CHARACTERIZATION OF THE COMPETENCIES OF FUTURE MATHEMATICS TEACHERS IN ECUADOR

Alba Alay Giler 1  
David Gutierrez-Rubio 2  
Juan Carlos Melero-Bolaños 3  
María Rodríguez-Baiget 4

ABSTRACT

Objective: To analyze the graduation profile of teacher training programs to identify and describe the specific skills that teachers should acquire during their initial training.

Theoretical Framework: The study is grounded in the theory of teacher training competencies, which asserts that teachers must possess cognitive abilities to adapt to different educational contexts, procedural skills to address specific professional challenges, and ethical attitudes to guide their educational practice.

Method: An ex post facto study was conducted with a mixed exploratory and descriptive approach, using as the study population the 13 Ecuadorian universities that offer teacher training in mathematics.

Results and Discussion: A total of 198 competencies grouped into 17 categories were identified. The most frequent category pertains to mathematical knowledge. Variations among the universities analyzed were observed, with some focusing more on content knowledge and others on competencies directly related to teaching practice.

Research Implications: The results can be used to enhance teacher training programs by integrating key competencies and developing more effective educational strategies. Additionally, they could influence the formulation of educational policies that establish clear standards, thereby improving educational quality and preparing teachers for current challenges.

Originality/Value: This study provides a mixed exploratory and descriptive approach to examine the graduation profile of teacher training programs in mathematics in Ecuador. It also offers guidance for the preparation of future teachers, ensuring alignment with current and future educational demands.

Keywords: Teacher Training, Mathematics Education, Competencies, Ecuador.

CARACTERIZAÇÃO DAS COMPETÊNCIAS DOS FUTUROS PROFESSORES DE MATEMÁTICA NO EQUADOR

RESUMO

Objetivo: Analisar o perfil de formação dos programas de formação de professores para identificar e descrever as habilidades específicas que os professores devem adquirir durante sua formação inicial.

Referencial Teórico: O estudo fundamenta-se na teoria das competências de formação de professores, que afirma que os professores devem possuir habilidades cognitivas para se adaptar a diferentes contextos educacionais.

1 Universidad Técnica de Manabí, Portoviejo, Ecuador. E-mail: alba.alay@utm.edu.ec  
Orcid: https://orcid.org/0000-0002-5436-9706

2 Universidad de Córdoba, Córdoba, España. E-mail: dgrubio@uco.es  
Orcid: https://orcid.org/0000-0002-4461-2223

3 Universidad de Córdoba, Córdoba, España. E-mail: z12meboj@uco.es  
Orcid: https://orcid.org/0000-0001-9844-2162

4 Universidad de Córdoba, Córdoba, España. E-mail: mariabaiget619@gmail.com  
Orcid: https://orcid.org/0000-0002-2880-3150
habilidades procedimentais para enfrentar desafíos profesionales específicos e atitudes éticas para orientar su práctica educativa.

Método: Foi realizado um estudo ex post facto com uma abordagem mista exploratória e descritiva, utilizando como população de estudo as 13 universidades equatorianas que oferecem formação de professores em matemática.

Resultados e Discussão: Foram identificadas 198 competências agrupadas em 17 categorias. A categoria mais frequente refere-se ao conhecimento matemático. Observaram-se diferenças entre as universidades analisadas, com algumas focando mais no conhecimento de conteúdos e outras em competências diretamente relacionadas à prática docente.

Implicações da Pesquisa: Os resultados podem ser utilizados para aprimorar os programas de formação de professores, integrando competências-chave e desenvolvendo estratégias educacionais mais eficazes. Além disso, podem influenciar a formulação de políticas educacionais que estabeleçam padrões claros, melhorando assim a qualidade educacional e preparando os professores para os desafios atuais.

Originalidade/Valor: Este estudo oferece uma abordagem mista exploratória e descritiva para examinar o perfil de formação dos programas de formação de professores em matemática no Equador. Além disso, oferece orientação para a preparação de futuros professores, garantindo alinhamento com as demandas educacionais atuais e futuras.

Palavras-chave: Formação de Professores, Educação Matemática, Competências, Equador.

CARACTERIZACIÓN DE LAS COMPETENCIAS DE LOS FUTUROS PROFESORES DE MATEMÁTICAS EN ECUADOR

RESUMEN

Objetivo: Analizar el perfil de graduación de los programas de formación docente para identificar y describir las habilidades específicas que los profesores deben adquirir durante su formación inicial.

