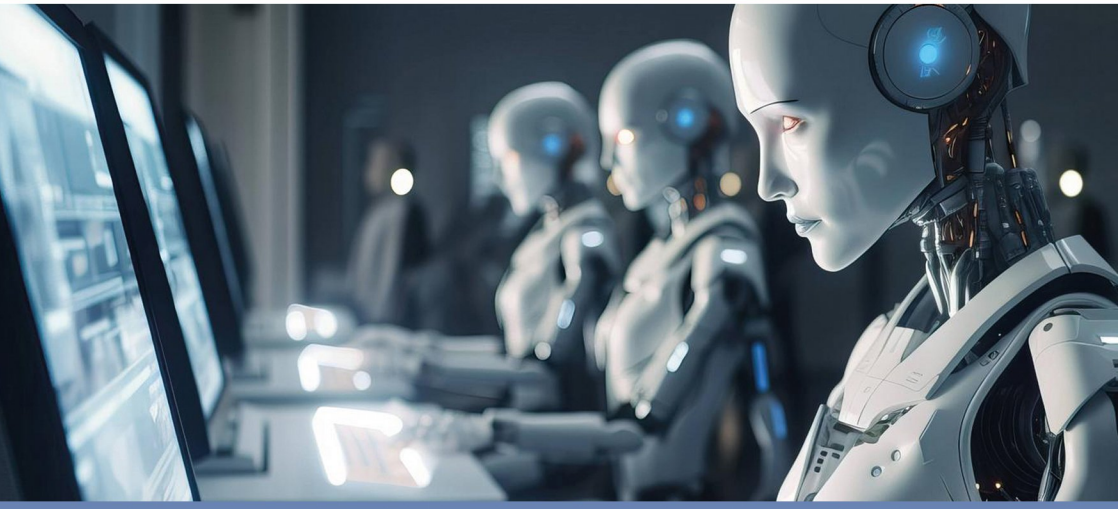
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Collective monograph
Колективна монографія

2025



ARTIFICIAL INTELLIGENCE AS A TOOL TO PROTECT THE ECONOMY FROM DISINFORMATION: INNOVATIVE SOLUTIONS AND INTERNATIONAL PRACTICES

ШТУЧНИЙ ІНТЕЛЕКТ ЯК ІНСТРУМЕНТ ЗАХИСТУ ЕКОНОМІКИ ВІД ДЕЗІНФОРМАЦІЇ: ІННОВАЦІЙНІ РІШЕННЯ ТА МІЖНАРОДНІ ПРАКТИКИ

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
ZAPORIZHZHIA NATIONAL UNIVERSITY

Запорізький
Національний
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The collective monograph is devoted to revealing the role of artificial intelligence in protecting the economy from disinformation; determining the peculiarities of implementing European experience in the use of artificial intelligence and digital technologies in the economy; studying the role of artificial intelligence and digital technologies in economic transformation and ensuring national security; to formulate theoretical, methodological and practical foundations for the introduction of artificial intelligence, digital transformation in order to protect the economy and increase its competitiveness, and ensure information security.

The monograph is based on the results of research within the framework of the project of basic scientific research, applied scientific research, scientific and technical (experimental) developments on the topic № 2/25 "Artificial intelligence as a tool to counter disinformation during the war and post-war economic recovery in Ukraine" (state registration number 0125U000996) (01.01.2025–31.12.2027).

The collective monograph is intended for scholars, teachers, students of higher education institutions, graduate students, doctoral students, practitioners, representatives of state authorities and local self-government, business, university administrative staff, representatives of civil society, the public and all interested persons.

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МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ЗАПОРІЗЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ

Запорізький
Національний
Університет

ШТУЧНИЙ ІНТЕЛЕКТ ЯК ІНСТРУМЕНТ ЗАХИСТУ ЕКОНОМІКИ ВІД ДЕЗІНФОРМАЦІЇ: ІННОВАЦІЙНІ РІШЕННЯ ТА МІЖНАРОДНІ ПРАКТИКИ

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3.2. DEVELOPING DIGITAL LANGUAGE COMPETENCE AS A FACTOR OF COMPETITIVENESS OF FUTURE MASTER'S DEGREE HOLDERS IN POWER ENGINEERING IN THE DIGITAL ECONOMY

Introduction. In the contemporary landscape of rapid technological advancement and global digitalisation, the development of high-level professional competencies among future engineers is no longer confined to technical knowledge alone. In fact, the demands of the digital economy call for a new type of specialist – one who combines deep subject-matter expertise with strong digital literacy and effective communication skills in international professional settings. For Ukrainian institutions of higher technical education, this shift requires a fundamental rethinking of pedagogical priorities, particularly in the realm of language instruction. Among the various competencies that contribute to the competitiveness of future master's degree holders in power engineering, digital language competence is emerging as a particularly vital element.

Digital language competence can be broadly defined as the ability to effectively use language – primarily English as the global language of science and technology – within digital environments to access, process, produce and communicate professional information. This competence involves not only linguistic and communicative skills, but also the confident use of digital tools and platforms to support these processes. For Ukrainian students in power engineering, whose future workplaces may range from international corporations to digitalised domestic enterprises operating within global supply chains, the ability to operate in multilingual digital contexts is a prerequisite for professional integration and success.

This chapter explores the formation of digital language competence as a key factor in enhancing the competitiveness of master's level students in the field of power engineering. In doing so, it seeks to contribute to the broader discourse on the role of digitalisation in higher education and, more specifically, on how linguistic preparation must evolve to meet the challenges of Industry 4.0 and beyond. The emphasis is placed on aligning the teaching of English for Specific Purposes (ESP) with digital educational technologies that support students' professional growth and readiness for real-world communicative situations in technical fields.

The Ukrainian context presents both unique challenges and opportunities. On the one hand, there is a strong tradition of engineering education and a growing awareness of the need for digital transformation in the academic sphere. On the other hand, the lingering effects of outdated teaching methodologies, underfunded infrastructure, and the consequences of the ongoing war have hampered the pace of educational innovation. Nevertheless, recent years have witnessed [1] an increased interest in integrating digital tools into ESP courses, with platforms such as Moodle, various learning management systems, online glossaries, technical text generators, and simulation software gaining traction. This shift has been particularly noticeable in technical universities, where the demand for relevant, industry-oriented English instruction is most acute.

The present chapter is structured into three interconnected sections. The first part analyses the role of digital language competence in preparing future power engineering professionals for the labour market. It draws attention to how digitalisation has changed communication patterns in engineering professions and emphasises the strategic importance of developing a flexible, digitally-supported command of English. The second part offers a detailed overview of digital educational technologies currently applied in ESP teaching, showcasing specific methods and tools used to enhance language instruction in technical disciplines. It highlights practical classroom solutions such as the use of Moodle for blended learning, electronic dictionaries and grammar tools for autonomous study, and project-based digital simulations for contextualised language practice. Finally, the third section presents actual recommendations for reinforcing digital language competence within master's degree programmes. These include curriculum integration strategies, examples of best practices, and proposals for fostering collaboration with European educational initiatives.

By focusing on the intersection of language, technology, and technical education, this chapter contributes to the broader effort of digitalising Ukraine's economy through the development of human capital. In particular, it underscores the role that language educators at technical universities play in shaping the communicative and digital readiness of the next generation of engineers. As Ukraine continues to move towards deeper integration with the European educational and economic space, the importance of equipping future specialists with strong digital language competencies cannot be overstated.

1. The role of digital language competence in the training of power engineering professionals

In the context of the digital economy, the competencies required of power engineering professionals are undergoing a significant transformation. Technical knowledge and hands-on skills, though still central to the profession, are no longer sufficient on their own. The globalisation of the labour market, the integration of smart

technologies, and the widespread adoption of digital systems in the energy sector have brought forth new demands – particularly in the areas of communication, collaboration, and information processing within digital environments. As a result, digital language competence is becoming [2] a critical component of a modern engineer's skill set, directly influencing employability, mobility, and professional growth.

Digital language competence, especially in English, serves a dual function. On the one hand, it facilitates access to the vast body of global scientific and technical knowledge, which is predominantly published in English. On the other hand, it enables engineers to participate in international projects, communicate with colleagues from different linguistic backgrounds, and navigate technical documentation, software interfaces, and standards that are often available exclusively in English. In digitalised workplaces – be they local firms with global partners or transnational corporations – the ability to function effectively in such environments is essential.

For power engineering students in Ukraine, this competence is particularly important. The country's energy sector is actively engaging in digital modernisation, with ongoing efforts to upgrade infrastructure, implement smart grid technologies, and adopt international safety and efficiency standards. These transformations are closely tied to European integration processes, requiring not only technological but also communicative alignment with the standards and practices of European partners. Consequently, Ukrainian graduates must be prepared not only to operate the latest digital equipment and systems but also to engage with digital content, follow technical procedures, and communicate with foreign colleagues – all in English.

It is important to recognise that digital language competence is not limited to traditional language skills such as grammar, vocabulary, or pronunciation. Rather, it encompasses the ability to use language purposefully within digital environments. This includes reading and interpreting technical specifications online, composing clear and concise reports using digital templates, participating in virtual meetings and discussions, searching for technical information using

appropriate keywords, and adapting messages to different audiences and communication platforms. In many ways, this competence blends language proficiency with digital literacy and professional orientation.

The role of language educators at technical universities, therefore, extends far beyond teaching English as an academic subject. In today's context, it is about equipping students with the communicative tools they need to function effectively in a digitalised professional world. This involves integrating authentic materials into the learning process – such as user manuals, software documentation, online forums, and case studies drawn from real-life engineering scenarios – as well as fostering the use of digital platforms that mirror those used in the workplace. At the same time, it requires a pedagogical shift from passive learning to active, student-centred approaches that prioritise communication, problem-solving, and the practical application of language skills.

