PROFESSIONAL IDENTITY PROFILES OF SECONDARY MATHEMATICS TEACHERS: A LATENT CLASS ANALYSIS

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This study examines the professional identity of secondary mathematics teachers as a dynamic construct related to training, professional experience, and professional perceptions. The aim of the study is to analyse the relationship between teachers' professional identity profiles and their evaluations of initial and continuing teacher education. Questionnaire data from 401 teachers of Compulsory and Upper Secondary Education were analysed using descriptive statistics, chi-square tests, and latent class analysis. The latent class analysis identified four differentiated teacher profiles combining academic background, professional trajectories, and perceptions of teacher education. The findings highlight the heterogeneity of secondary mathematics teachers and reinforce the need for flexible and differentiated models of teacher education.

INTRODUCTION

In secondary education, mathematics teachers play a key role not only in content transmission, but also in the development of students' reasoning, critical thinking, and problem-solving skills. Research in mathematics education has increasingly focused on teachers' professional characteristics and on their initial and continuing education, given their close relationship with teaching quality and students' learning processes. Previous studies have shown that differentiated teacher profiles are associated with both student achievement and the quality of classroom instruction (Holzberger et al., 2019).

Traditionally, secondary mathematics teachers have been assumed to possess strong disciplinary knowledge. However, several recent studies in Spain have highlighted a growing heterogeneity in teachers' mathematical background, partly due to the incorporation of graduates from fields other than mathematics (Martín de Diego, 2020; Muñiz-Rodríguez et al., 2015). This situation aligns with European evidence documenting persistent difficulties in attracting STEM graduates into the teaching profession (Davydovskaia et al., 2021), which has raised concerns about the adequacy and structure of initial teacher education pathways and their capacity to meet the demands of contemporary mathematics teaching (OECD, 2019).

In this context, the characterisation of mathematics teacher profiles gains relevance, as it allows for an analysis of how academic training, professional experience, and perceptions of teacher education are combined. Person-centred approaches have shown potential for identifying differentiated teacher profiles and examining their relationship

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with variables relevant to educational quality, although evidence remains limited in the context of secondary education (Holzberger et al., 2019).

This paper presents an integrated empirical study of secondary mathematics teachers, focused on initial and continuing teacher education as a central element in the construction of professional identity, understood as the set of self-understandings related to ways of being and projecting oneself in the profession (Losano, 2018). The aim of the study is to analyse the relationship between teachers' professional identity profiles and their evaluations of initial and continuing teacher education as components of professional identity construction. Using questionnaire data from teachers of Compulsory and Upper Secondary Education and a person-centred methodological approach, the study culminates in a latent class analysis that identifies differentiated teacher profiles. The main contribution lies in this typological characterisation, which provides evidence of the heterogeneity of secondary mathematics teachers and informs tailored approaches to teacher education.

THEORETICAL FRAMEWORK

Professional identity of mathematics teachers

This study is grounded in a conception of professional identity as a dynamic and contextualised process shaped by education, professional experience, and the social and institutional conditions of educational practice. Professional identity is understood as the set of self-understandings teachers construct regarding their ways of being and projecting themselves in the teaching profession (Losano, 2018). These self-understandings influence how teachers interpret their education, assess their professional development needs, and face the challenges of teaching mathematics.

In the case of secondary mathematics teachers, professional identity is influenced by prior educational trajectories and disciplinary specialisation, as well as by experiences associated with different models of pedagogical training. Differences in entry qualifications and perceptions of sufficiency of initial and continuing education shape diverse professional identities, which cannot be understood in a homogeneous or linear manner. Consequently, the analysis of professional identity requires approaches capable of capturing the coexistence of multiple patterns within the teaching population.

Person-centred approaches and teacher profiles

Person-centred approaches have gained prominence in educational research as an alternative to variable-centred approaches, as they allow the identification of patterns of combined characteristics within individuals, leading to differentiated profiles or typologies (Holzberger et al., 2019). This perspective is particularly suitable for the study of teachers, given the complex and multidimensional nature of their education, experience, and professional practice.

Applied to mathematics education, person-centred approaches have facilitated the identification of teacher profiles integrating beliefs, educational trajectories, and professional contexts, revealing meaningful differences in perceptions of professional competence and evaluations of teacher education. From this perspective, the study of teacher profiles provides an interpretive framework for analysing the heterogeneity of mathematics teachers and their professional identity in an integrated manner.

Latent class analysis as a theoretical and methodological tool

Within person-centred approaches, latent class analysis (LCA) provides a robust framework for identifying unobservable profiles based on patterns of responses to observed variables. LCA assumes the existence of an underlying latent variable that organises the population into mutually exclusive and exhaustive classes, enabling the identification of subpopulations with differentiated internal structures (Howard & Hoffman, 2017).

From both theoretical and methodological perspectives, LCA operationalises the notion of teacher profiles by allowing the joint analysis of personal, educational, and professional dimensions without imposing prior relationships among variables (Hartl & Holzberger, 2022). In mathematics teacher education, this approach makes it possible to move beyond a priori group comparisons and to identify data-driven profiles, aligning with a non-reductionist conception of teachers' professional identity.

