service science teachers creating spaces that encouraged a collegial identity for their future work.

The majority of examples Andrés and Carla gave involved the university and schools working together challenging the ontological status of relationships. They highlighted on several occasions the importance of working in a collegial, democratic, horizontal manner, considering teachers as actors with expertise rather than passive recipients. According to Andrés, they created resources for students to learn with their local territory as a live lab and appreciated how different subject matters intersect with their daily lives and communities. These activities were organized in conjunction between university-based educators and school teachers but, as Carla says, "the spaces where we have participated start with another dynamics, starts with the idea that school teachers also have something to say and not just to receive, you know what I mean?" (IV-1).

These experiences also show the need for others to promote change in practices. They are not asking researchers to change their research mindset but the nature of their relationships. Rather than perpetuating banking dynamics between institutions and people, and fragmentation of spaces with strong boundaries, Carla and Andrés work toward its contestation, involving others in such task. For them, the creation of spaces of collegiality is grounded in the need to work toward change collectively.

4.5 | Valuing their community as a space for cultivating hope

If Andrés and Carla could not identify changes happening in other places, it could invoke a feeling of hopelessness or, as Carla (IV2) said, "me alone doing something in a corner is not going to change big problems." However, their self-organized community works as a place to root their hopes and develop a sense of collective agency. Within the self-organized community, they experience a different culture of physics education, that differs from the hierarchical culture in the university. As such, this community acts as a space that allows them to see other educators' commitments to change in the school and university. It gives them hope that physics education can be different, more relatable with the real world, less hierarchical and rigid. For example, by valuing the territory as a place for learning or by valuing others' ideas to grow in knowledge and revise what they can take for granted.

> By being part of the (self-organized) community I can take ideas to change my own practice. Sometimes I have to think, how can I be less authoritarian? Or how can I change some embedded beliefs about physics within myself? Historical things, for example, related to gender and the examples we give. Being a teacher requires a reflective process, not just alone, because the university has a lot of inertia; it is hard to change things. Having a community of physics teachers helps. (Andrés-IV1).

However, inertia is a passive characteristic of bodies, and thus, subjects with agency can change that state. By self-organizing themselves in a community, they are opening spaces to change within themselves as subjects of transformation, creating a counter-narrative of what it means to be a physics educator. At the same time, they have learnt how differences are an essential part of the basis of education. Hybridity as the default rather than the exception feature. As they both argue, "We are usually scared of differences. In the community, differences are valued. Sometimes we don't agree at all, but we can revise our ideas, and challenge each other in a professional dialogue" (Andrés-IV1), "Working with others is important to mobilise ideas of what to do and share some experiences, good and bad, and cheer you up when you feel hopeless" (Carla-IV1).

By having a space to dialogue with others professionally, Andrés and Carla identify practices that contribute to transform physics education. They are moved by a sense of collective agency that can be expanded out of their community. As Carla shares:

> I usually share with preservice teachers about the community. I would like them to have their own in the future to preserve a sense of identity, a sense of collegiality that sometimes is lost when you finish university. The machine of work consumes you; the community allows me to fight against that machine. (IV-1).

As such, rooting ourselves in collective projects can challenge monolithic narratives and help us to find spaces for acting and being otherwise. However, as Carla and Andrés argue, the process of reflecting and finding spaces for change across places is personal and collective. They need others acting toward transformation, otherwise individual acts will not mean a significant change. The opposite is also true, collective efforts need to unfold in their daily practice and the constants revision of what they do.

5 | DISCUSSION

We began by noting that teacher educators are often absent actors in educational research. Our aim was to explore what a position as a school teacher and a teacher educator might offer as a space for agency, challenging a neoliberal context. The first research question was: *How does being a teacher and a teacher educator afford opportunities for the participants' sense of agency within the university and school?*

In neoliberal cultures, where teachers' identities are always defined and limited by others (Holloway & Brass, 2018), Andrés and Carla embracing their hybridity is itself an agentic positioning. They did not identify themselves as school teachers or teacher educators but bridged both, making space for a new actor to emerge who could contribute to the faculty of physics. From this position, they identified different structural tensions and boundaries, particularly at the university. However, within those boundaries, they also identified spaces to act upon, broadening the narratives available to negotiate within physics education. What Andrés and Carla are doing is reading the culture of physics education and transgressing such boundaries walking "over them" (Moura, 2021, p. 310). For example, disrupting the logic of progression that hierarchises the relationship between a schoolteacher and a teacher educator problematises the limits of who teacher educators are and can be.