Moreover, the development of digital language competence contributes to a broader set of XXI century skills that are valued across all sectors of the economy. These include critical thinking, adaptability, collaboration, and intercultural communication – all of which are essential for engineers working in increasingly complex and interconnected environments. For master's degree holders in power engineering, who are likely to take on leadership roles, these skills are even more important. Their ability to present technical solutions to diverse audiences, write reports for international stakeholders, and collaborate across borders is directly linked to their success and the reputation of the institutions that trained them.

In all, the role of digital language competence in the training of power engineering professionals cannot be overstated. It is a foundational element that underpins effective participation in the digital economy and supports Ukraine's broader goals of innovation, integration, and competitiveness on the global stage. As such, its systematic development within technical universities should be viewed as a strategic priority – one that bridges the gap between language education and professional engineering practice in the XX century.

The importance of English for specific purposes (ESP) in the context of digital transformation of the economy

As the global economy continues to evolve under the influence of digital technologies, the significance of English for Specific Purposes (ESP) in professional education is growing markedly. This shift is particularly evident in technical and engineering domains, where the use of English is no longer merely an academic requirement but a practical necessity for full participation in professional life. The digital transformation of the economy has intensified the need for sector-specific language training that is directly aligned with the communicative demands of rapidly changing work environments. For students of power engineering, and indeed all STEM disciplines, ESP functions as a bridge between technical knowledge and its effective application in globalised, multilingual, and technology-driven settings.

Unlike General English, ESP is tailored to the specific linguistic and communicative needs of learners operating within particular fields – whether engineering, finance, medicine, or law. In the context of digital transformation, this means equipping students with the tools to navigate domain-specific language in digital formats: reading technical manuals in PDF, following software installation instructions, participating in online engineering forums, or presenting findings during virtual conferences. These are not hypothetical situations but routine professional tasks for XX century engineers. Therefore, ESP instruction must evolve to reflect these realities, focusing not only on traditional grammar and vocabulary, but also on digital communicative functions, genre-specific writing, and cross-cultural interaction.

In recent years, the digitalisation of workplace communication has led to the emergence of new professional genres – ranging from email briefings and real-time chat support to digital maintenance logs and remote troubleshooting protocols. These forms of communication require a high level of linguistic precision, clarity, and awareness of digital etiquette. ESP instruction, when designed thoughtfully, prepares learners to function confidently in such environments. For example, in a power engineering context, students might work with

authentic materials such as datasheets for photovoltaic inverters, safety regulations published by international bodies, or operational manuals for smart grid systems – all in English. Through such exposure, they develop not only language skills but also professional literacy in their future domain.

Moreover, ESP plays a vital role in ensuring that graduates are capable of engaging with international standards and regulations, many of which are available exclusively in English. As Ukrainian industries become more integrated into European and global economic systems, the ability to understand and implement such standards becomes essential. In digitalised settings, where documentation is stored and shared electronically, and where systems often operate in English by default, this linguistic competence takes on an even greater level of importance. Whether calibrating a control system, interpreting sensor data, or preparing a project proposal for an EU-funded initiative, engineers must be able to interact fluently with English-language digital content.

ESP also supports the development of lifelong learning strategies – an essential attribute in the context of digital transformation, where technologies, platforms, and tools are constantly evolving. Engineers are increasingly expected to update their skills autonomously through online learning platforms, professional webinars, and digital certification programmes, the majority of which are conducted in English. In this regard, ESP instruction helps [3] students become independent users of English-language digital resources, giving them the capacity to stay current in their field and remain competitive in the labour market.

From a pedagogical perspective, teaching ESP in the context of the digital economy requires an innovative approach. It necessitates the integration of ICT tools, real-world tasks, interdisciplinary collaboration, and learner autonomy. Platforms such as Moodle can host ESP courses that incorporate multimedia materials, interactive exercises, and project-based learning activities. Students may be tasked with simulating online meetings, preparing reports using authentic templates, or conducting research using digital engineering databases.

These activities mirror the types of communicative situations they are likely to encounter in their future professions, making the learning process both relevant and engaging. By designing ESP courses around these digital practices, educators not only enhance students' language skills but also equip them with critical competencies needed to thrive in a technology-driven professional environment.

In all, English for Specific Purposes has become a fundamental pillar of professional education in technical disciplines. In the context of the digital transformation of the economy, its relevance has only deepened. ESP enables future engineers not only to communicate effectively within their professional community but also to access, interpret, and apply the wealth of knowledge that is increasingly mediated through English and digital platforms. For Ukrainian technical universities striving to prepare students for success in the international labour market, the integration of ESP into curricula is no longer optional – it is a strategic imperative.

ESP in Ukrainian technical universities: supporting national strategies for digital transformation

The integration of English for Specific Purposes (ESP) into the curricula of Ukrainian technical universities is increasingly recognised as a vital component of the country's broader digital transformation strategy. As Ukraine positions itself more firmly within the European and global knowledge economies, the demand for specialists who are both technically competent and communicatively agile in English continues to rise. Higher education institutions, particularly those specialising in engineering and applied sciences, are thus under growing pressure to modernise their language education in line with the needs of the digital economy and the strategic goals outlined in national policy documents.

The "Digital economy and society development concept of Ukraine" (2018) and related government initiatives have emphasized [4] the importance of digital skills, international cooperation, and the development of human capital as pillars of economic competitiveness. Language proficiency in English – especially in technical contexts – is explicitly recognised as a cross-cutting competence that enables access

to international research, digital platforms, and innovation networks. In this regard, ESP instruction at technical universities not only contributes to individual career readiness but also supports the national effort to foster a digitally competent workforce capable of engaging with global partners and standards.

At Vinnytsia National Technical University, as well as other leading technical institutions in Ukraine, the teaching of ESP has undergone a gradual but visible transformation. Traditional, textbook-based approaches are being replaced with blended and technology-enhanced models that simulate real-world communication tasks. For example, ESP instructors now make extensive use of platforms such as Moodle, Prometeus and Coursera where courses can include interactive quizzes, collaborative writing tasks, vocabulary training, and online presentations. These platforms allow for flexible delivery and continuous feedback, encouraging students to take ownership of their learning.

Moreover, Foreign Language Department is increasingly collaborating with subject-matter experts from engineering faculties to ensure that ESP content reflects the actual needs of the students' future professions [5]. Such interdisciplinary cooperation helps bridge the gap between language learning and professional application, making ESP instruction more meaningful and contextually relevant.

A particularly promising direction is the integration of project-based learning within ESP courses. Students may be asked to develop a prototype presentation for a smart energy solution, write a user manual for a fictional power system, or simulate an international tender process using English. These tasks not only improve language competence but also train students in digital collaboration tools, critical thinking, and cross-cultural communication – skills that are indispensable in today's digital work environment.

In addition, universities are starting to incorporate [6] open educational resources (OERs) and massive open online courses (MOOCs) into their ESP programmes. These materials, often developed by prestigious institutions and available in English, enable students to engage with up-to-date content and broaden their understanding of

both language and technology. They also reflect a shift towards lifelong learning, one of the key principles of the European Higher Education Area and a cornerstone of Ukraine's integration into the European educational space.

Despite positive developments, challenges remain. The digital infrastructure in some regions is still insufficient, particularly in wartime conditions, and not all language instructors have received adequate training in the use of educational technologies or the design of ESP content. Furthermore, the lack of unified national standards for ESP instruction in technical education results in a fragmented approach across institutions. Addressing these issues will require sustained investment, policy coordination, and professional development for educators.

Nevertheless, the current trajectory is encouraging. The increasing visibility of ESP within curriculum reform, the growing engagement of language teachers in digital innovation, and the alignment of educational goals with national strategies all point to a promising future. As Ukrainian technical universities continue to evolve in response to the digital age, the role of ESP – as both a linguistic and strategic tool – will only grow in importance.

Language competence as part of professional readiness for international cooperation and smart technologies

In the era of smart technologies and interconnected global systems, professional readiness extends far beyond technical mastery. It increasingly encompasses the ability to communicate, collaborate, and solve problems across cultural, disciplinary, and linguistic boundaries. As digitalisation reshapes the landscape of engineering, energy systems, and industrial operations, language competence – particularly in English – emerges as a core element of a future professional's toolkit. This is especially relevant for students of power engineering, who are preparing to enter workplaces that are both technologically sophisticated and globally integrated.

International cooperation is no longer a peripheral aspect of engineering; it is a central reality. Power engineers routinely engage

with colleagues, clients, and partners from other countries – whether through joint infrastructure projects, collaborative research, or transnational supply chains. The shift towards smart technologies, including smart grids, AI-driven monitoring systems, and Internet of Things (IoT) applications in the energy sector, further amplifies the need for precise, efficient, and adaptive communication. In such a context, language competence becomes [7] more than a communication skill – it becomes a tool for interoperability, knowledge transfer, and trust-building.

English has firmly established itself as the lingua franca of science, technology, and international business. Mastery of English allows professionals to access the latest scientific research, follow global engineering trends, and participate in professional networks. In the context of smart technologies, where innovation cycles are short and terminology evolves rapidly, the ability to engage with English-language content is vital for staying up to date. For example, understanding updates to technical standards, reading operational manuals for smart meters, or participating in international webinars requires not only technical literacy, but also strong language proficiency.

