

COMPETENCY ENGINEERING IN UNIVERSITY TEACHING: COMPARATIVE ANALYSIS OF INTERNATIONAL REFERENCE FRAMEWORKS

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Abstract- This article presents an in-depth comparative study of nine repositories of university teaching skills from various renowned international institutions. Using a rigorous methodology based on a careful comparison of these repositories, the main aim is to determine the key competences of a university teacher by identifying how often they are redundant. This approach aims to establish a precise mapping of the essential skills for university practitioners, with particular emphasis on the human aspect of higher education. In addition, the article highlights the growing importance of digital integration in university pedagogy, emphasizing the integration of digital skills as an essential element of the professional profile of university teachers. This study aims to respond to emerging educational needs and prepare teachers to meet the challenges of teaching in an ever-changing digital environment. In sum, this contribution seeks to enrich the debate on the professional development of university teachers by offering a holistic perspective on common expectations in terms of pedagogical skills, while highlighting the crucial importance of the human and digital dimensions in their daily practice.

Keywords: Competency Framework, University Teaching, Comparative Analysis.

1. GENERAL INTRODUCTION

University teaching is a dynamic and evolving field that requires a thorough understanding of the core competencies required of university teachers. The expectations and standards of higher education are constantly evolving, which raises the essential question of identifying the priority and relevant competences for practitioners in this field. The central issue of this study is the comparative analysis of nine competency frameworks from different world-renowned academic institutions [1].

The main aim is to categories and priorities these competences in university teaching in order to draw up an exhaustive list of the key competences expected of a university teacher, highlighting the similarities, divergences and emerging trends observed across these repositories. The competency framework for university teachers plays a crucial role in guiding the selection, professional development and quality assurance of teachers in higher education institutions. Studies have shown that these competency frameworks are essential for identifying key pedagogical skills, including learning management, psycho-pedagogical skills, digital literacy and problem-solving abilities. By aligning teaching practices with these frameworks, teachers are better prepared to educate students for a digital society by improving their digital skills and optimizing their teaching methods [2].

Implementing these competency frameworks has been shown to positively influence teachers' attitudes towards integrating information and communication technologies (ICT) into their courses, thereby improving both the theoretical and practical aspects of teaching [3]. This approach also enables universities to ensure the quality of teaching, improve student learning outcomes and adapt effectively to the changing educational landscape. To achieve our objective, we have adopted a systematic and rigorous methodology for analyzing the repositories. This approach involves a careful and methodical reading of each reference framework in order to identify the specific competences they define [4]. These skills will then be grouped into thematic categories to facilitate comparison and classification. An in-depth comparative analysis will then be undertaken to determine their relative importance and priorities them.

The originality and added value of this research will lie in the production of a structured and exhaustive list of essential teaching skills for university teachers, resulting

from an in-depth analysis of international reference frameworks [5]. This list will be a valuable resource for higher education practitioners, providing them with clear indications of the skills they need to develop in order to improve their teaching practice and respond effectively to the contemporary challenges of higher education. In summary, this scientific article sets out to provide an in-depth analysis of university teaching skills through the study of nine skills frameworks from renowned institutions. In this way, we hope to make a significant contribution to reflection and to the ongoing improvement of teaching practice in the context of higher education.

2. CONTEXT OF THE STUDY

University teaching is a constantly evolving field, essential for meeting contemporary societal demands and ensuring appropriate teaching standards. This evolution requires a thoughtful approach to the conceptualization of pedagogical methods, and in particular to the identification and development of the skills required of university teachers. In this context, competency frameworks play a crucial role in structuring the expectations and objectives of educational programs.

They systematically define the skills required in a specific field, which guides the training and assessment of students throughout their academic career. Competency frameworks do more than simply list competencies; they also clarify the vision of educational programs and demonstrate their added value in a changing context. As well as promoting interdisciplinarity and improving teaching methods, they help to enhance students' employability by aligning programs with the requirements of the labor market.

