Article

CADERNOS de TRADUÇÃO

The challenges of teaching translation technologies in the AI era

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Abstract: Integrating translation technology (TT) into specialized translation training has long been a challenge for Translation and Interpreting (T&I) undergraduate programmes. However, the emergence of artificial intelligence (AI), particularly generative AI, has intensified the debate on how universities should adapt to technological advancements in the language industry. While the profession rapidly embraces AI-driven tools, higher education institutions face structural, pedagogical, and institutional barriers that hinder their timely incorporation. This study critically examines five key challenges to the integration of TT in Spanish T&I undergraduate programmes: (1) the rigidity of the university system, (2) the heterogeneity of T&I curricula, (3) the lack of adequate physical and digital resources, (4) the need for faculty training in TT, and (5) the persistent gap between academia and the translation market. Drawing on recent literature, this study explores how these challenges impact the feasibility of incorporating TT into translator education and discusses its role in reshaping teaching methodologies. The findings highlight the urgent need for curriculum flexibility, interdisciplinary collaboration, and sustained dialogue between academia and industry. The article argues that a gradual, adaptive approach could mitigate institutional constraints while preparing students for evolving professional realities. Ultimately, this research underscores the importance of fostering a balanced approach between technological innovation and the core competencies of translation, ensuring that future translators can critically engage with AI-enhanced workflows.

Keywords: translation technology; artificial intelligence; translator training; higher education; curriculum design.

1. Introduction

Over the past four decades, the language industry has undergone unprecedented changes driven by global developments both in business and technology. These transformations have redefined the roles and responsibilities of translators, leading to new dynamics and employment

forms linked to the technologization of society (O'Connor & Benţa, 2022). In addition to these gradual shifts, recent exponential changes have sparked significant concern in the language industry and academia. Disruptive technologies, such as artificial intelligence (AI), machine learning (ML), large language models (LLMs), and chatbots, have rapidly reshaped the landscape (Rivas Ginel & Moorkens, 2024; TAUS, 2024).

Among these technologies, generative AI (GenAI) tools—such as LLMs, capable of producing high-quality text, translation, and localization outputs—have emerged as particularly transformative. These tools are already impacting workflows in the language industry, automating repetitive tasks, and enhancing productivity (Akhulkova, 2023; Jiménez Crespo, 2024). However, their rapid adoption poses unique challenges to trainers tasked with preparing future professionals. Translators are now expected to develop advanced post-editing, critical evaluation, and decision-making skills to effectively interact with and complement AI systems (Dorst et al., 2022).

Since the establishment of Translation and Interpreting (T&I) undergraduate degrees in Spain in the 1990s, the integration of translation technologies (TT) into curricula has evolved at a measured pace (Plaza-Lara, 2014; Sánchez-Castany, 2022). However, the current digital era demands innovative pedagogical approaches that transcend isolated technological modules[1] and promote the transversal integration of TT into specialized translation training. This is particularly critical as the language industry increasingly requires translators to master technological tools to ensure efficiency, accuracy, and consistency in specialized texts (González Pastor, 2022; Akhulkova, 2023) and to critically navigate ethical concerns and challenges posed by AI-driven automation (Rico Pérez & Sánchez Ramos, 2023).

From a pedagogical perspective, defining the skills and knowledge needed by future professionals in such a dynamic and uncertain context is highly complex. The rapid pace of technological evolution, coupled with the lengthy administrative processes required to update university curricula in Spain (Sánchez-Castany, 2025), raises fundamental questions for trainers. Should we continue preparing translators for the challenges of "yesterday," or should we focus on equipping them for "today" and, ideally, "tomorrow"? Furthermore, how can trainers balance the need to teach foundational translation skills with the imperative to integrate rapidly evolving technologies like GenAI?

This article emerges from a comprehensive review of existing literature and the author's own experience as both a professional translator and a trainer. It addresses the challenges faced by trainers, students, and universities in integrating TT into the teaching and learning environments of specialized translation. By combining theoretical insights with practical experience, this study examines the complexities of these possible challenges from the point of view of incorporating TT into specialized translation training. This raises organizational, financial, and academic challenges, which are critically examined in this paper.

This article is structured as follows. First, the introduction has outlined the context and relevance of TT in specialized translation training. The subsequent section identifies and analyses five key challenges to integrating TT into specialised translation modules: the rigidity of the Spanish

[1] For the purposes of this research, technological modules are those belonging to the areas of documentation, project management, text revision, editing and layout, technologies and terminology, according to the classification made by Sánchez-Castany (2022).

university system; the heterogeneity in the structure and organization of Spanish T&I curricula; the lack of adequate physical and digital resources; the need for technologically skilled trainers; and the gap between academia and the industry. Finally, the conclusion reflects on the implications of these challenges and proposes future directions for research in curriculum development in T&I studies.

2. Translation technologies in T&I undergraduate degrees

The integration of TT into translator education is not a recent phenomenon but rather a long-standing necessity shaped by the evolving demands of the language industry (O'Brien & Rodríguez Vázquez, 2019). In today's professional landscape, translators must be proficient in using a variety of tools to manage complex projects, process large volumes of text efficiently, and collaborate seamlessly in virtual environments. However, as Hurtado Albir (2020) points out, the effective incorporation of TT into T&I undergraduate curricula remains a significant challenge. This challenge manifests in several ways: the balance between theoretical and practical instruction, the tension between specialized and transversal integration, and the need to adapt to rapid technological advancements, among others (He, 2021).