Moreover, the implementation of smart technologies in energy systems often involves working with international software solutions, digital control systems, and platforms whose user interfaces, documentation, and support services are provided exclusively in English. Without the necessary linguistic competence, the ability to effectively operate, troubleshoot, or adapt such systems is severely limited. From this perspective, language competence directly influences technical performance and operational efficiency.

Beyond technical tasks, engineers are expected to communicate their ideas clearly to non-technical stakeholders, including project managers, regulatory authorities, or international investors. This may involve writing technical reports, preparing presentations, contributing to feasibility studies, or defending proposals – all of which require fluency in both professional content and appropriate language use. For Ukrainian students entering such global arenas, the ability to articulate

their knowledge and collaborate in English is essential for building credibility and fostering long-term partnerships.

At the educational level, integrating language competence into professional training is a forward-looking strategy. It supports the holistic development of future engineers who are not only experts in their field but also communicators, team members, and innovators. For example, at Ukrainian technical universities, ESP courses increasingly incorporate scenarios such as drafting a project proposal for an EU-funded energy initiative, simulating a multilingual team meeting on a smart grid rollout, or translating field-specific terms into accessible language for diverse audiences. These tasks prepare students for the kinds of international and interdisciplinary interactions they will encounter in real life.

Language competence also reinforces key soft skills that are crucial for success in the digital economy: adaptability, critical thinking, intercultural awareness, and digital communication literacy. These competencies enable professionals to navigate the dynamic, unpredictable environments characteristic of international engineering projects, where challenges are often complex, time-sensitive, and require collaboration across time zones and cultural frameworks.

In all, language competence is not a peripheral skill in the age of smart technologies – it is an integral part of professional readiness. For Ukrainian power engineering students and other future specialists in technical domains, mastering English means gaining access to the tools, communities, and innovations that drive global progress. As such, developing this competence must be seen not just as an educational goal, but as a strategic investment in the country's integration into the international digital economy.

Current demands of the labour market for digitally competent and linguistically agile engineers

The digital transformation of global industry has significantly reshaped the skillsets expected of engineering graduates, particularly in high-tech and energy sectors. The modern labour market is no longer seeking engineers who possess only technical proficiency;

rather, it increasingly demands professionals who are digitally competent, linguistically agile, and capable of functioning effectively in multicultural and multidisciplinary environments. This shift is especially evident in the field of power engineering, where digital tools, international cooperation, and innovation ecosystems define the nature of contemporary work.

Recruitment trends across Europe and internationally demonstrate a strong preference for candidates who exhibit not only domain-specific expertise but also high levels of digital literacy and communication skills in English. Employers expect future engineers to be proficient in operating digital platforms for project management, remote collaboration, data analysis, and system simulation. Tools such as SCADA systems, digital twin technologies, and cloud-based energy modelling platforms are now standard in many companies, and the ability to use them confidently is a clear hiring advantage. In parallel, English remains the dominant language for software interfaces, technical documentation, global standards, and cross-border team communication.

This dual requirement – of technological and linguistic agility – has important implications for engineering education. Language and digital skills are no longer considered "soft" or supplementary; they are core employability traits. International companies operating in Ukraine or recruiting Ukrainian graduates for positions abroad frequently list English proficiency and experience with digital tools as prerequisites in job descriptions. Furthermore, with the rise of remote and hybrid working models, engineers must often participate in international projects without leaving their home country, further intensifying the need for fluent digital communication.

Another defining characteristic of the modern labour market is the need for lifelong learners. Engineering roles today are dynamic, often involving upskilling and reskilling throughout one's career. Digital competence is central to this, as most ongoing professional development takes place through online platforms, webinars, digital certifications, and international e-learning courses – almost all of which are delivered

in English. Engineers unable to access and understand these resources risk falling behind in both knowledge and relevance.

In this context, linguistic agility refers not only to the ability to read and understand technical English but also to actively use the language in varied professional scenarios – writing emails, conducting virtual meetings, participating in collaborative design sessions, and explaining complex ideas to non-technical stakeholders. Such competence enables engineers to contribute meaningfully in international consortia, present research findings at global conferences, and even take leadership roles in multinational teams. For Ukrainian graduates seeking to enter this landscape, language proficiency significantly broadens career horizons, allowing access to employment opportunities across Europe, North America, and increasingly, Asia-Pacific regions.

Moreover, surveys of employers in the energy and engineering sectors often highlight a "skills gap" between what is taught in universities and what is required in real-world practice. One of the most cited gaps is communication in English, particularly in digital professional settings. Addressing this disconnect requires the early integration of digital and linguistic training into engineering curricula, with ESP courses playing a central role in this transformation.

Forward-thinking employers are also looking for candidates who demonstrate digital confidence – the ability to navigate new technologies, evaluate digital information critically, and adapt to emerging platforms. Combined with language skills, digital confidence creates professionals who are not only technically skilled but also versatile, innovative, and collaborative. These are the individuals who can thrive in agile project teams, contribute to sustainable energy solutions, and lead digital innovation efforts within their organisations.

In all, the labour market is sending a clear message: tomorrow's engineers must be fluent in both the languages of technology and of global communication. For Ukrainian students of power engineering, responding to this demand requires a learning environment that fosters digital literacy and robust ESP competence from the outset. Universities that invest in the development of these

competencies are not only preparing students for employment – they are equipping them to shape the future of the digital economy.

The evolving expectations of the labour market underscore a pressing need for educational strategies that develop not only domain-specific expertise, but also the digital and communicative competencies that empower students to thrive in globalised, tech-driven industries. As this chapter has illustrated, digital language competence is no longer a peripheral consideration in engineering education – it is a central pillar of professional preparedness, particularly in the context of Ukraine's integration into the European and global knowledge economies.

In response to these demands, Ukrainian technical universities must adopt innovative, practice-oriented approaches to teaching English for Specific Purposes (ESP), with a strong emphasis on digital tools and platforms that reflect real-world communication practices in the energy sector. The following section of this chapter will explore how such tools – ranging from learning management systems to AI-powered writing assistants and interactive simulations – can be effectively integrated into the ESP curriculum. It will also examine specific pedagogical techniques that enhance learner engagement, foster autonomy, and bridge the gap between classroom instruction and workplace expectations.

Through a closer look at these digital methodologies, we aim to highlight practical solutions for developing the kinds of language competencies that make future engineers not only employable but truly competitive in the digital economy of Ukraine and the whole world.

2. Integrating digital educational technologies into ESP teaching for power engineering students

The effective development of digital language competence among engineering students requires not only the recognition of its importance, but also the implementation of targeted, technology-enhanced teaching practices. English for Specific Purposes courses must evolve to reflect the linguistic demands of the modern engineering workplace, which is increasingly mediated by digital tools and collaborative platforms.

In Ukrainian technical universities, this evolution is not just desirable – it is essential. By strategically incorporating digital educational technologies into the ESP classroom, educators can create immersive, practical learning environments that prepare students for authentic communication tasks in the digital economy. Such an approach ensures that graduates are not only proficient in technical English but are also confident users of the digital communication tools that define contemporary engineering practice.

One of the most versatile and widely adopted tools in this context is the Moodle learning management system. Moodle allows instructors to design flexible, blended ESP courses that combine traditional classroom instruction with independent online learning. Through Moodle, students can access technical vocabulary modules, complete interactive grammar tasks, watch instructional videos, participate in forums, and submit assignments – all within a structured, accessible digital environment. This flexibility is especially valuable in the current educational landscape, where online and hybrid formats have become the norm due to logistical, geographical, and security-related challenges faced by Ukrainian institutions.

A key advantage of Moodle lies in its capacity to host authentic, field-specific materials that reflect the language used in professional engineering contexts. For instance, power engineering students can engage with real-world documents such as electrical safety regulations, user manuals for smart grid components, and excerpts from international standards (e.g. IEC or ISO guidelines). These resources not only improve students' technical reading skills but also expose them to the terminology and discourse structures typical of their future work environments. Additionally, instructors can integrate comprehension quizzes, vocabulary lists, and writing tasks based on these materials, encouraging both passive and active language use.

Beyond structured course content, ESP teaching can also benefit from digital tools that support independent language learning and language production. For example, the use of electronic dictionaries (such as ABBYY Lingvo or Cambridge Online Dictionary) enables students

to quickly look up technical terms and examples of use in real contexts. More advanced learners can also benefit from AI-based grammar and writing tools like Grammarly or QuillBot, which provide real-time feedback and encourage learners to reflect on their own language output. These tools are particularly useful for writing professional documents such as maintenance reports, incident logs, and technical summaries – genres commonly encountered in engineering workplaces.

Another promising innovation in the ESP classroom is the use of technical text generators and translation engines. Tools such as DeepL and ChatGPT can help students explore technical phrasing, sentence structuring, and genre conventions by generating model texts based on given prompts. While these tools should be used critically, under teacher guidance, they can enhance students' awareness of professional language use and offer support in developing their own written texts. For example, students can be tasked with generating a user manual section or a project description using such tools and then refining the output collaboratively, with a focus on clarity, accuracy, and register.

The table below (table 1) presents a comparative analysis of three prominent machine translation tools – DeepL, Google Translate, and ChatGPT – highlighting their strengths and limitations across key performance and usability criteria. This comparison provides insight into their suitability for different linguistic and professional contexts.

To foster communication skills in more dynamic ways, simulations and role-based scenarios offer highly effective methods. ESP instructors can design activities where students assume professional roles – such as project engineers, safety inspectors, or client representatives – and participate in simulated meetings, technical briefings, or problem-solving sessions. These scenarios can be supported by digital communication tools such as Microsoft Teams, Zoom, or Miro, which are widely used in industry and provide students with hands-on experience in navigating digital communication environments. Through such simulations, learners practise both linguistic skills and digital soft skills such as turn-taking in online discussions, presenting data via screen sharing, and negotiating meaning in intercultural teams.

