

Professional Profiles of Mathematics Teacher Educators: A Comparative Study between Spain and Latin America

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ABSTRACT

Background: According to the literature, the professional profile of Mathematics Teacher Educators (MTEs) influences both their specialised knowledge and their teaching practices. **Objective:** To identify the professional profiles of MTEs in Latin America and compare them with those identified in the Spanish context. **Design:** The study adopts an exploratory descriptive and comparative design. **Setting and Participants:** The study involved 83 MTEs from eight Latin American countries. For comparison with the Spanish context, previously collected data from 157 MTEs were used. **Data collection and analysis:** Data were collected using a questionnaire validated by experts from the MTSK network. Six closed-response items were analysed, relating to gender, age, educational background, professional experience in higher education and non-higher education settings, and routes into initial teacher education. Data were analysed using descriptive statistics and, where appropriate, inferential statistical tests. **Results:** The results reveal that, in the sample analysed, six professional profiles predominate, with initial degree qualifications (or equivalent) mainly in mathematics, education, and mathematics education. Furthermore, four professional profiles are shared with the Spanish context, although they differ in their distribution and configuration across the two contexts. **Conclusions:** The identified professional profiles exhibit both shared characteristics and context-specific features. From an exploratory perspective, these findings extend the current knowledge of MTEs' professional profiles in Latin America.

Keywords: Mathematics; Professional path; Professional profiles; Teacher educator.

Perfis profissionais dos formadores de professores de matemática: um estudo comparativo entre Espanha e América Latina

RESUMO

Contexto: O perfil profissional dos Formadores de Professores de Matemática (FPM) é um aspeto que, segundo a literatura, influencia tanto o conhecimento

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especializado como as práticas docentes destes profissionais. **Objetivos:** Identificar os perfis profissionais dos FPM na América Latina e compará-los com os do contexto espanhol. **Design:** Trata-se de um estudo descritivo e comparativo de caráter exploratório. **Ambiente e participantes:** Participaram 83 FPM de oito países latino-americanos e, para a comparação com o contexto espanhol, utilizaram-se dados previamente recolhidos de 157 FPM. **Coleta e análise de dados:** Os dados foram recolhidos através de um questionário validado por especialistas da rede MTSK. Foram analisados seis itens de resposta fechada relativos ao género, à idade, ao percurso formativo, à experiência profissional em contextos universitários e não universitários e à forma de acesso à formação inicial de professores. A análise foi realizada através de estatística descritiva e, quando a natureza dos dados o permitiu, mediante testes inferenciais. **Resultados:** Os resultados revelam que, na amostra analisada, predominam seis perfis profissionais, cuja formação de graduação (ou equivalente) se concentra principalmente nas áreas de Matemática, Educação e Educação Matemática. Além disso, foram identificados quatro perfis profissionais comuns ao contexto espanhol, embora apresentem distribuições e configurações distintas nos dois contextos. **Conclusões:** Os perfis profissionais identificados apresentam tanto características partilhadas como particularidades associadas a cada contexto. Numa perspetiva exploratória, estes resultados ampliam o conhecimento disponível sobre os perfis profissionais dos FPM na América Latina.

Palavras-chave: Formador de professores; Matemática; Perfil profissional; Trajetória.

INTRODUCTION

During recent decades, research in mathematics education has focused on mathematics teachers, examining their knowledge, beliefs, practices, and professional development. Building on Shulman's work (1986, 1987), a line of research became established seeking to understand teachers' knowledge and its influence on mathematics teaching. This interest naturally led to new questions about teacher education and, consequently, to recognition of the need to study those who make it possible: Mathematics Teacher Educators (MTEs).

MTEs have thus become an object of research in mathematics education (Giadas et al., in press), both because of the responsibility they assume in the education of future teachers and because of their contribution to improving the quality of mathematics education (Beswick & Goos, 2018; Castro Superfine et al., 2024). Considered key actors within the learning system (Ayalew, 2017), understanding who they are, how they enter this role, what knowledge they draw upon, and how they contribute to teachers' professional development has become a relevant research objective, encompassing the study of their professional profile, specialised knowledge, practices, and competences (Giadas, Pascual et al., 2024).

However, advancing our understanding of MTEs requires acknowledging the considerable heterogeneity that characterises these professionals (Even, 2014). This stems, in part, from the diversity of professional and academic contexts in which they work, both within and outside higher education (Chapman, 2021; Dengerink et al., 2015). Consequently, their education, experience, teaching practices, and knowledge display considerable diversity. Far from constituting an obstacle, this heterogeneity offers new opportunities to understand their professional knowledge and practice.

This heterogeneity also raises a fundamental question for the specialised literature: who becomes a teacher educator? There is no single answer, as reflected in the variety of terms used to refer to these professionals, which reveals different conceptions of their role, functions, and position within the education system. As Escudero-Ávila et al. (2021) point out, terminology is not neutral, as it provides clues about the role they play in teachers' professional development. In this regard, Dengerink et al. (2015) emphasise the need for a clear definition of who can be considered an MTE, while Jaworski (2008) proposes an operational definition, referring to those engaged in developing and improving mathematics teaching, both in initial teacher education and in teachers' professional development. Within this framework, it is necessary to review the main background studies underpinning research on MTEs' professional profiles.

BACKGROUND

The characterisation of MTEs has constituted one of the main lines of research in this field, with particular attention paid to their professional identity, educational and career trajectories, and the diversity of profiles within this group. These studies seek to understand who MTEs are and how their trajectories shape the knowledge and practices they develop. However, such characterisation faces the difficulty of clearly delimiting who belongs to this group.

This difficulty is reflected in the wide variety of terms used in the literature to refer to MTEs (teacher educator, facilitator, didactician, mentor, professional development provider, teacher developer, teacher of teachers), which reveal the plurality of contexts and functions in which they work (Even, 2014; Giadas, Pascual et al., 2024; Karsenty et al., 2023; Pascual, 2021; Taylan et al., 2022). As Pascual (2021) points out, this proliferation of labels is linked to the difficulty of recognising oneself as part of a homogeneous group, which affects the construction of a common professional identity. In this regard, Swennen et al. (2010) indicate that this identity incorporates multiple facets,

including those of former school teacher, university lecturer, teacher educator, and researcher.

This diversity of professional identities becomes particularly evident when comparing MTEs working in higher education and non-higher education contexts (Even, 2014). Dengerink et al. (2015) note that those who come from school settings and take on MTE roles retain a strong teacher identity, whereas those who work at university tend to develop an identity more closely linked to academia, shaped by research and disciplinary specialisation. In this regard, Zeichner (2005) argues that learning to become an MTE requires direct involvement in teacher education practice, accompanied by processes of reflection and self-study. Communities of practice (Wenger et al., 2002) also play a fundamental role in this professional development, as they foster the exchange of knowledge and the construction of professional identities (Olanoff et al., 2021; Taylan et al., 2022).

The construction of this professional identity also takes place in a context in which specific preparation for working as an MTE remains limited. Despite the importance of these professionals in mathematics teacher education, teacher education institutions do not always devote attention to their specific preparation (Ayalew, 2017). Several studies point to the absence of common or systematic initial preparation programmes, meaning that each MTE constructs their trajectory individually, drawing on diverse educational opportunities that are not always articulated with one another (Almeida et al., 2021; Jaworski, 2008; Karsenty et al., 2023; Olanoff et al., 2021; Sikko & Grimeland, 2021). Consequently, the construction of MTEs' professional identity may follow very different routes, shaped both by educational opportunities available to them and by the characteristics of each context.