As Avraamidou (2020) argues, "positioning provides space for multiplicity ... to essentially acknowledge the infinite ways of becoming a science person – a process that is always bound

within a place or socio-political context" (p. 326), which in turn offers "new subject positions, identities, and social relations" (Giroux, 2009, p. 18). In this study, the two educators are conscious of this hybrid identity and what is expected of them in the different communities in which they participate. Such hybridity shows that "identity and agency are complementary co-constructions leading to acts of social change" (Moore, 2008, p. 678). Such dialectical dynamics can guide teachers' professional commitments to advance toward justice-oriented education and pedagogies which in the case of Andrés and Carla, has to do with the place of school-teachers within the university. They both are pushing toward pedagogies of context that reflect on whom we are educating together with raising the epistemological status of pedagogy within the physics department. In doing so, Andrés and Carla politically and creatively take a space, moving the identified structural boundary.

Physics faculties offer the convergence of different actors, scientists, and science educators who act as teacher educators. Their discourses and beliefs regarding pedagogy frame the space where future physics teachers negotiate their ideas about pedagogy and physics (Larsson et al., 2020). As such, what notions of it they hold are a site of reflection, revision, and contestation – a site of power (Ball, 2016). By becoming a site of power, Andrés and Carla engage with practices that challenge hegemonic notions of physics education (that we discuss in answering the second question). They are developing counternarratives that bring dialogue and collaboration as ontological needs for the physics department.

Andrés's and Carla's sense of agency is also cultivated in their self-organized community that is neither the university nor the school. This community acts as a space in between, where a different culture is created. A culture where structural hierarchies between university and school are replaced by a culture of collegial and trans-institutional dialogue. Acknowledging the community as a space to root and cultivate their hopes reflects the importance of collectives for challenging individualistic neoliberal cultures that are sometimes subtle or embedded with ourselves that are hard to identify.

It is important to notice that Andrés's and Carla's experiences are also possible because they have contractual relations with both settings, which is usually not the case for mentor teachers, for example. We believe science faculties will benefit from incorporating more school teachers as teacher educators. Such incorporation, as Vanegas et al. (2015) has argued, needs to consider contractual relationships rather than a partnership without payment (e.g., mentor teachers) which perpetuate power dynamics and injustice by not valuing the labour that the process include.

The second research question was, *how does participation in different communities, such as school and university, contribute to a physics educator's transformation of the practice of science teaching?*

Andrés's and Carla's agency allows them to see structural and unspoken tensions embedded in initial teacher education that reproduces hierarchies and banking pedagogies. Some of the tensions they identify are rooted in neoliberal values, such as the individualized and fragmented work that Fardella (2019) has argued deeply embed university-based educators. Andrés and Carla challenge such a culture by posing the need for dialogue and collaborative spaces moved by a collective agency cultivated in the different communities they belong to.

Their ethical commitment with physics education is rooted in envisioning pedagogies of context and dialogue between the subject/object of study and the subject of learning, school students and pre-service teachers. It is essential to acknowledge and reflect on *what*, *how*, and *why* we educate in science (Moura, 2019), but it is also essential to reflect on *who* is learning? Students, either pre-service teachers or school students, are not empty vessels or homogeneous

subjects. Reflecting on these questions is one of Andrés's and Carla's contributions to initial teacher education, and it shapes their agentic decisions.