Table 1

Comparative analysis of DeepL, Google Translate, and ChatGPT based on translation quality, context awareness, and usability features

Feature	DeepL	Google Translate	ChatGPT
1	2	3	4
Translation quality	Very high for European languages; natural and idiomatic	Good across many languages; sometimes literal or robotic	High-quality, context-aware translations; can adapt to tone
Context awareness	Moderate – considers sentence context	Low – often translates sentence-by-sentence	High – understands broader context (paragraphs or documents)
Supported languages	~30 languages	Over 130 languages	Over 50 languages (depending on model version)
Specialization handling	Good for business and general topics	Broad coverage, but less specialized	Can handle technical, legal, academic, and creative texts
Idioms & figurative speech	Generally good for common phrases	Often mistranslates or translates literally	Excels at interpreting idiomatic and figurative language
Customization and style control	Limited (formal/ informal in some languages)	Limited	High – can mimic specific tone, register, or user instructions
Real-time translation	Yes, via web and desktop app	Yes, in mobile and web apps	No real-time, but fast with longer inputs

Continuation of Table 1

1	2	3	4
Offline availability	Desktop app (partially offline)	Yes (mobile app downloads)	No (requires cloud access)
Text length limit	Limited (max ~5000 characters per input)	~5000 characters	Much higher (especially in Plus/ GPT-4 versions)
Document translation	Yes (supports .docx, .pptx, .pdf)	Yes (limited formatting retention)	Yes (retains structure if prompted well, but no file upload)
Cost	Free for basic, paid for Pro features	Free (ads may appear)	Free or subscription-based (ChatGPT Plus)
Best use cases	Formal documents, emails, business texts	Everyday phrases, travel, quick translations	Academic, technical, nuanced texts, content rewriting

Source: Created by authors

In addition to simulations, case-based learning provides another valuable pedagogical strategy. By working through real or hypothetical case studies related to smart technologies, renewable energy integration, or system failures, students engage with professional language in context. These tasks encourage the development of problem-solving skills, critical thinking, and the ability to articulate complex ideas in English – an essential competence for future engineers involved in strategic decision-making and international cooperation.

Project-based learning, too, has shown [8] excellent potential in combining digital and linguistic development. For instance, students might be asked to design a bilingual brochure for an energy-efficient solution, create a video presentation on the benefits of solar panels for rural areas, or prepare a technical briefing for foreign stakeholders.

These projects integrate the use of technical vocabulary, digital tools (e.g. Canva, PowerPoint, video editing platforms), and communication strategies, reflecting the authentic demands of contemporary engineering professions.

In sum, the thoughtful integration of digital educational technologies into ESP instruction creates a more responsive, realistic, and engaging learning environment. It enables students not only to acquire professional language skills, but also to practise using them in the kinds of digital contexts that they will encounter in the workplace. For Ukrainian universities committed to preparing globally competitive graduates, the implementation of such methods should be seen not as an optional enhancement, but as a core element of XX century professional education. By embracing this shift, institutions can foster a new generation of engineers who are linguistically agile, digitally competent, and fully prepared to meet the complex demands of the international labor market.

The use of moodle for blended and distance learning formats

The increasing need for flexibility in education, particularly in times of crisis and transition, has prompted higher education institutions worldwide to adopt learning management systems (LMS) as integral components of curriculum delivery. Among the various platforms available, Moodle has established itself as one of the most accessible, versatile, and pedagogically effective solutions for both blended and distance learning environments. In the context of teaching English for Specific Purposes to power engineering students, Moodle provides a structured, interactive space where language instruction can be closely aligned with professional needs and digital literacy development.

At its core, Moodle serves as a virtual classroom that enables the delivery of content, the facilitation of communication, and the monitoring of student progress – all in one platform. Its open-source nature makes it particularly suitable for Ukrainian universities operating under budget constraints, while its modular structure allows educators to design courses that reflect the specific linguistic and technical

demands of their students' future professions. In ESP settings, where relevance and contextualisation are key, Moodle supports the creation of learning pathways that mirror real-world communication tasks encountered by engineers.

In blended learning formats, Moodle complements face-to-face instruction by allowing students to engage with digital content before or after in-class activities. For example, an instructor might assign a pre-lesson vocabulary module on smart grid terminology, followed by an in-class discussion on energy distribution systems. Alternatively, students may be asked to watch a video explanation of a technical process and complete a quiz on Moodle to check comprehension prior to a live seminar. This structure encourages flipped learning, where classroom time is reserved for active language use, such as collaborative problem-solving or technical debates, while individual preparation happens online at the learner's own pace.

In fully distance-based scenarios, such as those necessitated by wartime disruptions or public health emergencies, Moodle becomes the central hub for instruction. All components of ESP teaching – reading, writing, listening, and speaking – can be adapted to the online environment using Moodle's built-in tools. These include forums for asynchronous discussions, assignment upload features, integrated video links, quizzes, glossaries, and grading systems. Students can submit technical descriptions, respond to simulated workplace scenarios, or participate in peer-reviewed writing tasks, with timely feedback provided by instructors. This model ensures continuity of learning even when face-to-face interaction is not possible.

An important pedagogical advantage of Moodle is its support for authentic materials and task-based learning. Teachers can upload real industry documents – such as user manuals, technical specifications, or professional standards – and build exercises around them. For example, a lesson on reading technical diagrams might include an embedded PDF of a wiring schematic, followed by comprehension questions and a writing task requiring students to describe the system in English. These materials can be supplemented with digital dictionaries, video

explainers, and vocabulary games, allowing for multimodal input that accommodates diverse learning preferences.

Furthermore, Moodle enables the personalisation of learning through adaptive pathways and differentiated tasks. Students with varying levels of English proficiency can be directed towards resources that match their competence, while those requiring additional support may receive individualised feedback or remedial activities. This adaptability is particularly useful in large, mixed-ability groups, which are common in Ukrainian technical universities. It also fosters learner autonomy, as students can revisit materials, track their own progress, and manage their time effectively – essential skills in both academic and professional contexts.

From an administrative perspective, Moodle offers robust tracking features that allow educators to monitor student engagement and performance over time. Attendance, activity completion, quiz scores, and assignment submissions can all be analysed to identify learning gaps or students at risk of falling behind. Such insights are valuable not only for day-to-day teaching, but also for programme evaluation and curriculum development, particularly when aiming to align language training with industry expectations.

In all, the use of Moodle in ESP teaching provides a sustainable and scalable solution for developing digital language competence among power engineering students. Whether in blended or distance formats, Moodle supports pedagogical innovation, fosters independent learning, and ensures that language instruction remains relevant, accessible, and integrated with students' professional development. For Ukrainian universities navigating the twin challenges of digital transformation and geopolitical instability, platforms like Moodle offer a path toward resilience, continuity, and educational excellence.

Application of electronic dictionaries, AI-based grammar tools, and online technical glossaries to enhance vocabulary and grammar acquisition

In the teaching of English for Specific Purposes (ESP), particularly within technical disciplines such as power engineering, the development

of a precise and contextually appropriate vocabulary is essential. Equally important is the acquisition of grammatical accuracy, especially when dealing with complex sentence structures often required in technical writing. The integration of digital tools such as electronic dictionaries, AI-powered grammar assistants, and online technical glossaries into ESP instruction represents a significant advancement in language learning methodology, providing students with immediate access to linguistic support tailored to their field.

These tools not only assist in real-time correction and clarification but also foster learner autonomy by encouraging students to actively engage with authentic materials. For example, engineering students can use online corpora to analyze how specific technical terms are used in real-world academic and industrial contexts. This exposure helps bridge the gap between classroom learning and professional communication. AI-powered grammar assistants further support students in constructing syntactically complex sentences that meet the conventions of technical documentation. As a result, students gain greater confidence in producing written reports, abstracts, and project descriptions that are both linguistically accurate and professionally appropriate.

In addition, the use of digital platforms allows instructors to monitor student progress more effectively, providing targeted feedback and adaptive support based on individual learning trajectories. This level of personalization was rarely achievable with traditional methods. Importantly, the integration of technology does not replace the teacher but enhances the instructional process, allowing educators to focus on higher-order language skills such as critical reading and effective argumentation. In this context, digital tools function as an extension of the learning environment, reinforcing classroom instruction and preparing students to operate confidently in a globalized, digitally driven workforce. Ultimately, the thoughtful incorporation of these resources into ESP instruction supports not only linguistic development but also the broader goal of professional readiness.

Electronic dictionaries serve as indispensable tools for ESP learners, allowing for quick, context-sensitive look-up of unfamiliar terms.

Unlike traditional print dictionaries, digital platforms such as ABBYY Lingvo, Cambridge Dictionary Online, and Longman Dictionary of Contemporary English offer learners multiple definitions, example sentences, collocations, pronunciation guides, and sometimes even translations. For instance, a student encountering the term "*inverter*" in a text about photovoltaic systems can access not only a general definition but also sample uses within technical contexts, such as "*solar inverter*" or "*DC to AC inverter*." This deepens understanding and reinforces domain-specific usage.

Moreover, electronic dictionaries are accessible across various devices – computers, tablets, smartphones – which supports learning anytime and anywhere. Teachers can integrate dictionary tasks into ESP lessons, encouraging students to build personal glossaries, identify synonyms, and compare usage across contexts. These activities foster active vocabulary engagement and raise learners' awareness of subtle distinctions in meaning that are especially relevant in technical communication.