In Spain, T&I undergraduate degrees display significant variation in their curricular designs. This diversity stems largely from the autonomy granted to universities when these programmes were first implemented in the 1990s[2]. While this autonomy has allowed institutions to tailor their offerings to local contexts and demands, it has also resulted in considerable heterogeneity in how core competencies, including TT, are integrated into curricula (Ortego Antón, 2022). Despite these differences, most institutions recognize the importance of specialized translation training, often organizing it into distinct specialization tracks. These tracks typically comprise fields such as legal, economic, technical, scientific, audiovisual, and literary translation, as well as localization and interpreting (Sánchez-Castany, 2022).

A cornerstone of translator education lies in developing instrumental competencies, which encompass skills related to machine translation (MT), post-editing (PE), information literacy, terminology management, and computer-assisted translation (CAT) tools (Li et al., 2023). These instrumental skills are essential components of the broader translator competence framework, which also includes linguistic, cultural, and professional subcompetencies (PACTE, 2005). Specialized translation modules, by their very nature, provide an ideal environment for merging these diverse skill sets. By situating learning within realistic, professional-like scenarios, these modules enable students to apply their knowledge holistically, bridging the gap between theory and practice (Olalla-Soler, 2019).

In Spanish T&I undergraduate programmes, TT-related content is typically introduced through standalone modules, often in a simplified and decontextualized manner (Rico Pérez, 2017). Documentation or text editing modules, which generally serve as an entry point to TT training, are commonly offered in the early stages of the curriculum. More advanced modules, covering topics

[2] Among the regulations in force for the organisation of T&I undergraduate degrees, the Royal Decree 822/2021, of 28 September, which establishes the organisation of university education and the procedure for quality assurance stands out. This royal decree grants the centres the same high level of autonomy in the planning and design of degree programmes as the previous ones.

such as CAT tools, terminology management, and MT are usually introduced in later stages (Cid Leal et al., 2019; Sánchez-Castany, 2022). This compartmentalized approach, while practical for structuring curricula, has been criticized for its limitations. Specifically, it often prevents students from making connections between the tools they learn to use and their potential applications in specialized translation contexts (Rico Pérez et al., 2018). As a result, students may perceive these tools as peripheral rather than central to their professional development. Mahfouz (2018) highlights that this perception can lead to underutilization of TT in practice, even among graduates who have been formally trained in these technologies.

The lack of standardization across Spanish T&I undergraduate programmes further complicates the issue. The scope and depth of TT training vary widely among institutions, with some programmes focusing intensively on specific tools and others offering a more generalized overview (Sánchez-Castany, 2022). This disparity makes it difficult to propose a uniform methodology for TT training that is adaptable to all academic contexts.

When TT is taught in isolation from other aspects of translator training, students often struggle to see its relevance to real-world tasks. This disconnection is exacerbated by the limited opportunities for the applied use of these tools in specialized translation modules (Nunes Vieira et al., 2021). Ideally, TT training should do more than familiarize students with technical functionalities; it should also foster the ability to critically apply these tools to solve specific translation problems (Li et al., 2023). This comprehensive approach integrates technical proficiency with higher-order problem-solving skills, aligning with the demands of specialized fields such as legal, medical, and technical translation (Muñoz-Miquel et al., 2020; Sánchez-Castany, 2023).

Efforts to address these challenges often emphasize the importance of situated learning as a didactic approach. Situated learning involves recreating real-world professional conditions within the classroom, enabling students to apply TT in contextually relevant ways. This pedagogical method has been widely advocated for TT training in general (Ramírez-Polo & Ferrer Mora, 2010; González-Davies & Enríquez-Raído, 2016; Hernández Pardo & Romana García, 2021) and for specific technologies such as CAT tools (Bowker & Marshman, 2010; Mellinger, 2017; Nunes Vieira et al., 2021), MT (Pym, 2013; Mellinger, 2018), and corpora (Borja Albi, 2019). Examples of situated learning include case studies, project-based learning, and simulations of professional workflows. These methods not only enhance students' technical skills but also cultivate their ability to integrate these tools into broader translation processes.

Despite its potential, the implementation of situated learning in TT training within Spanish T&I undergraduate programmes faces several obstacles. Curricular rigidity often limits the flexibility needed to incorporate innovative pedagogical approaches (Candel Mora, 2017). While resource constraints—including limited access to software and hardware—were cited in earlier works (e.g., Doherty & Moorkens, 2013), the situation has notably evolved: many universities now employ cloud-based virtual platforms hosting CAT tools, complemented by widespread student use of personal laptops, which significantly reduces access barriers (Rothwell et al., 2025). However, disparities remain, especially where institutional licensing or internet connectivity varies. An ongoing challenge is ensuring that trainers themselves possess adequate technical expertise, as many faculty members continue to require additional up-skilling to teach advanced TT concepts effectively,

complicating efforts to integrate these tools seamlessly into specialized translation modules (Rico Pérez & González Pastor, 2022; Sánchez-Castany, 2023).

Another key aspect of TT training is the consideration of its ethical dimensions. As TT become increasingly sophisticated, future translators must be equipped to navigate not only their technical functionalities but also the broader implications of their use (Guerberof-Arenas & Moorkens, 2023). This includes understanding issues such as data privacy, algorithmic bias, and the impact of automation on the translation profession. By addressing these dimensions, TT training can prepare students to engage with technology in a way that is both informed and responsible (Ramírez-Polo & Vargas-Sierra, 2023).

