THEORY AND METHODS OF CULTIVATING ENGLISH LANGUAGE COMPETENCE AMONG FUTURE BACHELORS OF COMPUTER SCIENCE IN THE CONTEXT OF DISTANCE LEARNING

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Abstract

The relevance of this study is underscored by the imperative to cultivate professional English competence among IT students against the backdrop of education digitalization and market globalization. This article elucidates the findings from an investigation into the efficacy of distance learning methodologies in fostering English language competence among students specializing in "Computer Science" across Ukraine, Poland, and Kazakhstan. The purpose of the study was to determine the dynamics of various components of foreign language competence under the influence of targeted pedagogical interventions. The methodological framework included a pedagogical experiment involving both control and experimental groups (CG and EG), standardized testing, a paired t-test, an online questionnaire, and a content analysis of open-ended responses. The results showed statistically significant changes within the experimental groups ($p < 0.05$), with an improvement ranging from +21 to +23 points across all components. The beneficial effects of scaffolded materials, authentic communicative tasks, and intercultural interaction were demonstrated. The scientific novelty of this research lies in the synthesis of a component-based approach to evaluating language competence with the intercultural context inherent in distance learning. Prospects for further research are related to the adaptation of the proposed model to other fields of study and the examination of its implications within professional environments.

Keywords: English-language competence; Distance learning; Pedagogical experiment; Component approach; Intercultural communication.

TEORIA E MÉTODOS DE CULTIVO DA COMPETÊNCIA EM LÍNGUA INGLESA ENTRE FUTUROS BACHARELADOS EM CIÊNCIA DA COMPUTAÇÃO NO CONTEXTO DO ENSINO À DISTÂNCIA

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Resumo

A relevância deste estudo é sublinhada pelo imperativo de cultivar a competência profissional em inglês entre os estudantes de TI no contexto da digitalização da educação e da globalização do mercado. Este artigo esclarece os resultados de uma investigação sobre a eficácia das metodologias de ensino à distância na promoção da competência linguística em inglês entre estudantes especializados em "Ciência da Computação" na Ucrânia, Polónia e Cazaquistão. O objetivo do estudo foi determinar a dinâmica de vários componentes da competência linguística estrangeira sob a influência de intervenções pedagógicas direcionadas. O quadro metodológico incluiu uma experiência pedagógica envolvendo grupos controle e experimental (GC e GE), testes padronizados, um teste t pareado, um questionário on-line e uma análise de conteúdo das respostas abertas. Os resultados mostraram mudanças estatisticamente significativas dentro dos grupos experimentais (p < 0,05), com uma melhora variando de +21 a +23 pontos em todos os componentes. Foram demonstrados os efeitos benéficos dos materiais de andaimes, as tarefas comunicativas autênticas e a interação intercultural. A novidade científica desta pesquisa reside na síntese de uma abordagem baseada em componentes para avaliar a competência linguística com o contexto intercultural inerente ao ensino à distância. As perspectivas para futuras pesquisas estão relacionadas à adaptação do modelo proposto a outros campos de estudo e ao exame de suas implicações em ambientes profissionais.

Palavras-Chave: Proficiência em inglês; Ensino a distância; Experimento pedagógico; Abordagem por componentes; Comunicação intercultural.

TEORÍA Y MÉTODOS PARA CULTIVAR LA COMPETENCIA EN LENGUA INGLESA ENTRE LOS FUTUROS LICENCIADOS EN INFORMÁTICA EN EL CONTEXTO DE LA ENSEÑANZA A DISTANCIA

Resumen

La relevancia de este estudio es subrayada por el imperativo de cultivar la competencia profesional en inglés entre los estudiantes de TI en el contexto de la digitalización de la educación y la globalización del mercado. Este artículo explica los resultados de una investigación sobre la eficacia de las metodologías de aprendizaje a distancia en el fomento de la competencia del idioma inglés entre estudiantes especializados en "Ciencias de la Computación" en Ucrania, Polonia y Kazajstán. El objetivo del estudio era determinar la dinámica de los diversos componentes de la competencia en lenguas extranjeras bajo la influencia de intervenciones pedagógicas específicas. El marco metodológico incluyó un experimento pedagógico que involucró tanto a grupos de control como experimentales (GC y GE), pruebas estandarizadas, una prueba t emparejada, un cuestionario en línea y un análisis de contenido de respuestas abiertas. Los resultados mostraron cambios estadísticamente significativos

dentro de los grupos experimentales (p < 0,05), con una mejora que oscilaba entre +21 y +23 puntos en todos los componentes. Se demostraron los efectos beneficiosos de los materiales andamiados, las tareas comunicativas auténticas y la interacción intercultural. La novedad científica de esta investigación reside en la síntesis de un enfoque basado en componentes para evaluar la competencia lingüística con el contexto intercultural inherente a la enseñanza a distancia. Las perspectivas de investigación futura están relacionadas con la adaptación del modelo propuesto a otros campos de estudio y el examen de sus implicaciones en entornos profesionales.