Inviting scientists to work with them and their school students, creating spaces with educators in other science departments are ways of opening golden cages (Fardella, 2019). Andres and Carla also problematise the hierarchies they have identified. Hierarchies such as the punitive logic of assessment which has been shown to affect science education (Adams & Gupta, 2017). Such logic preserves the idea of science for "the smart people" and is particularly prevalent in physics (Berge et al., 2020). Hierarchies, also, such as the tension between being a scientist or a physics teacher (Aydeniz & Hodge, 2011) may be challenged by taking hybrid positions such as Andrés's and Carla's. In this point, this study resonates with Larsson et al. (2021) regarding the assumption they identified in their context as "if you know physics, it's not difficult to teach" (p. 16), which may be similar to the narrow views of pedagogy as a series of techniques that some educators in physics departments hold. These practices reproduce an epistemic hierarchy and are dangerous for future teachers' identity development because, as Wallace (2018) argues, they are also products of a process that in neoliberal settings reproduces hierarchies among types of knowledge, and as a result, among people.

However, by positioning themselves with different views and practices, Andrés and Carla disrupt hegemonic practices by incorporating formative assessment, acting on curricular materials, and creating spaces of encounter between pre-service and in-service teachers, to name a few. In the same way as Bakx et al. (2016), they realized there is flexibility at the university that gives them scope to enact their agency at those daily practices. These spaces they encounter to act upon are essential because "looking only for big changes teachers may lose touch with the transformative potential in any activity" (Shor & Freire, 1987, p. 35). Reverberating daily acts that change cultures may invite others to look for such interstices for change. However, they acknowledge that individual agency is not enough to achieve their aims; there is a need for others; otherwise, it can cause a feeling of hopelessness.

In sum, Andrés and Carla provide bridges between institutions and the individuals that belong to them, such as school and university, between subject disciples such as pedagogy and physics. Their hybrid identity position problematises assumptions and ways of being in physics education, moving toward what Wallace (2018) calls one of the ethico-political tasks of teacher educators by making themselves accountable for what type of narratives future physics teachers have and working toward the unmaking of embedded neoliberal values and structural golden cages.

6 | CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH

The first contribution of this paper is to address a gap in our knowledge of who teacher educators are, and to show the opportunities that Andrés's and Carla's hybrid identities offer for crossing borders between communities. From their experiences, we can demonstrate that there is a room for individual agency within the neoliberal university. However, collective agency is necessary for educational transformation at the macro level. The second contribution is to show how the use of border crossing and hybridity as theoretical framing to explore the nature of the places we belong, allows the possibility of demonstrating that even though there is a hegemonic way of being within science departments permeated by neoliberal values such as individualism, banking relations, and productivity, there are still counter-narratives and thus science culture is

not homogeneous. We need to advance in exploring such counternarratives spaces as a way of mapping other stories of science education (Tolbert & Bazzul, 2017).

For science teacher educators, a clear message is the need to work in multiple spaces for dialogue. For example, by creating professional communities within and across science faculties, as has been done by Andrés and Carla and in other initiatives (e.g., González-Weil et al., 2014). In so doing, different knowledge and expertise can promote collaborative knowledge creation to improve initial teacher education that considers the richness of physics content and the contributions of pedagogical knowledge experts.

A limitation of this study is its overall scope. The article drew on the experiences of two physics educators, and it would be beneficial to have a broader picture to explore the experiences of other science disciplines. By broadening the scope, we would gain a more comprehensive picture of how neoliberalism permeates and exerts its influence in the culture of university science departments, as well as what other counternarratives experiences exist. Nevertheless, our findings suggest that it is imperative to know who the teacher educators are, and what structural issues they face, since they shape the educational experiences of future teachers and thus, school students. Moreover, learning with them requires more engagement with their experiences, how they continue negotiating meaning across contexts. Crossing borders is a process, not an event, and thus it involves time, which is a limitation of the study, as the temporal aspect was not considered in depth. Future research needs to consider a more extended period for research as well as different methodologies that are suited to addressing this, such as participatory action research.

