Oltre l'EMI: UMNIA - l'Università Multilingue Nativa tramite IA per un'internazionalizzazione nel XXI secolo - Beyond EMI: UMNIA - The

Beyond EMI: UMNIA – The *AI-Native Multilingual University* for Internationalization in the 21st Century

A White Paper

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This document constitutes the reference framework of the UMNIA proposal, a model for AI-enabled multilingual higher education. Further academic, editorial, and operational developments are envisaged on this basis.

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Abstract

In recent decades, the internationalization of universities has progressively translated, in practice, into an increasing adoption of *English-Medium Instruction* (EMI), to the point of establishing, in many contexts—albeit with local and sectoral variations—a de facto English monolingual regime. This evolution, however, appears to be in tension with the broad and well-established political-institutional consensus (UN, UNESCO, EU, Council of Europe, international academic networks) that recognizes multilingualism as a structural value of academic excellence, equity, inclusion, and cultural sustainability. The present work is grounded in a systematic analysis of the scientific evidence concerning the effects of EMI in higher education. This evidence shows that English monolingualism is not neutral, particularly in contexts of advanced disciplinary training: it generates cognitive, pedagogical, social, and economic costs that fall disproportionately on non-native English-speaking students and faculty, reducing learning effectiveness, classroom interaction, teaching quality, and epistemic plurality. These effects are particularly well documented in technical and scientific disciplines, where EMI is more widespread, but they are not confined to specific disciplinary areas and affect the university system as a whole. The work further shows that the expansion of EMI has not been primarily driven by pedagogical or scientific considerations, but rather by a combination of institutional inertia, symbolic incentives, *academic marketing* strategies, and pressures stemming from international rankings. In this context, English tends to function more as a reputational indicator and instrument of symbolic legitimation than as a means for achieving educational excellence. Building on this analysis, the present document proposes a paradigm shift: a transition from the massification of EMI to a model of *Artificial Intelligence–Enabled Native Multilingual University* (UMNIA). In this model, faculty and students may, in formal contexts of teaching and disciplinary learning, operate in their own language—thus maximizing comprehension, expressive precision, and cognitive effectiveness—while linguistic mediation, the cornerstone of internationalization, is ensured by advanced systems of neural machine translation and AI-based simultaneous interpretation. The aim is not to eliminate English, but to overcome its assumed inevitability as the sole possible language of academia, while preserving its role as a lingua franca and as the language of international student life. The work demonstrates that this model is now technically mature, economically sustainable, and—within the framework of digital infrastructures already essential to the functioning of universities—already partially operational in numerous academic and institutional contexts, or frequently employed informally. The necessary technical features, possible implementation strategies, costs at different scales, and empirical, institutional, and practice-based evidence supporting its feasibility are analyzed in detail. Ample space is also devoted to examining the main ideological, cultural, pedagogical, technological, and economic objections, showing how they do not hold under current conditions. Taken together, the analyses conducted indicate that UMNIA makes it possible to reconcile internationalization, inclusion, and linguistic equity; to improve the quality of teaching and learning; to strengthen the epistemic and

cultural diversity of the university; and to realign it with the technological transformations of the twenty-first century. The question that arises today is not whether to change, but whether to consciously guide a transition that is already largely present and visible in informal practices of individual linguistic mediation, or to undergo it in a fragmented and ungoverned manner.

Keywords: higher education policy; language policy; linguistic dominance; linguistic diversity; educational inclusion; multilingual university; artificial intelligence; English Medium Instruction; machine translation; cognitive load.

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This gift of a common tongue is a priceless inheritance, and it may well some day become the foundation of a common citizenship. [...] Here you have a plan [...] for an international language capable of a very wide transaction of practical business and interchange of ideas. The whole of it is comprised in about 650 nouns and 200 verbs or other parts of speech – no more indeed than can be written on one side of a single sheet of paper. What was my delight when, the other evening, quite unexpectedly, I heard the President of the United States suddenly speak of the merits of Basic English [...] Such plans offer far better prizes than taking away other people's provinces or lands or grinding them down in exploitation. The empires of the future are the empires of the mind.

Winston Churchill, "The Gift of a Common Tongue", Harvard, 6 September 1943

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Introduction

In recent decades, the internationalization of universities has come to be equated with a progressive and widespread adoption of the English language across all aspects of teaching, a practice technically known as *English Medium Instruction* (EMI). In many European and international contexts, this choice has become not one among several possible strategies, but the virtually exclusive mode through which academic institutions have sought to respond to the pressures of competition, student mobility, and international evaluation systems. This document starts from the observation that such an approach, while historically understandable, has produced and continues to produce significant side effects at the cognitive, pedagogical, linguistic, and epistemic levels, as extensively documented in the scientific literature. EMI emerged in a technological context in which linguistic mediation was costly, fragmented, or impracticable; today, however, the material conditions that once justified its adoption have fundamentally changed.

The aim of the present work is not to call into question the role of English as a lingua franca of international scientific cooperation, nor to advocate a return to localist academic models belonging to the past. Rather, it seeks to explore in a systematic way whether and how neural machine translation and simultaneous interpretation technologies—now mature and widely deployed in many advanced domains—can support and develop internationalization while overcoming the structural limitations of EMI. The proposal detailed here—the model of an *Artificial Intelligence–Enabled Native Multilingual University* (UMNIA)—is conceived as an operational paradigm shift in the management of language as a tool for disciplinary learning in the contemporary university, not as an ideological rupture or a marginal experiment[1]. It is grounded in four main scientifically supported assumptions:

1. the functional distinction between the language of international communication and the language of disciplinary learning;
2. the need to reduce non-essential cognitive loads in advanced educational processes;
3. the technical feasibility of reliable, controllable, and scalable linguistic mediation;
4. the economic and organizational sustainability of such mediation at the institutional scale.

The present document is elaborated as a *programmatic and foundational white paper*: it aims to delineate a theoretical framework, supported by empirical evidence and feasibility analysis, and is not intended as a conclusive form of possible implementations, but rather as a basis for subsequent scientific, technical, and institutional developments in different application contexts. In particular, this study does not propose the uniform and immediate adoption of a single model, but rather the opening of a gradual transition toward institutionally integrated forms of AI-enabled native multilingualism – a transition that is experimental, measurable, and capable of being governed. As such, this work

[1] The name "UMNIA" echoes the Latin "omnia" (all), reflecting the proposal's aim of linguistic inclusivity and universal accessibility.

seeks to provide institutional actors –rectors, administrators, and policy-makers– with both a comprehensive overview and a set of conceptual tools to assess, in an informed and critical manner, a transformation that, as will be shown, is already underway in practice. This "multilingual revolution" is made possible by automatic translation technologies, which are analyzed here; a significant part of this process is already taking place informally, through the autonomous and unregulated use of digital tools, particularly by students. In this context, any attempt to prohibit, or even simply ignore, such practices appears increasingly unrealistic: the concrete risk is that linguistic mediation will continue to operate regardless, but outside any framework of responsibility, quality control, and institutional integration within teaching. The question is not whether such a transformation will occur, but whether universities will choose to govern it explicitly and responsibly, or instead undergo it in a fragmented and unregulated manner.

The text is structured as follows. The initial sections examine the international consensus on multilingualism and the scientific evidence concerning the limits of EMI. This is followed by a discussion of the institutional dynamics that have driven its expansion despite such evidence. The UMNIA model is then introduced, outlining its technical features, costs, implementation strategies, and the substantial body of empirical evidence already available, both at the institutional level and within informal student practices. A dedicated section addresses the main objections in a systematic manner, followed by concluding reflections of a strategic and policy-oriented nature.

1 Diagnosis: problem and its causes

1.1 International Consensus on Multilingualism in Knowledge

1.1.1 Political and Institutional Positions

Over the past twenty years, all major international organizations—from the United Nations to UNESCO, from the Council of Europe to the European Commission, as well as academic networks such as *Circle U.*—have clearly and consistently stated that **multilingualism**, understood as the functional and non-exclusive coexistence of multiple languages across different domains of university life, constitutes a structural value not only for academic excellence, but also for equity, inclusion, and cultural sustainability [1]. These recommendations do not merely reflect a political preference; they are grounded in the idea that linguistic diversity is an essential component of the university's public mission: a university system that renounces linguistic plurality also relinquishes a decisive part of its epistemic richness.

This orientation emerges first and foremost from the positions adopted by the United Nations. The United Nations General Assembly Resolution on multilingualism [2] defines linguistic diversity as a "fundamental value" of the Organization and underscores its central role in ensuring equitable participation of states in global decision-making processes. Within the framework of International Mother Language Day, it is reaffirmed that *access to education in one's own language is a primary educational right* and an essential condition for social cohesion—a principle that the educational literature extends to higher education, particularly in phases involving complex conceptual acquisition.

In the educational domain, UNESCO's position is even more explicit. The *Universal Declaration on Cultural Diversity* [3] recognizes linguistic diversity as part of the heritage of humanity and affirms that languages are fundamental instruments of creativity and human development. This orientation is further elaborated in the document *Education in a Multilingual World* [4], in which the Organization maintains that education should be grounded in the mother tongue, promote multilingual educational policies, and counter any form of linguistic hegemony that hinders equitable access to knowledge, without excluding the role of shared vehicular languages in contexts of international cooperation.

Similarly, the Council of Europe has recognized the structural dimension of multilingualism in educational systems. The *European Charter for Regional or Minority Languages* [5] defends linguistic plurality as a European public good and as a foundation of the continent's democracies. Recommendation *CM/Rec(2022)9* [6] reiterates these principles and explicitly calls for moving beyond monolingual approaches through organizational models that distinguish the different uses and functions of languages. The

European Commission has expressed itself in the same direction with the communication *Multilingualism: an asset for Europe* [7], which defines linguistic diversity as a "pillar of the European project". The Council Conclusions of the European Union of 2022 and 2024 [8, 9] emphasize the need to promote genuine multilingual internationalization and to *counteract trends of uncontrolled Anglicization*.

At the academic level, this consensus is reflected in numerous declarations issued by international academic and university networks.

In this regard, particular attention should be paid to the European Federation of National Institutions for Language—*European Federation of National Institutions for Language* (EFNIL) [10]—which brings together numerous European academies and linguistic institutes with the aim of promoting standard/national/official languages, starting from the premise that European multilingualism is a valuable reality that must be preserved for the future. Following several preparatory meetings, a decisive milestone was reached at the conferences held in Mannheim (14–16 December 2000), at the Institut für Deutsche Sprache, and in Florence (25–27 October 2001), at the Accademia della Crusca and the Opera del Vocabolario Italiano, where the text of the *Mannheim Recommendations* for the promotion of Europe's standard/national/official languages was discussed and definitively approved, and which the Member States of the European Union are invited to take into account in their policies, in order to foster European standard languages and thereby support the persistence of a multilingual Europe. At a subsequent conference in Brussels (19–21 June 2002), the European Federation of National Institutions for Language was formally established, with the participation of academies and language institutes from 14 EU countries; in Italy, the Accademia della Crusca and the Opera del Vocabolario Italiano are members.

Within the specifically university context, the *Helsinki Declaration on Multilingualism in Higher Education* is one of the clearest statements, involving a very large number of European universities [11]; in particular, it argues that monolingualism reduces both inclusion and the quality of higher education. Along the same lines, the *Graz Declaration* of 2020 directly links linguistic diversity to a *democratic responsibility* of educational institutions. Finally, the *Circle U. Multilingualism Conference Final Report* [12] strongly reaffirms the idea of a multilingual university, also enabled by emerging language technologies, without prescribing a single model but indicating a direction of possibility.

1.1.2 Scientific Evidence: English Monolingualism as a Structural Obstacle

Research on this topic indicates that these political positions are consistent with the current scientific state of the art. These studies converge in showing that English monolingualism dominant in science, understood as an exclusive regime rather than a functional use of English as a lingua franca, is not neutral and entails systemic costs. On the contrary, it generates a set of systemic disadvantages, widely documented, that disproportionately affect non-native English-speaking researchers.

Numerous studies quantify the negative effects of English monolingual dominance in global scientific production. A 2023 study shows that non-native English-speaking re-

searchers require up to 90% more time to read scientific articles, up to 50% more time to write them, and face editorial rejection rates up to 2.6 times higher than native speakers [13]. The authors conclude that this constitutes what they term a *cognitive and material tax*, which reduces productivity, visibility, and career opportunities for non-native English speakers. As will be discussed, the same mechanisms of cognitive load and linguistic overinvestment operate in advanced educational contexts as well, where English functions as the language of instruction (English medium instruction, EMI).

Sociolinguistic and economic studies show that the dominance of English as the sole lingua franca produces a redistribution of resources from non-Anglophone to Anglophone countries, estimated in tens of billions of euros per year [14]. English thus functions as a mechanism of structural competitive advantage, which strongly manifests itself in higher education and academic career paths: native speakers benefit not only from fluent linguistic competence, but also from a cultural and rhetorical advantage in publication practices, in *peer review*, at conferences, and in access to international scientific networks [15].

At the same time, the growing predominance of English contributes to a progressive reduction in the capacity of national languages to express advanced scientific concepts, with consequences that affect in particular education, public dissemination, and scientific communication with society. Scholars studying these dynamics argue that this linguistic impoverishment reduces the ability of the public to participate in informed debate on complex scientific issues, creating an increasing distance between the scientific community and society [15, 16]. This gap, they note, represents a concrete risk for the functioning of democracy, as it assigns to the community of experts an increasingly separate and opaque role with respect to citizens.

Taken together, these studies converge on a relevant point: English monolingualism not only compromises equity and the quality of research, but also limits the epistemic and cultural diversity of academia, reducing the capacity of universities to fully carry out their democratic and scientific mission. The political positions of international institutions are therefore consistent and scientifically well grounded in promoting multilingualism in knowledge. However, the question remains open as to how to translate this consensus into organizational and pedagogical models capable of overcoming monolingualism without renouncing internationalization.

1.2 In contrast with international recommendations on inclusivity, diversity, and excellence

1.2.1 The non-critical adoption of *English Medium Instruction*

English Medium Instruction (EMI) is the practice of adopting English as the exclusive language of instruction in academia. Despite the strong political support for multilingualism outlined in § **??**, European and global universities are moving in the opposite direction, in most cases without a systematic evaluation of pedagogical effects, toward a continuous and progressive anglicization. The literature shows, however, that this ex-

pansion of EMI has not been driven primarily by pedagogical considerations, but rather by economic, competitive, and symbolic dynamics that have established English as the dominant language of higher education. Several studies show that EMI has grown mainly as a result of the globalization of university systems. Indeed, many institutions display a kind of quasi-automatic organizational and reputational dynamic, associating English with modernity, internationalization, and professional opportunity, often without precisely assessing its effects on learning [17]. This is confirmed by specific studies showing that EMI is adopted in internationalization strategies independently of its actual pedagogical effectiveness [18].

This process is part of the broader trend of *Englishization* in European higher education. Extensive studies document how anglicization has become structural and is often implemented top-down through mechanisms of governance, funding, and evaluation, responding more to pressures of global competition than to considerations of educational merit [19]. Researchers emphasize that English continues to spread because, despite increasingly visible concerns, it is still perceived as the language of scientific excellence and internationalization. The literature also recognizes that English plays a central role in academic marketing processes: the *Global Mapping of EMI* by the British Council shows that the adoption of English is often motivated by the need to attract international students and compete in the global education market [20]. English thus becomes an identity marker, a "quality label", an immediate signal of prestige and openness in a context where it indeed plays a central role in the international circulation of knowledge.