2.1. Evolution of Teaching Methods in Higher Education: Theoretical Perspectives and Current Trends

University pedagogy is a key area within higher education, focusing on the development and training of university teachers to ensure teaching standards meet contemporary societal demands. This field encompasses several dimensions, including the conceptualization of teaching and research [6], the development of practical frameworks for faculty, the stimulation of student enthusiasm for learning, the understanding of academic performance, as well as the ongoing organization of educational activities and the integration of technological advances [7].

Recent work highlights the importance of reconsidering fundamental aspects of the pedagogical role of universities, including student learning objectives, the role of educators and societal outcomes [8]. In addition, studies of postgraduate programs indicate a trend in pedagogical practices towards student-centered approaches, despite a correlation between students' academic backgrounds and their perceptions of teaching methods [9].

Furthermore, the influence of trends towards the standardization and democratization of higher education,

as well as the need for creative pedagogical innovations, were highlighted [10]. The evolution of the university educational landscape [11] is marked by constant adaptation to the new missions assigned to universities, including the reception of an increased number of students with diversified backgrounds responding to social expectations. This context is leading to the adoption of innovative teaching practices, often based on the use of new audiovisual and IT tools, aimed at reducing failure rates, offering specialized vocational training and reaching new audiences.

In short, university teaching is a field that is constantly evolving [12], encouraging teachers to rethink their teaching approaches to better meet the contemporary challenges of higher education. The current role of university teaching goes beyond the simple transmission of knowledge to involve a collective process of co-production of knowledge [13]. This discipline, which is specific to universities [14], is attracting growing interest in higher education circles [15], as evidenced by the debates and events devoted to its development.

2.2. Competency Profile for University Teachers

The skills required of university teachers in a changing educational landscape are multifaceted and essential to ensure effective teaching that is relevant to students' needs. The integration of digital skills is central, enabling teachers to make effective use of technology to enhance student learning and to support the development of digital skills [16]. At the same time, soft skills are increasingly valued in higher education, over and above technical skills alone. Employers increasingly value these soft skills, such as communication, collaboration and adaptability, which have become crucial for career success [17].

The move towards student-centered education also highlights the importance of teachers adapting their teaching methods to the individual needs of learners. This involves cultivating respectful and trusting relationships with students, as well as providing constructive feedback to optimize the educational process [18]. In the complex context of blended learning, teachers need to develop research and instructional design skills in order to implement blended learning strategies effectively. This requires assessment skills and a thorough understanding of learners' needs in a variety of learning environments [16]. Despite the persistent challenges, in-service training for teacher-researchers remains a crucial lever for improving the quality of university teaching [19].

Initiatives to support teachers in their professional development are essential to meet the challenges of the profession, in particular by enabling novice teachers to develop the skills needed in a changing academic environment [20]. In conclusion, the skills of university teachers go well beyond simply mastering academic content. They encompass digital, general and pedagogical skills, as well as an ability to adapt to the changing needs of students and learning contexts. Recognition of these diverse skills is essential to support quality university education that is adapted to contemporary challenges.