Some questions that remain open and that presented themselves during the course of this exploration are, what other structural limits do people encounter within the culture of physics education? How often do we cross borders to learn with others democratically? What is our role in disrupting the borders of our fields and the university? Where are we cultivating our hopes? Those are challenges for future research. Exploring our own practices through self-study, for instance, and how can we contribute to reproducing or producing ways of being within science is also worth considering. In doing so, we can contribute to making science education pedagogies more diverse, inclusive, social, and epistemically just.

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ENDNOTE

[1] "Andrés" and "Carla" are both pseudonyms

REFERENCES

Adams, J. D., & Gupta, P. (2017). Informal science institutions and learning to teach: An examination of identity, agency, and affordances. *Journal of Research in Science Teaching*, *54*(1), 121–138.

Aikenhead, G. S. (1996). Science education: Border crossing into the subculture of science. *Studies in Science Education*, *27*(1), 1–52.

Akkerman, S., & Bakker, A. (2011). Boundary crossing and boundary objects. *Review of Educational Research*, *81*(2), 132–169.

Apple, M. W. (2011). Global crises, social justice, and teacher education. *Journal of Teacher Education*, *62*(2), 222–234.

Apple, M. W. (2014). *Official knowledge. Democratic education in a conservative age* (3rd ed.). Routledge.

Archer, L., MacLeod, E., & Moote, J. (2020). Going, going, gone: A feminist Bourdieusian analysis of young women's trajectories in, through and out of physics, age 10–19. In A. J. Gonsalves & A. T. Danielsson (Eds.), *Physics education and gender: Identity as an analytic lens for research* (pp. 9–29). Springer.

Archer, M. S. (2007). The ontological status of subjectivity: The missing link between structure and agency. In C. Lawson, J. Latsis, & N. Martins (Eds.), *Contributions to social ontology* (pp. 17–21). Routledge.

Avraamidou, L. (2020). Science identity as a landscape of becoming: Rethinking recognition and emotions through an intersectionality lens. *Cultural Studies of Science Education*, *15*, 323–345.

Avraamidou, L. (2021). Identities in/out of physics and the politics of recognition. *Journal of Research in Science Teaching*, *59*(1), 58–94.

Aydeniz, M., & Hodge, L. L. (2011). Is it dichotomy or tension: I am a scientist. No, wait! I am a teacher! *Cultural Studies of Science Education*, *6*, 165–179.

Bakx, A., Bakker, A., Koopman, M., & Beijaard, D. (2016). Boundary crossing by science teacher researchers in a PhD program. *Teaching and Teacher Education*, *60*, 76–87.

Ball, S. (2016). Subjectivity as a site of struggle: Refusing neoliberalism? *British Journal of Sociology of Education*, *37*(8), 1129–1146.

Bazzul, J. (2012). Neoliberal ideology, global capitalism, and science education: Engaging the question of subjectivity. *Cultural Studies of Science Education*, *7*(4), 1001–1020.

Bazzul, J. (2020). Science education needs manifestos. *Caderno Brasileiro de Ensino de Física*, *37*(3), 1020–1040.

Berge, M., Danielsson, A., & Lidar, M. (2020). Storylines in the physics teaching content of an upper secondary school classroom. *Research in Science & Technological Education*, *38*(1), 63–83.

Bhabha, H. (1990). The Third Space: Interview with Homi Bhabha. In J. Rutherford (Ed.), *Identity: Community, Culture, Difference* (pp. 207–221). Lawrence and Wishart.

Bhabha, H. K. (1994). *The location of culture*. Routledge.

Black, A. L., Crimmins, G., & Henderson, L. (2017). Positioning ourselves in our academic lives: Exploring personal/professional identities, voice and agency. *Discourse: Studies in the Cultural Politics of Education*, *40*(4), 530–544.

Bourke, T., Ryan, M., & Ould, P. (2018). How do teacher educators use professional standards in their practice? *Teaching and Teacher Education*, *75*, 83–92.

Buchanan, R. (2015). Teacher identity and agency in an era of accountability. *Teachers and Teaching*, *21*(6), 700–719.