Marco Teórico: El trabajo se sustenta en la teoria de competencias de formación docente, según la cual los docentes deben poseer capacidades cognitivas para adaptarse a diferentes contextos educativos, habilidades procedimentales para enfrentar desafíos profesionales específicos, y actitudes éticas que guíen su práctica educativa.

Método: Se llevó a cabo un estudio ex post facto con un enfoque mixto exploratorio y descriptivo, utilizando como población de estudio las 13 universidades ecuatorianas que ofrecen formación docente en matemáticas.

Resultados y Discusión: Se identificaron 198 competencias agrupadas en 17 categorías. La categoría más frecuente es la relativa al conocimiento matemático. Se aprecian diferencias entre las universidades analizadas, encontrando algunas más enfocadas al conocimiento de contenidos y otras a competências más orientadas a la docencia en sí.

Implicaciones de la investigación: Los resultados pueden utilizarse para mejorar los programas de formación docente al integrar competencias clave y desarrollar estrategias educativas más efectivas. Además, podrían influir en la formulación de políticas educativas que establezcan estándares claros, mejorando así la calidad educativa y preparando a los docentes para los desafíos actuales.

Originalidad/Valor: Aporta un enfoque mixto exploratorio y descriptivo para examinar el perfil de graduación de programas de formación docente en matemáticas en Ecuador. Además, ofrece orientación para la preparación de futuros docentes, asegurando su alineación con las demandas educativas actuales y futuras.

Palabras clave: Formación Docente, Educación Matemática, Competencias, Ecuador.
1 INTRODUCTION

Taking into account the changes and demands that have been presented in relation to the preparation of professionals in the field of teaching, the initial training of mathematics teachers acquires a significant relevance in the context of higher education and the improvement of the quality of mathematics education. The research carried out on this topic happen and concludes that the importance of initial training for mathematics teachers lies in its direct impact on the students' learning process. Moreover, it stands out that highly qualified teachers in mathematics have a positive effect on the academic performance of students [1]. With these results, it is necessary to reflect on the skills and competencies that future mathematics teachers acquire during their initial training in teaching.

In the current context of initial teacher training, identify the criteria that define the teaching profile represents a complex challenge for universities and pedagogical institutes in charge of preparing future educators. This is even more difficult when considering the social, cultural and technological changes that have taken place in recent years. Until the beginning of the 21st century, the ability to teach was considered adequate for anyone who showed certain specific competencies related to the domain of a particular knowledge. However, today, a professional who teaches a subject, especially mathematics, must demonstrate not only a domain of mathematical knowledge, but also the ability to present it in different ways in order to facilitate student understanding.

In the scientific literature have been found different contributions with regard to the competencies that should characterize the profile of a mathematics teacher [2], [3], [4]. In some studies, it is concluded that teachers who have received solid training in mathematics have greater confidence in their ability to teach the subject [5]. Furthermore, they employ more effective teaching strategies and are able to adapt to the individual needs of students. It can be inferred then that mathematics teacher training provides future teachers with the fundamental disciplinary knowledge to teach this subject in a precise and understandable manner.

With the growing importance of teacher training in mathematics, it is crucial to examine the profile of future teaching professionals through the study of existing academic programs. This will allow us to know the skills that new teachers will acquire in their academic role in the field of mathematics. In light of the competencies established by experts in the field of teacher training, it is necessary to explore the different approaches that researchers have carried out in relation to the concept of teacher graduation profile. The teacher graduation profile implies an exhaustive description of the professional skills that future teachers must acquire during their
initial training in order to face the challenges of educational practice. This suggests that the graduation profile should be a clear and detailed reference that guides the preparation of teachers [6].

In line with the previous definition, the teacher graduation profile is understood as a skill set of knowledge, skills and attitudes that a teacher must develop at the end of their initial training, in order to perform effectively in their educational work. This conception highlights the importance of comprehensive training that covers not only theoretical aspects, but also practical skills and professional dispositions necessary to offer quality education. Likewise, from another perspective, the teacher graduation profile is considered a comprehensive description that include the characteristics and competencies that a teacher must possess when their initial training is conclude.