Palabras clave: Competencia en inglés; Aprendizaje a distancia; Experimento pedagógico; Enfoque por componentes; Comunicación intercultural.

1. Introduction

The concept of foreign language communicative competence assumes a central role in contemporary methodologies of language instruction. Researchers delineate it as a comprehensive amalgamation of knowledge, skills, attitudes and experiences essential for understanding others and achieving communicative objectives in a foreign language. Moreover, foreign language competence is regarded as an integral personal and professional attribute of a specialist (Munkova et al., 2024). Domestic scholars emphasize that it constitutes an essential element of contemporary specialists' education, particularly within the domain of computer science (IT). In this discipline, proficiency in English is imperative for effective professional communication, scholarly literature processing, as well as participation in global initiatives.

The escalating significance of English as a medium for professional interaction, access to specialized resources, and collaborative endeavors in an international environment necessitates the targeted cultivation of English language competence among students pursuing IT specialties (Fidianingsih, 2025). At the same time, traditional methodologies of language instruction within higher education institutions frequently overlook the nuances of the professional context, intercultural engagement, and the rapidly evolving demands for communicative adaptability in the technological domain (Smakova and Paulsrud, 2020; Fandieieva, 2020). Particular attention should be devoted to the organization of an effective educational process in a remote or hybrid format, a concern that has gained prominence in the aftermath of the COVID-19 pandemic and amid the wartime conditions in Ukraine. A remote learning environment compels educators to adopt innovative approaches to content development, structuring the material, interactivity facilitation, and language immersion support.

In light of the aforementioned considerations, it is pertinent to explore and experimentally evaluate methodologies that harmonize a professional orientation (specifically in the IT sector), an intercultural dimension, scaffolded support for the educational process, and applicability in a distance-learning format. The scholarly novelty of such methodologies resides in the integration of a component analysis of foreign language competence (linguistic, discursive,

sociolinguistic, sociocultural, and strategic) with pedagogical strategies tailored to students' needs in computer-related disciplines. Despite the existence of a considerable body of literature in the domains of ESP (English for Specific Purposes) and CLIL (Content and Language Integrated Learning), research that amalgamates an intercultural perspective, digital flexibility, pedagogical intervention, and empirical validation of effectiveness across multiple countries remains insufficient. This is particularly salient for the nations of Eastern Europe and Central Asia, where the IT sector is burgeoning, yet language training does not always meet international standards. Taking these factors into account, the study aims to develop and assess the efficacy of distance methods for fostering English language competence among students of computer specialties in an international educational context.

The purpose of this study is to experimentally evaluate the efficacy of the author's distance methodology in cultivating English language proficiency among students specializing in Computer Science, particularly within the context of intercultural interaction. Research objectives are as follows: I) to ascertain the baseline level of English language proficiency among experimental group (EG) and control group (CG) students across three nations; II) to implement an experimental distance learning program, taking into account the component structure of language competence and intercultural context; and III) to analyze the dynamics of changes in language proficiency levels and assess the methodology effectiveness through a comprehensive evaluation of testing results and student reflections.

2. Literature review

The theoretical underpinnings of foreign language competence formation are anchored in the competence approach. Shandruk and Arkushina (2021), analyzing the evolution of the term "competence", elucidate the essence of cultivating foreign language communicative competence among students in non-language specialties. Bosa et al. (2025) agree with the expediency of employing an integrated approach and underscore that the historical development of the competence approach has established the groundwork for comprehending professional foreign language competence. Other scholars delineate the structure of this phenomenon. For instance, Drozdova and Rudnytska (2021) identified the content and structural components of foreign language competence (hereinafter referred to as CFC), which are pivotal for the advancement of didactic foundations for its cultivation. Iswati and Triastuti (2021) advocate for a clear structuring of this competence and emphasize that its components should be the focal point of intentional development within the educational process.

A consensus among numerous authors indicates that the effective cultivation of foreign language competence necessitates contemporary pedagogical methodologies that engage students and align learning with authentic communication contexts. Maican and Cocoradă (2021) substantiated the efficacy of project-based activities as a means of enhancing the

communicative competence of students in technical specialties, highlighting the significance of integrating linguistic and professional components. This perspective is further endorsed by Kohut (2022): after synthesizing recent theoretical literature, the scholar delineated promising avenues for adapting didactic principles to the particularities of various educational fields. This emphasis on the professional context resonates with Lourido-Badía's findings (2024). The researcher demonstrated the paramount importance of developing English for Specific Purposes (ESP) materials tailored to the nuances of specific disciplines, in particular sports sciences and psychology.