The absence of specific preparation programmes also hinders the consolidation of clear routes into the MTE role. Unlike other, more structured educational professions, the routes to becoming an MTE are diverse, weakly institutionalised, and vary according to context (Gómez, 2009; Smith, 2003). Some authors highlight key elements of this transition, such as reflection on practice and participation in communities of practice (Dengerink et al., 2015; Zeichner, 2005). Consequently, MTEs develop heterogeneous professional trajectories that affect the knowledge and competences they draw upon in their professional practice.

The qualifications of those who teach in teacher education programmes are often not examined in sufficient depth (Castro Superfine et al., 2024), and the transition to the MTE role is rarely supported by programmes specifically

designed for this purpose. The idea persists that school teaching experience is sufficient preparation to take on teacher education (Zeichner, 2005), overlooking the pedagogical and epistemological complexity of the role. In some contexts, such as certain universities in the United States, teacher education courses are taught by doctoral students (Zeichner, 2005). This lack of systematic preparation is also reflected in the fact that many MTEs acquire their professional knowledge primarily through postgraduate studies, suggesting a trajectory that is more academic than professional (Flores-Medrano et al., 2020; Malambo, 2023). Models such as that of Goodwin et al. (2014) recognise this postgraduate knowledge as part of MTEs' knowledge.

The diversity of trajectories described above makes the professional profile a particularly useful framework for understanding how MTEs' professional routes are configured. Smith (2003) argues that the professional profile can be understood as a multidimensional construct, shaped by the interplay between different dimensions of MTEs' professional trajectories, including initial education, postgraduate specialisation, teaching experience in different contexts, teacher education activities undertaken, and participation in learning, practice, or research communities. From this perspective, the professional profile makes it possible to understand the heterogeneity of MTEs by jointly considering the different dimensions that shape their professional trajectories.

From this conception of professional profile, the literature has begun to pay increasing attention to the transitions into the MTE role and to the study of MTEs' professional profiles. Far from being a linear or predefined process, this transition involves diverse trajectories that shape the knowledge and practices developed by these professionals. In this regard, Sikko and Grimeland (2021) examine the trajectories of two theoretical mathematics researchers who become MTEs in primary teacher education, revealing the complexity of these routes. Similarly, larger-scale studies, such as TEDS-M (Tatto et al., 2008) and the UNESCO-led initiative conducted across several Latin American countries (Cox et al., 2021), have explored the selection, education, and experience of MTEs, helping to make their role in improving mathematics education more visible. These are complemented by more context-specific studies, such as those of Alves and Silva (2024) in Brazil, Avalos-Rogel and Hernández-Escobar (2021) in Mexico, Giadas, Pascual et al. (2024) in Spain, and Masingila and Olanoff (2022) in the United States, which, through different methodological approaches, contribute to characterising the professional profile of MTEs in different educational contexts.

Despite these advances, important gaps remain regarding this professional group. The TSG-35 group of the International Congress on Mathematical Education (ICME) recently placed the following questions at the centre of its work: “Who are MTEs? What do we know about their knowledge, practices, and beliefs?” (TSG-35 Working Team, 2024, p. 498). The persistence of these questions shows that a robust, systematic, and empirical characterisation of MTEs is still lacking. Consequently, the literature agrees on the need for further research into their professional profiles as a means of understanding and improving mathematics teacher education processes.

In order to advance this field of research, the present study follows this line of inquiry and has a twofold objective: to identify the professional profiles of MTEs in Latin America and to compare these profiles with those found in the Spanish context. Unlike previous studies, it includes a more diverse sample of Latin American countries and is not restricted to a specific educational stage.

Accordingly, the research questions are: (RQ1) What differences and similarities exist in the gender and age distributions of MTEs in the Latin American and Spanish contexts? (RQ2) What educational trajectories and professional experience, in both higher education and non- higher education contexts, characterise MTEs in Latin America? (RQ3) What are the most common routes into initial teacher education among MTEs in the Latin American and Spanish contexts? (RQ4) What professional profiles can be identified among MTEs in the Latin American context?

METHODOLOGY

This study adopts a descriptive and comparative design (Bisquerra Alzina, 2009), with the aim of identifying the professional profiles of MTEs in the Latin American context and comparing them with those previously identified in the Spanish context. The instrument used was a questionnaire designed in Microsoft Forms® by experts from the MTSK network (Mathematics Teachers’ Specialised Knowledge; <https://redmtsk.net/>), to explore MTEs’ educational trajectories, experience, and beliefs. The questionnaire was originally designed in Spanish and was subsequently translated and adapted into Portuguese and Italian by bilingual speakers of each language, to ensure the linguistic and conceptual equivalence of the instrument and enable its administration across the different contexts represented within the MTSK network.

The questionnaire consists of 27 items divided into two sections: MTEs’ profiles and MTEs’ beliefs. The first section comprises 17 items addressing

general aspects of MTEs, including information on gender, age, country, institutional affiliation, academic background, professional experience, and the characteristics of the education institutions and programmes in which they work. The second section comprises nine items concerning MTEs' beliefs about the content of initial teacher education and their perceptions of professional learning needs. The instrument had previously been validated by experts from the MTSK network (Rojas & Pascual, 2023).

The target population of the study consisted of MTEs working in higher education institutions and involved in initial or continuing teacher education. The study received approval from the Ethics Committee of the University of Oviedo, and the administration of the questionnaire was preceded by obtaining participants' informed consent, ensuring that participation was voluntary and anonymous.

The questionnaire was administered in Latin America in several stages. First, it was distributed to the network coordinators in the different countries: Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Peru, and Venezuela. Second, each coordinator contacted a network representative at each member institution in their country. This person was then responsible for distributing the questionnaire among MTEs at the same institution, regardless of whether or not they were members of the network. This procedure involved purposive and chain-referral sampling, supported by the structure of the MTSK network. Although the reach of the questionnaire made it possible to obtain a relatively large sample, the possibility of self-selection bias is acknowledged, since MTEs more closely connected to the network or with a greater interest in educational research may have been more inclined to participate.

Following administration of the questionnaire at different universities in these countries, 83 MTEs from the Latin American context participated in the study. To compare the two contexts, previously collected data from 157 MTEs in the Spanish context were used (Gíadas, Pascual et al., 2024). The Latin American participants were distributed as follows: Argentina (15), Brazil (4), Chile (5), Colombia (2), Costa Rica (20), Mexico (31), Peru (5), and Venezuela (1). The Spanish MTEs belonged to 28 different institutions, whereas the Latin American MTEs came from 29 different institutions.

Although the number of participants differs between the two contexts, comparability was sought through the use of the same instrument and consistency in the procedure for distribution and data collection. Nevertheless, differences in sample size and composition mean that the comparison should be interpreted primarily from a descriptive perspective, aimed at identifying

general trends and patterns rather than making population-level inferences. Accordingly, statistical tests are used as support for the descriptive analysis, and their results are interpreted in light of the limitations arising from the non-random nature of the sample.