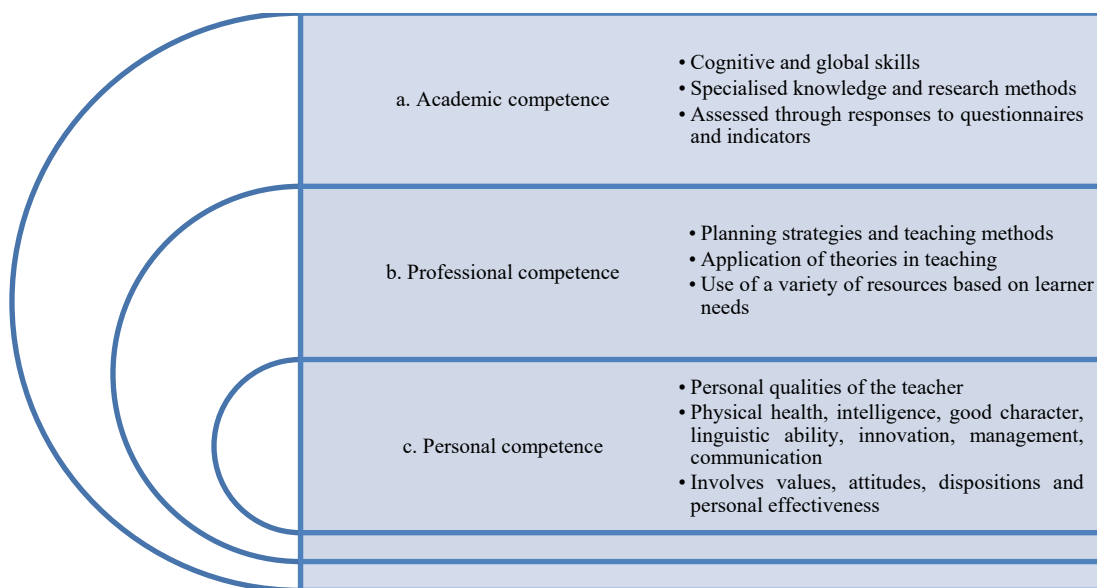


Figure 1. The skills of a university teacher [21]

2.3. Conceptualizing Competency Frameworks: Role, Functioning and Implications for University Pedagogy

Competency frameworks are of significant importance in various educational contexts, defining in a structured way the competencies required in a specific field or organization [3]. They are particularly useful in areas such as the teaching of health research ethics [22], where frameworks such as FRESCO have been developed to guide educational programs [23]. In the United States, these frameworks are increasingly used to adapt educational programs in response to changing professional and educational needs [24]. Even older competency frameworks, such as those defining medical competencies in India, continue to demonstrate their relevance over time [25].

A competency framework, is a structured document that articulates the competencies expected at the end of a training course, thus clarifying the output profile of a diploma and the competencies that graduates should master, whether or not they have received direct vocational training [26]. It is an essential tool for clarifying, evaluating and improving university training programs, going beyond a simple ideological or passing trend [27].

These reference frameworks play a crucial role in improving the quality of higher education [27], making it possible to clearly define the vision of programs, demonstrate their added value and ensure the coherent and evolutionary development of programs [27]. In addition, they promote interdisciplinarity, improve teaching and assessment methods, and help to enhance students' employability [27]. Their use is consistent with international standards and quality approaches, in line with the Bologna Process [27].

The use of competency frameworks is a global trend in higher education, supported by European recommendations and driven by the growing need to adapt educational programs [28]. The very definition of competence encompasses complex notions, defined by

the ability to perform tasks effectively in a variety of contexts [28]. Despite this diversity of definitions, the assessment of skills remains focused on their effectiveness in concrete situations [28].

In conclusion, competency frameworks are essential tools in university education, making it easier to adapt programs to current needs and contributing to continuous improvement in the quality of education.

3. RESEARCH METHODOLOGY

3.1. Research Problem and Objective

In the field of university teaching, identifying the essential skills for teachers remains a crucial challenge. This study aims to address this issue by prioritizing university teaching skills on the basis of an analysis of nine international reference frameworks. Our aim is to determine which competencies are most frequently cited, thereby providing empirical data to inform teacher training and institutional policies aimed at promoting the quality of higher education.

3.2. Method

A rigorous methodology was adopted for this analytical study of repositories of competences in university teaching. Nine repositories were carefully selected, taking into account specific criteria such as the reputation of the issuing institutions and comprehensive coverage of competences relevant to university teaching. The data extracted from these repositories was processed systematically and anonymized to preserve the integrity of the institutions and individuals mentioned. The skills identified in each repository were then categorized according to specific themes and areas to facilitate their comparative analysis.

Advanced statistical analyses, including competency frequency, co-occurrence and similarity analysis, were used to explore the relationships between these competencies.