This integral vision includes pedagogical, disciplinary, didactic, ethical and socio-emotional aspects, recognizing the complexity and diversity of roles and responsibilities that teachers confront in their daily practice. These definitions of the teacher graduation profile highlight the importance of complete and relevant initial training that allows future teachers to acquire the necessary skills in order to face the challenges of the teaching profession. Therefore, the graduation profile must be a solid reference point that guides the curricular and pedagogical planning of teacher training programs, ensuring the adequate preparation of teachers to provide quality education [7], [8].

Initial teacher training programs in various countries, such as Germany [9], Australia [10], Denmark [11], the United States [12] and the United Kingdom [13], are based on a national competitive framework. These frameworks are based on the previously mentioned models of teacher knowledge, with the purpose of identifying the knowledge, skills and attitudes that future teachers must acquire during their initial training, in order to achieve an effective education in their subsequent teaching work. At the regional level of South America, a diversity of studies has been carried out in countries such as Colombia, Peru and Chile, which have provided valuable contributions on the graduation profile of mathematics teachers. These studies highlight the importance of developing pedagogical, didactic and disciplinary competencies during the initial training of mathematics teachers. Moreover, the need to acquire pedagogical skills, solid disciplinary knowledge and skills in the use of educational technologies is emphasized. Research also highlights the importance of developing didactic, pedagogical and disciplinary competencies, and skills in research and the use of technological resources for teaching.
At the regional level of South America, a diversity of studies has been carried out in countries such as Colombia, Peru and Chile, which have provided valuable contributions on the graduation profile of mathematics teachers. These studies highlight the importance of developing pedagogical, didactic and disciplinary competencies during the initial training of mathematics teachers. Moreover, the need to acquire pedagogical skills, solid disciplinary knowledge and skills in the use of educational technologies is emphasized. Research also highlights the importance of developing didactic, pedagogical and disciplinary competencies, and skills in research and the use of technological resources for teaching [14].

In the field of Higher Education in Ecuador, a specific skill set has not been established for future mathematics teachers. According to historical information from the country's universities, the training of mathematics teachers has not been independent, because it has been integrated as a complementary part of the teaching of physics. As of 2014, with the implementation of regulations for the standardization of titles and degrees granted by Higher Education institutions in Ecuador, universities have included this career within the field of Pedagogy of Experimental Sciences. Therefore, graduates receive the title of Bachelor of Mathematics and Physics Pedagogy.

In 2015, the Academic Network of Pedagogy of Experimental Sciences careers was established, specifically in mathematics and physics. Initially, this network was made up of six universities and its main objective was to carry out a process of redesigning academic programs. The purpose was to define a graduation profile that adjusted to a common skill set. In 2016, other seven universities joined this process, which made it possible to establish shared curricular aspects that contributed to achieving a more standardized graduation profile at the national level. In 2019, due to changes in the Academic Regime Regulation established by the Higher Education Council of Ecuador (CES), higher education institutions made curricular adjustments through the process of harmonization of study plans. These curricular adjustments are those that are currently in force in mathematics courses at the country's universities. Each of these universities determines the graduation profile of future mathematics teachers according to their own training context. Gumport and Snymand [15] state that knowing how changes in academic structures occur allows universities to establish a certain balance between the stability of academic programs and the changes that societies require in new times.
2 THEORETICAL FRAMEWORK

2.1 CONCEPTUALIZATION AND TYPES OF COMPETENCIES

Weinert [16] affirmed that the term competence is used both in the scientific and social fields with different meanings that are in the semantic field of the terms "ability," "aptitude," "capacity," "competence," "effectiveness" and "skill." In general form, it defines the concept of competence as a set of prerequisites individually or interindividual available to act successfully in areas of significant tasks. This definition has been influential in large-scale competency studies in teacher education. Understands cognitive abilities; motivation, volition, social disposition and the ability to solve problems; and the motivation, determination and social willingness to put solutions into practice [17].