The table below (table 2) provides a comparative overview of three major digital language platforms – ABBYY Lingvo, Cambridge Dictionary Online, and the Longman Dictionary of Contemporary English (LDOCE). The comparison covers key aspects such as linguistic functionality, usability, and educational value, offering insights into their respective strengths for learners, translators, and educators.

In addition to dictionaries, AI-based grammar tools such as Grammarly, QuillBot, and LanguageTool have become highly effective assistants in developing grammatical competence among ESP students. These tools go beyond basic spell-checking: they analyse sentence structure, detect register mismatches, and provide suggestions for improving clarity, coherence, and tone. For example, when a student writes a sentence such as "*This system allow to reduce energy consumption*," Grammarly will immediately flag the error and suggest a corrected version: "*This system allows energy consumption to be reduced*."

Table 2

Comparison of digital language platforms: ABBYY Lingvo, Cambridge Dictionary Online, and LDOCE

Feature	ABBYY Lingvo	Cambridge Dictionary Online	LDOCE
1	2	3	4
Primary function	Translation dictionary with multiple bilingual pairs	Monolingual English learner's dictionary	Monolingual English learner's dictionary
Language support	20+ languages; strong in Russian-English / French-German	English only (with some bilingual support for learners)	English only
Pronunciation	Audio in multiple accents (e.g., UK, US)	Audio in UK and US accents	Audio + phonetic transcription using IPA
Example sentences	Varies by dictionary pack; often good for context	Rich, contextual examples from real usage	Extensive examples from real-life usage
Collocations & usage notes	Moderate; varies by dictionary used	Yes; highlights common collocations and grammar notes	Yes; includes 'Collocation boxes' and grammar patterns
Grammar & language notes	Limited (depends on dictionary pack)	Comprehensive grammar, word family, and frequency notes	Strong focus on grammar, usage, and learner-friendly features
Search features	Fast search, wildcard, morphology-aware	Instant search, search suggestions	Smart search, wildcard, integrated thesaurus
Offline availability	Yes (Windows, mobile apps)	No (online only)	Yes (premium versions)

Continuation of Table 2

1	2	3	4
Customization	Yes (user dictionaries, add own words)	No	Limited (some personalization in premium tools)
Integrated learning tools	Flashcards, quizzes, history	Word lists, quizzes, English grammar exercises	Word frequency indicators, vocabulary trainer
Audience focus	General users, professionals, translators	ESL/EFL learners, students, teachers	ESL/EFL learners, exam takers (e.g., IELTS, TOEFL)
Cost	Paid (with free basic versions available)	Free	Freemium (basic free, paid extras for LDOCE Online)
Best use cases	Fast translation, reference for multilingual users	Language learning, pronunciation, academic writing	Learning academic and spoken English, preparing for exams

Source: Created by authors

This instant feedback is especially beneficial for learners who are preparing professional texts such as reports, abstracts, or maintenance instructions, where precision and clarity are non-negotiable. Students also benefit from explanations provided by the software, which helps them understand not just what is wrong, but why – a critical feature for long-term grammar acquisition. Teachers may assign grammar improvement tasks using these tools or ask students to revise their writing based on AI suggestions and reflect on the changes made.

Another valuable resource in ESP instruction is the use of online technical glossaries, which provide field-specific terminology with definitions written for professionals or learners in the target domain. Platforms such as Electropedia (by the IEC), IEEE Glossary, and Energy Glossary by the U.S. Energy Information Administration offer

reliable, up-to-date definitions of specialised terms used in the power and energy sectors. For example, a student researching "smart metering" can refer to Electropedia for the official IEC definition, which provides context and precise usage relevant to international standards. Such resources not only enhance students' understanding of domain-specific terminology but also familiarize them with the standardized language used in international technical communication, which is essential for their future professional engagement.

The following table compares (table 3) three specialized terminology platforms – Electropedia by the International Electrotechnical Commission (IEC), the IEEE Glossary, and the Energy Glossary by the U.S. Energy Information Administration (EIA). These resources are critical for ensuring consistency and clarity in technical and energy-related documentation.

Table 3

Comparison of technical glossary platforms: Electropedia, IEEE Glossary, and EIA Energy Glossary

Feature	Electropedia (IEC)	IEEE Glossary	Energy Glossary (EIA)
1	2	3	4
Publisher	International Electrotechnical Commission (IEC)	Institute of Electrical and Electronics Engineers (IEEE)	U.S. Energy Information Administration (EIA)
Scope	Electrotechnical and energy-related terms	Electrical, electronic, and computing terms	Energy production, consumption, and policy terms
Terminology depth	Highly structured and internationally standardized	Concise definitions from IEEE standards	General definitions intended for policymakers and the public

Continuation of Table 3

1	2	3	4
Audience	Engineers, standards developers, international regulators	Researchers, engineers, standards developers	General public, policymakers, educators
Search functionality	Alphabetical + thematic browsing	Search via IEEE Xplore or standards documents	Keyword search with straightforward results
Update frequency	Regularly updated as standards evolve	Updates align with standard revisions	Updated periodically with changes in energy sector
Cross-references	Yes, includes links to related terms and standards	Limited; depends on document structure	Basic internal linking within glossary entries
Access	Free online access	Access varies (some content behind paywall)	Fully free online access
Best use cases	Developing international standards, precise technical writing	Understanding IEEE standards, technical documentation	Public communication, energy education, and policymaking

Source: Created by authors

These glossaries are particularly useful when students work on reading comprehension tasks, translation exercises, or project-based writing in ESP courses. By consulting authoritative sources, students learn to recognise correct terminology, differentiate between similar technical concepts (e.g. "*current transformer*" vs. "*potential transformer*"), and avoid literal translations or incorrect usage that may arise from general-language resources.

To maximise the benefits of these tools, instructors can design integrated tasks that combine vocabulary acquisition, grammar refinement, and professional reading or writing. For example, in a lesson on renewable energy systems, students might be asked to:

- read a short excerpt from a manufacturer's datasheet on wind turbine controllers;
- use an electronic dictionary to clarify unfamiliar terms (e.g. "*yaw control*," "*anemometer*," "*cut-in speed*");
- draft a paragraph summarising the system's operation using appropriate grammar and technical vocabulary;
- run the paragraph through Grammarly or QuillBot, compare the original and revised versions, and reflect on the corrections.

Such tasks promote learner autonomy, digital literacy, and linguistic accuracy – three pillars of successful ESP education in the digital age.

In all, the application of electronic dictionaries, AI-based grammar tools, and online technical glossaries empowers engineering students to engage with technical content more confidently and accurately. These tools not only support the development of linguistic competence but also mirror the resources professionals rely on in real workplaces, thereby reinforcing the authenticity and practicality of ESP instruction. Their integration into the language curriculum is both a pedagogical necessity and a strategic enhancement of students' readiness for participation in the global digital economy.

Simulations and case-based learning as tools for developing digital communication and language skills

As the demands of the modern labour market evolve, so too must the methodologies used in English for Specific Purposes (ESP) instruction. Traditional approaches, while still useful for foundational skill-building, are often insufficient to prepare learners for the realities of XX century workplaces – particularly those shaped by globalisation, digitalisation, and interdisciplinary collaboration. To address this, simulations and case-based learning have emerged as powerful, practice-oriented strategies that mirror authentic workplace

communication scenarios and foster both linguistic and digital competencies. These methods are especially relevant in the context of power engineering education, where the ability to engage in problem-solving communication is central to professional success.

Simulations offer students a structured opportunity to experience workplace-like communication tasks within a safe, educational environment. In ESP courses, this often means replicating realistic technical or professional interactions such as safety briefings, project coordination meetings, technical presentations, or maintenance report discussions. These activities are conducted using the language of the target field, and, where possible, via digital platforms that are also commonly used in industry – such as Zoom, Microsoft Teams, or Slack. By engaging in these simulations, students not only practice relevant vocabulary and discourse patterns but also develop essential soft skills like clarity, teamwork, and digital communication etiquette that are increasingly valued in modern engineering workplaces.

For example, students may be assigned roles in a simulated international engineering team tasked with evaluating the feasibility of implementing smart grid infrastructure in a rural area. Each student is given a specific function – such as system designer, environmental analyst, or financial coordinator – and must prepare and present their analysis in English. The simulation may take place entirely online, requiring students to use screen-sharing features, upload digital documents, respond to real-time queries, and collaborate in breakout rooms. Through this process, learners practise domain-specific vocabulary, improve fluency, and gain experience in managing digital tools for communication – skills directly transferable to future employment settings.

The table below (table 4) compares three widely-used collaboration platforms – Zoom, Microsoft Teams, and Slack. Each of these tools supports communication and teamwork in professional and educational settings, but they differ in features, integrations, and optimal use cases.