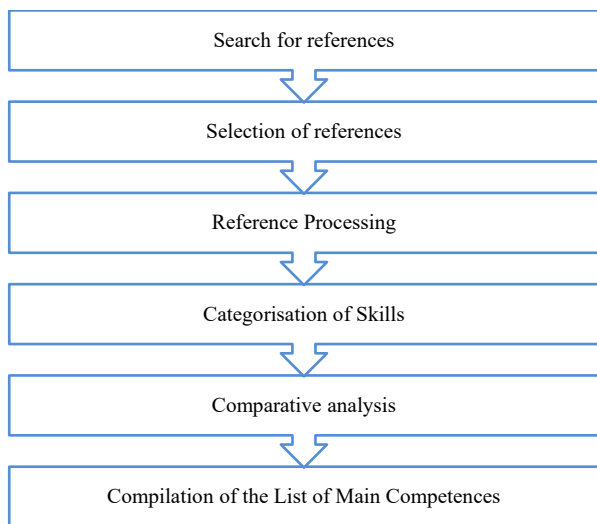


Figure 2. A methodical approach to the comparative analysis of 9 repositories of university teaching skills

The results obtained were validated using cross-validation techniques to ensure their robustness and relevance in the context of higher education. This rigorous methodological approach helped to highlight the main priority skills in university teaching, thus providing informed recommendations for educational practices and the professional development of teachers.

3.3. Selection of Competency Frameworks

The selection of the nine university pedagogy competency frameworks for this study represents a significant geographical and institutional diversification. They come from universities in various French-speaking countries such as France, Canada and Belgium. This geographical diversity makes it possible to explore the different perspectives and practices in higher education, as well as the cultural and institutional specificities influencing the competences expected of university teachers.

Table 1. Description of the selected competency frameworks

| Author | Country | Index | General skills | Specific skills |
|--|-----------|-------|----------------|-----------------|
| Savoie-Mont-Blanc University | (France) | R1 | 6 | 20 |
| University of Quebec in Montreal | (Canada) | R2 | 4 | 12 |
| University of Aix-Marseille | (France) | R3 | 10 | 42 |
| University of Quebec at Trois-Rivières | (Canada) | R4 | 11 | 33 |
| National School of Public Administration | (Canada) | R5 | 10 | |
| Free University of Brussels | (Belgium) | R6 | 3 | 11 |
| Catholic University of Louvain | (Belgium) | R7 | 3 | 10 |
| University of Paris-Diderot | (France) | R8 | 4 | 11 |
| University of Lille | (France) | R9 | 4 | 21 |

3.4. Criteria for Inclusion and Exclusion of Standards

The inclusion and exclusion criteria used to select the nine repositories of university teaching skills were rigorously applied in order to ensure the relevance and representativeness of the repositories chosen for this study. These criteria made it possible to give priority to repositories highlighting skills that are essential for university teaching, aligned with current teaching objectives, representative of a diversity of teaching approaches, and reflecting the contemporary needs of university teachers and students. Accordingly, only the reference frameworks that meet these criteria have been selected for this comparative analysis of university teaching skills.

- **Relevance of teaching skills:** The repositories were included on the basis of the relevance of their skills to university teaching. For example, the Université Savoie-Mont-Blanc in France focuses on resource management and learning assessment, which are essential skills for teachers. On the other hand, repositories focusing solely on research skills have been excluded because they are not directly linked to university pedagogy.

- **Alignment with pedagogical objectives:** repositories were included if they were aligned with the objectives of effective and innovative pedagogical practice. For example, the University of Quebec in Montreal in Canada emphasizes the planning of teaching-learning situations

based on the development of the skills targeted in the program, which is relevant to current university teaching practices. On the other hand, reference frameworks focusing solely on administrative skills have been excluded because they do not correspond to the specific pedagogical objectives sought.

- **Representativeness of pedagogical approaches:** The repositories were selected to represent a wide range of pedagogical approaches, thus reflecting the diversity of educational practices. For example, Canada's École national administration pulque emphasizes leadership and problem-solving skills, thus complementing benchmarks focusing on specific pedagogical skills. On the other hand, repositories focusing solely on technical skills have been excluded because they do not capture the richness of teaching practices.