Consistent with the multidimensional conception of professional profile proposed by Smith (2003), the present study operationalises this construct in terms of educational trajectory, professional experience, route into initial teacher education, gender, and age. Given that the literature indicates that the absence of specific preparation programmes and common routes leads to diverse professional trajectories among MTEs (Almeida et al., 2021; Jaworski, 2008; Karsenty et al., 2023; Olanoff et al., 2021; Sikko & Grimeland, 2021), educational trajectory is considered the central dimension for identifying professional profiles. Professional experience, route into initial teacher education, gender, and age are used to characterise the identified profiles.

To this end, MTEs' responses to the following questionnaire items were analysed:

- gender, with the possible values: *male*, *female*, and *I do not identify/prefer not to say*.
- age, with the possible ranges: *20–30 years*, *31–40 years*, *41–50 years*, and *51 or older*.
- academic background at undergraduate degree (or equivalent qualification), master's degree (or equivalent qualification, according to the terminology used in each country), and doctoral degree. At each academic level, the possible values are: *mathematics (or related scientific areas)*, *education (teacher education)*, *mathematics education (didactics of mathematics or educational mathematics)*, *pedagogy (or related areas)*, and *not applicable*. For clarity, in the text, the following labels will be used, respectively: mathematics [Math], education [Edu], mathematics education [MathEd], pedagogy [Ped], and not applicable [NA].
- professional experience in higher education, with the possible ranges: *5 years or less*, *between 6 and 15 years*, *between 16 and 25 years*, and *more than 25 years*. It should be noted that this experience includes both initial and continuing teacher education.
- professional experience outside higher-education, focusing on the educational stages of early childhood education (0–6 years), primary education (6–12 years), and secondary education (12–16/18 years).

The possible values for this item are: *currently only*, *in the past only*, *currently and in the past*, and *I have never undertaken this activity*.

- route into initial teacher education, whose possible values are shown in Table 1.

Table 1

Possible responses to the item on routes into initial teacher education

While working as a school teacher, I began teaching in initial teacher education programmes.
While working as a school teacher, I became involved in continuing teacher education and subsequently began teaching in initial teacher education programmes.
After completing my undergraduate education, I began teaching in initial teacher education.
During my postgraduate education, I began teaching in initial teacher education.
After completing my postgraduate education, I began teaching in initial teacher education.
While teaching courses in my area of specialisation at university, I became involved in initial teacher education.

Professional profiles were identified following the procedure used by Giadas, Pascual et al. (2024) in the Spanish context. First, MTEs' educational trajectories were identified from the combination of their academic background at undergraduate, master's, and doctoral levels. The trajectories occurring most frequently were then selected, characterise in terms of professional experience, route into initial teacher education, gender, and age, thereby yielding the professional profiles considered in this study.

MTEs' responses were collected in a spreadsheet and analysed using RStudio software. For the Latin American context, all variables considered in this study were analysed. For the Spanish context, the results reported by Giadas, Pascual et al. (2024) concerning gender, age, educational trajectory, and professional experience were used, and an analysis of the item on routes into initial teacher education was added to complete the characterisation of the professional profiles.

Data analysis was conducted by calculating absolute and relative frequencies for each variable analysed. The results tables were produced from these frequencies, and the R packages *plotly* and *ggplot2* R were used to create

the graphical representations. In addition, where the nature of the data allowed, inferential statistical tests were conducted using Fisher’s exact test and the two-sample test for equality of proportions with Yates’ continuity correction (Lehmann & Romano, 2005), with a significance level of 5% in both cases.

RESULTS

The results are organised into four sections in order to address the research questions. Regarding geographical distribution, Mexico accounted for the largest proportion of participants (37.34%), followed by Costa Rica (24.1%) and Argentina (18.1%). Participation from each of the remaining countries was below 6%, while no responses to the questionnaire were obtained from Ecuador.

(RQ1) What differences and similarities exist in the gender and age distributions of MTEs in the Latin American and Spanish contexts?

Table 2 presents the gender distribution of MTEs in both contexts. Women constituted the majority group (55.4% in Latin America and 50.3% in Spain), with no statistically significant differences between the two distributions according to Fisher’s exact test ($p = 0.5945$).

Table 2
Gender of MTEs

Gender	Percentage	
	Latin American context (N=83)	Spanish context (N=157)
Female	55,4 %	50,3 %
Male	44,6 %	47,8 %
I do not identify/Prefer not to say	0 %	1,9 %

Table 3 shows the age distribution of MTEs. In both contexts, most participants were aged 41 years or older, although the distribution across the two upper age ranges differed slightly. In the Latin American context, the largest group comprised MTEs aged 41–50 years (42.2%), whereas in the Spanish context, the group aged 51 or older predominated (35.7%). The percentages in the 31–40 age range were similar in both contexts (22.9% and 25.5%, respectively), and the 20–30 age group was the least represented in both samples. These differences were not statistically significant according to Fisher’s exact test ($p = 0.2042$).

Table 3*Age of MTEs*

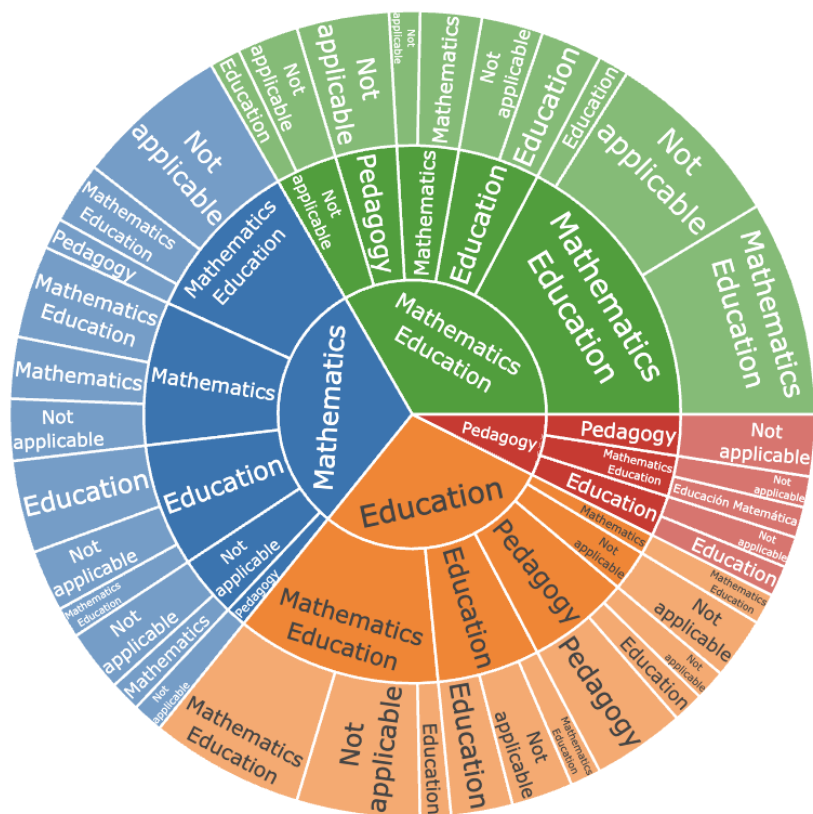
Age range	Frequency (Percentage)	
	Latin American context (N=83)	Spanish context (N=157)
20-30 years	2 (2,4 %)	12 (7,6 %)
31-40 years	19 (22,9 %)	40 (25,5 %)
41-50 years	35 (42,2 %)	49 (31,2 %)
51 years or older	27 (32,5 %)	56 (35,7 %)

(RQ2) What educational trajectories and professional experience, in both higher education and non-higher education contexts, characterise MTEs in Latin America?