That said, while Spanish T&I undergraduate degrees have made significant strides in incorporating TT, there remains considerable room for improvement. The current approach, characterized by compartmentalization and lack of standardization, often limits students' ability to apply TT meaningfully in specialized translation contexts. To address these challenges, a more integrated and flexible approach is needed. This would involve not only curricular innovation but also a commitment to pedagogical practices that prioritize real-world applicability and critical engagement. As Sánchez-Castany (2025) suggests, such an approach can equip future translators with the skills they need to thrive in an increasingly technologized industry. By fostering a deeper understanding of TT and its applications, Spanish T&I undergraduate programmes can better prepare their graduates to meet the demands of a rapidly evolving profession.

3. Challenges in integrating translation technologies into specialized translation classrooms

The integration of TT into the specialized translation classroom represents a complex and multifaceted challenge within the context of T&I undergraduate programmes in Spain. While the incorporation of TT has gained momentum due to the growing demands of the professional market (González Pastor, 2022), several critical obstacles continue to hinder its effective implementation. These challenges include, but are not limited to, the rigidity of the Spanish university system, the heterogeneity in the structure and organization of T&I undergraduate degrees, the lack of adequate physical and digital resources in academic institutions, the need for properly trained trainers in TT, and the limited dialogue between academia and the language industry.

Importantly, addressing these challenges is not a linear process but a circular and interconnected one. The aforementioned challenges are intricately linked and often influence one another within the curricular design and development of T&I undergraduate degrees (Sánchez-Castany, 2025). Their emergence and resolution do not necessarily follow a chronological order, nor do they align with the sequence presented here. For a holistic and sustainable integration of TT into specialized translation training, all these factors must be considered simultaneously. However, the weight and scope of each challenge within the curricular design may vary significantly, and their practical implementation may require differentiated approaches depending on institutional and contextual constraints.

Furthermore, while a comprehensive integration of TT demands a unified strategy, certain components of this approach can be examined, isolated, and implemented progressively. This allows academic programmes to adapt to immediate needs while building toward long-term curricular

innovation. In the sections that follow, we will examine those five key challenges in detail, shedding light on how they shape the integration of TT in specialized translation training and exploring potential strategies to overcome these barriers.

3.1. The rigidity of the Spanish university system

In the last few decades, the rapid advancement of technology and the increasing flow of information have led to profound societal transformations. What once allowed for steady, well-reasoned decision-making now shifts and dissipates at a remarkable speed, creating what Royo (2017) aptly describes as a "gaseous society". This metaphor highlights the volatility and fleeting nature of knowledge in a context where information can become outdated almost instantly. Within this environment, higher education institutions, including Spanish universities, face significant challenges in adapting to the demands of such an evolving world.

In recent years, the rise of GenAI and ML has further intensified these challenges, as universities are now expected to equip students with the skills and competencies necessary to navigate increasingly automated and data-driven professional contexts (Akhulkova, 2023). Faculty members must also contend with rapidly shifting pedagogical paradigms, as GenAI tools can facilitate new forms of cheating or plagiarism, while simultaneously providing innovative opportunities for authentic, research-oriented learning experiences (Prieto Ramos, 2024).

The rigidity of the Spanish university system, often cited as a structural impediment (López Poza, 2019; Cànovas, 2022), exacerbates this issue. Universities in Spain are governed by a stringent regulatory framework, including national policies and internal institutional regulations, which makes it particularly difficult and slow to implement curricular updates or integrate emerging technologies. As a result, academic programmes often rely on outdated educational paradigms that fail to align with the rapidly changing needs of society and the professional market (Guerberof Arenas & Moorkens, 2019).

This rigidity has direct implications for the integration of TT into specialized translation training. Although TT evolves at a fast pace, academic curricula are often slow to adapt (Hurtado Albir, 2020). Programmes may include outdated tools or neglect critical advancements, leaving students ill-prepared for the realities of the translation profession (Cànovas, 2020). Moreover, the administrative processes required to approve curricular changes can be time-consuming, further delaying the inclusion of relevant and up-to-date technological content (Candel Mora, 2017). When considering the integration of GenAI solutions, the time lag in approving curricular modifications becomes even more pronounced, as these advanced tools can become obsolete at an equally rapid pace, thereby intensifying the gap between academic training and the language services market.

One of the core challenges for trainers lies in navigating this rigid system while attempting to implement innovative teaching methodologies, such as situated learning, which emphasizes real-world applicability. While trainers may have the motivation and expertise to redesign their modules to include TT, institutional constraints often limit their ability to do so effectively. This misalignment between institutional structures and societal needs contributes to a widening gap between academic training and professional practice.

To address this issue, a multi-level approach is necessary. Policymakers should work towards greater curricular flexibility to allow for the swift incorporation of technological advancements. Simultaneously, universities could adopt more dynamic models for periodic curriculum reviews, enabling faster adaptation to industry trends. Ultimately, mitigating the rigidity of the Spanish university system will require coordinated efforts from all stakeholders, including government bodies, university administrators, and trainers. By cultivating a more agile institutional culture, higher education providers can respond more effectively to the rapid pace of TT and AI-driven innovations, ensuring that both trainers and students benefit from the most current tools and methodologies available.