RELATED LITERATURE

The background of this study lies in research aimed at characterising secondary mathematics teachers based on personal, educational, and professional variables. In the Spanish context, García-Longoria & Blanco (2005) constitute a reference study, highlighting the heterogeneity of secondary mathematics teachers in terms of academic background, pedagogical training, and professional development.

Subsequent research has examined the adequacy of mathematics teacher education to the demands of teaching practice, revealing highly diverse educational trajectories derived from different entry qualifications and pedagogical training models (Teaching Skills Course before 2009 and later MSTE). These trajectories are associated with differentiated perceptions of the sufficiency of initial education and continuing professional development needs (Muñiz-Rodríguez et al., 2015; Martín de Diego, 2020). Quantitative studies have further shown significant associations between teachers' qualifications, professional experience, administrative status, and evaluations of the education received (Garrido-Rojas et al., 2024).

More recently, typological perspectives have been adopted to identify differentiated teacher profiles based on combinations of educational and professional variables. For example, Muñiz-Rodríguez et al. (2020) identified distinct profiles among prospective mathematics teachers and analysed their relationship with perceptions of competency development, confirming the absence of a homogeneous profile in teacher education.

At the international level, person-centred approaches, widely discussed within the PME research community (Müller & Gold, 2026, among others), have contributed to the identification of teacher profiles by analysing joint response patterns and overcoming the limitations of variable-centred analyses (Holzberger et al., 2019).

Despite these advances, relatively few studies have integrated, for in-service mathematics teachers, the joint analysis of personal characteristics, initial and continuing education, and professional status using person-centred methodologies. This gap justifies the need for research that identifies teacher profiles based on large empirical datasets and analyses their relationship with evaluations of teacher education.

METHODOLOGY

This study adopts a quantitative, empirical approach framed within person-centred research, aimed at identifying homogeneous subgroups within a population based on observed response patterns (Holzberger et al., 2019). In this framework, latent class analysis (LCA) is used as the main analytical technique to identify teacher profiles without imposing prior relationships among variables.

The data analysed were obtained through a questionnaire designed to study secondary mathematics teachers in Compulsory and Upper Secondary Education. The instrument comprises 28 items organised into five blocks: personal data, academic background, initial pedagogical training, continuing education, and professional development. For the analyses reported here, 19 variables were selected, excluding open-ended items and those specific to MSTE-trained teachers, to ensure comparability across participants.

The questionnaire was distributed to public and private schools in Andalusia through mathematics departments, using convenience sampling (Cohen et al., 2018). Data analysis followed a two-step strategy. First, Pearson's chi-square (χ^2) tests were conducted to explore bivariate associations between educational and professional variables. Subsequently, an LCA was performed using the selected variables as observed indicators. Models with two to six classes were estimated, and model selection was based on AIC, BIC, and entropy, prioritising solutions with lower information criteria and entropy values above 0.80.

Once the final model was selected, class membership and conditional response probabilities were analysed to characterise the resulting teacher profiles. Statistical analyses were conducted using IBM SPSS Statistics and JAMOVI.

RESULTS

Preliminary results

This study is constructed on a progressive sequence of empirical analyses. In an initial exploratory phase, a descriptive analysis was conducted to characterise secondary mathematics teachers in terms of preservice training, professional experience, and perceptions of initial and continuing education. These results revealed marked

heterogeneity within the group, particularly regarding entry qualifications and evaluations of the sufficiency of initial education.

Differences by academic background were especially relevant: teachers holding a degree in Mathematics tended to evaluate their initial education more positively, whereas those from related degrees reported greater demand for specific training in mathematics didactics. These findings helped to delimit key variables and informed subsequent analyses.

In a second phase, Pearson's chi-square tests identified statistically significant associations between university degree, professional experience, administrative status, and perceptions of the sufficiency of initial education. While these results partially confirmed the descriptive patterns, they also highlighted the limitations of bivariate analyses in capturing the complexity of teachers' trajectories, motivating the use of a person-centred latent class analysis.

Variables included in the analysis

The latent class analysis was conducted using 19 variables grouped into four dimensions: academic training, pedagogical training, professional experience, and evaluation of the education received, as shown in Table 1.