In addition, the growing influence of international university *rankings* reinforces this process. According to the International Association of Universities, global rankings implicitly favor Anglophone models, emphasizing scientific production in English and the attraction of international students [21]. Similarly, recent studies show that rankings have contributed to linguistic homogenization, reinforcing the idea that English is an essential condition for academic excellence [22]. As will be shown in the following section, empirical studies suggest a significantly different picture: scientific evidence indicates that the widespread adoption of English in non-Anglophone universities tends to undermine actual excellence. Nevertheless, the availability of courses in English is widely perceived as an indicator of quality. "English means excellence, modernity, competitiveness": this association is widely shared and often taken for granted, in the absence of systematic empirical evidence regarding its actual benefits [23]. This commonly held view, which does not find consistent support in the available evidence, nevertheless reinforces the self-reinforcing cycle of anglicization: English continues to expand within universities because it is already dominant, driven by media, organizational, and marketing dynamics, without being accompanied by systematic pedagogical evaluation or by thorough monitoring of learning outcomes and educational quality.

It is also important to note that the expansion of EMI is not homogeneous across disciplines. It is particularly pronounced in STEM fields (Science, Technology, Engineering, and Mathematics), where English is often regarded as the "natural" language of teaching and knowledge production, whereas in the humanities and social sciences resistance to monolingualism tends to be higher. Consequently, it is especially within STEM contexts—due to their conceptual density, terminological specificity, and modes of

disciplinary practice—that the structural effects of EMI become most evident and measurable, in terms of cognitive load, reduced instructional effectiveness, and diminished classroom interaction.

Overall, the adoption of English as a language of instruction appears to be the result of systemic dynamics—globalization, marketing, international competition, and ranking incentives—that drive linguistic uniformity. It is precisely this gap between declared principles and actual practices that makes it urgent to explore new models of university organization capable of addressing the systemic conditions that have made EMI dominant, without denying the need for internationalization, and that can reconcile it with linguistic equity.

1.2.2 Evidence of the didactic failure of EMI in higher education

The adoption of EMI is often presented as a modern and inevitable choice. However, the international scientific literature presents a markedly different picture: EMI produces significant cognitive, pedagogical, social, and economic costs, which are typically not taken into account in university decision-making processes. From a broad and well-established body of literature on the topic, a number of paradigmatic results from the most relevant studies are presented here.

It is important to note, first of all, that, at least in a European context, admitting an imperfect command of English carries a form of *social stigma*, which translates into didactically relevant forms of self-censorship. This has been documented in specific studies conducted, in particular, in contexts with Germanic native languages, where, in principle, English proficiency is very high [24]. Although, when directly asked, the vast majority of students and lecturers report that they "do not notice differences" between teaching in their native language (L1) and in English (L2), the analysis of data, comprehension tests, and classroom recordings shows otherwise. This constitutes an important warning signal. When a shift from L1 teaching to English is proposed, surveys are sometimes conducted among students to assess acceptance. However, the literature consistently shows that the results of such surveys are often unreliable, due to the dynamics of stigmatization observed. When EMI is implemented and its effectiveness is evaluated using rigorous methods, the results are consistent and indicative of significant critical issues. Randomized controlled studies in Scandinavian contexts, where proficiency in English as L2 is among the highest in Europe, have examined university physics courses delivered in two identical versions, one in L1 (in the specific case, Swedish) and the other in L2 (English) [24]. Student-side evaluation shows that, in the latter case, participation decreases significantly, uncertainty in understanding questions increases, and reluctance to speak emerges due to linguistic exposure [24, 25]. Particularly relevant is the finding on learning outcomes: students taught in their native language achieved 73% more correct answers than those in the EMI group. In addition, dropout rates increased by almost 25% (from 57% to 71%) in the English-taught group [24]. Similar results have been documented, with quantitative variations, across other European and disciplinary contexts.

The systematic analysis of classroom interaction provides a clear indicator of the didactic degradation associated with EMI. Observational studies based on transcripts and

direct counts show that, with the same course, instructor, and content, the number of student questions drops sharply when teaching is conducted in English rather than in the native language. It is worth emphasizing that the Scandinavian data are particularly indicative: despite very high levels of English proficiency, EMI lectures consistently show reductions in student questions and spontaneous interventions exceeding 40%, with peaks up to 60% depending on discipline and institutional context [26, 27]. Consistent results are found in other European contexts: analyses of university lectures show that EMI is systematically associated with a marked reduction in dialogic interaction, with an increase in low-complexity control questions at the expense of exploratory and conceptual questioning [28]. Controlled comparative studies, in which the same instructor delivers the same lesson once in L1 and once in English, confirm that the decline concerns not only the quantity but also the quality of questions, with a significant reduction in cognitively engaging forms of inquiry [29].

Similar findings emerge on the instructor side. Studies show that EMI, when English is used as the exclusive and permanent language of instruction, produces problematic effects even when lecturers have high proficiency. Research conducted in technical faculties in the Netherlands shows a significant reduction in pedagogical redundancy, clarity, expressiveness, and fluency, a slowdown in speech rate of up to 17%, and a marked increase in preparation time (+67%), along with greater difficulty in improvising examples and reformulations [30]. Since redundancy and prosodic variation are among the primary predictors of teaching effectiveness, their systematic reduction implies a structural decline in instructional quality [31].

Overall, these findings indicate that the compression of classroom interaction is a *structural effect* of content learning in L2 (EMI), rather than a simple consequence of insufficient linguistic competence. The persistence of these effects even among students and instructors who report comparable competence in L1 and L2 further suggests that the penalty is intrinsic to L2 disciplinary learning. The failure of EMI can be quantitatively traced to a substantial increase in *cognitive load*, which, according to recent studies, can be expressed as a reduction in comprehension capacity of approximately three quarters and a decrease in instructional pace of nearly one fifth, according to standard metrics in the literature, ultimately leading to superficial and fragmented learning [32]. This will be analyzed in the following section.

At a global scale, EMI is embedded within a broader pattern of linguistic asymmetries in science. Non-Anglophone researchers must invest significantly more time to read (+90%), write (+50%), and present (+93%) their work, despite the growing, often informal use of language support tools [13]. They also face higher rejection rates and receive requests for linguistic revision 12.5 times more frequently than native speakers. These factors slow career progression, penalize researchers from non-Anglophone countries, and weaken scientific pluralism (fig. 1.1) [13]. At the epistemic level, recent work shows that the dominance of English does not merely create linguistic barriers, but tends to homogenize intellectual perspectives, privileging Anglo-American frameworks and reducing cultural and conceptual diversity in research [33]. Similarly, in applied sciences, negative effects emerge in the production and use of local knowledge, with documented impacts on decision quality and data representativeness [34, 35].

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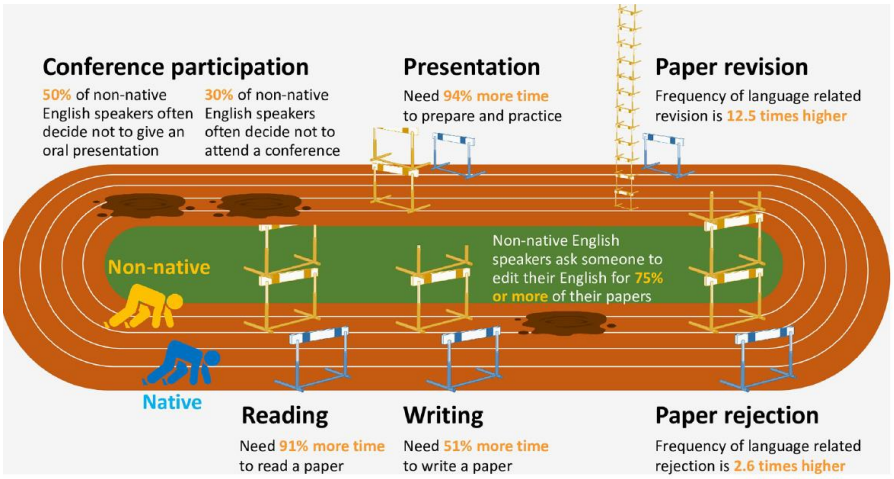

Figure 1.1: Image from [13], fig. 5. Estimation of the obstacles faced by non-native English speakers in carrying out different scientific activities.

In the Italian context, EMI is often introduced for reasons of institutional prestige or international visibility, rather than pedagogical or scientific considerations. This leads to what the literature calls "cosmetic internationalization", which does not improve the quality of educational provision and may instead weaken the role of the national language in knowledge production [36]. Finally, several scholars warn of an increasing risk of *domain loss*, that is, the gradual loss of the ability of national languages to express advanced scientific concepts, with consequences for epistemic diversity, circulation of ideas, and the cultural autonomy of academic institutions [14, 15].

In summary, a broad and convergent body of evidence shows that EMI is not merely a linguistic choice, but a structural mechanism that, in light of available empirical evidence, substantially reduces teaching effectiveness, increases cognitive load, amplifies academic inequalities, penalizes non-Anglophone students and researchers, limits epistemic diversity, and risks weakening one of the core foundations of the university: linguistic and disciplinary plurality as a source of knowledge.

1.2.3 The *Structural Cause*: Why EMI Is Intrinsically Sub-Optimal

The question therefore arises as to the *structural cause* of this phenomenon. Given the breadth of the range of cases, and considering in particular the Scandinavian case, where English is known at very high levels, the cause of such marked declines is not to be found in a lack of linguistic competence. The scientific literature provides a precise explanation, invoking the problem of *cognitive overload* [32]. During the learning process, the human brain has a limited capacity to process information. If this process takes place through a language that is not the native language L1, regardless of how well the latter is known, inevitably part of the mental resources (the so-called *cognitive load*, *cognitive load*) will be diverted from the understanding of concepts to the decoding of the language. Such

linguistic effort is not the objective of the lesson, but a *side effect*: it subtracts mental resources from the comprehension of disciplinary content, thereby impairing the ability to follow reasoning, take notes, assimilate abstract concepts, and engage in discussions [25, 28, 32, 35].

The *Cognitive Load Theory* (*Cognitive Load Theory*, CLT) describes this learning dynamic in detail, distinguishing between the *intrinsic cognitive load* of disciplinary content (IL) and the *extraneous cognitive load* (EL), that is, the load not directly functional to the learning of disciplinary concepts [37, 38]. In the case of disciplinary teaching in the native language (L1), the extraneous load associated with linguistic decoding (EL_1) is null, since linguistic processes are automated ($EL_1 = 0$). In the case of instruction in another language, in L2, however, a portion of the extraneous load (EL_2) is inevitably constituted by the effort of linguistic processing ($EL_2 > 0$), which competes with conceptual processing for access to the limited resources of working memory.

It is important to note that this dynamic is inherent to the human brain and therefore unavoidable: the linguistic cost of any intellectual activity that does not take place in the native language is not the effect of imperfect competence, but a structural constraint. Numerous studies in psycholinguistics and neurolinguistics show that, even in highly competent L2 speakers, linguistic processing always requires a greater involvement of executive control and monitoring resources than in L1 [39–41]. Consequently, the total cognitive load associated with disciplinary learning in L2 is systematically higher than in L1. From a formal point of view, this asymmetry can be expressed by observing that, for the same disciplinary content,

$$CL_{\text{tot}}^{\text{L}_2} = IL + EL_2 > IL + EL_1 = IL = CL_{\text{tot}}^{\text{L}_1}. \tag{1.1}$$

The term EL_2 may decrease as linguistic competence improves, in the specific case of EMI, by "learning English better". However, the evidence shows that this cost can never be completely eliminated [39]. In other words, any intellectual activity carried out in L2, and in particular disciplinary learning, may become more efficient with experience, but cannot reach the same level of cognitive efficiency as learning in L1 [1] . It is as in the case of a marathon runner competing with a weight on their shoulders: with training the weight may be perceived as less burdensome, but the condition never coincides with that of running without load. It follows that EMI cannot, structurally, constitute a pedagogically optimal solution, but is always an intrinsically sub-optimal compromise and therefore acceptable only in the absence of alternatives.

[1] The empirical behavior of linguistic load can be modeled mathematically, starting from relation (**??**), as a monotonically decreasing function of linguistic competence, P, with a finite horizontal asymptote. A simple functional form consistent with the literature on learning curves and automatization may be

$$EL_{\text{ling}}^{\text{L2}}(P) = k_0 + k_1 e^{-\lambda P},$$

with $k_0 > 0$, $k_1 > 0$ and $\lambda > 0$. Models of this type are widely used in cognitive psychology to describe the reduction of computational cost with practice and experience, while maintaining a non-eliminable minimal cost [42, 43]. In the present context, the choice of the exponential function is indicative. The most important element is not the specific form of the curve, but the presence of the term $k_0 > 0$, that is, a residual cognitive cost, reflecting the structural imprint of the native language L1 in linguistic processing.

The consequence is significant: the failure of EMI does not primarily depend on poor implementation, insufficient linguistic training, or cultural resistance, but derives directly from a fundamental cognitive constraint of the brain. Learning complex concepts in a non-native language is not impossible, but it never allows one to deploy the full extent of one's cognitive resources. Any model of internationalization that systematically imposes a non-native language as the language of disciplinary learning introduces an unavoidable cognitive overload and, therefore, cannot maximize pedagogical effectiveness.

1.2.4 Inertia, Distorted Incentives, and the Pursuit of *Rankings*: The Drivers of EMI Expansion

The question is unavoidable: if EMI compromises learning quality, disadvantages non-native English-speaking students, and weakens the vitality of national languages, why do universities continue to adopt it? The answer does not lie in institutional irrationality, but in the structure of incentives within which universities operate. The literature shows that the reasons do not primarily concern pedagogical effectiveness, but rather a set of institutional, symbolic, and economic dynamics that drive Anglicization independently of educational outcomes.

1. A first factor is **institutional superficiality in the evaluation of EMI**, by which we mean the absence of systematic *ex ante* and *ex post* assessments, not a lack of competence among actors. Many universities introduce courses and entire programs in English without any structured monitoring of their effects on teaching or disciplinary competencies. Indeed, authoritative studies note that the adoption of English often occurs as an *organizational automatism* typical of contexts under high reputational pressure, supported more by superficial perceptions of modernity and prestige than by data-driven analysis [17]. In the Italian case, for example, EMI has been introduced in the absence of a defined pedagogical framework, investments in language training for faculty, and above all without evaluation of its impact on learning processes [36]. A similar situation has emerged in several European and non-European countries, where EMI has spread as a standard solution without evidences of improvement in academic excellence [15].

2. A second element concerns the **distorted incentives generated by the pursuit of international *rankings***. Major global rankings—in particular the *Times Higher Education World University Ranking (THE)* [44], the *QS World University Ranking (QS)* [45], and the *Academic Ranking of World Universities (ARWU)* [46]—privilege indicators that, often independently of actual internal teaching dynamics, effectively favor Anglophone or Anglicized institutions: publications in English, international collaborations measured through Anglophone networks, student mobility toward English-speaking countries, and the presence of international faculty and students. As comparative analyses of global rankings show [47–49], these evaluation systems assign disproportionate weight to "international outlook" metrics, generating systemic pressures that push universities to expand EMI offerings not for pedagogical reasons, but to "signal" competitiveness [16].

This dynamic is described in the comprehensive study by [15] as a self-reinforcing process leading to a form of "academic doping", understood as the optimization of formal indicators at the expense of real educational outcomes: English becomes a tool of reputational positioning rather than of genuine educational quality. Studies on university governance policies confirm that the pursuit of rankings produces imitative behavior and linguistic choices driven not by cost-benefit analysis, but by logics of symbolic legitimation [19, 22].

3. The persistence of EMI is also reinforced by the **linguistic asymmetries of global science**. The requirement to use English functions as a kind of "hidden tax" on non-English-speaking countries [14], generating a redistribution of time, resources, and opportunities in favor of native speakers [13]. It is important to emphasize that these costs are not due to the fact that individuals "do not know English well enough" or that they must "learn English better"—slogans often repeated uncritically: it is sufficient *not to be a native speaker*, even with high levels of certified proficiency, to be compelled to pay, to some extent, this inescapable "hidden tax". This produces a vicious cycle: non-Anglophone universities attempt to imitate Anglophone models in order to "recover" competitiveness, but in doing so further reinforce the advantage of native speakers and the perception that English *coincides* with internationalization [15].