MTEs' educational trajectories were reconstructed from the combination of their qualifications at undergraduate, master's, and doctoral levels. Figures 1 and 2 represent these trajectories using three concentric rings: the inner ring corresponds to undergraduate education (or an equivalent qualification), the middle ring to master's education (or the equivalent qualification according to the terminology used in each country), and the outer ring to doctoral education. Figure 1 presents the trajectories for the Latin American context, while Figure 2 shows those for the Spanish context.

In both contexts, educational trajectories combining the four areas considered were identified. However, their distribution differed between the two contexts. Whereas an undergraduate degree in mathematics clearly predominated in Spain, the Latin American context showed a more balanced distribution among *mathematics*, *education*, and *mathematics education*. Furthermore, the *not applicable* category at doctoral level was more frequent in the Latin American context. Specifically, 48.2% of the participating Latin American MTEs did not hold a doctoral degree, compared with 22.9% of the Spanish MTEs. The two-sample test for equality of proportions showed that this difference was statistically significant ($p < 0.05$), indicating a higher proportion of MTEs with doctoral education in the Spanish context.

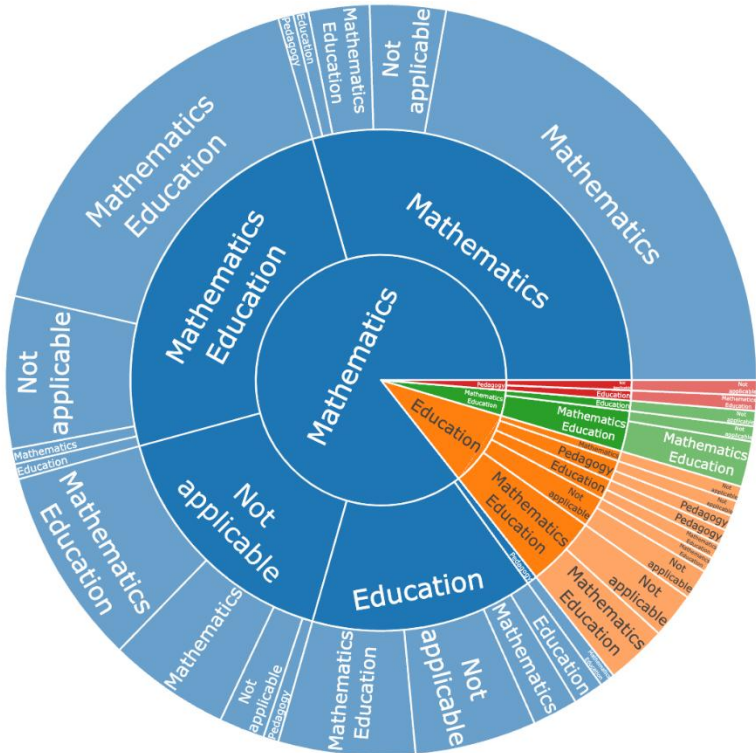
Figure 1
Educational trajectories in the Latin American context.



Note. Authors' own work.

Figure 2

Educational trajectories in the Spanish context.



Note. Adapted from “Perfiles de formadores de profesorado de matemáticas en el contexto universitario español” (p. 448), by P. Giadas, M. I. Pascual, L. Muñiz-Rodríguez, L. J. Rodríguez-Muñiz and L. C. Contreras, 2024, PNA, 18(5).

The high diversity of educational trajectories observed in Figure 1 made it difficult to identify trajectories sufficiently representative for subsequent characterisation. In particular, the high proportion of MTEs without doctoral education (48.2%) considerably increased the number of possible combinations, while distinguishing between the *education* and *pedagogy* categories generated trajectories with very low frequencies. Given this dispersion, in a second phase of the analysis, both categories were grouped under a single category (Edu), and only the combination of undergraduate and master’s education was considered. This procedure identified six predominant educational trajectories which, taken together, included 62 of the 83

participants, representing approximately 75% of the Latin American sample (Table 4).

Table 4

Most representative educational trajectories in the Latin American context

Educational trajectory [Undergraduate/Master's]	Frequency
MathEd/MathEd	14
Edu/Edu	14
Edu/ MathEd	12
Math/MathEd	8
Math/Math	7
Math/Edu	7

Note. MathEd= Mathematics Education; Edu = Education; Math = Mathematics.

Figures 3 and 4 show the distribution of MTEs’ professional experience in higher education in the Latin American and Spanish contexts, respectively. In both contexts, the most frequent configuration corresponded to MTEs with *between 6 and 15 years* of experience in initial teacher education and *5 years or less* in continuing professional development. In the Latin American context, there was also a notable presence of MTEs with *between 6 and 15 years* of experience in both areas and of MTEs with *between 16 and 25 years* of experience in both initial and continuing teacher education. By contrast, in the Spanish context, the second most frequent configuration corresponded to MTEs with *5 years or less* of experience in both areas. This difference suggests greater university professional experience among MTEs in Latin America than in Spain.

In the Latin American context, four configurations accounted for most of the MTEs’ professional experience in higher education. The most frequent corresponded to those with *between 6 and 15 years* of experience in initial teacher education and *5 years or less* in continuing teacher education (16.87%), followed by *between 6 and 15 years* of experience in both initial and continuing teacher education (12.05%), *5 years or less* in both areas (10.84%), and *between 16 and 25 years* of experience in both types of teacher education (10.84%).

Figure 3

Professional experience in higher education in initial and continuing teacher education in the Latin American context.

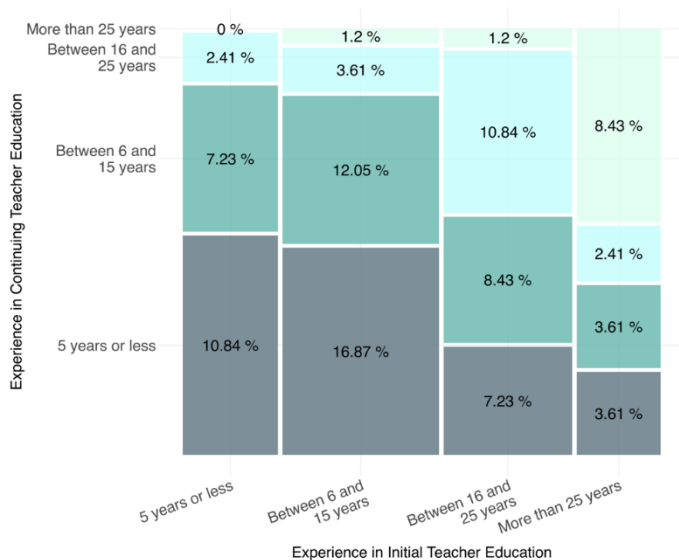
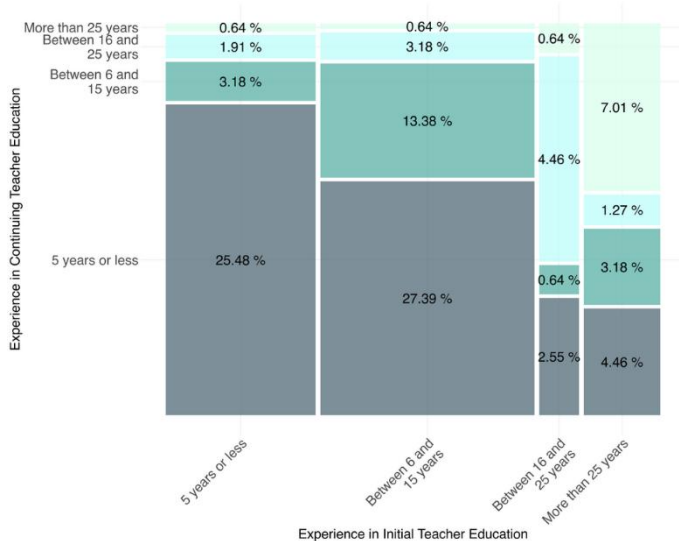