Klieme and Leutner [18] start from this definition, but emphasize the understanding of competencies as cognitive performance dispositions, specific to each context, that functionally reply to the situations and demands in certain areas. Therefore, teaching competencies refer to the skills, knowledge, attitudes and abilities that a teacher must possess to effectively carry out their educational work [4]. These competencies go beyond the domain of specific content and cover pedagogical, didactic, emotional and relational aspects. In relation to this definition, Pinto [19] considers that professional competencies involve three dimensions, or aspects of the same phenomenon, these dimensions can be defined as:

1. Cognitive Competences: they are fundamentally the knowledge disciplinary, whose center knows how to understand, analyse, relate and synthesize certain knowledge, phenomena either system.
2. Procedural Competencies: These are those that allow you to know what to do in certain situations. Situations professionals; that is to say, aimed at generating some products.
3. Attitudinal Competencies: those referring to ethical aspects that guide and give meaning in knowing and doing. However, competency-based training is not limited to a training oriented exclusively toward in relation with their do, but also of the know to do, in consequence, it theoretical, it procedural and attitudinal they must be harmoniously considered in the processes of teaching-learning.

Rico [20] points out the four general competencies that the person must possess and develop. Teacher of mathematics has that see with the domain of:

a. The mathematical contents of secondary education from a mathematical perspective superior and his knowledge as teaching-learning objects.
b. The Organization curricular and planning of these contents’ mathematicians for his teaching.

c. Ability to analyse and interpret the productions math of the students.

d. “Manage” ability the content mathematical in the classroom.

A diversity of authors has studied the skills necessary to carry out teaching work. According to Poblete and Díaz [21] the mathematics teacher must have the ability to promote a favourable environment and confront sociocultural diversity in the teaching of mathematics, the ability to apply mathematical knowledge, adapt as a teacher, promote ethical development and work as a team. This statement made by the authors allows us to infer that the teaching of mathematics must be contextualized, interdisciplinary and integrative of mathematical contents to real situations and relate them to their usefulness in other disciplines. Other authors, such as Pinto [19], consider that the mathematics teacher must have competencies based on knowledge, skills, and personal and professional characteristics that make them an expert in effective teaching.

According to Paez [17], the essential skills that a mathematics teacher must have must be oriented towards the management and design of teaching situations, the comprehensive training of students, the development of critical thinking and innovation, as well as the promotion of scientific research and of interdisciplinarity. From the point of view of the ontosemiotic approach to mathematical knowledge and instruction (EOS) [22], the teacher must be able to analyse the mathematical activity when solving problems, identifying the practices, objects and processes put in place. At stake, and the variables that intervene in the statements, in order to formulate new problems and adapt them to each educational circumstance. The development of this competence is a challenge for teacher educators, due to the diversity of dimensions and components to take into account.

In the educational system, teachers are participants in a specific social context and must develop professional skills that allow them to exercise critical judgment when making decisions about their practice, depending on the prevailing conditions and betting on the context of the specific action [23].

3 CONCEPTUAL APPROACHES TO THE GRADUATION PROFILE OF THE MATHEMATICS TEACHER

The graduation profile of the teacher in mathematics refers to the comprehensive description of the competencies, knowledge, skills and attitudes that a teacher must have
developed at the end of their initial training in mathematics, with the purpose of carry out effectively in the teaching of this subject discipline. The graduation profile represents the set of attributes that the teacher is expected to have acquired and can apply in their educational practice.

According to the University of Playa Ancha [24].

“Profile associated with the disciplinary training of the profession. Uses logical-mathematical procedures to communicate, conceptualize, develop algorithms, distinguish and infer ideas, factors or consequences of real cases or situations in the field of plane Euclidean geometry, algebra (classical and linear), the calculus in one variable, referential numerical systems, number theory, descriptive statistics and probability, incorporating the use of mathematical software. In addition, it designs computer programs and integrates virtual resources to promote learning.”

4 TEACHER TRAINING IN MATHEMATICS IN ECUADOR

From the year 2012 with the implementation of the Organic Law of Higher Education (LOES) current, the creation of careers or the redesign of the careers offered by Universities and Higher Technological Institutes at the time, now Higher University Institutes, must respond to the principle of pertinent, Art. 107 which states that: According to the University of Playa Ancha [25].

Higher education responds to the expectations and needs of society, to national planning, and to the development regime, to the prospect of global scientific, humanistic and technological development, and to cultural diversity. For it. Higher education institutions will articulate their teaching, research and social engagement activities to academic demand, to local, regional and national development needs, to innovation and diversification of professions and academic degrees, to trends of the local, regional and national occupational market, to local, provincial and regional demographic trends: to the link with the current and potential productive structure of the province and the region, and to national science and technology policies.