3.2. Heterogeneity in the structure and organization of Spanish T&I curricula

The structure and organization of undergraduate T&I degrees in Spain exhibit significant heterogeneity, as highlighted in Sánchez-Castany (2022, 2023, 2025). This disparity, also noted by Hurtado Albir (2020), stems from diverse institutional frameworks and curricular designs, which vary widely between universities. While diversity can bring innovation and adaptability, it also poses considerable challenges to the integration of TT into specialized translation training. The following section identifies key obstacles linked to curriculum design, sequencing of technological content, and inter-departmental coordination, offering critical insights into their implications for pedagogy and student outcomes.

One significant point raised in Sánchez-Castany (2023) concerns the heterogeneity between T&I programmes, including disparities in how content is allocated versus instructional time —rather than simply a flaw of curricular rigidity. This variation in credit/time distribution across institutions, echoed in studies in other academic contexts (O'Brien & Rodríguez Vázquez, 2019; Khoshsaligheh et al., 2019), constraints the inclusion of embedded, practical TT activities within translation modules. Translation trainers report that existing module designs across different universities tend to prioritize theoretical frameworks or generic technological skills (e.g., corpus-based research and basic document process) over immersive, field-specific tools (e.g., CAT tools, terminology management systems, or MT engines). Moreover, institutional constraints on credits and resource deployment mean that even when universities offer TT-dedicated modules, they frequently focus on foundational and introductory, leaving little room for advanced or specialized applications. This issue is compounded by the disparity in technological infrastructure and resources between public and private universities, which often translates into unequal opportunities for students —an issue that will be further explored in the following section. Consequently, graduates emerge underprepared for the professional demands of real-world translation (Ramírez-Polo & Vargas-Sierra, 2023; Rothwell et al., 2025).

Another critical challenge lies in the sequencing of technological content across T&I programmes. Most undergraduate degrees concentrate TT instruction in the early years, often through standalone modules (Rico Pérez, 2017). While this structure establishes a foundation of procedural knowledge, it fails to ensure the horizontal integration of TT across the curriculum. By the time students engage in specialized translation modules during their final years, their exposure to TT has often been limited or diluted (Sánchez-Castany, 2023). For TT integration to be effective,

a more balanced sequencing approach is required. Foundational technological competencies should be introduced early, followed by their iterative application in practical translation modules. This model, supported by situated learning theory (Kiraly, 2000), would allow students to contextualize their technological skills within domain-specific translation tasks, thereby bridging the gap between theory and practice.

Coordination among departments and modules within T&I undergraduate degrees emerges as a persistent issue. As Sánchez-Castany (2023) notes, some universities manage T&I undergraduate degrees through dedicated departments, while others distribute responsibility across multiple academic units. The latter arrangement can lead to disjointed curricula, with overlapping content in some areas and critical omissions in others. A lack of communication between faculty members exacerbates this issue, resulting in misaligned module objectives and disconnected learning outcomes. In addition to structural challenges, the absence of cohesive coordination often hampers the progression of technological competencies throughout the curriculum. For instance, students may be expected to use TT tools in advanced translation modules without receiving adequate preparation in earlier stages. Conversely, foundational modules might emphasize skills that are never reinforced or applied later in the program. Establishing mechanisms for regular communication and curriculum mapping among faculty could mitigate these issues and promote a more cohesive pedagogical framework (O'Brien & Rodríguez Vázquez, 2019).

Furthermore, the emergence of GenAI models and advanced natural language processing techniques has heightened the need for cohesive coordination. As more sophisticated tools enter the language industry, students must learn not only how to operate these systems but also how to critically evaluate outputs generated by AI-driven MT engines. Without a clear curricular roadmap that anticipates GenAI integration, students are likely to encounter a fragmented learning experience, in which some modules incorporate cutting-edge tools while others remain anchored in outdated practices. This inconsistency can undermine students' confidence and leave them uncertain about the professional relevance of their training.

Another complicating factor is the disparity in students' technological competencies upon entering or progressing through T&I undergraduate programmes. While earlier studies like Ramírez-Polo & Ferrer Mora (2010) highlighted these gaps, more recent research suggests that despite widespread exposure to digital tools, students still exhibit diverse levels of readiness for translation-technology tasks (Rothwell et al., 2025). The EMT Survey 2023 highlights that while many students are familiar with cloud-based CAT tools and MT platforms, their ability to apply these effectively and critically still varies significantly across cohorts. While not directly tied to curriculum design, these gaps influence the feasibility of implementing situated learning environments. Students with limited technological proficiency may struggle to engage with TT-intensive translation tasks, leading to uneven outcomes within the same cohort. To ensure equitable engagement in situated TT environments, universities could adopt proactive measures, such as offering workshops on basic TT skills or diagnostic assessments to identify knowledge gaps. These interventions would help identifying and supporting students who may need foundational up-skilling —addressing real gaps even today, despite improved general access to personal devices and software—, enabling all students to benefit from TT-focused instruction.

Likewise, incorporating project management skills into TT instruction can be particularly beneficial in preparing students for real-world scenarios. TT-driven project management includes mastering tools that allow translators to schedule tasks, track revisions, and collaborate with peers in cloud-based environments (Sánchez-Castany, 2024). By engaging with simulated or live translation projects that use professional management platforms, students gain practical insights into how GenAI outputs and CAT tools can be evaluated, edited, and integrated into larger workflows. This holistic approach helps bridge the gap between theory, technology, and professional practice (Fuentes Pérez & Sánchez Ramos, 2024).