Butler, J. (2009). *Dar cuenta de sí mismo. Violencia ética y responsabilidad*. Amorrortu.

Calabrese-Barton, A., & Tan, E. (2010). We be burnin'! Agency, identity and learning in a green energy program. *Journal of the Learning Science*, *19*(2), 187–229.

Carlone, H. B., & Webb, S. M. (2006). On (not) overcoming our history of hierarchy: Complexities of university/school collaboration. *Science Education*, *90*(3), 544–568.

Carlone, H. B., Johnson, A., & Eisenhart, M. (2014). Cultural perspectives in science education. In N. G. Lederman & S. K. Abell (Eds.), *Handbook of research on science education* (Vol. II, pp. 651–670). Routledge.

Carter, L. (2004). Thinking differently about cultural diversity: Using postcolonial theory to (re)read science education. *Science Education*, *88*, 819–836.

Carter, L. (2014). The elephant in the room: Science education, neoliberalism, and resistance. In L. Bencze & S. Alsop (Eds.), *Activist science and technology education* (pp. 23–26). Springer.

Catanzaro, G., & Wegelin, L. (2019). Hacia una dialéctica de la autonomía: Encrucijadas del individuo en el neoliberalismo [towards a dialectics of autonomy: The crossroads of the individual in neoliberalism]. *Intersticios sociales*, *18*, 37–78.

Cisternas, T. (2011). La investigación sobre formación docente en Chile: Territorios explorados e inexplorados. *Calidad en la educación*, *35*, 131–164.

Clandinin, D. J., & Connelly, F. M. (2000). *Narrative inquiry: Experience and story in qualitative research*. Jossey-Bass.

Cochran-Smith, M. (2021). Rethinking teacher education: The trouble with accountability. *Oxford Review of Education*, *47*(1), 8–24.

CNA. (2018). Carreras de pedagogía: análisis de fortalezas y debilidades en el escenario actual. Serie de Estudios CNED, 2014. Consejo Nacional de Educación. http://www.cned.cl/public/Secciones/SeccionIndicesPostulantes/indices_pregrado.aspx

Cofré, H., González-Weil, C., Vergara, C., Santibáñez, D., Ahumada, G., Furman, M., Podesta, M., Camacho, J., Gallego, R., & Pérez, R. (2015). Science teacher education in South America: The case of Argentina, Colombia and Chile. *Journal of Science Teacher Education*, *26*(1), 45–63.

Cornejo, R., & Insunza, J. (2013). El sujeto docente ausente de las movilizaciones educativas: Un análisis del discurso docente. *Psicoperspectivas*, *12*(2), 72–82.

Davies, B., & Bansel, P. (2007). Neoliberalism and education. *International Journal of Qualitative Studies in Education*, *20*(3), 247–259.

Denzin, N. (2017). Critical qualitative inquiry. *Qualitative Inquiry*, *23*(1), 8–16.

Emirbayer, M., & Mische, A. (1998). What is agency? *American Journal of Sociology*, *103*(4), 962–1023.

Faikhamta, C., & Clarke, A. (2013). A self-study of a Thai teacher educator developing a better understanding of PCK for teaching about teaching science. *Research in Science Education*, *43*, 955–979.

Fardella, C. (2019). Abrir la jaula de oro. La universidad managerial y sus sujetos [opening the golden cage. The managerial university and its subjects]. *Revista Izquierdas*, *49*, 2299–2320.

Fardella, C., Sisto, V., & Jimenez, F. (2017). La transformación de la universidad y los dispositivos de cuantificación [University transformation and quantification devices]. *Estudos de Psicologia*, *34*(3), 435–448.

Fardella, C., Sisto, V., & Jiménez, F. (2015). Nosotros los académicos. Narrativas identitarias y autodefinición en la universidad actual [we, the academics. Identity narratives and self-definition in today's university]. *Universitas Psychologica*, *14*(5), 1625–1636.

Fenwick, T. (2009). Responsibility, complexity science and education: Dilemmas and uncertain responses. *Studies in Philosophy and Education*, *28*, 101–118.