Figure 4

Professional experience in higher education in initial and continuing teacher education in the Spanish context.



Note. Adapted from “Perfiles de formadores de profesorado de matemáticas en el contexto universitario español” (p. 449), by P. Giadas, M. I. Pascual, L. Muñiz-Rodríguez, L. J. Rodríguez-Muñiz and L. C. Contreras, 2024, PNA, 18(5).

Figures 5 and 6 present MTEs’ non-university professional experience in the Latin American and Spanish contexts, respectively. In early childhood education, a similar pattern was observed in both contexts, with a clear predominance of MTEs who had never worked professionally at this educational stage. A similar pattern was also observed in primary education, although the Latin American context showed a greater representation of MTEs with previous experience. The main differences between the two contexts were found in secondary education. In both cases, the largest group comprised MTEs who had worked at this educational stage only in the past; however, in the Latin American context, this group accounted for a notably larger proportion of participants, whereas in the Spanish context the differences between those who had worked only in the past and those who had never undertaken this activity were less pronounced.

Figure 5

Non-university professional experience in the Latin American context.

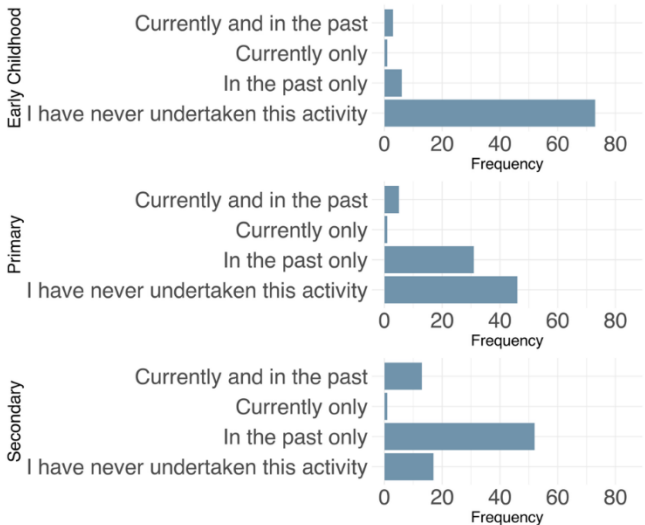
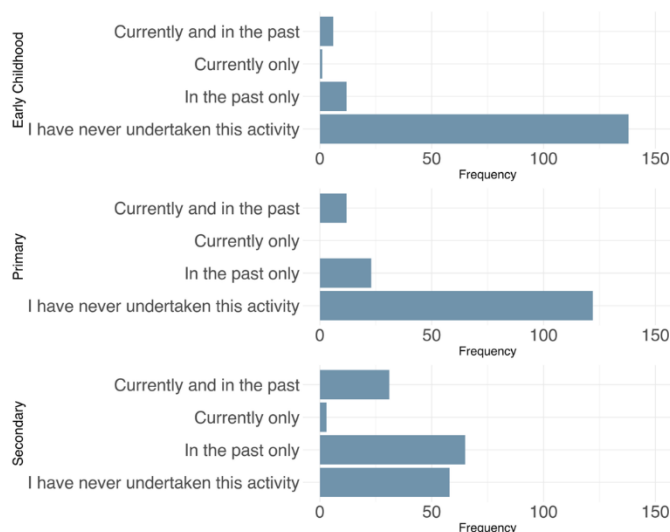


Figure 6

Non-university professional experience in the Spanish context.



Note. Adapted from “Perfiles de formadores de profesorado de matemáticas en el contexto universitario español” (p. 449), by P. Giadas, M. I. Pascual, L. Muñiz-Rodríguez, L. J. Rodríguez-Muñiz and L. C. Contreras, 2024, PNA, 18(5).

(RQ3) What are the most common routes into initial teacher education among MTEs in the Latin American and Spanish contexts?

Table 5 shows the different routes by which MTEs entered initial teacher education. In the Latin American context, the most frequent routes corresponded to starting this activity during postgraduate education (*RE4*) (21.7%), after undergraduate education (*RE3*) (20.48%), and after postgraduate education (*RE5*) (20.48%), with very similar percentages. By contrast, in the Spanish context, the predominant route was entry after postgraduate education (*RE5*), accounting for 29.94% of cases. Taken together, the routes linked to previous experience as a school teacher (*RE1* and *RE2*) accounted for 27.74% of cases in the Latin American context, compared with 21.65% in the Spanish context. Conversely, entry while simultaneously teaching in another subject area at university (*RE6*) was more frequent in Spain (12.74%) than in Latin America (8.43%). Although descriptive differences were observed between the two contexts, Fisher’s exact test ($p = 0.434$) indicated that the distribution of

routes into initial teacher education did not differ statistically significantly between the Spanish and Latin American contexts.

Table 5

Routes by which MTEs entered initial teacher education

Route of Entry (RE)	Percentage in Latin America	Percentage in Spain
While working as a school teacher, I began teaching in initial teacher education programmes (RE1)	18,1 %	12,10 %
While working as a schoolteacher, I became involved in continuing teacher education and subsequently began teaching in initial teacher education programmes (RE2)	9,64 %	9,55 %
After completing my undergraduate education, I began teaching in initial teacher education (RE3)	20,48 %	17,2 %
During my postgraduate education, I began teaching in initial teacher education (RE4)	21,7 %	17,83 %
After completing my postgraduate education, I began teaching in initial teacher education (RE5)	20,48 %	29,94 %
While teaching courses in my area of specialisation at university, I became involved in initial teacher education (RE6)	8,43 %	12,74 %
N	N=82	N=156

Note. There is one missing value in both the Latin American and Spanish contexts.

(RQ4) What professional profiles can be identified among MTEs in the Latin American context?

Once the predominant educational trajectories in the Latin American context had been identified (Table 4), they were characterise in terms of gender, age, professional experience, and route into initial teacher education. Joint analysis of these dimensions made it possible to identify the predominant professional profiles of MTEs in the Latin American context.