- **Taking account of changes in the educational context:** Frameworks were included if they took account of changes in the educational context and the needs of contemporary students. For example, the University of Lille in France emphasizes skills related to adapting to the environment and appropriate communication, reflecting the current needs of university teachers. On the other hand, reference frameworks that are obsolete or too specific to a particular context have been excluded because they cannot be generalized to other teaching situations.

3.5. Statistical Approach to Data Analysis

In our analysis of the nine repositories of university teaching skills, we adopted a robust statistical approach to extract key information. This methodology enabled us to identify the most relevant competences and their frequency of appearance in the repositories. The different statistical techniques used played distinct roles.

Table 2. Statistical Approach to Data Analysis

| Statistical approach | Role |
|----------------------------------|--|
| Frequency of skills | Identification of the most commonly mentioned skills, reflecting their relative importance |
| Co-occurrence | Analysis of frequent associations between skills to understand their inter-relationship |
| Similarity analysis | Measure proximity between skills to identify similar groups |
| Multiple Correspondence Analysis | Exploring the complex relationships between skills, repositories and other variables |

3.6. Ethical Considerations in Research

In the course of this study aimed at analyzing nine repositories of competences in university pedagogy, overriding emphasis was placed on ethical considerations. Before using the repositories, the appropriate authorizations were obtained from the institutions concerned, and the objectives of the analysis were clearly defined. The data extracted was processed in such a way as to guarantee the anonymity of the institutions and individuals mentioned. In accordance with the ethical and professional standards of educational research, transparency and integrity were maintained at every stage of data collection, analysis and interpretation. Acknowledging and respecting the diversity of perspectives and contexts represented in the benchmarks ensured that any discriminatory bias was avoided. The conclusions of this study are based on a rigorous analysis of the repositories, with a commitment to the ethical and responsible use of the results, making a constructive contribution to the field of university pedagogy.

4. PRESENTATION OF RESULTS

4.1. Process for Selecting and Consolidating University Teaching Skills

In order to reduce the general competences (55) and elementary competences (160) extracted from the nine repositories of university teaching competences to a final list of 18 key competences, we followed a rigorous analytical methodology. First, we extracted all the relevant competences from the selected reference frameworks. Next, a crucial step was to identify and eliminate redundancies, by grouping similar skills together to avoid duplication. This process of grouping by similarity made it possible to structure the skills into broader thematic categories, making them easier to understand and analyze. We then selected the most representative competences frequently cited in the reference frameworks, taking into account their relevance and importance in the context of university teaching.

Finally, a thorough validation of the coherence and completeness of the list was carried out, enabling less essential or less frequent competences to be eliminated, resulting in a final list of 18 key competences in university teaching. This rigorous methodological approach made it possible to rationalize and consolidate the competences extracted from the reference frameworks, thus providing a synthetic and scientifically founded vision of the expectations and standards in terms of competences for university teachers.

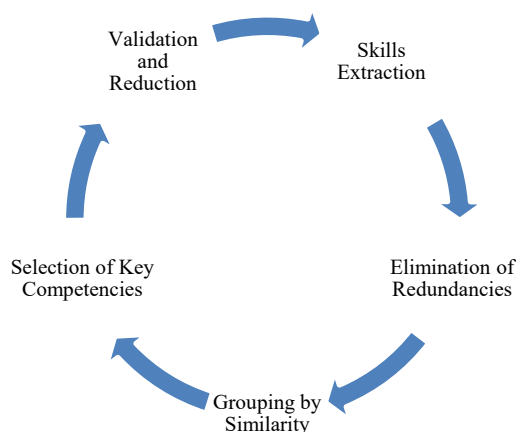


Figure 3. Process for selecting and consolidating university teaching skills

4.2. Categorizing Skills

To group together the skills extracted from the nine reference frameworks in an effective and objective way, we used a simple approach based on similarity analysis. This is how we proceeded:

1. Pre-processing the skills: We began by standardizing and pre-processing the extracted skills by converting them into numerical representations. For example, for the competences ‘Defining learning objectives’ and ‘Establishing pedagogical objectives’, we used natural language processing techniques to make them comparable.
2. Similarity calculation: Next, we measured the similarity between each pair of skills using the cosine similarity method. This measure allows us to quantify how close two skills are in terms of meaning and content. For example, if the cosine similarity between ‘Defining learning objectives’ and ‘Establishing pedagogical objectives’ is high, this indicates a high degree of similarity between these skills.
3. Competency Clustering: We have grouped competencies into clusters using a similarity-based clustering approach. For example, skills that are very similar to each other are grouped together in the same cluster. This allows us to form coherent groups of skills that share common characteristics.
4. Cluster validation: Finally, we validated the resulting clusters by examining the skills grouped together in each cluster. For example, if a cluster contains skills related to learning assessment, this confirms the relevance of the grouping based on similarity.

Table 3. Mapping skills groups in university education

| Cluster | Skills | Number | Average similarity |
|----------------------------------|--|--------|--------------------|
| Design | Define learning objectives Structure teaching content and sequences Use appropriate teaching tools and resources | 3 | 0.85 |
| teaching | Lead lessons interactively Manage teaching and learning situations Guide and support students as they learn | 3 | 0.78 |
| Teaching and | Define clear assessment criteria Measure learning achieved in class Provide constructive feedback | 3 | 0.82 |
| Learning management | Collaborate with other teachers and educational players Participate in team-based teaching projects | 2 | 0.76 |
| Assessment of learning | Reflect on and adapt teaching practice Take part in training courses and exchange ideas with other teachers | 2 | 0.80 |
| Collaboration and teamwork | Communicate in a manner appropriate to the context Act ethically and responsibly in professional practice | 2 | 0.78 |
| Ongoing professional development | Adapt to your environment and students' needs Innovate teaching and assessment methods | 2 | 0.79 |
| Communication and ethics | Integrate information and communication technologies into teaching | 2 | - |

In Table 3, each skill cluster is accompanied by the number of skills it contains and the average similarity between the skills in the cluster (measured, for example, with cosine similarity).

The average similarity indicates the extent to which the skills in the same cluster are semantically similar to each other. This approach provides more detailed insights into the structuring of skills in university teaching by highlighting the most coherent and significant groupings.