Given the heterogeneity of Spanish T&I undergraduate curricula, any proposal for TT integration must account for contextual variability. Building on the call for greater curricular flexibility and institutional agility outlined in the previous section, this requires not only top-down structural reforms but also bottom-up adaptability at the programme level. Flexibility and responsiveness should therefore be prioritized, allowing programmes to tailor their approaches based on institutional capacities, student profiles, and technological ecosystems. For instance, universities with robust technological resources could focus on advanced TT applications, while those with limited means might prioritize foundational skills complemented by external training opportunities. Moreover, to ensure coherence and progression, curriculum designers must embrace a dynamic approach to content sequencing, ensuring that TT training evolves in tandem with advances in the language industry. These pedagogical adaptations must be supported by ongoing dialogue between academia and the profession, as well as regular curriculum reviews to align educational outcomes with market demands (Carreira, forthcoming). In this way, macro-level structural reforms and micro-level curricular strategies can work in concert to foster a more integrated and responsive translator training model.

3.3. Lack of adequate physical and digital resources

In higher education, the availability of appropriate physical and digital resources is not merely a convenience; it is an essential requirement for effective teaching and learning (Doherty & Moorkens, 2013). This assertion is especially relevant in the context of T&I undergraduate programmes, where the integration of TT into the curriculum is a key aspect of preparing students for the demands of the professional market (Akhulkova, 2023). However, as highlighted in Sánchez-Castany (2023), many institutions offering T&I undergraduate programmes lack the necessary infrastructure and resources to support such integration effectively. This section examines the challenges associated with inadequate resources in T&I programmes, exploring their implications for curricular design, teaching methodologies, and the acquisition of technological competencies.

One of the primary factors contributing to the lack of adequate resources for undergraduate programmes continues to be insufficient funding for higher education in Spain. While public expenditure dropped from 79.1% to 65% between 2009 and 2018 (CC.OO., 2022), more recent trends show only a modest recovery. According to the 2024 OECD *Education at a Glance* report, public funding now covers around 67% of tertiary education—just marginally above the OECD average of 68%. Spain continues to spend about 4.9% of its GDP on education, aligning with the OECD average (OECD, 2024). Although there was a slight increase in per-student expenditure

following the Covid-19 pandemic (e.g., a 0.8% rise from 2019 to 2020 and a further 3.4% in 2021) (OECD, 2023), overall funding levels have remained stable rather than substantially improved since 2018. The impact of this underfunding is particularly pronounced in public universities, which often lack the financial means to invest adequately in state-of-the-art facilities, software licensing, and other essential resources.

In the context of T&I undergraduate programmes, this financial limitation can directly affect access to industry-standard tools —but the landscape has shifted considerably. Many CAT vendors now offer free academic licenses to universities and students: memoQ provides free institutional and student licenses through its University Program and Student Discount Program[3], while RWS (Trados Studio) partners with hundreds of universities globally to facilitate curriculum integration[4]. Moreover, findings from the EMT Survey 2023 note the widespread adoption of cloud-based, cost-free academic access, alongside a move towards "embedding professional contexts and workflows" in training (Rothwell et al., 2025). However, even with such accessible licensing, financial constraints can remain due to costs tied to instructor training, server hosting, certification paths, and support infrastructure. Without sufficient institutional investment in accompanying faculty development and infrastructure, students may still struggle to gain hands-on experience with the full range of professional tools they are likely to encounter in their future careers.

Another significant challenge is the selection of software tools for T&I undergraduate programmes is. Despite TT's central role in the language industry, their inclusion in academic programmes is fraught with difficulties. As noted in Sánchez-Castany (2023), universities are under considerable pressure to adopt the most widely recognized and commercially dominant software solutions. While some vendors offer educational discounts, these licenses can still represent a substantial expense for institutions operating on tight budgets.

Additionally, the bureaucratic processes involved in acquiring and installing software licenses further exacerbate the issue, as trainers often encounter delays and administrative hurdles when requesting licenses. These obstacles not only limit the scope of tools available for classroom use but also hinder the flexibility needed to adapt quickly to new technological advancements. To address these challenges, some trainers have turned to open-source or trial versions of translation tools (Rothwell et al., 2023). While these alternatives can provide students with valuable experience, they are not without limitations. As noted by Nunes Vieira et al. (2021), open-source tools have become increasingly sophisticated and are capable of meeting many of the needs of T&I undergraduate programmes. However, open-source tools, though increasingly compatible with commercial software via exchange formats such as TMX or XLIFF (Melby et al., 2023), may lack the advanced features and user support of their proprietary counterparts.

The scarcity of adequate resources also has significant implications for teaching methodologies in T&I undergraduate programmes. As Sánchez-Gijón (2016) suggests, one way to mitigate the impact of limited resources is to cultivate a critical approach to TT among students. By developing foundational skills with freely available or open-source software, students can learn to adapt their knowledge to different technological environments. This approach not only equips students with practical skills but also fosters adaptability, a crucial competency in the rapidly evolving

[3] See MemoQ (2025) for more details.
[4] See RWS (2025) for more details.

field of translation. Authors such as O'Brien and Rodríguez Vázquez (2019) emphasize the importance of encouraging students to critically evaluate the tools they use. This critical perspective enables students to understand the strengths and limitations of various technologies, empowering them to make informed decisions about which tools to adopt in different professional contexts. However, achieving this level of engagement requires consistent exposure to TT throughout the curriculum, something that is often hampered by the lack of adequate resources.