4. Finally, EMI is sustained by **organizational narratives and status symbols**. Many universities use English as an *identity marker* of international openness, independently of its educational effectiveness. Again, this dynamic aligns with the concept of "cosmetic internationalization", understood as a misalignment between external signaling and internal quality: a choice that generates high symbolic returns despite limited or even negative educational impact [36]. Analyses in language policy show that such choices are often driven not by pedagogical strategies, but by competitive pressures, institutional imitation, and the desire to align with perceived standards of the global knowledge market [15, 16].

Overall, the expansion of EMI does not reflect an improvement in educational provision, but rather the convergence of organizational inertia, distorted incentives, reputational pressures, and asymmetric advantages. Understanding these dynamics is essential for developing alternative models that reconcile internationalization with linguistic equity without sacrificing educational quality or epistemic diversity, and that, rather than ignoring these constraints, realign their underlying incentives.

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2 Proposal: academic languages as optimizable infrastructures

2.1 The Transition from the Massification of EMI to Multilingual Pluralism

2.1.1 From Standardized Higher Education to a Modern University of Excellence

Despite international declarations strongly reaffirming the strategic value of multilingualism, higher education today faces a clear contradiction. On the one hand, multilingualism is celebrated as a condition for scientific excellence, educational equity, and epistemic diversity; on the other hand, universities persist in pursuing monolingual models based on *English Medium Instruction* (EMI), implemented in a direction that promotes the massification of higher education, understood as linguistic standardization rather than as an expansion of access. Until recently, EMI presented itself as a modern and effective response to the demands of internationalization. However, as shown in the previous section, it has generated significant cognitive, pedagogical, and cultural costs, reducing teaching quality, widening inequalities, weakening inclusivity and academic and disciplinary identities, and contributing to the gradual erosion of national academic languages. In many contexts, the pressure toward English has ultimately eroded part of the university's cultural vitality, calling into question its very mission.

One possible solution, in theory, would be to reject EMI and return to a model based exclusively on national languages. However, in a globalized academic world, such a choice would be unsustainable, both at the scientific and institutional levels: internationalization is now perceived as indispensable, and universities operate within scientific and educational networks that require a constant ability to communicate across linguistic boundaries.

A dilemma thus emerges, rooted in a binary linguistic framework: EMI is undermining precisely those values of plurality, diversity, and inclusion that universities are meant to uphold, yet abandoning internationalization is simply unrealistic. The question therefore becomes: how can global openness be reconciled with the preservation of linguistic diversity? How can English be prevented from becoming a force of cultural homogenization while ensuring that the university remains an institution capable of engaging with the world?

The answer cannot come from the past, but from the present: from twenty-first-century technologies, not as an automatic solution, but as an infrastructure to be actively governed. Artificial intelligence, advanced machine translation, and simultaneous interpre-

tation systems now open unprecedented possibilities. It is these emerging technologies that make it possible to conceive a model which, in formal contexts of teaching and disciplinary learning, can overcome the limitations of EMI, preserve linguistic plurality, and at the same time support genuine internationalization. From this starting point, a new paradigm may emerge which, if accompanied by explicit institutional choices and careful process design, can lead to a university capable of reconciling excellence, inclusivity, and international engagement.

2.1.2 Rethinking the Paradigm

For more than twenty years, the European university has internalized an almost automatic reflex of historical and organizational nature: the idea that *internationalization* is synonymous with *Anglicization*. A linear and highly simplified formula—in effect, a conditioned reflex:

$$\text{INTERNATIONAL} = \text{ENGLISH} = \text{EXCELLENCE}. \tag{2.1}$$

"Internationalization coincides with Anglicization; Anglicization is a seal of quality; quality guarantees excellence."

These statements have acquired the status of self-evident and unquestionable truths, in the absence of empirical verification of their effects. Many decision-makers—often acting in good faith and under stringent institutional constraints—have invested years in building courses, programs, and entire structures in English, firmly believing that this was the *only possible path* under given technological and organizational conditions to make their institutions competitive. When such a path is construed as the *only possible one*, one moves from *equality* to *identity*: not merely "A equals B", but rather "A *coincides* with B", that is, "A and B are the same thing", "A is nothing other than another name for B".

$$\text{INTERNATIONAL} \equiv \text{ENGLISH}$$

$$\text{ENGLISH} \equiv \text{EXCELLENCE}$$

When we claim that a problem has a single solution, Karl Popper reminds us [50]:

> Whenever a theory appears to you as the only possible one, take this as a sign that you have neither understood the theory nor the problem which it was intended to solve.

"It is *natural* that Anglicization is the *only possible* response to internationalization, to the point of coinciding with it."

And yet what appears natural is often nothing more than a *mental habit* that has solidified into a system. When technological conditions change, when new tools render established practices obsolete, ideas once thought untouchable must be reconsidered. Today, space must be made for a genuine *Copernican revolution*: it is no longer the university that must revolve around English, but rather contemporary technology which, if properly designed and institutionally governed, makes it possible to construct a system in which each language can once again become a valuable perspective on the world.

This is not to deny the importance of English, but rather to show that it is no longer *inevitable* as the exclusive language of disciplinary education. For decades, English monolingualism has been regarded as a necessary toll for participation in global science. However, the cognitive, pedagogical, cultural, and epistemic costs of EMI—extensively quantified in the literature and discussed above—have begun to undermine this narrative: English as the sole language of the university does not automatically produce inclusion, diversity, or excellence; it increasingly risks undermining precisely these hard-won principles. The reality is that EMI has become a *transitional technology*, historically understandable but now structurally surpassable. It is a bridge built when no alternatives existed to bridge linguistic distance—one that may have functioned, albeit at significant cost, for a certain period, but which now reveals clear structural limitations.

Rectors, deans, and governing boards have long asked: "Is Anglicization not the only solution for internationalization?" "Is it not a desirable, or at least inevitable, solution?" "Is Anglicization not the only appropriate response for a modern and excellent academy?" As the philosopher of science Paul Feyerabend put it:

> [T]o these questions my answer will be a firm and resounding NO! [51]

To university decision-makers, the answer is clear: scientific evidence, the current state of higher education, the historical moment, and above all technological progress clearly point to a negative answer.

The pursuit of growth, improvement, excellence, and inclusion requires the adoption of an *integrated multilingualism*.

In the countries that have most extensively experimented with English Medium Instruction, evidence of its pedagogical shortcomings has led to an explicit reformulation of university language policies, culminating in the adoption of the principle of *parallel language use* [52–54], which represents a first and partial alignment with the recommendations of international organizations on multilingualism (§ 1.1). This principle aims to preserve the use of national academic languages without renouncing internationalization, by allowing, within a fundamentally multilingual framework, the coexistence of English and the local language, the latter not in a subordinate position but as a legitimate academic language of equal status. *Parallel language use* is now formally required and widely implemented in the university systems of Sweden, Denmark, Norway, and Finland, according to official guidelines [55]. In the Netherlands, a significant correction of the "English-only" model is underway: after a phase of strong Anglicization, there has been a renewed strengthening of national-language programs alongside those in English. Switzerland provides another example, where EMI has been integrated into a structurally multilingual system that has never adopted English as the exclusive language of instruction [56, 57]. Compared to English monolingualism, parallel multilingualism represents a substantial advancement: it acknowledges that teaching effectiveness is not independent of language, and that the national language plays a crucial role in both disciplinary and social formation. Nevertheless, this model remains intrinsically binary, limited in scalability, difficult to optimize, and only partially reflective of the true linguistic plurality of contemporary reality.

A more inclusive and functional response can be achieved by expanding multilingualism and using each language for the function in which it is most efficient. This becomes possible thanks to the technologies of the twenty-first century: advanced machine translation, simultaneous interpretation, and real-time subtitling make it possible to optimize linguistic functions, clearly distinguishing between the language in which teaching and classroom interaction take place and the languages through which students access disciplinary content, thereby preventing linguistic decoding from interfering with the learning process. On this basis, a new paradigm can be outlined, which we propose to define as *functional native multilingualism*. In this model—an evolution of *parallel language use*—teaching and interaction remain anchored to the institution's native language, while multilingual access to content is ensured through scalable technological mediation, thus resolving the dilemma between teaching quality and internationalization while broadening and systematizing the multilingual approach. These new technologies thus make it possible to construct a model that, in formal contexts of teaching and disciplinary learning, can overcome the limitations of EMI, preserve linguistic plurality, and at the same time enhance genuine internationalization. From this starting point, a new paradigm can emerge which, if supported by explicit institutional choices and careful process design, can lead to a university capable of reconciling excellence, inclusivity, and international engagement (Table 2.1).

The tools that the twenty-first century has made available to overcome *language barriers* were previously inconceivable: neural machine translation and real-time simultaneous interpretation systems are already widely used in professional and institutional contexts. In a world where such technologies exist, the idea that internationalization must necessarily coincide with linguistic replacement becomes entirely anachronistic. The contemporary university is no longer forced to choose between the national language and a global language: it can aspire to a higher form of internationalization, based on **functional multilingual interconnection**. This new model—an *Artificial Intelligence–Enabled Native Multilingual University* (UMNIA)—does not eliminate English, but frees it from the inappropriate role of being the only possible language. It allows faculty and students to operate in the language that, in formal contexts of teaching and disciplinary learning, maximizes comprehension and cognitive quality, while at the same time preserving and indeed enhancing full and effective international openness.

This is the *Copernican revolution* that must be embraced: not a technical adjustment, but a paradigm shift. It requires moving beyond the idea that English is the center of the academic universe and recognizing that the technologies of the twenty-first century allow linguistic plurality to be restored to the core of the university's mission.

This is a *conceptual revolution* being asked of the academic world: a rethinking of its fundamental assumptions. It will not be easy for decision-makers who have strongly supported the expansion of EMI over the past two decades. Yet this is the direction in which, as will be shown, *the world is already moving*, in an informal, uneven, and as yet ungoverned manner. Multilingualism through AI-based translation is a future that is already present and widely embraced in many of the most dynamic contexts. The university is called upon to overcome the institutional inertia that has so far characterized these processes.

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Historical period	Model	Language of instruction	Advantages	Limitations
∼ 40 years ago	**Local monolingualism** (L1)	National language (L1)	Maximum teaching effectiveness; strong cultural and social integration	Limited international access; low inclusivity for non-native students
∼ 20 years ago	**English monolingualism** (EMI)	Lingua franca (English)	Standardized international access; simplification	Increased cognitive load; reduced interaction; inequalities; weakening of national scientific languages; monolingual massification
∼ 10 years ago	**Parallel multilingualism**	L1 and lingua franca (English) in distinct parallel tracks	Recovery of teaching effectiveness; protection of national languages; response to EMI limitations	Limited scalability; course duplication; linguistic binarism; lack of functional optimization
Today	**Functional native multilingualism**	L1 for teaching; multiple languages for content access; lingua franca for informal interaction	Maximum cognitive effectiveness; scalable multilingual inclusion; overcoming L1/English binarism; valorization of diversity and inclusion	Requires reliable technological infrastructures and explicit institutional design

Table 2.1: Evolution of linguistic models in higher education

2.1.3 The AI-Enabled Native Multilingual University

The answer to the issues outlined above, the proposal presented here, is to build *at scale* an **AI-Enabled Native Multilingual University** (UMNIA), in which each instructor, within their own institution, teaches in their own language and each student learns in the language in which they understand best, in formal contexts of disciplinary teaching and learning, thanks to next-generation neural simultaneous translation systems made available by AI technologies, deployed and governed as support infrastructure rather than as a replacement for human interaction. This is not science fiction, nor a purely theoretical exercise, as demonstrated by already widespread practices of transcription, subtitling, and real-time translation in academic and professional settings. It is a model fully implementable with currently available technologies, already in use—often experimentally or partially—in many of the world's most advanced academic and research institutions, or in increasingly widespread informal contexts. We will show that it is *technically mature* and *economically sustainable*, provided that explicit institutional design is in place, and

that it is supported by a growing body of *scientific evidence*, as well as by concrete, already operational experiences.

The system that will be built is a **multilingual university**, because technology enables the simultaneous management of multiple languages in everyday practice. It will be **native**, because multilingualism will not be imposed from above as an external element displacing what already exists—such as the imposition of English at the expense of teaching in national languages—but will instead be integrated harmoniously into existing realities, like the emergence of a living, organic system. All of this will be possible **through AI**, that is, by employing technologies that make possible today what until just ten years ago was considered science fiction.

Although conceived as a model applicable to the entire university system, the *AI–Enabled Native Multilingual University* proposal is particularly relevant to addressing the critical issues generated by EMI in technical and scientific disciplines. In these fields, the high conceptual density, intensive use of formalism, and inherent abstraction of the content make the cognitive overload induced by instruction in a non-native language especially detrimental to deep learning. It is no coincidence that, within the literature on cognitive load, a significant portion of the most robust empirical evidence on the limitations of EMI comes from studies conducted precisely in scientific and technological contexts [15, 24, 25, 30, 58].

The *AI-Enabled Native Multilingual University* is not opposed to English and does not eliminate it: it eliminates its inevitability as the exclusive language of disciplinary transmission. By aiming at efficiency and excellence, it restores centrality to national academic languages, raises the quality of teaching, expands inclusion, strengthens internationalization, and ultimately enables academia to be global without becoming monolingual. This transformation is not an abstract hypothesis: it is a path the world has already begun to follow. Universities that adopt it now will lead the change; those that ignore it, in a context where individual linguistic mediation is already a widespread practice, risk losing positions (Fig. 2.1).

All of this will be further developed in the following sections.

2.1.4 Optimizing University Teaching

A key element of the paradigm shift proposed here consists in applying an explicit criterion of pedagogical optimization, which is completely disregarded within the current EMI model.

Disciplinary teaching and language teaching follow different logics. A course in physics, law, or engineering has as its primary objective the transmission and assimilation of the specific concepts of physics, law, or engineering; a language course, by contrast, aims to develop communicative, lexical, and pragmatic competencies in a given language. This, however, also applies to the specific language of the discipline. A course in "English for physics" is not meant to *teach concepts of physics*, but to *teach how a physicist should express themselves professionally in English*.

In practice, English Medium Instruction is highly inefficient on both fronts: it neither ensures deep disciplinary learning nor constitutes an effective means for acquiring ad-

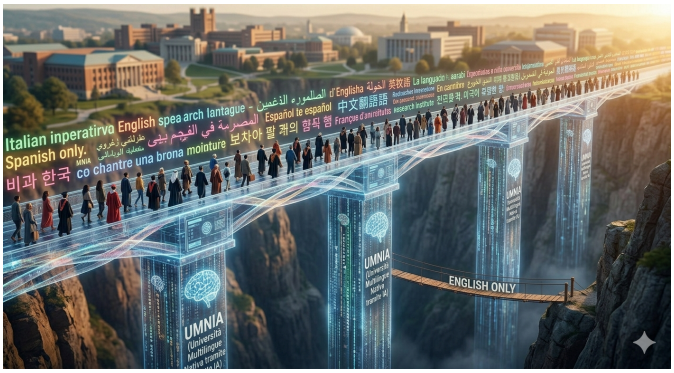

Figure 2.1: UMNIA is the evolution of EMI, enhancing internationalization by building an efficient and technologically advanced bridge between languages and cultures.
(Image generated by AI.)

vanced linguistic skills, in particular specialized technical English. Studies show that a student attending an EMI course listens to a professor who generally speaks incorrect technical English or, when formally correct, still limited, simplified, and imprecise [30, 59–62]; the student, for their part, tends to listen passively, without intervening or interacting [26–29]. The result is that actual exposure is to a *poor technical language* and, moreover, the student remains passive. There is no real language practice, not even at the specialist level, no specific exercises, no exposure to exemplary phonetics, and even less production attempts. This is not surprising: even when delivered under EMI, a disciplinary lecture is not a language course, not even a specialized one. Its goal is to teach the discipline, not English, which at that moment serves merely as a *medium*, as the very name EMI indicates. Ultimately, the generalist linguistic exposure characteristic of EMI courses is too unfocused to produce solid language learning, while at the same time negatively interfering with the transmission of disciplinary concepts and content. Expecting a single pedagogical device to simultaneously fulfill different functions necessarily implies renouncing its optimization (Table 2.1.4).