Table 6 presents the gender distribution of MTEs in each of the identified educational trajectories. The MathEd/MathEd and Edu/Edu

trajectories showed a relatively balanced distribution between women and men, whereas women predominated in the remaining trajectories, particularly Math/Math and Math/Edu.

Table 6

Educational trajectories of MTEs by gender

Educational trajectory [Undergraduate/Master's]	N	Female	Male	I do not identify/Prefer not to say
MathEd/MathEd	14	7	7	0
Edu/Edu	14	6	8	0
Edu/ MathEd	12	8	4	0
Math/ MathEd	8	6	2	0
Math/Math	7	6	1	0
Math/Edu	7	6	1	0

Note. N = number of MTEs with the educational trajectory; MathEd = Mathematics Education; Edu = Education; Math = Mathematics.

Table 7 presents the age of MTEs in each of the educational trajectories considered. MTEs aged 31 years or older predominated in all trajectories, while participants under the age of 30 were very few, with only one case in each of the MathEd/MathEd and Edu/Edu trajectories. Furthermore, the Edu/Edu and Math/Edu trajectories consisted exclusively or predominantly of MTEs aged 41 years or older.

Table 7

Educational trajectories of MTEs by age

Educational trajectory [Undergraduate/Master's]	N	20-30 years	31-40 years	41-50 years	51 years or older
MathEd/MathEd	14	1	4	4	5
Edu/Edu	14	1	0	6	7
Edu/ MathEd	12	0	4	5	3
Math/ MathEd	8	0	2	3	3
Math/Math	7	0	1	4	2
Math/Edu	7	0	0	3	4

Note. *N* = number of MTEs following the educational trajectory; *MathEd* = *Mathematics Education*; *Edu* = *Education*; *Math* = *Mathematics*.

Table 8 shows MTEs’ professional experience in higher education for each educational trajectory. To facilitate interpretation of the results, only configurations with a frequency greater than one participant are considered.

The Math/Math trajectory showed the clearest pattern, as most MTEs combined *between 6 and 15 years* of experience in initial teacher education with *5 years or less* in continuing teacher education. Three configurations stood out in the Edu/MathEd trajectory: *between 6 and 15 years* of experience in initial teacher education and *5 years or less* in continuing teacher education (4 MTEs), *between 6 and 15 years* in both initial and continuing teacher education (3 MTEs), and *more than 25 years* of experience in initial teacher education together with *between 16 and 25 years* in continuing teacher education (2 MTEs). Similarly, in the Math/MathEd trajectory, the most frequent configuration corresponded to more than 25 years of experience in both initial and continuing teacher education (3 MTEs), although the combination of *5 years or less* in initial teacher education and *between 16 and 25 years* in continuing teacher education was also observed (2 MTEs).

By contrast, the MathEd/MathEd and Edu/Edu trajectories showed greater diversity in configurations of professional experience in higher education. In the former, four configurations were identified with frequencies ranging from two to three MTEs, whereas in the latter no configuration exceeded three MTEs. Similarly, in the Math/Edu trajectory, the most frequent configuration corresponded to only two participants, reflecting greater dispersion in professional experience in higher education within this trajectory.

Table 8
Educational trajectories of MTEs by university professional experience

Educational trajectory [Undergraduate/Master’s]	N	Professional experience in higher education [Initial teacher education/Continuing teacher education]	Frequency
MathEd/MathEd	14	5 years or less/5 years or less	3
		Between 16 and 25 years/5 years or less	3
		Between 16 and 25 years/Between 16 and 25 years	2

		More than 25 years/5 years or less	2
		Between 16 and 25 years/5 years or less	2
Edu/Edu	14	Between 16 and 25 years/Between 6 and 15 years	3
		Between 6 and 15 years/5 years or less	4
Edu/MathEd	12	Between 6 and 15 years/Between 6 and 15 years	3
		More than 25 years/Between 16 and 25 years	2
		5 years or less/Between 16 and 25 years	2
Math/MathEd	8	More than 25 years/More than 25 years	3
Math/Math	7	Between 6 and 15 years/5 years or less	5
Math/Edu	7	Between 16 and 25 years/Between 16 and 25 years	2

MTEs' professional experience outside higher education for each educational trajectory is presented in Table 9, distinguishing between early childhood education, primary education, and secondary education.

Experience in early childhood education was limited across all educational trajectories, although the Math/Edu trajectory included the largest number of MTEs with experience at this stage. More pronounced differences were observed in primary education. The Edu/MathEd trajectory included the largest number of MTEs with experience at this stage, followed by MathEd/MathEd and Edu/Edu, with seven cases each. By contrast, the Math/MathEd and Math/Math trajectories included very few MTEs with professional experience in primary education.

The situation changed in secondary education. In the Math/MathEd and Math/Math trajectories, all MTEs had professional experience at this educational stage. This experience was also widely represented in the

MathEd/MathEd and Edu/MathEd trajectories, whereas in the Edu/Edu trajectory the numbers of MTEs with and without experience in secondary education were similar.

Table 9

Educational trajectories of MTEs according to professional experience outside higher education

Educational trajectory [Undergraduate/Master's]	N	Experience in early years education		Experience in primary education		Experience in secondary education	
		No	Yes	No	Yes	No	Yes
MathEd/MathEd	14	12	2	7	7	1	13
Edu/Edu	14	12	2	7	7	8	6
Edu/MathEd	12	10	2	3	9	1	11
Math/MathEd	8	8	0	6	2	0	8
Math/Math	7	7	0	6	1	0	7
Math/Edu	7	4	3	3	4	2	5

Note. N = number of MTEs following the educational trajectory; MathEd = Mathematics Education; Edu = Education; Math = Mathematics.

Table 10 presents MTEs’ routes into initial teacher education for each of the trajectories considered. The MathEd/MathEd and Math/Math trajectories showed a greater presence of MTEs who entered initial teacher education after completing their postgraduate education (RE5). In the Edu/Edu trajectory, entry through involvement in continuing professional development while working as a school teacher (RE2) and entry during postgraduate education (RE4) were similarly represented. Likewise, in the Edu/MathEd trajectory, entry after undergraduate education (RE3) and during postgraduate education (RE4) were the most prominent routes. The Math/Edu trajectory mainly combined entry after undergraduate education (RE3) with entry into the role of MTE while working as a school teacher (RE1). Finally, the Math/MathEd trajectory showed a very balanced distribution across the different routes, with no single route clearly predominating.

Table 10

Educational trajectories of MTEs by route into initial teacher education in the Latin American context

Educational trajectory [Undergraduate/Master's]	N	Route of Entry (RE)						N/A
		RE 1	RE 2	RE 3	RE 4	RE 5	RE 6	
MathEd/MathEd	14	3	2	1	2	5	1	0
Edu/Edu	14	2	4	2	3	1	2	0
Edu/ MathEd	12	2	0	3	4	2	1	0
Math MathEd	8	1	1	2	1	1	1	1
Math/Math	7	1	1	1	0	4	0	0
Math/Edu	7	2	1	3	0	1	0	0

Note. N = number of MTEs with the educational trajectory; MathEd = Mathematics Education; Edu = Education; Math = Mathematics; N/A = missing data.

Overall, characterising the educational trajectories in terms of gender, age, professional experience, and routes into initial teacher education made it possible to identify six predominant professional profiles among MTEs in the Latin American context. The characteristics of each profile are described below.