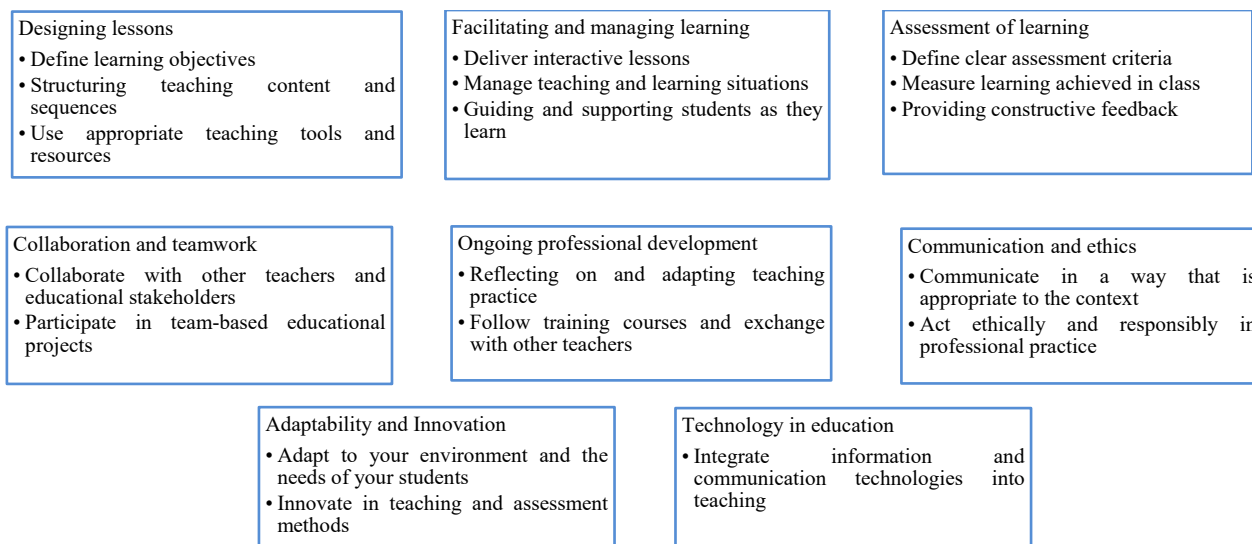


Figure 4. Categorizing university teaching skills

4.3. Frequency of Skills

Calculating the frequency of skills identified in the university teaching standards is of crucial importance for several reasons. Firstly, this statistical analysis enables us to determine which competences are the most prevalent and widely shared across the different repositories, thus providing an insight into common expectations of university teachers. Secondly, by quantifying the frequency of each competency, we can identify key areas that merit particular attention in teachers' professional development. It also allows us to highlight emerging trends or potential gaps in expected competencies, thereby guiding teacher training and development efforts. Finally, this quantitative approach reinforces the scientific rigor of our study by providing tangible empirical data that support our conclusions and recommendations in the field of university pedagogy.

Table 4. Frequency of university teaching skills according to the 9 reference frameworks

| Competency Categories | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | Frequency |
|-----------------------------------|----|----|----|----|----|----|----|----|----|-----------|
| Designing teaching | X | | X | X | | X | | | X | 5 |
| Facilitating and guiding learning | X | X | | X | | X | | X | | 6 |
| Assessment of learning | X | | X | X | | X | X | | X | 7 |
| Collaboration and teamwork | X | X | | | | X | X | X | | 6 |
| Ongoing professional development | | | | | | | X | X | X | 3 |
| Communication and ethics | X | X | | X | | | | | X | 4 |
| Adaptability and Innovation | | X | | X | | X | | X | | 4 |
| Use of ICT | | X | X | | | | | X | | 3 |

4.4. Skills Ranking

An analysis of university teaching skills based on nine frameworks reveals the key skills that should be at the heart of teachers' professional development. The most frequently cited competences are assessing learning (in 7 frameworks), leading and managing learning, and collaboration and teamwork (in 6 frameworks each). These competences underline the importance of an effective and collaborative learning environment. Other

essential skills, such as teaching design, communication and ethics, as well as adaptability and innovation, are also highlighted. On the other hand, continuing professional development and the use of information and communication technologies (ICT) require particular attention, as they are less frequently cited in the reference frameworks. This ranking makes it possible to identify the priority areas for enhancing the skills of university teachers.

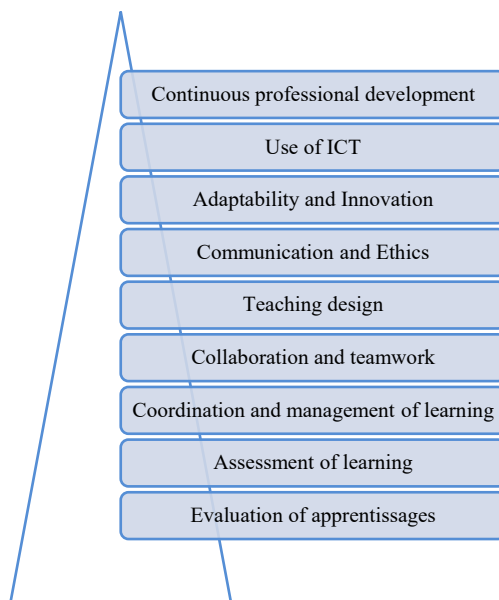


Figure 5. Pyramid for ranking university teaching skills

5. DISCUSSION OF RESULTS AND OUTLOOK

The identification of essential competences for university teachers on the basis of nine international pedagogical reference frameworks is a crucial step in meeting training and professional development needs in the field of higher education. The results highlight a number of important aspects that deserve to be discussed with a view to guiding institutional policies and educational practices.