Fernández, M. B. (2018). Framing teacher education: Conceptions of teaching, teacher education, and justice in Chilean national policies. *Education Policy Analysis Archives*, *26*(34), 1–37.

Fernández, R., Albornoz, N., Cornejo, R., & Etcheberrigaray, G. (2016). Los discursos sobre autonomía del trabajo docente en el nuevo marco regulatorio educativo chileno. *Currículo sem Fronteiras*, *16*(2), 283–302.

Freire, P. (1970). *Pedagogy of the oppressed* (50th Anniversary ed.). Bloomsbury.

Freire, P. (1985). *The politics of education: Culture, power and liberation*. Bergin & Garvey Publishers.

Freire, P. (1994). *Pedagogy of hope*. Continuum.

Freire, P. (1998). *Pedagogy of freedom: Ethics, democracy and civic courage*. Rowman and Littlefield.

Freire, P., & Macedo, D. (1987). *Reading the Word and the World*. Literacy Bergin & Garve.

Freire, P., & Macedo, D. (1995). A dialogue: Culture, language, and race. *Harvard Educational Review*, *65*(3), 377–402.

Fu, G., & Clarke, A. (2019). Individual and collective agencies in China's curriculum reform: A case of physics teachers. *Journal of Research in Science Teaching*, *56*(1), 45–63.

Gaete, M., & Camacho, J. (2016). Vivencias de practicantes de pedagogías en ciencias: prácticas de conocimiento científico y pedagógico [Life experiences of pre-service teachers undertaking a bachelor of sciences and education program]. *Educação e Pesquisa*, *43*(2), 341–356.

Geduld, D., Baatjes, I., & Sathorar, H. (2020). Preparing foundational phase educators: Reading the word and world through transect walks. In J. Kirylo (Ed.), *Reinventing pedagogy of the oppressed* (pp. 15–26). Bloomsbury.

Glaser, B. (1965). The constant comparative method of qualitative analysis. *Social Problems*, *12*(4), 436–445.

Giroux, H. A. (2009). Paulo Freire and the politics of postcolonialism. In A. Kempf (Ed.), *Breaching the colonial contract* (pp. 79–89). Springer.

Giroux, H. A. (2011). The disappearing intellectual in the age of economic Darwinism. *Policy Futures in Education*, *9*(2), 163–171.

González-Vallejos, M. P. (2018). El estudio del formador latinoamericano: Un campo de investigación 'en construcción' [the study of the Latino American teacher educator: A research field 'under construction']. *Revista Internacional de Investigación en Educación*, *10*(21), 35–54.

González-Weil, C., Gómez, M., Ahumada, G., Bravo, P., Salinas, E., Avilés, D., Pérez, J., & Santana, J. (2014). Principios de desarrollo profesional docente construidos por y Para profesores de ciencia: Una propuesta sustentable que emerge desde la indagación de las propias prácticas [principles of teacher professional

development built by and for science teachers: A sustainable proposal that emerges from the inquiry of self-practices]. Estudios Pedagógicos, Número Especial, 105–126.

Harding, S. (1993). Rethinking standpoint epistemology: What is 'strong objectivity'? In L. Alcoff & E. Potter (Eds.), *Feminist epistemologies* (pp. 49–82). Routledge.

Hazari, Z., Sonnert, G., Sadler, P. M., & Shanahan, M.-C. (2010). Connecting high school physics experiences, outcome expectations, physics identity, and physics career choice: A gender study. *Journal of Research in Science Teaching*, *47*(8), 978–1003.

Hernández-Silva, C., López-Fernández, L., González-Donoso, A., & Tecpan-Flores, S. (2018). Impacto de estrategias de aprendizaje activo sobre el conocimiento disciplinar de futuros profesores de física, en un curso de didáctica [impact of active learning strategies on future physics teachers' disciplinary knowledge in a didactic course]. *Pensamiento Educativo, Revista De Investigación Latinoamericana*, *55*(1), 1–12.