The first profile [MathEd/MathEd] comprises MTEs with a background in *mathematics education* at both undergraduate and master's levels. It shows a balanced distribution between women and men and professional experience in higher education, distributed across several configurations, with none clearly predominating. The most frequent route into initial teacher education is entry after completing postgraduate studies (RE5).

The second profile [Edu/Edu] corresponds to MTEs with a background in *education* at both undergraduate and master's levels. It consists of MTEs aged 41 or older and shows a relatively balanced distribution between women and men. It is also the trajectory with the lowest presence of MTEs with professional experience in secondary education. The most frequent routes are collaboration in continuing teacher education while working as a school teacher (RE2) and entering initial teacher education during postgraduate education (RE4).

The third profile [Edu/MathEd] mainly comprises women with an undergraduate background in *education* and a master's degree in *mathematics*

education. It is characterised by including the largest number of MTEs with professional experience in primary education. In addition, the most frequent routes into initial teacher education are entry after undergraduate studies (*RE3*) and during postgraduate education (*RE4*).

The fourth profile [Math/MathEd] consists mainly of women with an undergraduate background in *mathematics* and a master's degree in *mathematics education*. All MTEs in this trajectory have professional experience in secondary education. Furthermore, the different routes into initial teacher education show a similar distribution, with none clearly predominating over the others.

The fifth profile [Math/Math] comprises MTEs with a background in *mathematics* at both undergraduate and master's levels. Women predominate and, unlike the other profiles, it presents a predominant configuration of professional experience in higher education, characterised by *between 6 and 15 years* of experience in initial teacher education and *5 years or less* in continuing teacher education. In addition, all MTEs have professional experience in secondary education, and the most frequent route is entry into initial teacher education after completing postgraduate studies (*RE5*).

Finally, the sixth profile [Math/Edu] mainly comprises women with an undergraduate background in *mathematics* and a master's degree in *education*. It consists exclusively of MTEs aged 41 or older and includes the largest number of MTEs with professional experience in early childhood education among the identified trajectories. The most frequent route corresponds to entry into initial teacher education after undergraduate education (*RE3*) and while working as a school teacher (*RE1*).

In summary, the six profiles identified reflect differentiated educational trajectories characterised by different combinations of age, professional experience, and routes into initial teacher education.

To complete the comparison between the Latin American and Spanish contexts, the route into initial teacher education was added to the predominant educational trajectories previously identified for the Spanish context by Giadas, Pascual et al. (2024). The results are presented in Table 11.

Table 11

Educational trajectory of MTEs by route into initial teacher education in the Spanish context

Educational trajectory [Undergraduate/Master's/ Doctorate]	N	Route of Entry (<i>RE</i>)						N/A
		<i>RE</i> 1	<i>RE</i> 2	<i>RE</i> 3	<i>RE</i> 4	<i>RE</i> 5	<i>RE</i> 6	
Math/Math/Math	34	1	1	2	5	14	10	1
Math/ MathEd / MathEd	26	2	4	3	7	9	1	0
Mat/NA/ MathEd	13	2	1	5	1	2	2	0
Edu/ MathEd / MathEd	4	0	0	0	2	2	0	0
MathEd / MathEd / MathEd	3	1	1	1	0	0	0	0

Note. *N* = number of MTEs in the educational trajectory; *Math* = Mathematics; *MathEd* = Mathematics Education; *Edu* = Education; *NA* = Not applicable; *N/A* = missing data.

In the Math/Math/Math and Math/MathEd/MathEd trajectories, the most frequent route corresponds to entry into initial teacher education after completing postgraduate studies (*RE*5). In the Math/NA/MathEd trajectory, the most frequent route is entry after undergraduate education (*RE*3). By contrast, no predominant route is identified in the Edu/MathEd/MathEd and MathEd/MathEd/MathEd trajectories, although these results should be interpreted with caution given the small number of MTEs included in these two trajectories.

DISCUSSION AND CONCLUSIONS

This study constitutes an empirical contribution to the characterisation of the professional profiles of MTEs in the Latin American context. The general characterisation of the sample reveals several similarities and differences compared with previous studies conducted both in Latin America and in other international contexts, particularly regarding gender and age distributions, level of academic education, and MTEs' educational trajectories. Regarding gender, the data collected show a slight majority of women among the participants, which contrasts with the findings of the Mexican study by Avalos-Rogel and Hernández-Escobar (2021), where men predominated, and instead aligns with the results of the UNESCO report (Cox et al., 2021), which highlights a greater female presence in most of the Latin American countries analysed. Regarding

age, the results show a concentration of MTEs aged 31 or older. This finding differs from that reported by Alves and Silva (2024) and Cox et al. (2021), who place this concentration from age 41 onwards.

The results also show that 48.2% of the participating MTEs do not hold a doctoral qualification. This finding contrasts with the study conducted by Giadas, Pascual et al. (2024) in the Spanish context, where most MTEs hold this qualification, as well as with the US context described by Masingila and Olanoff (2022), where it is increasingly common to find MTEs with doctoral degrees, predominantly in *mathematics education*. This situation can be interpreted in light of the particular characteristics of postgraduate education in Latin America. Flores-Medrano et al. (2020) note that professionally oriented postgraduate programmes predominated over research-oriented programmes in this context, leading institutions to prioritise the professional preparation of MTEs. The same authors also highlight that the strengthening of mathematics education research in the region takes place mainly through master's programmes rather than doctoral programmes. Along the same lines, Ruiz (2017) argues that the specialisation of Latin American MTEs is mainly undertaken through master's level studies.

These characteristics of the education system are also reflected in the educational trajectories identified. Whereas Giadas, Pascual et al. (2024) describe a predominance of trajectories beginning with undergraduate education in *mathematics* in the Spanish context, the present study reveals greater diversity in educational pathways. This diversity may be explained, at least in part, by the existence, in some Latin American countries, of specific undergraduate degrees in *mathematics education* (Concha-Zelada et al., 2024), an option that does not exist in the Spanish context, where no specific undergraduate degree in this discipline is offered (Rico, 1999). Overall, these results highlight the influence of context on the configuration of MTEs' educational trajectories, shaped both by the academic provision available and by the characteristics of teacher education systems.

With regard to the first research objective, (to identify the professional profiles of MTEs in the Latin American context), six predominant professional profiles were identified, constructed from the most frequent educational trajectories and their characterisation according to gender, age, professional experience, and route into initial teacher education. The educational trajectories underpinning these profiles differ from those described in studies conducted in Brazil (Alves & Silva, 2024) and Mexico (Avalos-Rogel & Hernández-Escobar, 2021), where MTEs with undergraduate education in *mathematics* predominate.

By contrast, the present study identifies diverse trajectories combining undergraduate education in *mathematics*, *education*, and *mathematics education*, with none constituting the predominant route into the MTE role. This finding extends the available evidence on MTEs' professional profiles by considering a sample drawn from different Latin American countries and highlights the diversity of trajectories through which this role is entered.