Table 4

Comparison of collaboration platforms: Zoom, Microsoft Teams, and Slack

Feature	Zoom	Microsoft Teams	Slack
1	2	3	4
Primary function	Video conferencing	Integrated communication and collaboration	Messaging and collaboration
Strengths	High-quality video/audio, webinars, virtual backgrounds	Strong Office 365 integration, videochat, collaboration tools	Fast and organized messaging, robust app integrations
Video conferencing	Excellent; focus on meetings and webinars	Very good; integrates with scheduling and calendar	Basic; best used with third-party plugins
Messaging & chat	Basic in-meeting chat	Full-featured persistent chat, threads, mentions	Excellent chat with threads, emojis, reactions, rich formatting
File sharing	Available during meetings	Integrated with OneDrive and SharePoint	File sharing with Slack storage or linked cloud services
Integrations	Good: Outlook, calendar, whiteboards, Zoom Apps	Excellent with Microsoft products, third-party apps	Extensive app directory: Google, Microsoft, Trello, GitHub
Breakout rooms	Yes (strong feature)	Yes (limited flexibility)	No native support (some workarounds)
Security & compliance	End-to-end encryption (E2EE) available	Enterprise-grade security, compliance features	Good security; enterprise-level compliance

Continuation of Table 4

1	2	3	4
Mobile app	Full-featured and intuitive	Robust mobile experience	Highly rated mobile chat app
Free version	Yes, limited to 40-minute meetings	Yes, with limited features	Yes, with limited integrations and storage
Best use cases	Online meetings, webinars, education	Corporate environments, team collaboration	Agile teams, project management, developer collaboration

Sourse: Created by authors

Case-based learning complements simulations by engaging students in the in-depth analysis of real or hypothetical scenarios drawn from professional contexts. These cases typically involve [9] a technical problem or decision-making challenge and require students to work collaboratively to identify solutions, justify their recommendations, and communicate their findings in English. In power engineering contexts, this might include topics such as analysing the causes of a transformer failure, evaluating competing renewable energy proposals for an industrial site, or drafting a response to a customer complaint about voltage irregularities.

A well-designed case study encourages students to read and interpret technical documents, extract relevant information, apply critical thinking, and present conclusions in written or oral form. For example, after reviewing a manufacturer's fault log and a customer's complaint email, students may be asked to write a short formal report summarising the findings and recommending preventive measures. The instructor may then guide students through a peer review process, followed by submission through Moodle, where additional feedback can be provided using AI-assisted writing tools or grading rubrics.

Both simulations and case-based activities promote communicative competence in context, which is a core aim of ESP. Importantly, they also strengthen soft skills – such as teamwork, adaptability, and digital collaboration – which are now recognised as vital components of professional readiness in engineering. In multilingual teams or international projects, engineers must frequently present their work, negotiate with stakeholders, and respond to feedback from diverse audiences. Case-based and simulation tasks provide students with a rehearsal space for these complex interactions.

Additionally, these methods support interdisciplinary integration, encouraging students to draw on their engineering knowledge while developing language and communication strategies. Teachers may collaborate with faculty from technical departments to design tasks based on current research or applied technologies in the field, thereby reinforcing the connection between language learning and students' core disciplines. Such collaboration also strengthens the authenticity of learning and increases student motivation, as learners can see a direct link between their ESP work and future professional roles.

In terms of assessment, simulations and case-based learning lend themselves well to formative and performance-based evaluation. Teachers can assess students not only on language accuracy but also on clarity, effectiveness of communication, teamwork, and professionalism. Rubrics that include language criteria alongside content and digital skills are particularly useful in capturing the multifaceted outcomes of these activities.

In all, simulations and case-based learning represent an effective response to the pedagogical challenges of preparing engineering students for global, digitally connected workplaces. They foster the development of ESP competencies in ways that are both engaging and aligned with real-world professional practices. By integrating these methods into ESP curricula, Ukrainian technical universities can ensure that their graduates are not only linguistically prepared, but also capable of navigating the digital tools and communicative demands of their future engineering careers.

Use of technical text generators and translation engines (e.g. DeepL, ChatGPT) for comprehension and production of engineering texts

The digitalisation of education and the growing presence of artificial intelligence in language processing have opened new opportunities for enhancing English for Specific Purposes (ESP) instruction in technical fields. Among the most transformative tools [10] in this area are technical text generators and translation engines, such as DeepL and ChatGPT, which enable students not only to access professional-level content but also to produce and refine their own texts in authentic formats. In the context of teaching ESP to students of power engineering, these technologies are proving to be valuable allies in supporting comprehension, vocabulary development, genre awareness, and written fluency.

DeepL, widely regarded for its high-quality machine translation capabilities, is especially useful for students working with technical documents that may be initially available in Ukrainian or another native language. Unlike earlier generations of translation software, DeepL excels in preserving terminology and syntactic clarity across complex subject matter. For example, when translating a section of an operating manual for a solar inverter system, DeepL provides not only accurate term equivalents (e.g. "*maximum power point tracking*", "*inverter efficiency*"), but also produces grammatically coherent English texts that are suitable for classroom analysis or adaptation into student reports.

In ESP instruction, teachers can leverage this tool in various ways. Students might begin with a Ukrainian-language technical document and use DeepL to generate a preliminary English version. This version can then be reviewed critically in class, allowing students to identify translation challenges, correct inaccuracies, and compare machine output with standard engineering phrasing found in original English-language manuals. This activity not only sharpens reading comprehension but also raises students' awareness of industry-specific terminology, collocations, and register.

Similarly, ChatGPT, powered by advanced natural language processing, offers [11] remarkable capabilities for generating technical texts on demand. Students and instructors can prompt the system to produce summaries, technical descriptions, formal letters, safety instructions, or product comparisons based on specific engineering topics. For instance, when asked to generate a paragraph describing the function of a synchronous generator, ChatGPT can provide a coherent, concise explanation in English, which students may then paraphrase, expand, or adapt for different purposes (e.g. a presentation slide or a maintenance instruction leaflet).

Beyond text generation, ChatGPT can also support language exploration and clarification. Students may input complex sentences or technical explanations and ask the tool to simplify them, define specific terms, or explain grammatical constructions. This promotes learner autonomy and provides immediate, tailored support for those working with unfamiliar content. Used under instructor supervision, ChatGPT can function as a digital assistant that helps students practise engineering communication in meaningful, targeted ways.

Importantly, these tools can also assist with text revision and editing. Students writing technical texts – such as system specifications, short reports, or project proposals – can use AI tools to check grammar, refine wording, and adjust tone. For instance, a student writing "*We install system for solar energy with good effectiveness*" might receive improved suggestions such as "*We install high-efficiency solar energy systems*", learning in the process about appropriate adjective use, article placement, and industry-preferred terminology.

From a pedagogical standpoint, incorporating AI-powered tools into ESP instruction supports [12] scaffolded learning. Beginners can use translation tools to understand input texts, while more advanced learners engage with generated texts as models for their own production. Tasks may include:

- comparing AI-generated texts with authentic technical manuals;
- editing or correcting AI-produced paragraphs based on grammar or factual accuracy;

- using ChatGPT to generate role-play scripts for simulations;
- analysing translation inconsistencies between DeepL and human-written equivalents.

Such tasks encourage students to think critically about language form, function, and appropriateness – core elements of communicative competence. However, it is crucial that these tools are used ethically and pedagogically, with clear guidance on their limitations. Students should be made aware that while AI tools are helpful, they are not infallible: terminology may still be used out of context, nuances can be lost, and factual errors may occasionally appear. Therefore, AI outputs must always be verified against reliable sources, especially in highly technical or safety-critical contexts.

In all, the integration of technical text generators and translation engines into ESP instruction offers significant benefits for comprehension, vocabulary acquisition, writing development, and learner engagement. For power engineering students in Ukrainian universities, these tools provide accessible, immediate support in navigating the linguistic demands of their field. When applied thoughtfully and critically, they not only accelerate language learning [13] but also familiarise students with the kinds of AI-assisted communication processes already shaping the future of engineering work worldwide.

The diverse range of digital tools explored in this section – from learning platforms like Moodle to AI-powered writing assistants and simulation-based learning – demonstrates the rich potential of technology to enhance language acquisition within technical education. These innovations not only support the development of digital language competence, but also reflect the real-world communication environments that engineering graduates will encounter in their professional lives. However, to ensure that such tools are used effectively and sustainably across institutions, broader strategic planning is required. The final section of this chapter outlines a set of practical, evidence-based recommendations for integrating digital language development into master's-level engineering

programmes. These proposals aim to guide educators, administrators, and policymakers in strengthening the linguistic and communicative readiness of Ukraine's future engineers within the digital economy.

3. Practical recommendations for strengthening digital language competence in technical master's programmes

The effective integration of digital language competence into the training of future power engineers requires more than isolated classroom innovations – it demands a systematic, institution-wide approach that aligns educational objectives with the evolving needs of the digital economy. As Ukrainian technical universities continue to modernise their curricula and increase alignment with European standards, it becomes essential to embed English for Specific Purposes (ESP) instruction within a digital framework that reflects current labour market demands, technological trends, and international cooperation strategies. This section outlines practical, actionable and working recommendations aimed at strengthening and maintaining the sustainability of digital language competence in technical master's programmes in Ukrainian technical universities during full-scale russian invasion of Ukraine.

Integrate ESP and digital literacy into core curriculum design

Rather than treating ESP as an auxiliary or optional subject, universities should incorporate it as a core component of professional training. This requires a curriculum that recognises digital language competence as a cross-cutting skill, vital not only in academic settings but also in the workplace. Specifically, master's programmes in engineering should:

- include mandatory ESP modules focused on domain-specific vocabulary, documentation, and digital communication formats;
- align course content with actual workplace practices – e.g. writing system specifications, understanding technical standards in English, or participating in virtual project meetings;
- encourage interdisciplinary cooperation between language instructors and technical faculty to develop authentic tasks and assessments that blend language and subject knowledge.