AI–Enabled Native Multilingual University makes possible a functional and rational separation of educational objectives, overcoming a major structural ambiguity of the current EMI system. As summarized in Table 2.1.4, disciplinary teaching, general language teaching, and technical-specialized language teaching pursue distinct goals, require different pedagogical strategies, and presuppose non-overlapping instructor competencies. Treating them as if they could be effectively compressed into a single pedagogical device delivered by a single instructor inevitably leads to a substantial loss of efficiency.

Within the UMNIA framework, the language is chosen so as to maximize cognitive comprehension and conceptual precision, while international openness is ensured through automatic linguistic mediation. The teaching of foreign languages—including technical-specialized English—is efficiently relocated to its appropriate pedagogical domain: ex-

	Disciplinary teaching	Language teaching (general)	Language teaching (technical)
Educational objective	Transmission and assimilation of disciplinary concepts	Development of communicative and lexical competencies in the language	Development of communicative and lexical competencies in the technical-specialized variety of the language
Type of teaching	Discipline-specific	Language-specific	Specific to the technical-specialized microlanguage
Type of instructor	Instructor trained in the discipline	Instructor trained in the language	Instructor trained in the language with specific knowledge of the technical microlanguage
Teaching strategies	Disciplinary	Linguistic	Linguistic, restricted to the disciplinary microlanguage

Table 2.2: Comparison of disciplinary, general language, and technical language educational objectives

plicit, designed, and assessable pathways, entrusted to instructors trained in language teaching and oriented toward specific disciplinary microlanguages. This strengthens precisely internationalization and preparation for the labor market, because it implements a logic of pedagogical optimization that produces better outcomes across all dimensions. EMI, in attempting to fulfill different functions simultaneously, proves inefficient both in disciplinary and in linguistic terms. The UMNIA paradigm overcomes this compromise by rationally reallocating cognitive effort, pedagogical devices, and teaching competencies according to the specific objectives pursued by the university.

2.1.5 A Revolution with No Losers: No One Loses, Everyone Gains

Every transformation encounters resistance. Academic decision-makers have spent years building programs in English, convincing colleagues, governing boards, and students that EMI was the primary path to internationalization. For many, questioning this model would amount—at an institutional and reputational level—to declaring the work done so far a failure. This concern is understandable, but unfounded in practice: the transition toward an *AI-Enabled Native Multilingual University* does not produce losers; it does not discredit those who have invested in EMI. It *moves the horizon of what is possible forward.*

For years, EMI has been a compromise solution shaped by the technological and orga-

nizational conditions of its time. In a world without effective machine translation, where placing a simultaneous interpreter in every classroom was inconceivable, adopting a lingua franca was considered an acceptable compromise. Global English has played—and continues to play—a valuable role in facilitating mobility, enabling collaboration, and supporting the development of global science. No one questions this contribution at the level of international scientific communication. However, EMI belongs to the world that produced it, not to the present one. It can now be recognized as a *transitional technology*, functional yet limited.

For this reason, the transition toward an *AI-enabled natively multilingual university* does not represent a repudiation of past EMI policies; rather, it constitutes their *natural evolution* in the present: the more mature and inclusive form of what EMI sought to achieve but could not fully deliver. No language is eliminated; no skill is rendered obsolete; no investment is wasted. On the contrary, everything built so far is enhanced by a technological infrastructure that amplifies its effectiveness when integrated within an explicit and accountable governance framework. It represents a shift from a functional but costly and inefficient solution to one that is more efficient, more equitable, and more sustainable (Fig. 2.2).

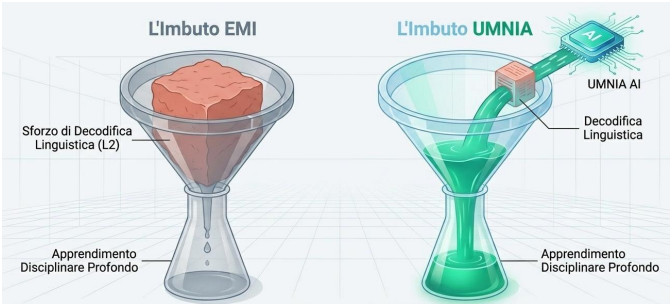

Figure 2.2: The *cognitive funnel*: EMI introduces frictions that UMNIA eliminates through technology.

It is like moving from a nineteenth-century steam locomotive to a twenty-first-century high-speed electric train.

Not to deny the past, but to take advantage of more efficient technologies for the same objectives. The proposed change does not eliminate costs; it redistributes them rationally. *No one loses* because English does not disappear: only its status as the sole possible language is removed. *No one loses* because the efforts made toward internationalization remain valid; indeed, they are strengthened and enhanced. They are complemented by tools that enable richer and more inclusive linguistic flows, aligned with the vision of international institutions. *No one loses* because organizational structures will not be dismantled, but made more flexible.

Above all, *everyone gains*. Students gain in comprehension, cognitive depth, and participation. Faculty gain expressive freedom, disciplinary precision, and teaching quality. Universities gain international attractiveness without sacrificing identity or mission.

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Academia recovers a standard of excellence, raising the *real* level of preparation. Society gains graduates and professionals with deeper expertise in their respective fields. National systems gain epistemic diversity and cultural cohesion.

This is the strength of the proposed revolution: it does not ask for the past to be disavowed, but to be taken to the next level. It does not ask for a choice between English and national languages, but for their integration into a common framework. It does not ask for what exists to be dismantled, but for the door to be opened to what the university can become.

It is a *revolution without losers* because it is not directed against anyone, but in favor of everyone. A revolution that does not subtract, but adds; does not close, but opens; does not eliminate, but multiplies; does not divide, but connects. For this reason, no decision-maker is forced into a defensive position: they may choose to actively govern the transition or to undergo it in a fragmented manner.

2.2 Practical Implementation: Technical Features

2.2.1 General Characteristics of AI Translation Systems Required for a Native Multilingual University

To assess the feasibility of the proposed transformation, it is first necessary to clarify what is to be implemented. Three categories of language technologies can be identified, whose coordinated use gives rise—modularly and progressively—to an *AI-Enabled Native Multilingual University*. Each of these categories addresses specific needs of academic activity.

1. **Neural simultaneous translation of lectures**.
   These systems translate, in real time, what is said by the instructor, allowing each student to follow the course in the language that ensures maximum cognitive understanding. This is the core component of the model, integrable with asynchronous and redundant modes of access to content, which makes it possible to overcome the limitations of EMI without renouncing internationalization.

2. **Non-simultaneous translation and multilingual management of teaching materials**.
   This includes the automatic translation of slides, handouts, notes, LMS materials, forums, exercises, administrative documents, and any textual resources made available to students. This component ensures uniform access to content regardless of the instructor's original language, while preserving the original materials.

3. **AI tools supporting teaching and inclusion**.
   These include automatic subtitles, transcripts, summaries, automatic language simplification, highlighting of key concepts, and tools designed for students with learning disabilities, hearing impairments, non-native students, and more generally for students who require additional cognitive support at specific stages of learning. These tools extend accessibility and enhance the quality of learning.

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For these technologies to be reliable in a university context, they must satisfy several technical conditions.

1. *Low latency. Latency* is the time between the instructor's spoken delivery and its translation. To preserve cognitive continuity and teaching rhythm, latency must remain below 3 seconds, comparable to that of a human simultaneous interpreter in standard instructional use. Only low latency allows discourse to be followed naturally [63].

2. *Disciplinary accuracy.* University content includes specialized terminology, formulas, and complex conceptual structures. A reliable system must support the integration of specialized glossaries, adapt to specific disciplinary domains, handle technical lexicons and complex formalisms, and maintain terminological consistency throughout the lecture, with an overall accuracy exceeding that of the English typically spoken in class by non-native instructors [63, 64].

3. *Flexibility and local adaptability.* An AI system can achieve high disciplinary accuracy within low latency if it is preconfigured through *RAG* (*retrieval-augmented generation*), that is, by loading and preprocessing discipline-specific materials relevant to the lecture being translated. A practically usable system for university teaching must rely on *lightweight RAG* that can be implemented locally: preparation prior to the lecture must be carried out autonomously by the instructor, by uploading specific materials (slides, notes, handouts, books, etc.) related to the lecture, with time and effort comparable to ordinary preparation of teaching materials [63, 64]. It is worth noting that within the EU there exists the *IATE* tool, a multilingual glossary of technical terms across disciplines, continuously updated and already used as a reference for EU legislative production, freely available in a format easily integrable into digital systems [65]. Alignment with such a resource represents an initial form of *ex ante* validation and quality control.

4. *Acoustic robustness.* Lectures exhibit high variability: instructors' accents, environmental noise, spontaneous discussion, and variations in pace and tone. A system usable in classrooms must be able to recognize natural speech even under suboptimal conditions.

5. *Scalability and integration.* The technology must integrate with existing university platforms (LMS, videoconferencing, recording systems) without requiring invasive and costly infrastructure. It must serve multiple disciplines and courses simultaneously and adapt to peak usage during teaching hours, as already occurs with other essential digital university services.

6. *Security and data governance.* In an academic context, it is essential to ensure compliance with regulations on confidentiality, intellectual property, and security, along with institutional control over voice and textual data, and protection of recordings and transcripts, with full institutional ownership of the data.

7. *Inclusivity and cognitive support.* Modern systems must provide additional learning-support functionalities: subtitles, searchable transcripts, summaries, text simplification, generation of complementary materials [66]. These features significantly enhance quality, accessibility, and inclusiveness of teaching, and were not available in integrated and scalable form in traditional lecture-based instruction prior to 2020. This is especially beneficial for students with cognitive difficulties or disabilities, and more generally for those requiring additional support.

8. *Technological leap compared to the past.* It is crucial to emphasize that current AI-based translation technologies differ radically from pre-AI translation systems [63, 66]. They have nothing in common with the "old" machine translators of the early 2000s, where text was translated word by word, often producing humorous or nonsensical results. Modern AI translators are capable of understanding the *context* of individual words and sentences. In particular, these advanced technologies:
   - are based on next-generation *end-to-end* neural models [66];
   - operate without separate channels for recognition and translation [63, 66];
   - function in real time, not post hoc [63];
   - improve through adaptation to course-specific content [63, 64];
   - handle accents, noise, and spontaneous speech [66];
   - produce coherent, fluent translations suitable for disciplinary content [64].

These general characteristics constitute the technical foundation of the proposed model. In the following subsection, we will show how these requirements are already met by operational systems used in numerous universities, scientific institutions, and professional contexts, making the transition fully realistic and feasible in the short term.

2.2.2 Systemic Solutions Already in Use: Institutional Realities

Today, the implementation of an *AI-Enabled Native Multilingual University* is, from a technical standpoint, fully achievable and no more complex than other digital infrastructures already in place. The three core functions identified in the previous section—simultaneous translation, non-simultaneous content translation, and pedagogical support tools—are already largely feasible and widely implemented through mature technologies, and are operational in leading academic, scientific, and institutional contexts, particularly, though not exclusively, in technical and scientific fields. We present here several of the many examples documented worldwide and in the scientific and technical literature, selected to represent different contexts and levels of institutional integration.

An international reference in the field is the *International Conference on Spoken Language Translation* (IWSLT), a globally recognized conference series in computational linguistics and machine translation. The results of IWSLT campaigns are published in the prestigious *ACL Anthology*, a leading reference in the field. To study, support, and improve practical implementations, IWSLT organizes yearly systematic evaluations of machine translation systems under realistic conditions (continuous speech, noise, accents,

disciplinary content, etc.). These evaluations constitute the primary scientific benchmark for assessing the reliability of speech translation systems in scenarios comparable, in complexity and variability, to those of university teaching. Of particular relevance are the 2023 studies, which demonstrate levels of quality already largely sufficient for instructional use [67, 68].

Among implementations *already in use* in academia, the most established example is undoubtedly the *Lecture Translator* developed at the Karlsruher Institut für Technologie (Karlsruhe Institute of Technology, KIT), Germany's leading technical university. Development of this system began as early as 2005 under the direction of Professor Alex Waibel, and it has been in operational use since 2011. It is described in numerous scientific publications as a neural translation system specifically designed for classroom environments, with an integrated pipeline handling speech recognition, translation, and text output, delivering typical latencies of 2–3 seconds [69], that is, comparable to those of a human simultaneous interpreter. The official KIT portal documents the continuous use of the *Lecture Translator*, showing how neural simultaneous translation has become a routine practice in teaching at Karlsruhe and demonstrating the long-term operational sustainability of such systems [70]. In addition to its regular use at KIT, the system is also employed in other high-level German academic and scientific contexts, including conferences and events organized by the Deutsche Akademie der Naturforscher Leopoldina (German National Academy of Sciences), as well as numerous national conferences [71–73].

Neural transcription and translation systems are also used for the multilingual management of teaching content, institutional materials, and technical resources at the Universitat Politècnica de València (Spain) [74]. Subsequent studies show that simultaneous translation models developed at the same institution can maintain latencies below 3 seconds under continuous speech conditions [75]. Applications and services based on these technologies are regularly documented by the MLLP research group [76]. The maturity of these technologies is further demonstrated by their use within complex scientific consortia. Automatic transcription and translation systems are continuously employed in technically demanding and terminologically rigorous environments such as CERN, for the management of multilingual technical audiovisual content, confirming the robustness of contemporary neural models [77, 78].

Within the European Union, the European Commission's *eTranslation* service represents one of the most advanced AI-based neural translation engines, including domain-specific training in political and legal fields. It is used across the EU by public administrations, industry, and academia for activities requiring conceptual precision and terminological consistency comparable to academic standards, including translation, summarization, transcription, and multilingual content processing [79, 80]. The same *eTranslation* system is used by ELITR, a European consortium that has developed advanced systems for speech translation, automatic subtitling, and report generation, applied to academic conferences, institutional meetings, and training activities [81]. Charles University in Prague employs these tools in its daily activities and has served as coordinator of a large international consortium developing this project [82].

The University of Geneva also integrates advanced machine translation technologies

into its activities, particularly within the humanities. Accessible communication solutions developed at the Faculty of Translation and Interpreting rely on both specialized neural models and the EU *eTranslation* infrastructure for multilingual content management [83].

Further examples come from Asia and the United States. In South Korea, Pusan National University uses simultaneous translation systems in multiple languages for lectures and seminars, already tested in official academic events and intended for broader implementation in teaching [84]. Kyungpook National University has introduced a similar service across its entire course offering, providing lecture translation into multiple languages [84]. In Japan, academic and industrial projects have experimented with AI-based language support systems for international students [85]. In Southeast Asia, the National University of Singapore provides real-time transcription services for lectures, integrated into teaching infrastructure and designed to support non-native students and those with learning difficulties [86]. In the United States, dedicated educational solutions such as those developed by the National Captioning Institute are used for lectures, courses, and campus activities, with effects extending well beyond formal accessibility and impacting overall learning quality [87].