5.1. Relevance and Variability of Teaching Competences

The diversity of the reference frameworks selected from different French-speaking countries illustrates the variability of the competences expected of university teachers. This geographical diversity reflects the cultural and institutional specificities that influence expectations in terms of teaching skills. For example, some reference frameworks emphasize specific skills related to the management of teaching resources, while others stress interpersonal skills such as collaboration and teamwork. This variability highlights the importance of adopting a flexible approach to the design of teacher training programs, taking into account local contexts and the specific needs of institutions.

5.2. Statistical Analysis & Structuring of Competences

The statistical methodology used to analyze the competences extracted from the repositories has enabled

an effective structuring of university pedagogy competences. By grouping similar skills into clusters, this approach makes it easier to understand the relationships between the different dimensions of teaching practice. For example, the clusters identified, such as 'Designing teaching' or 'Leading and managing learning', highlight coherent groupings that can guide teachers' professional development. This analysis also makes it possible to identify potential gaps in certain less frequently cited competences, such as 'Continuous professional development' or 'Use of ICT', which could require greater attention in training programs.

5.3. Frequency of Competencies and Training Priorities

The frequency of competences identified in the repositories offers valuable insights into common expectations of university teachers. Skills such as assessing learning, leading courses interactively and collaborating with other educational players emerge as essential priorities for guaranteeing the quality of higher education. This quantitative analysis makes it possible to identify the key areas that deserve particular attention in the professional development of teachers, highlighting the fundamental skills needed to foster an effective and inclusive learning environment.

5.4. Implications for Training and Institutional Policies

The results of this study provide valuable empirical data that can guide institutional policies on teacher professional development. By identifying priority skills and potential gaps, this study contributes to the development of more targeted training programs adapted to the specific needs of university teachers. In addition, the insights gained can serve as a reference for designing educational policies that encourage pedagogical innovation and inter-institutional collaboration.

5.5. A Perspective on the Integration of ICTE into University Teaching Skills

The perspective of information and communication technologies (ICTE) in university teaching [29] is emerging as a crucial area to be integrated into teacher training programs. Although less frequently mentioned in the reference materials analyzed, this dimension is becoming increasingly important in today's educational landscape. Successful integration of ICTE fosters innovative teaching methods, facilitates access to digital teaching resources and improves student engagement. These results highlight the need to take greater account of ICTE-related skills in institutional policies and professional development programs for university teachers, in order to respond effectively to the challenges and opportunities of digital education.

6. CONCLUSION

In conclusion, our rigorous study of the process of competency selection and consolidation in university pedagogy proved to be a significant contribution to the understanding of competency frameworks in the context of higher education. Based on the exhaustive extraction of 215 initial competences from nine competency frameworks, our analytical methodology reduced this set to a final list of 18 key competences. This approach involved several steps, including a careful extraction followed by a grouping step aimed at eliminating redundancies, resulting in a thematic structuring into six clusters.

Analysis of the frequency of competences enabled us to identify the most prevalent areas in the frames of reference, thus highlighting the competences that are essential for the professional development of university teachers. This approach has provided an overview of expectations in terms of skills, thus contributing to the continuous improvement of higher education [30]. In addition, our study is part of the wider context of the crucial importance of competency frameworks in the development of university pedagogy. These frameworks define the essential skills and knowledge that educators should possess, helping to identify the key competencies required for effective teaching, such as learning management and psycho-pedagogical skills, which are common to a variety of propositions.

They also guide teaching and learning centers in developing skills for sustainable transformations in higher education institutions, focusing on aspects such as

leadership and organizational processes. In addition, competency-based teaching enables teachers to accurately identify and teach to practical competency standards, thereby improving the quality of human resource training. By integrating knowledge, skills and values, competency-based university education promotes the all-round development of future educators, strengthening innovation, communication and digital skills in a variety of educational contexts. In short, our rigorous methodological approach provides a solid foundation for understanding and applying key competencies in university teaching, contributing to effective and inclusive teaching practice in the ever-changing context of higher education.

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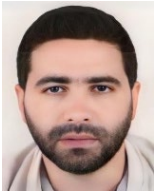
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