Another dimension of the resource challenge lies in the disparity between public and private universities. As noted in CC.OO. (2022) and Sánchez-Castany (2023), private institutions are generally better equipped to invest in the latest technologies and infrastructure. This creates an uneven playing field, potentially affecting students' technological preparedness. While direct empirical studies comparing technological competence in translation students across public versus private universities in Spain remain scarce, related research suggests a performance gap tied to resource differences. For example, graduates of public-service T&I programmes—typically housed in public universities—often report limited exposure to professional translation technologies, which may hinder their employability and industry readiness (e.g., Alcalá's public service T&I study; see Vitalaru & Pena Díaz, 2024). Consequently, when public institutions are unable to provide students with adequate resources, the profession as a whole risks becoming less accessible to individuals from diverse socioeconomic backgrounds, reinforcing the need for equitable institutional support.

While financial constraints and institutional bureaucracy are significant barriers, the role of faculty members and institutional support cannot be overlooked. Trainers play an essential role in advocating for resource allocation and finding creative solutions to resource limitations. For instance, trainers can collaborate with software vendors to negotiate favourable licensing agreements or seek external funding for technology initiatives.[5] However, collaboration with vendors is not always straightforward: while some companies offer generous academic licensing schemes, others are less responsive or maintain pricing structures that remain unaffordable for public institutions. Additionally, institutions can support faculty efforts by streamlining administrative processes and providing professional development opportunities focused on integrating TT into the curriculum.

Addressing the resource challenges in T&I undergraduate programmes requires a multifaceted approach. First, increased public investment in higher education is essential for ensuring that all students have access to the tools and resources they need to succeed. Policymakers must recognize the key role of education in driving economic and social development and prioritize funding accordingly. Second, universities should explore partnerships with industry to gain access to the latest technologies. Collaborative initiatives, such as offering internships or co-developed training programmes, can provide students with hands-on experience while reducing the financial burden on institutions (Olalla-Soler, 2019). Finally, a shift toward open-source solutions and cloud-based platforms can offer a more sustainable alternative to costly proprietary software.

[5] For example, companies such as Phrase (2025) or Sketch Engine (2025) offer academic licences of their tools to universities at special prices (as well as memoQ and RWS, already mentioned above).

3.4. The need for technologically skilled trainers

A key factor for the successful implementation of any proposal involving TT in university curricula is the proper training of teaching staff. As previously emphasized, the academic rigour and practical relevance of a degree program are largely shaped by the expertise and preparedness of its faculty. For the integration of TT into specialized translation modules, trainers must possess not only domain-specific knowledge in translation but also a solid understanding of TT and the pedagogical methodologies necessary to teach them effectively. However, current realities in translator training programmes reveal significant challenges in this regard.

Studies like Sánchez-Castany (2023) highlight a widespread perception among trainers that insufficient training in TT remains a persistent issue. This gap stems from several factors, including the lack of time for professional development, limited availability of targeted training programmes, and even resistance to technology due to entrenched perceptions. For instance, Prensky's (2001) concept of "digital immigrants" offers valuable insight into the challenges faced by trainers who were not raised in a digital world. Such individuals may view technology with scepticism or unease, which can translate into hesitancy in incorporating TT into their teaching practices (Koskinen & Ruokonen, 2017; Cadwell et al., 2018). While this struggle is not universal, it is influenced by prior experiences, positive or negative, with digital tools and by the broader societal shift toward technology-mediated practices. Resistance to change, coupled with occasional frustrations in navigating complex software systems, can result in a reluctance to engage with TT. This resistance, in turn, risks fostering a dismissive attitude toward technology among students. Koskinen and Ruokonen (2017) warn of the potential for negative faculty attitudes to influence learners' perceptions of TT, thereby undermining efforts to cultivate technological competence and critical thinking skills in future translators.

Beyond the attitudinal barriers, the technical complexity of TT itself can pose a challenge for trainers. Tools such as CAT software, translation management systems, terminology management systems, and MT tools often require a significant investment of time and effort to master. For trainers, this investment is compounded by the additional burden of designing pedagogical frameworks to effectively integrate these tools into their teaching. Without adequate institutional support, the time and effort required for trainers to develop proficiency in these tools can become a deterrent, further contributing to the skills gap.

Given these challenges, it is essential to adopt measures that empower faculty members with the knowledge and confidence needed to effectively use TT in the classroom. Professional development programmes tailored to the specific needs of translation trainers are key. Such programmes should address both the technical aspects of TT and the pedagogical strategies for integrating these tools into teaching. One promising approach is the adoption of blended or hybrid training models that combine online and in-person learning, enabling faculty to engage with training materials at their own pace while benefiting from peer interactions and hands-on workshops. As Sánchez-Gijón (2016) highlights, it is important to encourage students to develop critical skills that can be applied across different commercial and open-source software platforms. This approach is equally relevant for faculty training, as it equips trainers with the flexibility to adapt their teaching to a variety of technological environments. Additionally, fostering a collaborative learning culture among faculty members can help mitigate feelings of isolation and reduce resistance to change.