Hernández, C., Gómez-Martínez, Y., Ruz, R., Silva, M., & Tecpan, S. (2020). Formación de profesores de física en Chile; realidad y desafíos [physics teacher training in Chile; reality and challenges]. Revista electrónica de investigación educativa, Formación de profesores de Física en Chile: realidad y desafíos.

Holloway, J., & Brass, J. (2018). Making accountable teachers: The terrors and pleasures of performativity. *Journal of Education Policy*, *33*(3), 361–382.

Hökkä, P., Vähäsantanen, K., & Mahlakaarto, S. (2017). Teacher educators' collective professional agency and identity–transforming marginality to strength. *Teaching and Teacher Education*, *63*, 36–46.

King, H., & Nomikou, E. (2018). Fostering critical teacher agency: The impact of a science capital pedagogical approach. *Pedagogy, Culture & Society*, *26*(1), 87–103.

Kemmis, S. (1988). *El curriculum más allá de la teoría de la reproducción*. Morata.

Kincheloe, J. (2017). The knowledges of teacher education: Developing a critical complex epistemology. In A. Darder, D. Torres, & M. Baltodano (Eds.), *The critical pedagogy reader* (pp. 503–517). Routledge.

Larsson, J., Airey, J., Danielsson, A. T., & Lundqvist, E. (2020). A fragmented training environment: Discourse models in the talk of physics teacher educators. *Research in Science Education*, *50*(6), 2559–2585.

Larsson, J., Airey, J., & Lundqvist, E. (2021). Swimming against the tide: Five assumptions about physics teacher education sustained by the culture of physics departments. *Journal of Science Teacher Education*, *32*(8), 934–951.

Larsson, J., & Airey, J. (2021). On the periphery of university physics: Trainee physics teachers' experiences of learning undergraduate physics. *European Journal of Physics*, *41*, 1–23.

Loughran, J. (2014). Professionally developing as a teacher educator. *Journal of Teacher Education*, *65*(4), 271–283.

Lunenberg, M., Dengerink, J., & Korthagen, F. (2014). *The professional teacher educator: Roles, behaviours and professional development of teacher educators*. Sense Publishers.

Mayo, P. (2012). *Politics of indignation*. Zero books.

Mayo, P. (2019). Praxis, hegemony, and consciousness in the work of Antonio Gramsci and Paulo Freire. In C. A. Torres (Ed.), *The Wiley handbook of Paulo Freire* (pp. 305–320). Wiley Blackwell.

Merrill, B., & West, L. (2009). *Using biographical methods in social research*. Sage.

MINEDUC. (2016). Ley N° 20.903. Crea el Sistema de Desarrollo Profesional Docente y Modifica otras Normas. Gobierno de Chile.

Moore, F. M. (2008). Agency, identity, and social justice: Preservice teachers' thoughts on becoming agents of change in urban elementary science classrooms. *Research in Science Education*, *38*(5), 589–610.

Morales-Doyle, D., Varelas, M., Segura, D., & Bernal-Munera, M. (2021). Access, dissent, ethics, and politics: Pre-service teachers negotiating conceptions of the work of teaching science for equity. *Cognition and Instruction*, *39*(1), 35–64.

Moura, C. (2019). O Ensino de ciências e a justiça social – questões para o debate. *Caderno Brasileiro de Ensino de Física*, *36*(1), 1–7.

Moura, C. (2021). Science education research practices and its boundaries: On methodological and epistemological challenges. *Cultural Studies of Science Education*, *16*, 305–315.

Muñoz-Garcia, A. L. (2019). Intellectual endogamy in the university. *Learning and Teaching*, *12*(2), 24–43.

Murray, J., & Kosnik, C. (2011). Academic work and identities in teacher education. *Journal of Education for Teaching*, *37*(3), 243–246.

Osborne, J. (2006). Towards a science education for all: The role of ideas, evidence and argument. ACER Research Conference Archive.