Expand the use of digital tools through structured methodologies

While digital tools such as Moodle, Grammarly, ChatGPT, and DeepL are readily available, their educational impact depends on how thoughtfully they are embedded into teaching. Universities should:

- provide guidelines and training for ESP teachers on the pedagogical use of digital platforms and AI tools;
- create institutional repositories of ready-to-use tasks and lesson plans that integrate these tools in meaningful ways;
- promote the use of blended learning formats, with clear task sequencing, formative feedback, and real-world communication simulations;
- establish digital portfolios for students to document their language progress, project outputs, and AI-assisted writing samples.

Develop institutional support systems for teachers and learners

To successfully implement these innovations, support mechanisms must be put in place:

- offer continuous professional development for ESP instructors in educational technologies, curriculum development, and AI literacy;
- ensure access to updated infrastructure, including stable LMS platforms, online libraries, and AI-powered tools;
- provide technical assistance and mentoring for new staff members engaging with digital course design;
- encourage communities of practice where educators can share insights, challenges, and innovations in digital ESP teaching.

Promote collaboration with european educational and research platforms

One of the most effective ways to raise the standard of ESP instruction and digital competence is through international collaboration. Ukrainian institutions should:

- encourage student participation in MOOCs (e.g. FutureLearn, Coursera, edX) that offer content in English related to power engineering, sustainability, and innovation;
- apply for Erasmus+ mobility programmes and joint projects focusing on digital and linguistic competence development;

- engage in virtual exchanges and co-teaching opportunities with European partner universities to model real-life international communication;
- align ESP learning outcomes with CEFR descriptors and the European Framework for the Digital Competence of Educators (DigCompEdu).

Evaluate and certify digital language competence

Establishing a clear system for assessment and recognition of digital language skills reinforces the seriousness of ESP in technical education. Recommendations include:

- incorporating performance-based assessments, such as digital presentations, online report writing, and participation in virtual debates;
- offering micro-credentials or digital badges for the successful completion of ESP modules focused on digital communication;
- collaborating with industry partners to validate assessment tasks and ensure they reflect actual workplace expectations;
- encouraging students to sit for international certifications (e.g. IELTS, TOEIC, Cambridge BEC) alongside university ESP courses, with institutional support.

In summary, the development of digital language competence in technical master's programmes requires an integrated, future-oriented strategy. It is not sufficient to introduce technology into the classroom on an ad hoc basis; rather, universities must cultivate a digital learning culture that values communication as a professional tool, aligns language instruction with economic priorities, and empowers both teachers and students to engage confidently with the demands of the global labour market. By implementing the recommendations outlined above, Ukrainian technical universities can play a vital role in shaping a new generation of engineers who are not only technically proficient, but also linguistically agile and digitally fluent – ready to contribute meaningfully to the digital transformation of the economy.

Examples of successful implementation and student feedback

The effectiveness of digital tools and approaches in ESP instruction is most clearly demonstrated through real-life examples of classroom

application and the experiences of students themselves. Across several Ukrainian technical universities, educators have begun systematically integrating digital platforms, AI-based tools, and task-based methodologies into ESP courses – often with highly positive outcomes. These case studies illustrate not only the pedagogical viability of such innovations, but also their perceived value by the very learners they are intended to support.

At Vinnytsia National Technical University, an ESP module for master's students in power engineering was recently redesigned to include blended instruction via Moodle, along with regular use of Grammarly and DeepL for writing support. The course focused on preparing students to communicate technical information clearly and accurately in international contexts. Assignments included writing product descriptions, composing responses to customer enquiries, and summarising technical reports using authentic data sheets and industry-standard templates.

Students were encouraged to use DeepL to translate Ukrainian-language engineering documents and then critically analyse the translation for terminology accuracy and tone. In writing tasks, Grammarly was used not only to identify surface-level grammatical errors, but also to prompt discussion about clarity, passive voice usage, and stylistic conventions in technical English. The final assessment included a simulated online presentation to international stakeholders, where students were evaluated on both linguistic clarity and digital delivery skills.

The study involved 103 students from the Faculty of Energy and Electromechanics, VNTU, all of whom participated voluntarily. In accordance with ethical research standards, informed consent was obtained from each participant, and all collected data was treated with strict confidentiality – no personal information was disclosed or published at any stage of the study.

Feedback from participants was overwhelmingly positive. In anonymous surveys, 88% of students reported increased confidence in reading and producing engineering texts in English. One student wrote:

"*Before, I was afraid to write technical reports in English because I wasn't sure of the grammar and the terms. With Grammarly and the glossary links, I could check myself and feel more secure. Also, it helped me understand the way professionals really write in English*."

Another commented on the benefits of Moodle's structured learning path:

"*I liked the combination of videos, tasks, and forums. It was like we were learning English, but with a clear purpose – for work, for communication in projects. It was not abstract*."

Similarly, ESP instructors introduced simulation-based learning activities into the master's programme in electrical systems and networks. In one project, students participated in a week-long role-play in which they were tasked with resolving a fictional blackout affecting multiple facilities. Working in teams, they had to compose internal memos, write service reports, and participate in video calls (via Zoom) with instructors posing as international consultants.

The instructors noted a marked improvement in both student engagement and language production. Many students took the initiative to use online glossaries (such as Electropedia and IEEE Glossary) to ensure accuracy in their descriptions of technical failures. AI tools like ChatGPT were allowed under supervision for drafting first versions of documents, which students then edited collaboratively using Google Docs, incorporating teacher feedback.

Student reflections following the activity indicated strong appreciation for the realistic context. As one group member shared:

"*It was like a real situation. We had to explain problems clearly, suggest solutions, and communicate formally. I learned not only new words but also how to organise my thoughts professionally in English*."

Another wrote:

"*Using Zoom and writing formal messages to 'consultants' was a new experience. It helped me think about how we will work in international teams in real jobs*."

Beyond this feedback, instructors observed increased student autonomy, improved collaborative writing skills, and greater

willingness to take risks in English communication. Importantly, several students later reported applying the skills acquired in ESP courses during internship interviews and work placements, particularly in tasks involving technical correspondence or online collaboration with international colleagues.

These examples confirm that when digital tools are used purposefully – embedded in tasks that mirror authentic professional scenarios – they not only enhance language development but also contribute to the overall confidence and communicative readiness of engineering students. Moreover, student feedback reinforces the notion that ESP instruction should be practical, context-driven, and aligned with the digital realities of modern industry. These findings underscore the importance of rethinking traditional ESP methodologies in favor of dynamic, technology-enhanced approaches that better prepare students for the linguistic and professional demands of the XXI century engineering workplace.

Prospects for cooperation with European educational platforms (e.g. Coursera, FutureLearn, Erasmus+ projects)

The ongoing digitalisation of higher education, accelerated by global trends and local challenges, has opened up unprecedented opportunities for Ukrainian technical universities to engage in strategic cooperation with European educational platforms. These platforms – such as Coursera, FutureLearn, and Erasmus+ – offer not only access to high-quality, internationally recognised educational content, but also serve as catalysts for institutional development, cross-border collaboration, and the strengthening of digital and linguistic competence among both students and educators. By integrating these resources into ESP curricula, universities can better align their language education with European standards, while also fostering a more inclusive and future-ready academic environment. Such integration empowers students to participate in international academic and professional communities, enhancing their mobility, employability, and capacity to contribute meaningfully to global engineering challenges.

One of the most immediate benefits of partnering with platforms like Coursera and FutureLearn lies in their vast repositories of professionally relevant courses, many of which are offered in English and tailored to the needs of engineering and technology students. For instance, Coursera hosts courses on smart grid technologies, renewable energy systems, and data analysis for engineers, delivered by institutions such as the University of Colorado Boulder, Delft University of Technology, and Imperial College London. These modules often include authentic technical texts, English-language video lectures, interactive assignments, and automated assessments – providing an immersive language and content learning experience that supports both subject mastery and ESP development.

Integrating these courses into university ESP programmes can significantly enhance students' exposure to authentic English-language materials while also encouraging autonomous learning habits. For example, an instructor might recommend or require students to complete a FutureLearn course on *Energy Transition* as a supplement to classroom instruction, with subsequent reflective assignments or discussion tasks built around the terminology, case studies, and professional discourse encountered in the online course. Such integration not only enriches the learning process but also familiarises students with the genre conventions and rhetorical styles used by professionals in their field.

The table below (table 5) presents a comparison of three prominent educational platforms and programs – Coursera, FutureLearn, and Erasmus+. These platforms differ in their delivery models, geographic reach, and primary target audiences, yet all play significant roles in expanding access to global education and lifelong learning.

Beyond content access, cooperation with these platforms opens the door to digital credentialing, allowing students to earn verified certificates that can strengthen their CVs and LinkedIn profiles. This enhances their global employability and demonstrates initiative and language competence to potential employers. Furthermore, students gain experience working in English-language learning environments, where communication with instructors and peers from other countries develops intercultural competence alongside technical and linguistic skills.