Finally, the widespread presence of language technologies in higher education is confirmed by the adoption, in many international universities, of translation, subtitling, and automatic transcription systems integrated into existing teaching ecosystems, demonstrating that the fundamental components of the proposed model are not future hypotheses, but already operational institutional realities [88, 89].

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3 Feasibility and roadmap

3.1 Practical Strategies

In light of the technologies currently available, the operational implementation of an *AI-Enabled Native Multilingual University* can proceed through different strategies, which are not mutually exclusive and are largely reversible, and can be adapted to the needs and resources of individual universities. The approach is scalable in terms of both technical complexity and cost. Broadly speaking, three levels of technological adoption can be distinguished, corresponding to increasing complexity and cost.

1. *Pilot projects using readily available commercial tools.* Experimental implementations can be initiated within individual courses or small teaching units without altering learning objectives or assessment methods. At this level, universities can rely on commercially available tools that require no long-term structural commitment and are based on speech recognition and neural translation. Solutions of this type are used in numerous international institutions, including platforms such as KUDO or DeepL. These are employed in universities and research institutes for lectures, seminars, and academic events, providing simultaneous translation and multilingual subtitles [84, 90], as well as real-time transcription and translation systems such as those developed, for example, by the National Captioning Institute for direct classroom use [87]. These tools allow rapid deployment of translation and subtitling services via *browser* or *app*, with reliable network connectivity as the key requirement.

2. *Scalable and customizable commercial solutions.* To extend the use of machine translation to entire degree programs, departments, or a substantial portion of teaching activities, customized versions of commercial solutions can be adopted, including disciplinary glossaries, dedicated channels, and terminological adaptation. Systems such as KUDO, DeepL, Microsoft Translator, and similar platforms support speech translation in dozens of languages with domain-specific glossaries. Tools implemented in Asia, such as those introduced by Pusan National University and Kyungpook National University, demonstrate that such solutions can be stably integrated into everyday teaching [84]. This strategy requires more structured service-level management rather than reliance on individual instructors, but does not involve complex infrastructural investments.

3. *Advanced infrastructures based on European proprietary systems.* For large-scale implementations, universities can adopt solutions based on European infrastructures such as *eTranslator* and, within the European Union, the systems developed

by the ELITR consortium. These tools offer installation on local servers or hybrid architectures already common in university services, ensuring full data control and deep customization, as demonstrated by their use in academic and institutional settings across Europe [79–81]. This strategy requires higher investments, which will be discussed in the next section, but guarantees stable, secure, and fully integrable multilingual coverage. Moreover, in the EU context, it provides a strategic advantage by contributing to technological independence from the current global leaders (the United States and China), in a period of geopolitical instability, with direct implications for academic data governance.

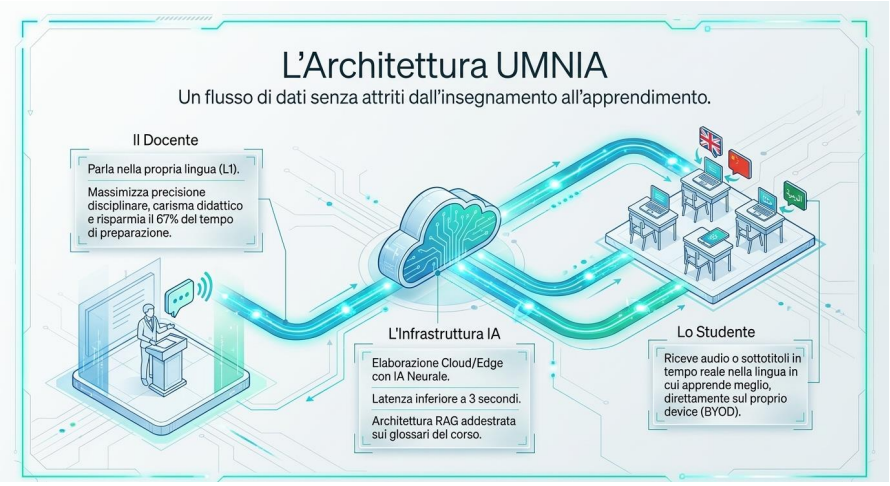

Figure 3.1: Schematic representation of the UMNIA classroom architecture.

At the *hardware* level, the requirements of this approach are modest and entirely comparable to those currently associated with digitalized teaching. At a basic and intermediate level, the infrastructure is similar to that already present in modern university classrooms (Fig. 3.1). Instructors require a good-quality microphone and a standard computer capable of handling audio streams and data flows. Students can use their own *smartphones*, *laptops*, or *tablets* to receive translations and subtitles. To generate translated audio without isolating students from their environment, bone-conduction headphones—commercially available—can be used on a voluntary basis. All commercial systems require a stable connection with sufficient bandwidth, as indicated in specifications of solutions used in the United States [87]. Systems installed on local servers reduce dependence on network connectivity, while requiring more advanced infrastructure for language processing, and can maintain acceptable functionality—albeit in degraded modes—even in the event of temporary service disruptions.

Overall, the range of available strategies shows that universities can introduce neural simultaneous translation and multilingual tools progressively, starting from small pilot

projects and advancing toward systemic integration at the departmental or institutional level, making adoption a deliberate strategic choice rather than a leap into the unknown.

3.2 Economic Implementation

3.2.1 Essential Costs: Software and Services

The implementation of an *AI-Enabled Native Multilingual University* entails surprisingly limited costs, thanks to both vertical scalability (the nature of the technologies employed) and horizontal scalability (the number of courses involved within a single institution). The figures reported here are reasonable estimates based on publicly available pricing of major commercial services. This subsection considers only the essential costs of software and services, while hardware and personnel components are addressed in subsequent subsections. A precise determination should be carried out by economists, administrative offices, and financial planning professionals.

Vertical scalability: technological levels.

Adoption can proceed through progressive levels. Broadly speaking, three can be identified.

1. *Basic commercial systems (level 1).*
   These solutions allow lectures and seminars to be translated in real time via *browser* or *app*, without local installation. They are typically offered as services for individual sessions or isolated events, *without framework agreements or operational continuity.* Solutions of this kind are already used in international university contexts, as shown by Korean cases [84] and by U.S.-based educational inclusion tools such as *Lightning Captions* [87].
   - Cost per single session (one-off scenario): **20 to 100 €**.
   - Cost for a semester course under a per-event regime: up to **1,500–3,000 €** (not representative of standard teaching).
   - Infrastructure cost: negligible compared to service costs, as it relies on existing classroom equipment. A classroom computer and a stable connection are sufficient.
2. *Customizable commercial systems (level 2).*
   For structured and continuous use—such as translation of regular teaching or entire degree programs—mature *cloud* platforms offer volume-based or bundled pricing models. In this regime, the unit cost of speech decreases significantly due to aggregation of hours and semester planning. Relevant examples include Microsoft Azure and DeepL. Azure Speech Translation applies predictable hourly pricing [91], while text translation is billed per million characters [92]. DeepL follows a hybrid model combining subscription and usage fees [93].

- Base speech translation components (ASR + MT, single language): **2–3 € per hour**.
- Estimated cost per multilingual lecture (5–6 European languages, 2 hours): approximately **15–25 €**.
- Translation of slides and texts: **10–25 € per million characters**.
- Infrastructure cost: essentially negligible, relying on standard existing systems.
- Cost per full semester course (approx. 60 hours, 5–6 languages): **500–900 €**.

3. *European proprietary systems (level 3).*
   Public European services such as *eTranslation* are entirely free for EU academic institutions [79, 80]. The ELITR consortium additionally provides advanced capabilities (speech translation, subtitling, report generation) tested in academic environments [81, 82].
   - Software licensing: **0 €** (*eTranslation* is free for EU public universities).
   - Integration and interface costs: **5,000–30,000 €** one-off.
   - Annual maintenance (local installations): **5,000–15,000 €**.

Note. Costs reported for levels 2 and 3 explicitly refer to standard university teaching, characterized by semester planning, operational continuity, and volume aggregation. Extending translation coverage to non-European languages represents an additional complexity level, here denoted as **level "3+"**. While feasible, this extension is not included in the present economic analysis.

Horizontal scalability: project scope.

1. *A single course.*
   This is the simplest and most cost-effective scenario for pilot projects. Under regular, continuous usage, costs remain contained due to volume pricing models.

   Estimated total cost: **500–900 € per semester**.

2. *An entire degree program.*
   A university degree program typically includes 5–6 active courses per semester. Under continuous operation, costs are dominated by speech processing, while text translation remains marginal.

   Estimated total cost: **6,000–9,000 € per academic year**.

3. *An entire university.*
   Assuming a medium-to-large European public university (20,000–40,000 students, approximately 40 degree programs), large-scale adoption remains financially sustainable due to scalability and the use of EU infrastructures.

Estimated annual cost: **150,000–350,000 €**.

Category	Estimated Cost	Notes
Single session (one-off)	20–100 €	One-off model
Standard multilingual lecture	15–25 €	5–6 languages, bundled pricing
Semester course	500–900 €	Approximately 60 hours
Degree program (annual)	6,000–9,000 €	5–6 courses per semester
Medium-large university	150,000–350,000 €	40 programs, 20,000–40,000 students

Table 3.1: Consistent summary of horizontal scalability costs.

As a side note, Table 3.2.1 shows that, considering only the *core cost* of software and services, a full institutional implementation corresponds to an expenditure of approximately **4 to 12 € per student per year**. While this figure reflects only the cost of access to language services and not the total infrastructure cost—which will be discussed later—it clearly demonstrates that the UMNIA model can be implemented *at scale* with a realistic annual cost on the order of ten euros per student in a typical European university (20,000–40,000 students). This estimate may appear optimistic, but it is fully supported by the sources discussed above.

3.2.2 Auxiliary Costs: Hardware, Infrastructure, and Connectivity

Alongside the costs related to software and services, the implementation of an *AI-Enabled Native Multilingual University* requires explicit consideration of the hardware and connectivity requirements necessary for students to access subtitles and translated audio. These costs differ significantly in nature from software costs: they are largely *one-off*, affect capital infrastructure, and do not grow proportionally with the number of teaching hours or courses delivered, but rather with the number of equipped classrooms. Three realistic infrastructure scenarios can therefore be identified, corresponding to increasing investment levels and quality of the educational experience.

1. **Scenario H1 – Full reuse of existing infrastructure.**
   In this scenario (commonly referred to as BYOD), the university relies entirely on existing classroom equipment (classroom computers, basic audio systems, and network connectivity), while access to translation (subtitles with or without audio) takes place through students' personal devices (smartphones, laptops, or tablets). This approach is consistent with *Bring Your Own Device* practices, which are widely adopted in European higher education [94, 95].

   From an infrastructure standpoint, network requirements are similar to those already needed for standard digital teaching and intensive use of LMS platforms. Any required upgrades mainly concern Wi-Fi capacity in high-density device environments, which is already standard in universities [96, 97].

   Incremental hardware cost: $\simeq$**0 €**.

Horizontal scalability:

single course: ≃**0 €**;

degree program: ≃**0 €**;

entire university: **0–tens of thousands of €** (only for possible network upgrades).

Note that ≃ 0 € indicates the absence of dedicated additional hardware investments, and does not exclude ordinary network management costs already borne by the institution.

2. **Scenario H2 – Use of already equipped classrooms (computer labs or teaching laboratories).**
In this scenario, multilingual teaching takes place in computer labs or classrooms already equipped with individual workstations, dedicated wiring, and connectivity. Translated audio can be delivered through individual wired headsets, a technically reliable solution already standard in many specialized teaching environments.

   In European universities, such facilities typically represent a minority share of the total teaching space (generally below 10%), but offer high quality and reliability [98].

   Additional unit cost (durable wired headset): **10–20 € per station**.

   One-off cost per classroom (50–100 students): **500–2,000 €**.

   Horizontal scalability:

   single course: **500–2,000 €**;

   degree program: ≃**0 €** (reuse of the same facilities);

   entire university: constrained by room availability, not budget.

3. **Scenario H3 – Dedicated infrastructure.**
The third scenario involves a dedicated and standardized setup for multilingual classroom delivery, including one device per student (educational tablet or lightweight laptop) and individual headsets, preferably bone-conduction devices. This technology is widely studied in educational and accessibility contexts, as it allows the ear to remain open, reduces fatigue, improves speech intelligibility in noisy environments, and avoids isolating students from the classroom experience [99, 100]. This scenario represents a maximum-quality option and is not a prerequisite for UMNIA adoption.

   The costs listed should be understood as one-off investments, with devices reusable across multiple academic years.

   Educational tablet: **150–250 € per student**.

   Bone-conduction headset: **80–150 € per student**.

   Total cost per student: **230–400 €** one-off.

Horizontal scalability (with reuse):

single course (50–150 students): **15,000–45,000 €**;

degree program: ≃**0 €** (reuse of equipment);

entire university (150–200 equipped rooms): **2.5–4,000,000 €** one-off (CAPEX).

These infrastructural investments, summarized in Table 3.2, once amortized over multiple academic years, must be evaluated in combination with the recurring software and service costs discussed in the previous subsection in order to determine the total cost of the model. It is worth emphasizing that Scenario H3 represents the upper bound of possible investment. Moreover, it is itself scalable: as H3a, by equipping only a subset of classrooms, or as H3b, by equipping an entire institution (20,000–40,000 students).

Scenario / Scale	**Estimated Cost**	**Notes**
H1 – Reuse of existing infrastructure	≃0 €	Students' personal devices; minimal network adjustments
H2 – Already equipped classroom	500–2,000 € per classroom	Wired headsets; existing computer labs or teaching laboratories
H3a – Dedicated infrastructure (classroom scale)	15,000–20,000 € per classroom	Shared devices, dedicated headsets, local adjustments
H3b – Dedicated infrastructure (institutional scale)	2.5–4,000,000 € one-off	150–200 equipped classrooms in a large university

Table 3.2: Orders of magnitude of hardware and infrastructure costs (one-off investments)

3.2.3 Operational Costs: Technical Staff, Infrastructure, Amortization

Technical staff With regard to technical support, it can be noted that in a scenario of structural adoption at the institutional level, it is realistic to assume that a single technical staff member can oversee the operation of multiple classrooms and infrastructures locally, covering approximately 15–25 rooms each. For a medium-to-large generalist university—with around 40,000 students and approximately 20 departments—this corresponds, as an order of magnitude, to about one full-time technician per department, partly overlapping with existing staff and partly dedicated to multilingual infrastructure management through the reallocation and specialization of competencies already present in IT and teaching support services [95].

From an economic perspective, the overall cost of such technical support represents a significant component mainly in the more ambitious infrastructure scenarios (in particular scenario H3b), but it does not scale proportionally with the number of courses or

teaching hours. Even when including this component, the annual cost per student remains limited and comparable to other teaching-support infrastructures already present in universities.

Infrastructure and amortization The infrastructure costs associated with scenarios H2 and H3 are largely to be understood as one-off investments (CAPEX), but they must be properly evaluated on an annual basis through amortization, in accordance with standard accounting practices for university infrastructure, and including routine maintenance and component renewal costs [101].

Assuming a structural deployment across a significant number of classrooms (on the order of 150–200 rooms in a large university), the total initial cost for hardware and network upgrades realistically falls between 2.5 and 4 million euros. Over a typical amortization horizon of 6–8 years, and including annual maintenance costs on the order of 5–8%, this corresponds to a total annual burden of approximately 500,000 to 800,000 euros (Table 3.3). These costs do not scale proportionally with the number of courses or students, but depend primarily on the number of equipped classrooms and represent a typical system-level infrastructure expenditure, comparable to that required for teaching laboratories, digital libraries, or campus IT networks [102].