Table 1: Coding of questionnaire items

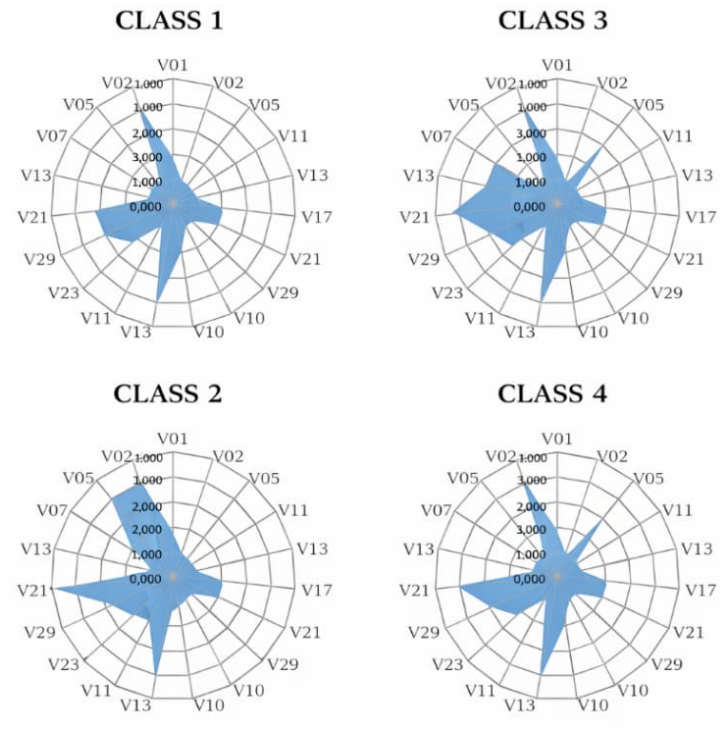
Code	Variable
V01	Age
V02	Gender
V03	University degree
V04	Main reason for choosing university studies
V05	Would you choose the same studies again?
V07	Other university studies
V08	Sufficiency of initial education
V09	Need to extend didactical training
V10	When should didactical training take place?
V11	When should teaching practice be carried out?
V12	Completion of the MSTE
V27	Usefulness of induction training
V28	Usefulness of training offered by teacher centres
V29	Professional experience
V30	Type of school

V31	Access to first teaching position
V32	Administrative status
V33	Most frequent professional difficulties

Selection of the latent class model

Models with two to six latent classes were estimated. Model comparison was based on AIC, BIC, and entropy criteria. The four-class model provided the most appropriate balance between model fit and parsimony, together with high entropy, indicating accurate classification of participants. The final solution identified four differentiated teacher profiles that reflect distinct combinations of educational background, professional experience, and perceptions of teacher education, reinforcing the heterogeneity of the teaching population, as seen in Figure 1.

Figure 1: Conditional response probabilities of the four latent classes across the observed variables



The first group is characterised by a high probability of holding a university degree in mathematics, working predominantly in public schools, and by relatively recent incorporation into the profession. Most chose their university studies with teaching in mind, reported high satisfaction with them, and accessed the system as interim teachers through public hiring pools, remaining largely in temporary positions. Their initial preparation is evaluated positively, particularly regarding mathematical content, and didactical preparation is perceived as adequate, suggesting a coherent professional identity linked to disciplinary training.

A second profile corresponds to highly experienced teachers, predominantly mathematics graduates working mainly in public schools as civil servants and trained through earlier pedagogical models. Although they generally consider their university studies satisfactory, they express more critical views regarding their adequacy for current teaching demands, emphasising professional experience as the main source of competence. This group differs from the first in having accessed the profession mainly through competitive examinations and in regarding didactical preparation during undergraduate studies as the preferred model.

A third profile groups teachers with non-mathematics degrees and heterogeneous academic backgrounds, who work predominantly in private schools and entered the profession through contractual hiring rather than competitive examinations. Their initial education is not uniformly evaluated as sufficient, and although satisfaction with university studies is moderately high, teaching was not always their initial career objective. This group shows stronger engagement in continuing professional development and pedagogical training, reflecting a dynamic identity shaped by the need to compensate for gaps in initial preparation.

Finally, a fourth profile is characterised by teachers with technical or engineering degrees and relatively limited teaching experience, who accessed the system through interim hiring and remain in temporary positions. Although they report the lowest satisfaction with their university studies—originally chosen for labour-market prospects rather than teaching—they tend to evaluate their initial teacher education as sufficient while simultaneously highlighting the need to reinforce didactical training, pointing to a professional identity in transition.

Across profiles, there is shared consensus that teaching practice is best undertaken within the MSTE, and broad agreement that didactical preparation should be strengthened. Perceptions of classroom challenges are also common, with lack of student interest emerging as the most pressing issue.

CONCLUSION

The results provide an integrated view of the professional identity of secondary mathematics teachers through the identification of four differentiated latent profiles, defined by specific combinations of academic training, professional trajectories, and evaluations of initial and continuing education. Latent class analysis demonstrates its capacity to move beyond variable-centred approaches and capture the heterogeneity of teachers' professional paths.

Profiles with strong disciplinary backgrounds and linear trajectories tend to evaluate their preparation more positively, whereas heterogeneous or experienced profiles show greater demand for didactical updating. The results also point to the positive role of the MSTE in shaping teachers' perceptions of the sufficiency of their initial education.

Overall, the study reinforces the need to conceive mathematics teacher education as a flexible and differentiated process. The typological characterisation obtained provides

empirical evidence to inform the design and improvement of initial and continuing mathematics teacher education models.

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