In order to comply with this principle of pertinent, Ecuadorian universities must articulate their academic offer with the needs and demands of society and include in the curricular design activities that promote and guarantee compliance with the 2030 SDG Agenda. From this social perspective, Higher Education institutions are responsible for offering quality academic programs that prepare future teachers with the knowledge and skills necessary to teach in an effective manner. Universities must offer comprehensive training that includes
theoretical, methodological and practical aspects, as well as teaching practice experiences in real educational institutions. In this sense, universities also have the responsibility of promoting research in the field of mathematics education and promoting the constant updating of teachers in relation to advances and trends in the field of mathematics and the teaching of this discipline. This involves providing opportunities for continuous training, conferences, workshops and spaces for exchanging experiences between teachers and researchers.

The training of mathematics teachers plays a fundamental role in the training of citizens capable of affront the challenges of today's society, where mathematical skills are increasingly necessary in several areas such as science, technology, economics and research. In the educational field, mathematics teachers have the responsibility of developing in students’ solid mathematical skills and a critical and analytical mentality. This involves not only transmitting mathematical knowledge, but also promoting problem-solving skills, logical reasoning, critical thinking and mathematical communication skills. Teachers must promote an inclusive learning environment, where all students have the opportunity to develop their mathematical potential and overcome possible barriers or stereotypes related to mathematics.

However, it is also necessary to recognize the need to pay balanced attention to all the mentioned categories in order to guarantee a comprehensive and quality teaching practice. Muñiz Rodríguez [26], designed and validated a competency framework for future mathematics teachers in Secondary Education along the lines of the frameworks that have been developed in other countries (Germany, Australia, the United States or the United Kingdom). This gave rise to a framework of thirty-three competencies classified into twelve areas: mathematical knowledge, mathematical didactic knowledge, teaching and learning processes, classroom management, teaching planning, evaluation and tutoring, student personal development, inclusion and attention to diversity, information and communication technologies, communication skills, participation in the educational community and professional ethics. This competency framework has been taken as a fundamental instrument for evaluating the development and acquisition of competencies during the initial training period of mathematics teachers.

Furthermore, the participation of universities in mathematics teacher training includes collaboration with the educational system and schools. Universities can establish inter-institutional agreements with educational institutions to carry out teaching practices, joint research projects, pedagogical support programs and links with society. This collaboration allows future teachers to come into direct contact with educational reality and strengthen their training through practical pedagogical skills in a real context.
With these premises, it is possible to affirm that the mathematics teacher in Ecuador has a significant impact on society and education in the country; their work goes beyond transmitting mathematical knowledge, as it involves training critical and capable citizens of using mathematics in their own daily life. For their part, universities play a fundamental role in the training of these teachers, providing quality academic programs, promoting research and constant updating, and collaborating closely with the educational system. Through this collaboration and comprehensive training, the preparation of highly competent mathematics teachers committed to improving mathematics education in Ecuador can be guaranteed. Currently, the initial training of mathematics teachers in Ecuador is governed by the Academic Regime Regulations [27].

In accordance and under the theoretical perspective on the competencies, the graduation profile of mathematics teachers and the regulatory framework in which future mathematics teachers are trained in Ecuador, the present study proposed the following objectives: In accordance and under the theoretical perspective on the competencies, the graduation profile of mathematics teachers and the regulatory framework in which future mathematics teachers are trained in Ecuador, the present study proposed the following objectives:

### 5 GENERAL OBJECTIVE

The objective of this study is characterizing the competencies of the mathematics teacher based on the analysis of the graduation profile of the career in which mathematics teachers are trained in Ecuador.

The research search for analyse the graduation profile of these programs in order to identify the necessary competencies that teachers must possess, considering the characteristics and requirements established in said graduation profile. That it searches is to understand and describe in detail the specific competencies that a mathematics teacher must acquire during their initial training, in order to perform effectively in their educational role. Likewise, it searches to provide a clear and precise vision of the competencies that mathematics teachers are expected to develop and apply in their teaching practice, in order to achieve the standards and requirements established in the graduation profile of the training programs.
6 METHODOLOGY

A mixed methodological approach of an exploratory and descriptive nature has been adopted, being classified as an ex post facto study due to the absence of variable manipulation. Conventional strategies inherent to educational research are applied in the curricular field, supported by documentary content analysis techniques.

6.1 POPULATION

The study population was made up of the 13 Ecuadorian universities that offer teacher training in mathematics. Table 1 shows the thirteen universities in which future mathematics teachers are trained in Ecuador with the respective study period number [28].