Cost item	**Estimated annual cost**	**Notes**
Technical staff	1.0–1.2 million €	≃20 FTE; 15–25 classrooms per technician
Infrastructure amortization	360,000–570,000 €	6–8 year horizon on 2.5–4 M€
Maintenance and renewal	130,000–260,000 €	5–8% annually of CAPEX
Total operational costs	**1.7–2.3 million € / year**	Infrastructure and staff at steady state

Table 3.3: Annual operational costs: technical staff and annualized infrastructure.

3.2.4 Validation Costs: Quality Control and Monitoring of Linguistic Output

Automated linguistic mediation at institutional scale requires an explicit quality assurance system, distinct from the disciplinary evaluation of content; the latter remains unchanged compared to the current EMI model and continues to be the responsibility of instructors. Linguistic quality control does not imply a full revision of lectures nor the presence of specialized validators for every language–discipline combination, but is instead based on *sample-based quality control* procedures, relying on standardized metrics, error typologies, and severity thresholds, according to internationally established practices, particularly within European Union institutions.

Specifically, ISO 17100, ISO 5060, and ISO 18587 define operational frameworks for evaluating the quality of machine translation output and for its post-editing, distinguishing between local errors, information-loss errors, and systemic errors. These standards

enable a functional evaluation of translation adequacy relative to its purpose, without requiring exhaustive review of all translated content [103–105]. They currently represent the operational benchmark for major multilingual institutions.

A model directly applicable to the university context is provided by the procedures adopted by the Directorate-General for Translation of the European Commission, which employs linguistic quality control systems based on sampling, formalized error typologies, and severity levels, implemented by internal and external professional linguists [106, 107]. In this model, quality is ensured through systemic monitoring that prioritizes traceability, comparability of results, and targeted corrective actions. From a technical standpoint, such procedures are now supported by multi-level automatic evaluation tools, which separately analyze the quality of speech recognition, machine translation, and real-time speech translation. A relevant example is the open-source platform SLTev, developed within the European ELITR project, which enables measurement of quality, latency, and stability of simultaneous translation, providing quantitative indicators suitable for sampling-based control and for detecting systemic issues [108, 109]. The use of such tools significantly reduces the need for human intervention, focusing validation efforts on genuinely critical cases.

From a practical standpoint, linguistic quality control and monitoring can be organized according to two realistic architectures.

1. **Architecture V1 – Outsourcing to external services.**
   One option is to entrust quality control to specialized third-party providers, following the model adopted by EU institutions. Currently, such services incur, for major European languages, average costs between 35 and 50 € per hour of review, in line with pricing structures used in European projects and large multilingual infrastructures [110]. Since these activities are sampling-based, monitoring 5–10% of content is sufficient to ensure systemic reliability. For a reference university of the size discussed above (20,000–40,000 students), this translates into a realistic annual cost between 120,000 and 250,000 €.

2. **Architecture V2 – Establishment of an internal integrated validation unit.**
   The creation of an internal quality control center represents a suitable architecture for a more advanced stage of implementation, when the system reaches larger scale. Such a center, which could build on and integrate existing university language centers, would adopt the machine translation evaluation protocols described above. A realistic configuration for this type of unit includes 3–6 full-time equivalent staff, with linguistic expertise and specialized training in evaluating machine translation output. This structure does not require coverage of every language–discipline combination, since validation concerns the preservation of information, terminological consistency, and functional adequacy of translations, while responsibility for scientific content remains with instructors. In this scenario, total annual costs can be estimated between 180,000 and 360,000 €. Furthermore, broader adoption of the UMNIA model and the V2 architecture across multiple universities would enable the formation of consortia among validation units, facilitating harmonization

of control procedures, exchange of expertise, and the development of economies of scale for further cost optimization.

In both cases, the economic impact of linguistic quality control remains limited relative to the overall cost of the UMNIA infrastructure, and significantly lower than the indirect costs associated with the inefficiency of the EMI model, which operates without any structured system for linguistic quality verification despite producing systemic effects on teaching effectiveness and knowledge transmission.

3.2.5 Conclusion

Taken together, the estimates presented show that the adoption of *AI–Enabled Native Multilingual University* at the institutional scale can be reduced to four clearly distinct cost components:

1. essential software and service costs (§ 3.2.1), with a recurring impact on the order of 4–12 € per student per year;
2. infrastructure hardware costs (§ 3.2.2), largely one-off but, when properly amortized and maintained, corresponding to approximately 10–15 € per student per year;
3. operational costs for technical staff and maintenance (§ 3.2.3), on the order of 20–25 € per student per year in a large European university;
4. validation, quality control, and monitoring costs (§ 3.2.4), on the order of 5–15 € per student per year in the same institutional context.

These components bring the total cost of a stable, steady-state implementation of UMNIA—extended across an entire institution for the main 5–6 European languages—to an indicative range of **40 to 55 € per student per year** for a large generalist European university (20,000–40,000 students). The variability in this estimate arises from different possible architectural configurations, not from technological or market uncertainty. It is important to stress that this estimate corresponds to a fully developed structural scenario, encompassing not only machine translation services but also the technical and infrastructural organization and the monitoring and control components required to ensure reliability and continuity over time (Fig. 3.2).

This level of expenditure is fully comparable to other permanent infrastructure services in higher education, such as learning platforms, digital libraries, or campus IT networks [111]. It follows that the adoption of *AI–Enabled Native Multilingual University* does not constitute an exceptional or experimental burden, but rather a standard investment and policy choice, broadly sustainable at scale and compatible with the economic structures of European public universities.

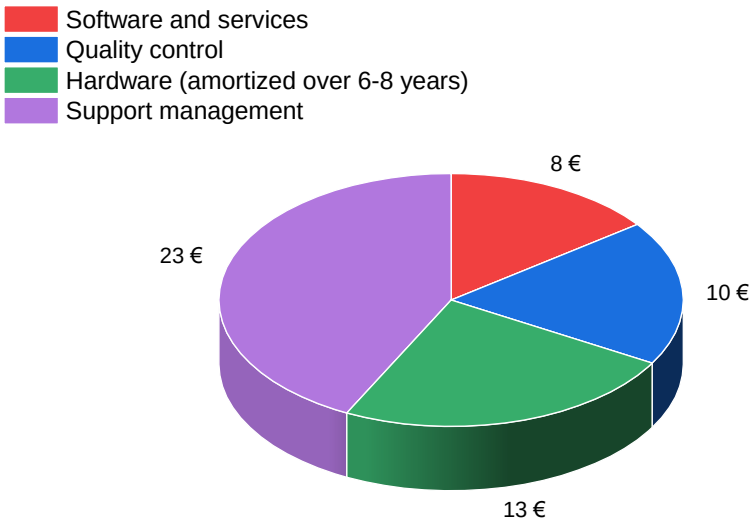

Figure 3.2: Breakdown of UMNIA per capita (per student) costs for a full steady-state implementation in a large European generalist university with 20,000–40,000 students.

3.3 Supporting Evidence and Scenarios

3.3.1 Personal Solutions Already in Use: Informal Practices

The analysis conducted so far has shown that the proposed architecture is feasible from every standpoint, whether technical (§ 2.2), infrastructural, or economic (§ 3.2). It is now worth assessing whether, beyond theoretical analysis, there already exist *observable elements within the academic landscape* that demonstrate the validity of the proposed approach. What evidence ensures that a linguistic mediation system of this kind is actually usable, effective, and sustainable in real academic contexts?

The answer lies in the fact that the *AI–Enabled Native Multilingual University* model presented here builds upon behaviors and strategies that are already widely adopted in academic environments. A macro-level overview of large-scale systems currently in use has already been provided in § 2.2.2. At this stage, however, it is useful to examine the issue at the micro level, focusing on individual users—students—and on everyday teaching practices.

Beyond institutional infrastructure, what is the current state of student practices? The scientific literature on EMI clearly shows that non-native English-speaking students are technologically often more advanced than academic infrastructures: many already make systematic, though informal, use of automatic translation tools. Through these means, they support their study activities, including comprehension of disciplinary texts, written production, and exam preparation. Such practices have spread despite the absence—or even prohibition—of formal recognition or guidelines governing their use in most insti-

tutions [112, 113]. Even more decisive is the evidence that this use extends beyond written texts: in transnational university contexts, where teaching is delivered through EMI, widespread use of automatic translation by students includes independent use of real-time voice translation during lectures [114].

It is important to emphasize that these practices emerge independently of institutional attitudes and, in some cases, even in tension with faculty expectations, while not formally violating any teaching regulations [112, 114]. Such institutional resistance constitutes a clear example of defensive conservatism within academia: to maintain an now outdated and inefficient framework (§ **??**), rather than to promote a transformation already underway (§ **??**).

Evidence from teaching laboratory contexts further shows that students who receive simultaneous translation support achieve better comprehension, participate more effectively in discussions, and demonstrate improved learning outcomes. This demonstrates that automatic translation tools do not merely compensate for linguistic limitations, but directly enhance the effectiveness of knowledge transmission [115]. Simultaneous translation solutions are also actively used by international students in European universities: tools such as Transync AI allow, for example, Chinese-speaking students to follow lectures delivered in German via real-time translation and subtitles in Mandarin, with minimal latency [90].

Taken together, these findings reveal a structural mismatch between actual practices and institutional representation. On the one hand, English is formally treated as the direct, necessary, and sufficient medium of access to knowledge; on the other, a significant portion of linguistic mediation already occurs through automatic tools, used informally, individually, and often without explicit acknowledgment. This situation gives rise to what can be described as an *institutional pantomime*: the effective use of technological translation support exists and is widespread, yet remains implicitly denied or relegated to a regulatory gray zone (Fig. 3.3) [112, 116].

3.3.2 Systemic contradictions laid bare

Within contemporary higher education, a structural contradiction also emerges between formally adopted inclusion policies and actual conditions of access to knowledge. On the one hand, institutions recognize cognitive and sensory barriers and provide support tools such as automatic captioning and lecture transcription to ensure inclusion of students with disabilities. On the other hand, the widespread adoption of EMI imposes a vehicular language that a substantial portion of the student population does not master at a level sufficient to process disciplinary content without penalty. Since this condition increases cognitive load and reduces comprehension, affecting interaction and access to content [117, 118], it effectively places *clinically typical students in a condition of cognitively induced disadvantage*, generated by the institutional environment itself rather than by individual limitations. Empirical evidence shows that students respond by adopting compensatory strategies similar to those designed for disability contexts, informally appropriating accessibility tools to make participation in EMI courses feasible. In particular, automatic captioning—introduced for students with disabilities—is widely used

Figure 3.3: The "institutional pantomime": EMI vs. student reality.
(Image generated by AI)

by non-disabled, non-native students [112, 119]. *Technologies originally designed for targeted inclusion thus become instruments of generalized compensation*, revealing a phenomenon of heterogenesis of ends: tools intended to include a minority end up mitigating a cognitive disadvantage affecting the majority, a disadvantage artificially produced by the institution's linguistic policies themselves [116].

This dynamic exemplifies the previously mentioned *institutional pantomime*. A typical situation involves an instructor who is a native speaker of language A teaching in English E to a classroom composed predominantly of students who are also native speakers of A, with a minority (for example 20%) of students whose native languages are B, C, or D. In such contexts, English is elevated to the official language of the classroom not to function as a lingua franca, but as a top-down institutional choice aimed at signaling internationalization [36, 117]. In practice, however, both groups of students rely systematically on individual mediation strategies, using translation and captioning tools to convert information from English into their preferred languages. Teaching thus appears monolingual, while actual cognitive processes are mediated by constant retranslation, often unacknowledged at the institutional level [112]. This discrepancy between the staged language and the effective language of comprehension constitutes a symbolic performance disconnected from real learning processes—a *pantomime*.

Even more striking are cases within Anglophone universities, which—according to traditional "Anglicization" models—should have no need for linguistic mediation. Yet technological tools for real-time transcription and translation are already widely used in leading U.S. universities. Institutions such as Stanford provide automatic captioning and transcription services (e.g., *CART* and live captioning) to facilitate access to educational

content. Initially introduced for accessibility purposes, these tools are now widely used by non-native students as cognitive support during in-person lectures [120, 121]. Their use, while not always formally regulated, is widely acknowledged and accepted. More broadly, the proliferation of AI-based transcription and translation tools in education shows that students increasingly follow lectures through real-time textual and translated streams on personal devices, reducing the cognitive burden associated with prolonged listening in a non-native language [122, 123]. In other words, even in fully Anglophone environments, it is implicitly recognized that effective teaching requires linguistic mediation tools that reduce cognitive load and maximize learning efficiency—yet this remains largely informal and unintegrated into pedagogical design.

3.3.3 A transition already underway

These practices demonstrate that the problem addressed by our proposal is not confined to peripheral systems: it is already recognized and technologically mitigated even in leading institutions at the core of the Anglophone academic world. What is missing is explicit institutional governance. UMNIA aims precisely to bring this mediation within a structured, transparent, and accountable framework, transforming individual adaptation into institutional design.

In light of this evidence, the key question is not whether such systems will be adopted, but whether their adoption will be explicit, equitable, optimized, reliable, and pedagogically controlled, or whether it will continue to evolve in an individual and uncoordinated manner. In this sense, institutional implementation of AI-based linguistic mediation does not introduce a foreign element, but renders transparent and governable a practice already in widespread use. Consequently, the viability of the proposed model does not depend on speculative assumptions about future student behavior. Rather, it is grounded in already established practices that academic institutions can choose either to recognize and govern, or to not recognize explicitly —at the risk of increasing misalignment between formal frameworks and actual practices, whose implications will be discussed in the concluding section.

4 Objections, challenges, and responses

A profound conceptual transformation such as the one proposed here—the shift from the massification of English Medium Instruction to a UMNIA model—will inevitably encounter numerous objections. These do not arise solely from technical or organizational considerations, but often reflect deeply rooted beliefs, institutional habits, and established narratives about academic internationalization. Below we list the main foreseeable objections and provide a concise response to each.

4.1 Identity-related aspects

First, it is useful to address some possible objections of a *symbolic and identity-related* nature, which often hinder a rational evaluation of the issue.

Ideological objection: "Are you against English?"; "English is the language of the future"; "English is the international language"; "We cannot do without English."
This objection arises from a fundamental misunderstanding: the proposal of an AI-enabled native multilingual university is not directed against English, nor does it seek to diminish its international importance. It is not motivated by an ideological intent of *opposition to English*, but by a practical aim of *improving the efficiency of internationalization* in higher education by implementing diversity and inclusion. The proposal fully recognizes the historical and current role of English as a language of global communication, scientific cooperation, and academic mobility. What is questioned is not English as such—whose status as a *lingua franca* remains undisputed—but its improper transformation into the exclusive language of higher education and advanced knowledge. The present proposal does not eliminate English; rather, it overcomes its historically assumed inevitability as the only possible academic language, proposing a new paradigm of internationalization aligned with the recommendations of major international institutions (see § 1.1) [2–9, 11, 12, 124].

Scientific objection: "English is the language of science"; "Research is international by definition"; "National languages are not suitable for advanced science."
This objection confuses a historical contingency with an epistemic necessity. It is true that most scientific production today is published in English, but this does not imply that science is intrinsically tied to a single language, nor that knowledge production occurs more effectively under monolingual conditions. On the contrary,

the history of science shows that linguistic pluralism has long been a source of epistemic richness. Today, several studies demonstrate that monolingual flattening is impoverishing scientific thought in a worrying way [13, 15, 16, 33, 34, 116]. The proposed model does not deny the international dimension of research, nor the useful role of English as a modern *lingua franca*, but separates knowledge production from the obligation to operate cognitively in a non-native language, preserving the capacity of national languages to express advanced scientific concepts and to sustain democratic intellectual debate [14, 15], in line with the policy directions of major international organizations [2–9, 11, 12, 124].

Cultural objection: "Is there still anyone in the 21st century who has problems with English?"; "People just need to learn English properly!"; "These are just English problems, solved by learning the language better."