The characterisation of these profiles also reveals a close relationship between MTEs' educational trajectories and their previous professional experience. This finding is consistent with Zeichner (2005), who describes a common transition from teaching in the school system to teacher education, often without specific preparation for undertaking this role. This relationship becomes particularly visible when examining the educational stage at which MTEs acquired such professional experience. The results show that MTEs with undergraduate education in *mathematics* have a greater presence of professional experience in secondary education. This finding is consistent with Ruiz (2017), who argues that, since the 1990s, the education of secondary education teachers in Latin America has been closely linked to the discipline of mathematics. Nevertheless, the identification of MTEs with undergraduate education in *mathematics education* and professional experience in secondary education shows that teaching experience at this educational stage is not exclusive to those with an initial background in mathematics.

A similar situation is observed in primary education. The Edu/MathEd profile includes the largest number of MTEs with professional experience at this stage and, in general terms, profiles whose undergraduate education is in the field of *education* include a greater presence of MTEs with experience in primary education than those whose undergraduate education is in *mathematics*. This finding is consistent with Ruiz (2017), who argues that primary education teachers in Latin America usually receive initial education focused on general education. It also contrasts with the findings reported by Masingila and Olanoff (2022) for the US context, where MTEs were found to have limited previous experience in primary education. Finally, age also helps to differentiate some of the identified profiles. Whereas the Math/Edu and Edu/Edu profiles consist exclusively of MTEs aged 41 or older, the remaining profiles are predominantly composed of participants aged between 31 and 50. However, these results do not allow a relationship to be established between age and educational trajectory; they only indicate that certain trajectories are associated with different age groups within the sample analysed.

With regard to the second research objective (to compare the professional profiles of MTEs in the Latin American and Spanish contexts), four professional profiles common to both contexts were identified (Giadas, Pascual et al., 2024): MathEd/MathEd, Edu/MathEd, Math/MathEd, and Math/Math. However, these profiles differ both in their frequency of occurrence and in some of the characteristics that define them. In addition, two further profiles (Edu/Edu and Math/Edu) were identified in the Latin American context that were absent from the study conducted in Spain. One of the main differences between the two contexts concerns MTEs' doctoral education. Whereas in the Spanish context most professional profiles include MTEs with doctoral degrees (Giadas, Pascual et al., 2024), in the Latin American context a substantial proportion of these professionals have not attained this level of education. One possible explanation for this difference lies in the different requirements of the university systems in the two contexts. As Flores-Medrano et al. (2020) note, in Latin America the specialisation of MTEs has traditionally developed through professionally oriented postgraduate programmes, whereas in Spain obtaining a doctoral degree is generally a requirement for developing an academic career. In this sense, the observed differences appear to reflect not only different educational trajectories, but also different routes of entry and progression within the university.

Among the shared profiles, the MathEd/MathEd profile shows the most marked differences between the two contexts. In Latin America, the predominant route is entry into initial teacher education after completing postgraduate studies, whereas in the Spanish context entry while MTEs are working as school teachers predominates, this profile includes a higher proportion of MTEs aged 41 or older in the Spanish context, suggesting more established professional trajectories than those observed in the Latin American sample.

By contrast, the Math/MathEd profile shows a very similar configuration in both contexts. The main difference concerns the route into initial teacher education: no clearly predominant route is identified in the Latin American context, whereas in the Spanish one entry after postgraduate studies is the most frequent option.

The Math/Math profile also shows differences related to professional experience in higher education and the route into initial teacher education. Whereas in the Latin American context a single configuration of higher education professional experience predominates (*between 6 and 15 years* of experience in initial teacher education and *5 years or less* in continuing teacher

education) the Spanish context shows a more diverse distribution (Giadas, Pascual et al., 2024). Likewise, in the Latin American context, the most frequent route is entry into initial teacher education after completing postgraduate studies, whereas in the Spanish context greater weight is given to entering this activity while simultaneously teaching *mathematics* at university. This finding is consistent with the progressive incorporation of mathematicians into the field of mathematics education described by Rico (1999).

Finally, the Edu/MathEd profile also shows differences related to age and professional experience outside higher education. Whereas in the Spanish context all MTEs in this profile are under 41 years of age (Giadas, Pascual et al., 2024), a broader age distribution is observed in the Latin American context. Similarly, the Latin American profile includes a greater presence of MTEs with experience in primary education. Nevertheless, both contexts show a similar pattern in routes into initial teacher education, with entry during postgraduate education and after completing postgraduate studies predominating.

Overall, the findings align with the literature documenting the diversity of MTEs' identities (Escudero-Avila et al., 2021) and the heterogeneity of their work contexts (Chapman, 2021). They also extend the available knowledge on the professional profiles of MTEs in the Latin American context by empirically identifying six predominant profiles and comparing them with those previously described in the Spanish context. In this way, the study complements the information provided by the UNESCO report (Cox et al., 2021) by incorporating a broader and more diverse sample of Latin American countries and a more detailed characterisation of MTEs' professional profiles. Furthermore, the identification of four professional profiles shared by the Latin American and Spanish contexts, together with the existence of profiles exclusive to the Latin American context, shows that although the two contexts share certain professional trajectories, these are configured differently depending on the context analysed.

The main limitations of this study include the size and representativeness of the sample, given that participation by MTEs was low or absent in some Latin American countries, and that there was a considerable difference in the number of participants between the Spanish and Latin American contexts. The non-random selection of the sample, although it enabled relevant and characteristic aspects of MTEs to be identified, limits the extent to which the findings can be extrapolated and prevents the statistical tests from being regarded as yielding conclusions of general applicability. In addition, identifying the professional profiles required adapting the analysis

procedure to the Latin American context by grouping the categories *education* and *pedagogy* categories and focusing the reconstruction of the educational trajectories on undergraduate education (or an equivalent qualification) and master's education, owing to the high proportion of MTEs who had not undertaken doctoral studies. Although these decisions facilitated the identification of sufficiently representative trajectories and enabled a more homogeneous comparison with the Spanish context, they may also have influenced some of the differences observed between the two contexts.

Nevertheless, the findings provide a valuable basis for guiding future research on the professional profiles of MTEs in different contexts. In this regard, it would be worthwhile to examine whether the professional profiles identified are replicated in larger and more representative samples from Latin American countries, as well as to explore how they evolve in other national contexts. It would also be valuable to investigate in greater depth the relationship between professional profiles and the specialised knowledge mobilised by MTEs in their professional practice, given Gómez's (2009) argument that professional profiles influence the type and depth of knowledge they develop. Finally, integrating the findings obtained in this study with other dimensions already analysed using the same questionnaire, such as the teacher education activities undertaken by MTEs (Giadas, Muñoz-Rodríguez et al., 2024) or their beliefs and perceptions regarding their professional preparation (Giadas et al., 2025), would allow progress towards a broader understanding of their professional profiles, incorporating not only their educational and professional trajectories, but also aspects related to their practice and professional development.

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AUTHOR CONTRIBUTIONS

PG, LMR, and LJRM conceived the idea presented in this study. PG developed the methodology, conducted the formal analysis and investigation, and prepared the original draft of the manuscript. PG, LMR, and LJRM reviewed and edited the manuscript. LJRM secured funding for the project.

LMR and LJRM supervised the research. All authors reviewed and approved the final version of the manuscript.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study will be made available by the corresponding author, PG, upon reasonable request.

TRANSLATION STATEMENT

The authors were responsible for translating the manuscript from Spanish into English.

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