Faculty learning communities or peer mentoring programmes can create spaces where trainers share best practices, troubleshoot challenges, and collectively explore new tools and techniques. These initiatives not only enhance individual competence but also contribute to a more cohesive and supportive academic environment.

Ultimately, addressing the challenges associated with faculty training in TT requires a cultural shift toward lifelong learning within academic institutions. Trainers must embrace the idea that technological competence is not a static goal but an ongoing process that evolves alongside industry practices (Thwe & Kálmán, 2024). Universities, in turn, must create environments that actively support and incentivize this mindset, fostering a culture of continuous improvement and innovation. As Bowker and Marshman (2010) argue, the goal of translation education is not merely to equip students with technical skills but to develop critical thinkers who can navigate the complexities of professional practice. Achieving this goal requires trainers who are not only knowledgeable but also adaptable and forward-thinking. By investing in the training and empowerment of faculty, universities can ensure that their programmes remain relevant and responsive to the demands of the language industry.

3.5. Bridging the gap between academia and the industry

One of the most pressing challenges facing T&I undergraduate degrees, especially in Spain, is the persistent disconnect between academia and the professional translation market (EUATC, 2024). This lack of dialogue not only limits the relevance of university curricula but also undermines graduates' readiness to meet the evolving demands of the language industry. Addressing this divide is pivotal, particularly when it comes to integrating TT into academic programmes. The alignment between academic instruction and professional practice ensures that students are adequately prepared for the complexities of the market and that their training reflects real-world expectations (Massey et al. 2024).

The gap between academia and the translation market is not a novel concern. As Pym (2011) aptly notes, universities often operate in ways that seem detached from professional realities, leading to the perception of academia as an "ivory tower". While some scholars, such as Wadensjö (2011), argue for maintaining a certain distance between academic inquiry and market practices to preserve the critical and reflective nature of education, the prevailing view emphasizes the need for closer alignment. The European Language Industry Survey (ELIS) 2024 corroborates this, highlighting the lack of studies that bridge translation market trends with pedagogical approaches (EUATC, 2024).

Factors contributing to this divide are manifold. On the one hand, many academics focus primarily in theoretical or abstract research, which plays an important role advancing knowledge, fostering critical thinking, and shaping the intellectual foundations of the field (O'Brien & Rodríguez Vázquez, 2019). However, this focus may not always align directly with the evolving demands of professional practice (Rodríguez de Céspedes, 2020). On the other hand, the rapid pace of technological innovation in the language industry presents challenges for academic programmes striving to remain current, particularly when faculty members are not actively engaged in professional translation practice (Márquez Garrido, 2022). As a result, a disconnection can emerge between academic instruction and professional realities, potentially leaving students unprepared for

a profession increasingly shaped by TT. Addressing this gap does not imply abandoning theoretical rigour but rather finding ways to integrate academic research and professional relevance in a mutually enriching manner.

One major obstacle to fostering collaboration between academia and the market lies in the organizational and cultural differences between the two. Universities are primarily driven by academic objectives, such as knowledge generation and dissemination, while the market prioritizes efficiency, client satisfaction, and profitability. These differing priorities can lead to misaligned expectations and even conflicting interests, particularly regarding issues such as confidentiality, workflow integration, and intellectual property (Carreira, forthcoming). Moreover, institutional constraints within academia, such as rigid curricula, limited funding, and bureaucratic hiring policies, exacerbate the difficulty of incorporating market-relevant training (López Poza, 2019). These challenges are particularly evident in the context of TT, where the acquisition and maintenance of software licenses, as well as the training required to use them effectively, demand significant financial and logistical resources.

Despite these challenges, the benefits of fostering dialogue and collaboration between academia and the market are well-documented. Such collaboration ensures that university curricula remain aligned with industry needs, enhancing students' employability and ensuring that academic programmes remain relevant (Álvarez-Álvarez, 2024; Faes & Massey, 2024). Additionally, engagement with the market can help universities identify emerging trends, such as new professional profiles or advances in TT, which can then inform curriculum design (Hurtado Albir, 2020). Mentorship programmes and internships are among the most effective initiatives for promoting collaboration between academia and the market (Aiping & Deliang, 2017). These initiatives provide students with firsthand experience in professional settings, allowing them to apply their academic knowledge in practical contexts while gaining insights into industry workflows and expectations. Professional associations also play a crucial role in bridging this gap by facilitating mentorship opportunities and fostering dialogue between trainers and practitioners (Olalla-Soler, 2019).

Another promising approach is the adoption of situated learning methodologies, which emphasize the use of authentic and realistic learning environments. These methodologies require close collaboration with industry partners to ensure that the learning context reflects real-world practices, particularly in the use of TT (Borja Albi, 2019; Sánchez-Castany, 2025). For instance, incorporating market-standard CAT tools, terminology management systems, and other technologies into classroom activities not only familiarizes students with these tools but also helps them develop critical thinking skills needed to adapt to different technological environments.

While the benefits of closer collaboration are clear, establishing sustainable partnerships requires significant investment in terms of time, resources, and effort. Universities must take proactive steps to strengthen ties with the market, such as creating advisory boards composed of industry professionals who can provide input on curriculum development. Regular dialogue between academia and the market is essential to identify and address skill gaps, anticipate future trends, and ensure that training programmes remain responsive to industry needs (Orlando, 2016). To facilitate these efforts, universities must also address the structural and institutional barriers that hinder collaboration. Streamlining administrative processes, increasing funding for industry partnerships, and providing incentives for trainers to engage with the market are key steps in this direction. For

example, trainers who actively participate in professional translation work or collaborate with industry partners should be recognized for their contributions (Carreira, forthcoming).