This objection is based on a well-documented conceptual misunderstanding: it *confuses distinct functions of language by conflating communication with learning.* Studies conducted in contexts with high average English proficiency—such as Sweden, the Netherlands, and Switzerland—reveal the same EMI-related issues (see § 1.2.2) observed elsewhere [25, 30, 58]. This shows that the problem is not how well English is known, but the *role* it plays as the language of disciplinary learning. Although often unnoticed, experts distinguish clearly between a *language of scientific communication* (*Wissenschaftssprache*, today English) and a *language of teaching and intellectual work* (*Lehrsprache* and *Forschungssprache*) [15]. English performs the former role effectively, enabling international collaboration, but proves systematically problematic in the latter [15]. The use of a non-native language in teaching introduces a dual cognitive load, even among highly proficient speakers [15]. This is a structural property of human cognition and cannot be eliminated. It does not mean that learning in another language is impossible; rather, it is inherently less efficient, because it *inevitably* imposes an additional cognitive burden that diverts mental resources from processing disciplinary content, reducing learning depth and teaching effectiveness [32]. This effect persists even at high levels of language proficiency: both students and instructors continue to devote cognitive resources to linguistic decoding at the expense of conceptual understanding [24, 25, 30, 58].

Arguing that EMI-related problems can be solved simply by "learning English better" therefore amounts to treating a structural cognitive constraint as an individual deficit. The UMNIA model, by contrast, acknowledges the empirical evidence underlying this distinction and uses technology to reduce, rather than increase, cognitive load, allowing both students and instructors to focus their mental resources on disciplinary content.

4.2 Educational and cognitive aspects

Having clarified this first level of objections, we can now address the more substantial ones from a *didactic and cognitive* standpoint, concerning the actual functioning of university learning.

Pedagogical objection: "Students will not learn English this way"; "If they follow lectures in their own language they will become complacent"; "English must be learned through immersion"; "Students will become dependent on translation".
This set of objections can be addressed by observing that language learning and disciplinary learning are two distinct processes, with different objectives, timeframes, and methods (see § 2.1.4 and Table 2.1.4). If the goal of a language course is, legitimately, to bring students to the highest possible proficiency in that language, the goal of a robotics course, for instance, is to bring them to the highest possible competence in robotics. It is pedagogically incorrect to expect a course in one discipline to fulfill the objectives of another (language learning). If the aim is to teach English optimally, an effective approach requires courses specifically designed for that purpose; a disciplinary course delivered in English as a second language has been shown to be largely ineffective for language acquisition and significantly inefficient for disciplinary learning [24, 25, 30–32, 35]. It should be recalled that the purpose of university teaching is not to teach a language, but to transmit advanced disciplinary knowledge. Confusing these two levels has produced EMI as an apparent but highly inefficient solution, resulting in substantial cognitive and pedagogical impoverishment (§ 1.2.2) [13–15, 24, 25, 30, 31, 33, 36]. *AI–Enabled Native Multilingual University* does not oppose the learning of English; on the contrary, it promotes targeted, explicit, and assessable language learning pathways, instead of forced immersion in often suboptimal English that undermines content comprehension. Conscious use of linguistic mediation does not eliminate cognitive effort, but relocates it within its appropriate disciplinary context.

Didactic interaction objection: "This may work for lectures, slides, or handouts, but university teaching is also interaction, questions, and debate. With different languages and automatic translation, it would become an unmanageable Babel."
This objection captures a real dimension of university teaching, but it compares the wrong benchmarks. The relevant comparison is not between UMNIA and an ideal classroom composed entirely of native speakers with frictionless interaction, but between UMNIA and the actual conditions produced by EMI. Empirical evidence shows that under EMI, interaction is significantly reduced: questions, spontaneous interventions, and meaningful discussions decline markedly when teaching is conducted in a non-native language, even in contexts with high English proficiency [26–28]. The real EMI classroom is not rich in debate; it is often silent, with limited, ritualized, and cognitively shallow interaction (§ 1.2.2). In this context, UMNIA does not eliminate interaction in a shared lingua franca: English remains

available when effective. What it adds is the possibility for students to formulate contributions more naturally and with lower cognitive cost, reducing the linguistic barrier that currently suppresses interaction. Questions can still be asked in a shared language, but when this constitutes an obstacle, mediation provides an additional channel. This is not a chaotic Babel, but an *enhancement of interaction* relative to a model that empirically suppresses dialogue. Compared to the real EMI classroom, UMNIA reduces the cognitive frictions that currently inhibit questioning, discussion, and conceptual exploration. Technology here does not replace interaction; it restores the conditions under which interaction can occur. The previous model remains available when useful, but is complemented by tools that enable recovery of the dialogical dimension that EMI has been shown to undermine.

Social objection: "University life is not just lectures: it is interaction, exchange, and social relationships"; "We cannot lock everyone into a bubble of automatic translations"; "If students no longer need to learn languages, they will not be able to interact".
These objections capture a real aspect of university life, but once again conflate functionally distinct domains. No multilingual university model questions the value of informal interaction among students, researchers, and faculty, nor the importance of cultural exchange, social life, and transnational networks. On the contrary, precisely because these dimensions are valuable, they should not be overloaded with additional functions. A lingua franca such as English can continue to serve as a language of social interaction in many contexts; the issue is that the language of disciplinary learning serves a different function, and studies show that forcing these functions to coincide leads to highly inefficient educational outcomes. It is telling that universities in the United States—traditionally pragmatic and evidence-oriented—are explicitly addressing this distinction. In contexts where deep disciplinary learning is at stake, they provide transcription and real-time mediation tools to reduce cognitive load and maximize learning effectiveness. If a Thai or Taiwanese student studies robotics in the United States, the goal is for their cognitive resources to be devoted to robotics, not to mastering phrasal verbs. Does this confine them to a bubble? On the contrary: in informal contexts of interaction, peer exchange, student life, and cultural integration, English continues to function as a lingua franca and is practiced naturally.

This separation of linguistic roles follows a principle of cognitive and cultural optimization: it does not reduce, but rather preserves the cultural value of international experience and the lingua franca. English can remain the language of spontaneous interaction, social relationships, and extracurricular activities; the language of learning, however, should be chosen so as not to introduce unnecessary cognitive burdens that subtract from disciplinary understanding. Confusing these two domains is both anachronistic and unscientific (§ 1.2.2), as it requires the language of interaction to also perform the function of the language of learning. In practice, this reflects the broader error of conflating communicative, interactive, and formative functions of language, a widespread mistake clearly identified in the scientific

literature [15, 24, 25, 30, 32, 58]. The UMNIA model implements precisely what this body of evidence highlights, explicitly structuring and governing the different roles that languages play in the academic ecosystem. It preserves English as a lingua franca of social interaction and everyday internationalization in many contexts, without imposing it as the exclusive language of learning when doing so is cognitively inefficient. In this way, the university does not renounce cultural exchange, but avoids overloading the cognitive system of students and faculty, while at the same time preserving—and indeed strengthening—the cultural value of encounters between languages and traditions.

4.3 Reliability and controls

Once issues of principle and pedagogical effectiveness have been addressed, further objections may arise concerning the *reliability of the system and its associated controls*.

Technological objection: "Who guarantees that the quality of the translation will be adequate?"; "It will never reach a native level."
This objection assumes that translation must reach native-level perfection in order to be useful, whereas in educational contexts the relevant criterion is not absolute linguistic perfection, but functional adequacy for understanding content. On the one hand, current neural translation technologies have already reached levels of accuracy and stability sufficient for instructional use. On the other hand, in terms of correctness, coherence, discursive stability, and conceptual transfer, the linguistic performance of these systems is now clearly superior to the average English L2 used by non-native researchers and instructors (Fig. 4.1) [13, 64, 115]. The issue is not whether translation is "perfect," but whether (1) it improves cognitive access compared to EMI, and (2) it outperforms the current average linguistic performance of non-native English-speaking faculty. Evidence shows that the answer in both cases is affirmative.

Control and responsibility objection: "I do not trust AI-based translators"; "Who verifies that the translation is correct?"; "Who guarantees quality over time?"
This objection is legitimate and should be taken seriously, but it is important to clarify that the problem of linguistic quality control does not originate with UMNIA: it is already present, and largely unresolved in practice, within the EMI model. Under EMI, the linguistic quality of the English used in teaching is not subject to any explicit procedure of verification, monitoring, or systematic evaluation, despite evidence showing that it is often characterized by imprecision, conceptual simplification, and structural discourse errors. In the UMNIA model, by contrast, automated linguistic mediation structurally includes an explicit system of quality control and assurance (§ 3.2.4). As discussed previously, no unjustified trust in technology is required: standardized protocols already exist for evaluating machine translation outputs and for assisted linguistic revision, formalized

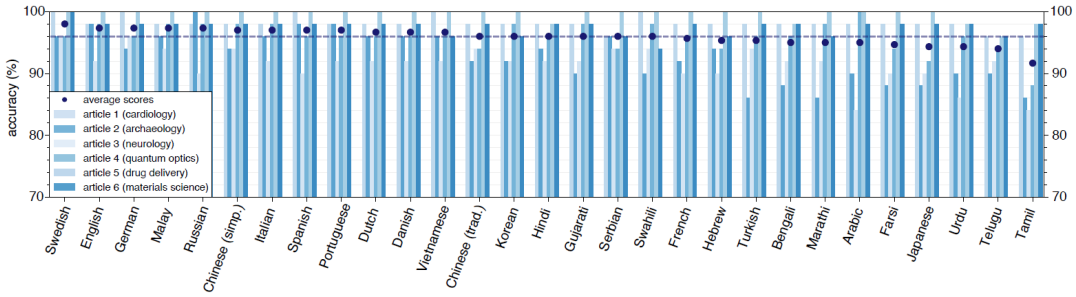

Figure 4.1: Image from [64], Fig. 3. Comparative evaluation of AI-based machine translation quality measured using QA metrics on scientific articles from six different disciplines translated into 28 languages. The dashed line indicates the overall average performance (95.9%), computed across all languages and articles.

at the international level in ISO 5060 and ISO 18587 standards [104, 105, 125–127]. These protocols allow the identification of error types, severity levels, and functional adequacy relative to intended use, making quality measurable and comparable over time. Practices adopted by European Union institutions demonstrate that linguistic quality control can be effectively organized through sampling procedures. Within this framework, existing university structures such as language centers represent a natural starting point for implementing such controls, potentially complemented at a later stage by inter-institutional consortia. The result is a system in which automated linguistic mediation is no longer informal and unregulated, but instead integrated into an explicit regime of responsibility, monitoring, and continuous improvement, transforming a weakness of the current system into a strength.

Reliability objection: "What if the translation makes mistakes?"; "Can translation errors have serious consequences?"; "You used a railway metaphor—what if there is an accident?"

This objection raises an important issue but is based on an unrealistic assumption: no complex system can completely eliminate errors. The defining feature of a reliable system is not the absence of errors, but the ability to reduce their frequency and severity and, above all, to make them observable, traceable, and correctable. The proper benchmark is therefore not UMNIA versus perfection, but *UMNIA versus the current EMI model*. The latter, as documented in the scientific literature, exhibits a systematically compromised level of communicative quality that is difficult to justify in advanced education. Numerous studies on academic English show that its use by non-native speakers in teaching and research involves a high incidence of grammatical, syntactic, lexical, and discourse-level errors affecting clarity, conceptual precision, and comprehension [59–62]. Despite this, such errors remain largely invisible and unmeasured under EMI, since no systematic evaluation proce-

dures exist. In this sense, the linguistic risk of the current system is high precisely because it is implicit and unmanaged. In the UMNIA model, by contrast, errors in automated linguistic mediation occur within a formalized environment in which system performance is continuously measured, compared, and improved according to explicit criteria (§ 3.2.4). As already documented, for major European languages, the average quality of contemporary machine translation—properly trained and monitored—exceeds the oral academic English of many non-native instructors, with the crucial additional advantage of controllability [64]. Thus, what constitutes an implicit and unmanaged risk under EMI becomes, under UMNIA, an explicit and manageable one. Returning to the infrastructural metaphor, the issue is not the impossibility of accidents, but the design of systems equipped with monitoring, control procedures, and corrective mechanisms. In this sense, UMNIA does not introduce additional risk compared to EMI; rather, it reduces it by introducing explicit control over the linguistic transmission of disciplinary knowledge.

4.4 Technical, organizational, and economic aspects

Further objections may arise of a *technical, organizational, and economic* nature.

Technical objection: "We will become dependent on technology"; "If the system fails, everything collapses".
This objection reflects a legitimate concern but does not introduce a new condition in contemporary universities. Over the past three decades, higher education institutions have undergone deep digitalization, making IT infrastructure central to their operation. A serious failure of university IT systems already results in the immediate disruption of core activities: email, teaching platforms, room and exam scheduling, meetings, conferences, and more. Universities are therefore already highly dependent on technology. This dependency has been accepted because its benefits are judged to far outweigh the risks, which are managed through redundancy, backups, and continuity procedures, as in any critical infrastructure. The UMNIA model does not introduce a new type of dependency, but integrates into the same infrastructural and operational logic that has governed the digital transformation of universities.

Organizational objection: "It is too complex"; "Faculty are not ready"; "We lack technical staff"; "We cannot change everything at once".
These objections reflect typical resistance to institutional change, already discussed in § 1.2.4 and 2.1. One of the main strengths of the proposed model is its explicit modularity and scalability (§ 3.1 and 3.2). It does not require immediate, comprehensive adoption, nor large upfront investments or long preparation periods. Instead, it builds on technological infrastructures already present in many institutions and on tools and practices already widely used in digital teaching. The model is therefore highly flexible and allows for gradual experimentation, pilot projects, and differentiated implementation strategies. Ultimately, the complex-

ity to be managed is no greater than that already addressed during the digital transformation of higher education over recent decades.

Economic objection: "We cannot afford it"; "It costs more than EMI"; "It would be better to invest in English courses".
This objection is contradicted by the economic analysis presented in § 3.2. The costs of automatic translation technologies are now limited, scalable, and in many cases lower than the direct and indirect costs associated with EMI, which include increased cognitive load, longer preparation times, reduced teaching effectiveness, and higher dropout rates [13, 16, 24, 25, 30, 32]. Moreover, many tools are already available through public infrastructures or institutional agreements [79, 80]. Investing in technologically mediated multilingualism does not replace language learning, but enhances its overall effectiveness.

4.5 Strategic positioning

Finally, some objections may concern the *strategic positioning of the university* and its relationship with evaluation, the labor market, and the broader historical context.

Principled objection: "University education should be difficult"; "Difficulty is formative"; "Translation lowers standards".
This objection is not only pedagogically problematic, but also stands in direct contradiction with the principles of diversity and inclusion that political decision-makers (UN, UNESCO, European Union, etc.) and Western academic institutions currently declare as core values and strategic objectives [2–9, 11, 12, 124]. It confuses the intrinsic difficulty of disciplinary content—an indicator of intellectual depth and rigor—with an artificial difficulty produced by the choice of a vehicular language not equally mastered by all. Introducing a systematic linguistic barrier creates a structural form of discrimination, penalizing different linguistic, cultural, and social groups, as well as students with specific cognitive difficulties, in direct opposition to the goals of inclusion, equity, and equal opportunity. From this perspective, removing the linguistic barrier does not lower standards, but raises them, as it shifts effort toward conceptual understanding, scientific argumentation, and critical thinking rather than mere linguistic decoding. The *AI–Enabled Native Multilingual University* proposal does not aim to level downward, but to enhance diversity as a cognitive and cultural resource, effectively including all students in the learning process and aligning university practices with the principles of diversity and inclusion that institutions themselves claim to pursue.