Table 1

Universities in Ecuador where mathematics teachers are trained

<table>
<thead>
<tr>
<th>Higher Education Institution</th>
<th>Academic periods/Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guayaquil University</td>
<td>9</td>
</tr>
<tr>
<td>North Technical University</td>
<td>9</td>
</tr>
<tr>
<td>University of Cuenca</td>
<td>8</td>
</tr>
<tr>
<td>Private Technical University of Loja (Distance education)</td>
<td>8</td>
</tr>
<tr>
<td>Machala University</td>
<td>9</td>
</tr>
<tr>
<td>Central University of Ecuador</td>
<td>9</td>
</tr>
<tr>
<td>National University of Chimborazo</td>
<td>9</td>
</tr>
<tr>
<td>National University of Education UNAE</td>
<td>9</td>
</tr>
<tr>
<td>IKIAM Amazonian Regional University</td>
<td>9</td>
</tr>
<tr>
<td>Luis Vargas Torres University</td>
<td>8</td>
</tr>
<tr>
<td>Technical University of Manabi</td>
<td>8</td>
</tr>
<tr>
<td>Eloy Alfaro Secular University of Manabí</td>
<td>9</td>
</tr>
<tr>
<td>Bolivar State University</td>
<td>8</td>
</tr>
</tbody>
</table>

6.2 COLLECTING INFORMATION

In the first term, the graduation profiles of the careers that make up the population under study it was consulted in the official websites of each of the universities. Then all the publicly accessible information that these institutions offer in relation to degrees related to mathematics teacher training was downloaded.

When this information was not available on the web platform, requests for information were made to the directors of said universities and a response was received from all of them, so the process of searching and compiling information was exhaustive. Despite this, we must indicate that some universities offered few information.
6.3 DATA PROCESSING

As a second step all the information obtained was downloaded and tabulated in an ad hoc database. From the documentary analysis supported by ATLAS Software Ti, a process of identification and characterization of the capabilities enunciated in the graduation profiles of the universities under analysis was carried out, organizing them into labels that highlighted the fundamental elements that characterize these profiles.

Subsequently, these labels were quantified in their respective categories in order to evaluate the frequency of relevant aspects. To validate the previous process, the labels and categories were subjected to an analysis through triangulation by experts in educational research and non-participants in the study, belonging to the University of Valladolid, University of Tolima and University of Salamanca.

Finally, a statistical analysis of the categories was carried out in relation to each academic institution in order to identify the interconnections between the universities and the most preeminent categories in the graduation profile of future mathematics teachers.

7 RESULTS

Taking into account the documentary review of the study universities, 198 labels were identified that determined the capabilities that the universities aim to develop and that mathematics teachers must know, master and apply in the exercise of educational work. Subsequently, these labels were grouped into categories. 17 categories describing the graduation profile of future mathematics teachers were obtained (Table 2).

When observing the frequencies associated with each category, it can be noted that some aspects receive more attention than others. The most frequent category is "Knowledge and Know" with 22.7% of the observed competencies belonging to said category, which indicates that there is a strong emphasis on the acquisition and application of specific knowledge of both mathematics and its teaching. Seto evidence an important weight in the studies on the knowledge of the subject that the future graduate must possess.
Table 2