Table 5

Comparison of educational platforms: Coursera, FutureLearn, and Erasmus+

Feature	Coursera	FutureLearn	Erasmus+
1	2	3	4
Type	Online learning platform	Online learning platform	EU-funded international education program
Provider	Private (Founded by Stanford professors)	Owned by The Open University (UK)	European Commission (EU initiative)
Delivery mode	Self-paced or instructor-led online courses	Scheduled online courses with social learning model	In-person mobility (exchange, internships) + virtual cooperation
Main focus	Professional development, university courses, degrees	Short courses, microcredentials, professional and academic skills	Student and staff exchange, institutional collaboration, capacity building
Target audience	Global learners, working professionals, students	Learners from the UK, EU, and globally	Higher education students, educators, youth workers, institutions
Certifications	Certificates, professional and university diplomas	Certificates of achievement, academic credit for some courses	Formal recognition through ECTS or learning agreements
Cost	Free audit; paid certificates, subscriptions, and degrees	Many free courses; paid upgrades for certificates	Grants and full funding for participants; free to access
Languages offered	Primarily English; some courses in Spanish, Chinese, etc.	English-focused; limited multilingual options	Multilingual (based on participating institutions)

Continuation of Table 5

1	2	3	4
Accreditation	University and industry accredited programs	Courses often from accredited universities	Official EU recognition; tied to higher education frameworks
Collaborators	Universities (e.g., Yale, Stanford), companies (e.g., Google)	Universities, British Council, professional bodies	EU universities, NGOs, vocational schools, national agencies
Best use cases	Upskilling, university degrees, career advancement	Short-term learning, professional development, academic enrichment	International study, teaching exchange, institutional development

Sourse: Created by authors

In parallel, participation in Erasmus+ projects offers [14] an invaluable avenue for building deeper institutional partnerships and fostering long-term cooperation between Ukrainian and European universities. Through Key Action 2 (Cooperation among Organisations and Institutions) and Capacity Building in Higher Education (CBHE) initiatives, Ukrainian institutions can:

- co-develop ESP and technical course content with European partners;
- implement joint digital learning programmes that blend language and subject instruction;
- train educators in CLIL (Content and Language Integrated Learning) methodologies and digital pedagogy;
- facilitate virtual exchanges and blended mobility projects, where students participate in international teamwork using English as a working language.

Such projects not only support curriculum innovation but also contribute to the internationalisation of education, a key objective

for Ukraine's integration into the European Higher Education Area. Moreover, Erasmus+ fosters sustainable development by funding digital infrastructure, promoting inclusivity, and encouraging the exchange of best practices across institutions.

The prospects for future cooperation are promising, particularly as Ukrainian universities seek to align with EU digital and educational strategies. By embedding the use of European platforms into formal ESP curricula and institutional strategies, universities can:

- bridge gaps in digital and linguistic competence;
- diversify learning experiences;
- expand their academic networks;
- increase resilience in times of crisis through decentralised, cloud-based learning models.

In conclusion, collaboration with European educational platforms is not merely an option for enriching ESP instruction – it is a strategic pathway toward raising the quality, relevance, and international competitiveness of Ukraine's technical education sector. It empowers students with the tools and experiences needed to operate confidently in global digital environments and positions Ukrainian universities as active contributors to the shared European educational space.

Policy-level recommendations for aligning digital language training with national goals of economic digitalisation

As Ukraine continues its strategic transition towards a digital economy, the role of higher education – particularly in technical fields – has become central to the development of the human capital needed to support this transformation. Within this context, digital language competence should be viewed not as an isolated educational objective, but as a strategically important component of national economic resilience and international integration. Effective policy-level interventions are essential to ensure that digital language training, especially in English for Specific Purposes (ESP), is fully aligned with broader digitalisation goals and labour market demands.

To achieve this alignment, universities must collaborate closely with industry stakeholders to identify the specific digital and linguistic

skills required across various sectors. Curriculum development should prioritize interdisciplinary approaches that integrate ESP with digital literacy, coding, data analysis, and critical thinking. This will not only enhance students' employability but also contribute to a more agile and innovative workforce. Policymakers must support these efforts by providing funding for educational technology, teacher training, and curriculum innovation. In addition, national standards for digital language competence should be developed to ensure consistency and quality across institutions. As digital transformation accelerates, the ability to communicate technical knowledge in English becomes a key differentiator in the global marketplace. Therefore, ESP programs should focus on real-world tasks, such as writing technical reports, engaging in virtual collaboration, and navigating international digital platforms. Universities should also foster partnerships with global institutions to offer students immersive language experiences and exposure to international best practices. Ultimately, a strategic emphasis on digital language competence will strengthen Ukraine's position in the global digital economy. By embedding ESP within a broader digital strategy, higher education can become a powerful driver of national resilience, innovation, and growth.

To further support this vision, academic institutions should leverage digital platforms and AI-powered tools to personalize ESP learning and make it more adaptive to individual needs. Emphasizing project-based learning and problem-solving in ESP courses can simulate real-world scenarios, reinforcing both linguistic and technical competencies. Government incentives for universities that demonstrate measurable progress in digital language integration could accelerate nationwide implementation. Moreover, strengthening teacher capacity through continuous professional development in digital pedagogy and ESP instruction is critical. Attention must also be paid to rural and underserved regions to prevent a digital and linguistic divide within the country. National education strategies should incorporate feedback mechanisms to continuously evaluate the effectiveness of ESP programs in meeting labour market expectations. Engagement with

the tech industry can provide students with internships, mentorship, and exposure to evolving digital communication practices. Promoting multilingualism, with English as a foundational component, can enhance Ukraine's competitiveness in regional and global collaboration. Recognizing ESP as a strategic investment rather than a supplementary skill will reshape perceptions of language education. As Ukraine builds a knowledge-based economy, digitally fluent and linguistically competent graduates will be essential to driving sustainable development and innovation.

In this transformative era, embedding digital language competence into the core of higher education policy is not just beneficial but imperative for Ukraine's long-term economic sovereignty and global relevance.

Firstly, national education and innovation policies should explicitly recognise ESP and digital language competence as priority areas within the broader digital transformation agenda. Government documents such as the Digital Economy and Society Development Concept of Ukraine (2020) and subsequent implementation plans can be revised or supplemented to include specific reference to:

- the integration of digital ESP into technical and vocational education;
- the promotion of English-language proficiency in digital communication for engineers, IT professionals, and technical personnel;
- the development of educational standards that incorporate digital communication skills as a measurable graduate attribute.

Secondly, the Ministry of Education and Science of Ukraine, in collaboration with leading technical universities and employers, should develop national ESP curriculum guidelines for master's programmes in engineering and related fields. These guidelines recommend:

- the inclusion of technology-enhanced language learning (e.g. LMS, AI tools, simulations);
- the use of authentic digital content relevant to industry sectors;
- a minimum English language level (e.g. B2+) as an exit requirement for technical master's graduates;

- competency descriptors for digital communication in English, aligned with the Common European Framework of Reference (CEFR) and digital competence frameworks such as DigCompEdu.

Thirdly, it is recommended that national funding instruments be designed to support the upskilling of ESP educators in both linguistic and technological domains. This include:

- professional development grants for teacher training in AI-assisted instruction and digital pedagogy;
- institutional incentives for cross-disciplinary collaboration between language departments and engineering faculties;
- the creation of digital repositories of ESP materials, tasks, and case studies, accessible to educators across Ukraine;
- state-supported participation in international educational partnerships (e.g. Erasmus+ Capacity Building, eTwinning, European MOOCs).

In addition, industry-education cooperation mechanisms should be strengthened to ensure that digital language training remains responsive to the needs of the real economy. This can be achieved by:

- establishing sectoral advisory boards involving employers, industry experts, and ESP instructors to review and co-develop course content;
- encouraging companies to provide examples of real technical documentation, workplace communication formats, and digital language use cases;
- facilitating internship and project opportunities in which students use English in digital professional environments.

To ensure long-term sustainability, policymakers should promote the development of national certification systems that assess and recognise digital language competence within higher education. These could take the form of micro-credentials, digital badges, or part of a broader graduate profile framework, linked to both academic transcripts and the national qualification register. Such recognition would help standardise quality, increase student motivation, and provide clear signals to employers.

Aligning these certification systems with international standards would facilitate student mobility and enhance Ukraine's participation in global academic and professional networks. By embedding certified digital language competence into national education benchmarks, Ukraine can foster a future-ready workforce equipped for the demands of the digital age.

Finally, policy must acknowledge the role of digital ESP training in Ukraine's post-war recovery and reintegration into the European community. By preparing graduates to work in international settings, contribute to cross-border infrastructure projects, and access global research and innovation networks, digital language competence becomes an enabler of economic rebuilding and resilience.

In all, aligning digital language training with national economic digitalisation goals requires a coordinated policy response – one that integrates curriculum reform, teacher development, institutional innovation, and public-private cooperation. By embedding these priorities into strategic documents, funding mechanisms, and accreditation systems, Ukraine can position itself not only as a consumer of global technologies, but as an active and competitive participant in the international digital economy.

Conclusion. In the rapidly evolving landscape of the global digital economy, the importance of integrating digital language competence into the professional training of future engineers can no longer be overstated. For students of power engineering in Ukraine, the ability to operate confidently in English across digital platforms is not simply an added advantage – it is a critical component of employability, innovation, and international collaboration. This chapter has examined the multifaceted role of English for Specific Purposes (ESP) within the context of digital transformation, highlighting how language competence intersects with technological fluency to shape the modern engineering professional. Through the use of digital tools such as Moodle, AI-based writing assistants, translation engines, technical glossaries, simulations, and case-based tasks, students gain [15] not only linguistic proficiency but

also valuable skills in digital communication, problem-solving, and autonomous learning.

Successful implementations at Ukrainian technical universities, backed by positive student feedback, underscore the practical relevance and transformative potential of digitally supported ESP instruction. Furthermore, prospects for cooperation with European educational platforms and the strategic alignment of digital language education with national policy objectives offer a roadmap for systemic, long-term progress. To fully realise this potential, universities must embrace a forward-looking vision supported by robust institutional policies, international partnerships, and investment in teacher development.

Ultimately, digital language competence is not merely a pedagogical goal – it is a strategic imperative for Ukraine's integration into the global knowledge economy. By embedding it within the fabric of technical education, Ukraine can empower a new generation of engineers to communicate, collaborate, and lead in an increasingly interconnected, digital world.

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