Finally, it is essential to foster a cultural shift within academia that values and prioritizes market engagement. This shift requires a re-evaluation of the traditional academic mindset, which often views professional practice as secondary to theoretical research. By embracing a more balanced perspective that recognizes the value of both theory and practice, universities can create a more integrated approach to translator training.

4. Conclusions and future work

The challenges analysed throughout this study highlight the complexity of proposing curricular changes across T&I undergraduate programmes in Spain. The issues addressed are diverse in nature, spanning pedagogical, technological, institutional, and economic dimensions, which complicates the generalization of solutions. While the proposed framework is intentionally broad and adaptable, its feasibility ultimately hinges on the unique characteristics and circumstances of each individual T&I undergraduate program. This underscores the need for context-sensitive strategies that consider the specific needs and limitations of each academic institution.

One of the key takeaways of this research is that adapting T&I curricula to the technological demands of the language industry cannot be postponed. The rapid pace of technological advancement necessitates swift yet thoughtful action. Waiting for the formal renewal of degree programmes risks widening the gap between academia and the market, potentially rendering translation graduates underprepared for professional realities. Instead, a pragmatic approach that incorporates incremental changes within existing curricular structures offers a viable pathway.

Given the heterogeneity of T&I programmes in Spain, a one-size-fits-all approach is unlikely to succeed. While this study has identified overarching challenges and offered general solutions, future work must focus on tailoring these proposals to specific contexts. A promising direction is the implementation of case studies that examine individual T&I undergraduate programmes in depth. Such studies would enable a granular analysis of program-specific constraints and opportunities, providing the foundation for bespoke curricular adjustments. Case studies could also help identify best practices that may be transferable across programmes. For instance, examining how certain universities have successfully integrated TT into their curricula or fostered collaboration with the professional market could serve as valuable benchmarks. These insights would enhance the adaptability of the proposed framework and contribute to a more nuanced understanding of how to overcome institutional barriers.

The incorporation of TT into the translation classroom is a cornerstone of this study's proposed framework. However, the effective integration of TT extends beyond the acquisition of tools; it requires a pedagogical shift toward situated learning methodologies. These methodologies emphasize the use of authentic, real-world scenarios that mirror professional practices, enabling students to develop both technical proficiency and critical problem-solving skills. Future research should explore innovative ways to create immersive learning environments that replicate professional translation workflows. This could involve partnerships with industry stakeholders to design realistic project-based assignments or the use of virtual platforms that simulate collaborative

translation environments. Additionally, the integration of AI and ML tools into the curriculum represents an exciting area for further investigation. These technologies are reshaping the language industry, and equipping students with the skills to navigate them will be essential for ensuring their employability.

A recurrent challenges discussed in the literature, and echoed in this contribution, is the lack of sustained dialogue between academia and the professional market. Bridging this gap is key for ensuring that T&I undergraduate programmes remain relevant and aligned with industry needs. However, achieving this requires concerted efforts from both academia and the market. Future initiatives should focus on fostering sustained partnerships between universities and language service providers. These partnerships could take various forms, including advisory boards, joint research projects, and co-designed training programmes. Internships and mentorship programmes should also be expanded to provide students with direct exposure to professional practices. Moreover, professional associations and industry stakeholders could play a pivotal role by acting as intermediaries that facilitate communication and collaboration. From an institutional perspective, universities must address structural barriers that hinder collaboration. This includes streamlining administrative processes, allocating dedicated resources for industry engagement, and incentivizing faculty members to participate in professional activities. Such measures would help create a culture of collaboration that benefits students, trainers, and industry stakeholders alike.

The success of curricular reforms ultimately depends on the broader institutional and policy framework within which T&I undergraduate programmes operate. Universities must prioritize the modernization of their infrastructure, ensuring that classrooms are equipped with the necessary technological tools and resources. Faculty development programmes should also be expanded to help trainers stay abreast of the latest advancements in TT and pedagogical approaches. At a policy level, national and regional education authorities must recognize the strategic importance of translation and interpreting in today's globalized economy. Increased funding for T&I undergraduate programmes, coupled with greater flexibility in curricular design, would enable universities to implement the types of adaptations outlined in this study. Additionally, policies that promote interdisciplinary collaboration between T&I undergraduate programmes and other fields, such as computer science and linguistics, could further enhance the integration of technology into translator training.

The findings of this study open up several avenues for future research. One area of interest is the development of metrics for evaluating the effectiveness of curricular reforms. These metrics could assess factors such as student satisfaction, graduate employability, and alignment with market demands, providing valuable feedback for ongoing improvements. Another promising line of inquiry is the exploration of how cultural and linguistic diversity influences the implementation of translation technologies in the classroom. Spain's multilingual landscape offers a unique opportunity to examine how TT can be adapted to meet the needs of different linguistic communities. Research in this area could yield insights that are not only relevant to Spain but also to other multilingual contexts. Finally, comparative studies that analyse T&I undergraduate programmes across different regions or countries could provide a broader perspective on best practices and emerging trends. Such studies would help identify global standards for translator training while highlighting the specific challenges and opportunities faced by Spanish programmes.

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Notes

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The data from this research, which are not included in this work, may be made available by the author upon request.

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