Categories of the observed competencies of the graduation profile

<table>
<thead>
<tr>
<th>Code</th>
<th>Category</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Knowledge and Know</td>
<td>28</td>
<td>12.7</td>
</tr>
<tr>
<td>02</td>
<td>Teaching Orientation</td>
<td>20</td>
<td>9.1</td>
</tr>
<tr>
<td>03</td>
<td>Management</td>
<td>13</td>
<td>5.9</td>
</tr>
<tr>
<td>04</td>
<td>Thinking Skills</td>
<td>12</td>
<td>5.5</td>
</tr>
<tr>
<td>05</td>
<td>Applied Didactics</td>
<td>11</td>
<td>5.0</td>
</tr>
<tr>
<td>06</td>
<td>Ethics Values and social</td>
<td>10</td>
<td>4.5</td>
</tr>
<tr>
<td>07</td>
<td>Vocational training</td>
<td>10</td>
<td>4.5</td>
</tr>
<tr>
<td>08</td>
<td>Didactic resources</td>
<td>10</td>
<td>4.5</td>
</tr>
<tr>
<td>09</td>
<td>Educative evaluation</td>
<td>40</td>
<td>4.5</td>
</tr>
<tr>
<td>10</td>
<td>Use of TIC in the educational context</td>
<td>10</td>
<td>4.5</td>
</tr>
<tr>
<td>11</td>
<td>Investigation and vinculation</td>
<td>10</td>
<td>4.5</td>
</tr>
<tr>
<td>12</td>
<td>Planning for education</td>
<td>10</td>
<td>4.5</td>
</tr>
<tr>
<td>13</td>
<td>Transversal skills</td>
<td>9</td>
<td>4.1</td>
</tr>
<tr>
<td>14</td>
<td>Class and pedagogical support</td>
<td>7</td>
<td>3.2</td>
</tr>
<tr>
<td>15</td>
<td>Innovation</td>
<td>5</td>
<td>2.3</td>
</tr>
<tr>
<td>16</td>
<td>Capabilities and domains</td>
<td>4</td>
<td>1.8</td>
</tr>
<tr>
<td>17</td>
<td>Teaching practice</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>220</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Another category with big presence in terms of frequency is "Teaching Orientation" with 12.7% of the competencies observed and classified into this category. This suggests that the training of future teachers will lay the foundations so that in pedagogical practice they are able to guide teaching in a contextualized, holistic, interdisciplinary, interculturally integrative way and with a gender focus. Teaching guidance also involves providing individualized direction, feedback and advice to students, which can be fundamental to their academic and personal development.

With a frequency of 9.1%, the category 04 "Thinking Skills" was identified, which involves promoting logical reasoning, problem solving, the capacity of abstraction and the application of mathematical concepts in everyday situations, beyond the technical knowledge related to mathematics content. This happen with less frequently than knowledge and know, which is indicative of that in the profile of the future teacher, the knowledge of contents is more important than the ability of reason. Also emerges the competencies related to "Management" and "Research and Linkage", revealing that these competencies are relevant in the training of future mathematics teachers. These two aspects are important into the educational field to improve teaching practice and contribute to the compliance of learning results and development of skills during the training process.

By analysing the different categories, we can see the importance that different universities assign to various key aspects such as knowledge, teaching orientation, educational...
evaluation, vocational training, teaching resources and thinking skills, which contrasts with the low presence of competencies related to teaching practice, tutoring and pedagogical reinforcement. Categories related to dealing with families are also missing, that form an important element of the students' educational environment [20].

Table 3 represent the different competencies of the graduation profile and how they are present in the universities analysed. The Technical University of Manabí stands out for the largest number of categories, followed by the Central University of Ecuador and the University of Guayaquil.

It is relevant to highlight the weight that category 01 "Knowledge and know" has in universities such as the Técnica de Manabí or Central del Ecuador. This category encompasses multiple dimensions, including the domain of the discipline, pedagogy, understanding of the context, use of didactic and assessment strategies, as well as research and critical thinking skills. This knowledge and skills are fundamental for the professional development of teachers and for the provision of high quality and relevant education for future mathematics teachers.

It can be observed that certain universities only seem to emphasise one or two competences, this may be due to the fact that they were the institutions that provided the most limited information after request.

**Table 3**

*Distribution of categories by universities analysed*

<table>
<thead>
<tr>
<th>Universidad</th>
<th>Categoría</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>01</td>
</tr>
<tr>
<td>Technical Univ of Manabi</td>
<td>22</td>
</tr>
<tr>
<td>Central Univ of Ecuador</td>
<td>12</td>
</tr>
<tr>
<td>University of Guayaquil</td>
<td>5</td>
</tr>
<tr>
<td>Particular Univ of Loja</td>
<td>1</td>
</tr>
<tr>
<td>University of Cuenca</td>
<td>3</td>
</tr>
<tr>
<td>University of Machala</td>
<td>2</td>
</tr>
<tr>
<td>University Laica Eloy Alfaro de Manabí</td>
<td>1</td>
</tr>
<tr>
<td>Estatal Univ of Bolívar</td>
<td>1</td>
</tr>
<tr>
<td>University National of Education UNAE</td>
<td>2</td>
</tr>
<tr>
<td>IKIAM University Regional Amazónica</td>
<td>2</td>
</tr>
<tr>
<td>University National of Chimborazo</td>
<td>2</td>
</tr>
<tr>
<td>Technical Univ of North</td>
<td>1</td>
</tr>
<tr>
<td>Univ Luis Vargaz Torres</td>
<td></td>
</tr>
</tbody>
</table>
The most present categories in the universities analysed are 01 (Knowledge and know) and 03 (Management), present in 10 out of 13 universities. This points to a certain consensus that mathematics teachers should acquire fluency in the technical knowledge of the subject they teach, as well as a good knowledge of the legal framework in the field of education. The next most common categories directly related to teaching activity are 02 and 09 (Teaching Guidance and Educational Assessment), which appear in 8 out of 13 universities. It is relevant that category 14 (Tutoring and Pedagogical Reinforcement) appears in only 4 of the 13 universities analysed, being that this important component of the educational field.