Economic-professional objection: "English is necessary for the labor market"; "Studying in English prepares students for the job market".
This objection captures a real issue, but interprets it in a misleading way. Economic analyses of language regimes show that the use of a dominant language as a systematic filter for access to the labor market is not neutral, but introduces significant distortions in the selection and allocation of skills. It has been shown that,

when a language becomes—as English does today—a generalized prerequisite, it tends to favor individuals with stronger linguistic proficiency even *at the expense of the disciplinary competencies* that are actually relevant to productivity [16]. In a historical context characterized by rigid linguistic barriers, such distorted selection could appear inevitable.

However, recent empirical evidence on high-skill labor markets shows a structural shift. With the spread of artificial intelligence and cognitive and linguistic support technologies, the importance of language proficiency as a limiting factor is progressively declining, while the importance of disciplinary, technical, and specialized skills—skills that AI can enhance but not replace—is increasing [128, 129]. In this context, English remains a useful and necessary competence, but gradually loses its role as an exclusionary filter.

The English Medium Instruction model moves in the opposite direction: it tends to privilege general linguistic exposure, necessarily of limited quality, at the expense of deep acquisition of disciplinary knowledge, and it does not guarantee effective learning of specialized technical English (§ 2.1.4). By contrast, the UMNIA model enables a clear separation and optimization of educational objectives. By freeing disciplinary courses from the improper role of acting as substitutes for language instruction, it *creates space for dedicated, discipline-specific English learning pathways*, designed and delivered by instructors trained for that specific purpose (§ 2.1.4).

The UMNIA approach thus follows a logic of pedagogical optimization: on the one hand, content-oriented courses produce better outcomes in terms of comprehension, depth, and disciplinary competence. On the other hand, the new paradigm supports the creation of targeted language courses focused on technical-disciplinary English, leading to more effective, conscious, and professionally relevant language acquisition. In this way, UMNIA strengthens preparation for the labor market also in terms of technical English, realigning higher education with an employment context where the primary value lies in disciplinary excellence, supported—rather than distorted—by linguistic competence.

Strategic objection: "How can we compete in international rankings?"; "We will lose positions in global rankings".
This objection is based on a partial and partly outdated understanding of how international university rankings operate. The main global ranking systems (QS, THE, ARWU) do not directly measure the language of instruction; therefore, they do not explicitly reward EMI as such. Instead, they rely on indirect indicators—international attractiveness, number of international students, research collaborations, scientific output, citation impact, academic reputation, etc.—which aim to reflect institutional quality, not the choice of a vehicular language. Adoption of EMI is therefore not a necessary condition for improving ranking positions, as demonstrated by the fact that many non-Anglophone universities hold high ranks, while numerous Anglophone institutions remain marginal.

Moreover, an increasing body of literature has explicitly questioned the adequacy of current ranking criteria, noting that they reflect a model of the university rooted in the 1990s. It has been observed that global rankings neglect increasingly central elements, such as pedagogical innovation, the use of digital technologies, linguistic inclusion, cognitive accessibility, and technology-enabled internationalization. As a result, a revision of evaluation criteria—now over thirty years old—has already begun [48, 130, 131]. In this context, EMI appears not only as a strategy with decreasing relevance for rankings, but as a short-term solution that imitates Anglophone models without addressing the structural factors that truly determine academic quality and international reputation.

By contrast, the UMNIA model aligns both with the criteria currently used in rankings and with their evolving direction. By improving teaching and research quality, enhancing genuine international attractiveness, and leveraging inclusive digital technologies, UMNIA acts directly on the indicators that evaluation systems measure. The real strategic risk in not adopting UMNIA is therefore the opposite: not losing ranking positions, but remaining locked into an inefficient linguistic model that slows institutional adaptation to technological transformation. In the medium to long term, UMNIA is not a threat to positioning, but rather creates favorable conditions for improving global visibility and reputation.

Temporal objection: "Perhaps in the future, but not now"; "The technology is not yet mature".
This is the typical objection associated with technological transition phases. However, the technologies required by the proposed model are already fully operational and in daily use, both at the institutional (macro) level—in leading academic and scientific contexts (§ 2.2.2)—and at the individual (micro) level, in autonomous usage scenarios (§ 3.3.1). Postponing adoption therefore means persisting with a model—EMI—that evidence shows to be inefficient, inequitable, and pedagogically problematic, while the technological trajectory is already moving forward.

4.6 Summary

Taken together, these objections show that resistance to change does not arise from a genuine lack of alternatives, but from the inertia of a paradigm that already belongs to the past. The *AI–Enabled Native Multilingual University* proposal does not abandon internationalization; it elevates it to a higher level, consistent with technological possibilities and with the values of diversity, inclusion, technological excellence, and disciplinary excellence that contemporary universities claim to pursue. It is therefore necessary for academic leaders—rectors, directors, deans, governing boards—to take a conscious decision of an explicitly *political* nature, aligned with the realities of the 21st century (Fig. 4.2).

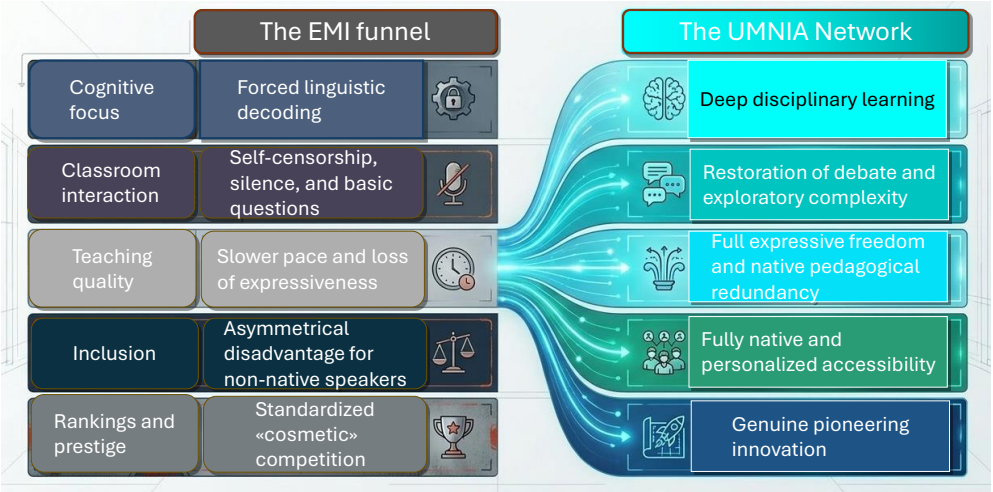

Figure 4.2: Comparison between EMI architecture and UMNIA architecture.

5 A fast-moving future

5.1 Forecasts: technological dominance and the inevitability of transition

The transition described in this document does not appear as a purely cultural or normative choice, but as the outcome of a structural dynamic identified as *inevitable* in the economic and sociological literature on technology: *technological dominance*. In the economics of innovation, a technology is said to be *dominant* when it performs the same function as a pre-existing technology in a systematically superior way across all relevant dimensions. Indeed, the previous technological solution is destined to be progressively abandoned in the medium term, because it becomes more costly and less efficient *along all relevant dimensions* [132–134]. The history of complex technological systems shows that such substitution processes are highly robust and characterized by strong temporal asymmetry: institutional delays and social resistance may slow down the adoption of the dominant technology, but cannot prevent its eventual outcome [135, 136]. In this sense, the trend should not be understood as mechanistic determinism, but as structural necessity.

In the present case, the function under consideration is linguistic mediation *in contexts of formalized and standardized communication*, such as university teaching. English-medium instruction can be regarded, in all respects, as a methodology—that is, an organizational technology with a high human cognitive cost—that fulfills a function, namely a *means* to achieve the transmission of concepts in academic teaching. In such a context, language plays a fundamentally instrumental role: enabling the efficient, accurate, and verifiable transmission of specialized content. If EMI is understood as a technology, it is subject to the same dynamics as other technologies. Therefore, the use of a lingua franca in teaching on the one hand, and AI-based automatic translation integrated into instruction on the other, constitute *competing technologies*. With respect to the required functions, AI-based translation currently displays a clear *functional dominance* across multiple independent and cumulative dimensions:

- reduction of individual cognitive cost;
- greater terminological precision in technical and specialized languages;
- improved allocation of mental resources;
- decreasing marginal costs;
- re-alignment of selection mechanisms from linguistic capital to disciplinary capital.

The economic theory of *technological substitution* shows that the coexistence of these advantages implies that the dominated technology will be replaced [132, 137]. This conclusion is supported by converging evidence. Among the most significant examples are the massive investments of major technology platforms in AI-based machine translation systems and multilingual language models, which constitute a strong signal of growing systemic adoption [135, 138]. Large companies such as Google, Microsoft, and Amazon are integrating neural machine translation, and more recently large language models, as core infrastructural components [139–141]. These decisions represent structural industrial investments oriented toward scalability, deep integration into organizational workflows, inclusion and valorization of diversity, and systematic reduction of the marginal cost of linguistic mediation through technological tools. In other words, major technology companies do not abandon English as a mediation tool, but complement it with advanced technologies to reduce linguistic friction.

In the European Union as well, indicators show that the adoption of AI-based linguistic mediation technologies is rapidly increasing across organizational contexts. In particular, the use of AI technologies for natural language processing and generation is growing significantly among enterprises (Fig. 5.1), indicating that the productive sector has already embarked on a progressive and sustained adoption of automatic translation tools.

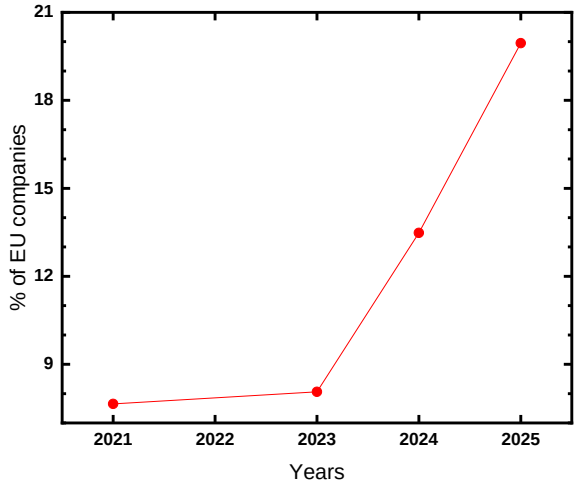

Figure 5.1: EU companies adopting AI-based language technologies, particularly those related to the analysis of written and spoken language, from the beginning of data collection (2021) to the most recent available data (source EUROSTAT, [142]). Note the clear discontinuity occurring after 2022.

In summary, in contexts of formalized communication, the systematic use of a lingua franca increasingly appears as a transitional technology, rational in an earlier historical phase but no longer supported by current technological conditions. In the presence of a structurally dominant technology, the crucial question for institutions is not whether the

transition will occur, but how it will unfold.

5.2 Conclusion: a university to be awakened

The analysis presented in this document leads to a clear and difficult-to-avoid conclusion: the transition from English Medium Instruction to the *AI–Enabled Native Multilingual University* model does not entail any substantial losses, but offers gains across all dimensions considered, in terms of efficiency, equity, teaching quality, and alignment with ongoing technological transformations. None of the objections examined reveals unavoidable systemic costs or structural losses; rather, what emerges is a consistent set of benefits affecting students, faculty, institutions, and higher education systems as a whole. EMI today represents a historically understandable but technologically outdated solution, like a steam locomotive. It is a model conceived for a time when linguistic mediation was costly, slow, or impractical. Continuing to expand its application amounts to persisting with a nineteenth-century transportation technology in a context where high-speed electric systems—efficient, scalable, and compatible with twenty-first-century needs—are already available. The UMNIA model represents precisely this infrastructural leap: not an ideological break, but a rational update made possible by the fastest-growing technologies of our time. Postponing this transition is not a neutral choice (Table 5.2 and Fig. 4.2). Whether or not university institutions take action, change is already happening informally and will therefore continue to spread, haphazardly and outside of any framework of public accountability. Already today, many students have begun to use real-time translation tools autonomously in order to understand lectures delivered in a vehicular language that is not fully accessible to them. In such a scenario, universities would risk finding themselves in the paradoxical position of formally maintaining EMI, while in practice cognitive access to content would be delegated to individual devices, without standards, without quality control, and without pedagogical integration. This would represent a simultaneous loss of authority, control, and educational coherence.

The adoption of *AI–Enabled Native Multilingual University* approach, by contrast, enables academic institutions to guide this transformation consciously, maintaining control over quality standards, evaluation processes, and educational objectives. The UMNIA assigns to technology what technology does best, as has always happened historically, thereby freeing human cognitive capacity for disciplinary content and restoring full legitimacy to languages within academia. The new paradigm makes it possible to realign the university with the values of inclusion, pluralism, disciplinary excellence, and public responsibility that it claims to uphold, restoring language to its functional role as a means of communication among scholars and citizens, without turning it into a structural barrier. The choice facing academic leaders is therefore not whether to change, but whether to do so in a deliberate and forward-looking way, or to undergo change belatedly and in a fragmented manner. Ultimately, this is a decision of a deeply *political* nature in the highest sense: whether the university intends to remain anchored in an outdated paradigm, or to board a train already in motion and take an active role in shaping the university of the future. The technological conditions are fully mature, the scientific evidence is

	EMI Model	**UMNIA Model**
	Transitional (obsolete) solution	*Advanced (updated) solution*
Primary objective	Surface internationalization (*rankings*)	Excellence and native internationalization
Cognitive load	High, inefficient	Natural, optimized
Inclusivity and diversity	Exclusionary	Broad accessibility
Teaching mode	Inefficient	Optimized
Teaching quality	Reduced due to loss of fluency	Full expressive capacity of the instructor
Quality control	Absent or informal	Monitored with explicit standards
Academia–society communication	Increasingly compromised	Active and vibrant

Table 5.1: Summary comparison between the EMI model and the UMNIA model.

available, and viable alternatives exist. Further delay would mean falling behind.

If universities do not address this transition now, explicitly and structurally, it is easy to imagine **what the scenario will be in about a decade**. In a classroom at an Italian, Finnish, or Austrian technical university, a Pakistani, Spanish, or Kenyan student will be sitting, having come to study engineering. The professor will enter and begin lecturing in English-correct, perhaps technically suitable, but strained in delivery, marked by hesitation, local accents, expressive limitations, and simplified structures. After a few minutes, the student will take out a smartphone, put on a discreet pair of headphones, and without asking permission or attracting attention, begin listening to that lecture translated simultaneously into Urdu, Catalan, or Swahili-rhetorically fluent, syntactically clear, even reproducing the tone and rhythm of the instructor's voice. In that moment, the university institution will still be formally adopting English Medium Instruction as a mark of international status, but reality will already be elsewhere: actual understanding will be mediated by individual technologies. These technologies, however, will remain unregulated, unintegrated, and outside institutional control, thereby exposing the university—despite its claims of being at the forefront—as increasingly detached from contemporary realities.

The paradox will then become evident: English will continue to be imposed as the official language, while technology will perform linguistic mediation in an informal, asymmetric, and uncontrolled way. In doing so, the university will not only have sacrificed teaching efficiency, but also its role as a guide and regulator of the educational process.

The choice is therefore clear. Universities can choose to become pioneers of future scenarios, recognizing now the technological possibilities needed to address the challenges of internationalization, inclusion, diversity, and excellence. They can consciously evolve their linguistic model, moving from the nineteenth-century steam locomotive –EMI– to

Figure 5.2: EMI vs. UMNIA (AI-generated image).

the high-speed system of the twenty-first century –UMNIA (Fig. 5.2). Or they can remain in the inertia of obsolescence and inefficiency, only to awaken a decade later and attempt to catch up with a world already far ahead, having lost both authority and excellence. This is a matter of institutional responsibility. To change now means to lead change; not to decide means simply to undergo it.

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