Pantić, N. (2015). A model for study of teacher agency for social justice. *Teachers and Teaching*, *21*(6), 759–778.
Pedraja, L., Araneda, C., Rodríguez, E., & Rodríguez, J. (2012). Calidad en la formación inicial docente: Evidencia empírica en las universidades chilenas. *Formación Universitaria*, *5*(4), 15–26.
Riessman, C. (2008). *Narrative methods for the human sciences*. Sage Publications.
Rivera-Maulucci, M. S., Brotman, J. S., & Fain, S. S. (2015). Fostering structurally transformative teacher agency through science professional development. *Journal of Research in Science Teaching*, *52*(4), 545–559.
Rivera-Maulucci, M. S. (2012). Social justice research in science education: Methodologies, positioning, and implications for future research. In B. Fraser, K. Tobin, & C. J. McRobbie (Eds.), *Second international handbook of science education* (pp. 583–594). Springer.
Robinson, S. (2012). Constructing teacher agency in response to the constraints of education policy: Adoption and adaptation. *Curriculum Journal*, *23*(2), 231–245.
Roth, W. M. (2008). Bricolage, metissage, hybridity, heterogeneity, diaspora: Concepts for thinking science education in the 21st century. *Cultural Studies of Science Education*, *3*(4), 891–916.
Ryder, J., Lidar, M., Lundqvist, E., & Östman, L. (2018). Expressions of agency within complex policy structures: Science teachers' experiences of education policy reforms in Sweden. *International Journal of Science Education*, *40*(5), 538–563.
Shagrir, L. (2015). Working with students in higher education–Professional conceptions of teacher educators. *Teaching in Higher Education*, *20*(8), 783–794.
Shor, I., & Freire, P. (1987). *A pedagogy for liberation. Dialogues on transforming education*. Bergin & Garvey.
Sisto, V. (2020). Desbordadas/os: Rendición de cuentas e intensificación del trabajo en la universidad neoliberal. El Caso de Chile [accountability and work intensification in the neo-liberal university. The case of Chile]. *Archivos Analíticos de Políticas Educativas*, *28*(7), 1–22.
Souto-Manning, M. (2014). Critical narrative analysis: The interplay of critical discourse and narrative analyses. *International Journal of Qualitative Studies in Education*, *27*(2), 159–180.
Thomson, P., & Gunter, H. (2011). Inside, outside, upside down: The fluidity of academic researcher 'identity' in working with/in school. *International Journal of Research & Method in Education*, *34*(1), 17–30.
Tolbert, S., & Bazzul, J. (2017). Toward the sociopolitical in science education. *Cultural Studies of Science Education*, *12*, 321–330.
Vanegas, C., Correa, E., & Fuentealba, R. (2015). La práctica del profesor de ciencias: Significados personales y experiencias de profesores en formación [Practic of science teacher: Personal meanings and experiences of trainee teachers]. *Perspectiva Educacional*, *54*(1), 17–34.
Vanegas, C., & Fuentealba, R. (2017). Triadic Thoughtful Table space to generate reflexive thoughts during initial training teaching practices. *International Journal of Advancement in Engineering Technology, Management and Applied Science*, *4*(12), 19–34.
Varelas, M., House, R., & Wenzel, S. (2005). Beginning teachers immersed into science: Scientist and science teacher identities. *Science Education*, *89*(3), 492–516.
Vildósola, X. (2017). El conocimiento sobre la epistemología de la ciencia Como eje Para mejorar la relación investigación-practica en la formación inicial docente en ciencias: el Caso de Chile [knowledge about the epistemology of science as an axis to improve the research-practice relationship in initial science teacher education: The case of Chile]. *Enseñanza de Las Ciencias, extra*, 89–96.
Wallace, M. (2018). The paradox of un/making science people: Practicing ethico-political hesitations in science education. *Cultural Studies of Science Education*, *13*, 1049–1060.
Williams, J., Ritter, J., & Bullock, S. M. (2012). Understanding the complexities of becoming a teacher educator: Experience, belonging and practice within a professional learning community. *Studying Teacher Education*, *8*(3), 245–260.

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