The mentioned list of categories covers various aspects related to teaching practice and education in general. These categories represent different areas of focus that are crucial to the development and success in the teacher education of future mathematics teachers (Table 4).

Table 4

<table>
<thead>
<tr>
<th>Competence</th>
<th>Description</th>
<th>Associated categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domains of mathematical Knowledge</td>
<td>Solid knowledge of mathematical concepts, theories and methods relevant to the educational level. Ability to transmit mathematical Knowledge clearly and effectively.</td>
<td>01, 04</td>
</tr>
<tr>
<td>Pedagogical Competence in Mathematics</td>
<td>Specific skills for teaching mathematics, including the design of teaching sequences, selection of teaching and assessment strategies, and adaptation to student needs.</td>
<td>02, 03, 05, 06, 07, 12, 16</td>
</tr>
<tr>
<td>Use of educational technologies in mathematics</td>
<td>Knowledge and ability to use technological tools and resources in teaching mathematics in a pedagogical way. Integration of technologies to improve learning and understanding of mathematical concepts and procedures.</td>
<td>08, 10, 15, 17</td>
</tr>
<tr>
<td>Promotion of mathematical Thinking</td>
<td>Promotion of logical reasoning, problem solving, abstraction and application of mathematical concepts in real situations. Development of a positive attitude towards mathematics and support in overcoming difficulties.</td>
<td>11</td>
</tr>
<tr>
<td>Assessment and feedback in mathematics</td>
<td>Skills to evaluate student learning in mathematics using different assessment instruments and techniques. Ability to provide constructive feedback and use the results to adjust teaching.</td>
<td>09, 14</td>
</tr>
</tbody>
</table>

From these detected competences it can be affirmed that for Ecuadorian universities, the mathematics teacher must have a solid domain of the mathematical concepts, theories and methods relevant to the educational level in which he or she will work. This involves a deep understanding of the different branches of mathematics, as well as the ability to transmit that knowledge clearly and effectively to students. Another category that characterizes the profile of the future mathematics teacher in Ecuador is the use of ICTs. The mathematics teacher must...
be familiar with the technological tools and resources available, such as specific software, graphing calculators and mobile applications, and be able to use them in an effective manner in the teaching and application of mathematical concepts, achieving that student can access to mathematical content and contexts that would otherwise be too complex to explore [29][30][31].

8 CONCLUSION

The graduation profile of mathematics teacher in the analyzed lesson plans highlight the importance of knowledge and know, reflecting the need for future teachers to be updated in their area of knowledge. Additionally, the ability to guide teaching and carry out effective educational evaluation are significant aspects for future teachers. These competencies underline the responsibility of facilitating students' academic growth by adapting teaching and assessment methods to their individual needs. Relevance has also been observed too in the capacity of future teachers to improve their pedagogical skills and competencies, as well as to adapt to new educational methodologies and technologies.

Even though some categories may receive more attention than others, all categories mentioned in the teaching profile are relevant in the university context, and none should be ignored. For this reason, is essential to recognize the need to balance and address all relevant areas for a comprehensive and successful teaching practice. The initial training of future teachers should focus on developing competencies in all these areas to ensure quality education and adequately prepare students for the challenges of the academic and professional world. Specialized knowledge in their field of study. They are also expected to develop skills in areas such as planning, innovation, evaluation, management, guidance and research. These multidimensional competencies reflect the complexity and responsibility of teaching work in the university context.

This study has revealed that the categories associated with the graduate profile of teachers in training are closely linked to a skill of multiple set, which also include ethical aspects and a social commitment to mathematics education, an indispensable subject for the training of several professions and performance of people in daily life.
REFERENCES