In the light of educational digitalization, Lee (2024) observes that the efficacy of online learning can rival that of traditional formats, provided that the needs of learners are duly considered. This reinforces the relevance of a contextual approach, that represents an amalgamation of linguistic and professional content, enhancing the motivation and practical significance of knowledge acquisition. Ptushka (2024) substantiates the feasibility of adapting CEFR standards for the training of prospective IT professionals, while Pamungkas (2023), Rahmawati et al. (2025), as well as Lourido-Badía (2024) emphasize the critical importance of contextualized and specialized ESP training. Maican and Cocoradă (2021) demonstrate the effectiveness of project-based activities in fostering communicative competence, whereas Kohut (2022) and Sutanto et al. (2022) draw attention to the adaptation of didactic principles and the pivotal role of educational leadership in the CLIL model's implementation.

As demonstrated by Fandeeva (2020), interactive technologies, in particular business games, multimedia, and Internet projects significantly enhance the development of foreign language communicative competence among students in technical disciplines. Her conclusions are corroborated by Kirovska-Simjanoska (2020) and Farmati et al. (2023), who substantiated the viability of a blended learning environment that amalgamates traditional and online methodologies, taking into account IT specificities. Such an environment invigorates students and enables them to simulate professional scenarios in a foreign language.

A critical prerequisite for cultivating foreign language competence is motivation and intercultural sensitivity. Notably, Holubnycha et al. (2021) underscore that without an appreciation of the cultural context, effective language acquisition remains unattainable, particularly within the IT sector, characterized by its interethnic interactions. The scholars highlight the necessity of incorporating international projects and diverse cultural content within the educational framework. At the same time, the study conducted by Klimova and Polakova (2021) and Povoroznyuk et al. (2022) elucidates the constraints inherent in remote learning formats. For example, students reported diminished motivation, a lack of face-to-face interaction, and challenges in speech development. Traditional, in-person learning is favored, as it fosters greater engagement and comprehension of the material.

The adverse aspects of emergency distance learning (hereinafter referred to as DL) were meticulously analyzed in studies by Turkish educators. For instance, having conducted interviews with would-be foreign language teachers,

Ergin et al. (2022), concluded that distance education is less efficacious for language acquisition in comparison to traditional pedagogies. Among the identified issues are the low quality of online materials, challenges in assessment, student passivity, inadequate methodological preparedness of educators, as well as the technical and psychological unpreparedness of students themselves for autonomous learning. Similar findings were obtained in the United States: according to a study by Adelson and Keen (2023), 83% of students deemed the online language learning experience to be less effective than face-to-face instruction, indicating a deficit in engagement and practice in oral language skills.

At the same time, certain researchers underscore the merits of distance and blended learning, provided that these modalities are meticulously orchestrated. Farmati et al. (2023) concluded that blended learning fosters language proficiency, affords flexibility, promotes autonomy, and encourages collaboration. Efficiency is markedly enhanced when in-person classes are skillfully supplemented by online activities, allowing students the opportunity to select a convenient pace and format for their learning. Nevertheless, the review alsohighlighted common challenges, such as a lack of self-discipline, procrastination, and technical difficulties, thereby indicating that outcomes are contingent upon individual circumstances. Furthermore, Al-Hammar and Elbakoush (2023) maintain that a well-considered course design (encompassing structure, interactivity, and feedback) can mitigate the deficiencies inherent in online learning. Innovative methodologies have proven particularly effective: the incorporation of interactive platforms, gamification elements, and project-based work has substantially enhanced student motivation and improved the learning outcomes.

A comprehensive literature review revealed that the cultivation of foreign language competence among IT students is perceived as a multifaceted challenge. There exists a consensus regarding its structure, components, and the necessity for adaptation to professional specificity. At the methodological level, interactive technologies, blended learning, and digital resources predominate. Despite the integration of innovations, researchers noted persistent difficulties: diminished motivation, a lack of face-to-face interaction, as well as the complexities associated with assessment. The least explored dimension of intercultural communication remains the interaction of students from diverse countries within the digital environment, with a notable scarcity of studies addressing this phenomenon.

3. Methods and materials

3.1. Research procedure

The study was conducted in the form of a pedagogical experiment, encompassing three stages: preparatory, formative, and final. The preparatory stage involved the selection of a sample, the diagnostics of the initial level of foreign language competence, and the adaptation of evaluative instruments to

accommodate a remote format. The formative stage spanned a duration of 12 weeks and encompassed training in accordance with the author's tailored English for Specific Purposes (ESP) curriculum, which covered 24 lessons (Table 1).

Table 1. The structure of the experimental ESP course "ProLang IT: English for Computer Science Specialists".

CLASSES	TOPIC OF THE LESSON	FORMAT	MAIN ACTIVITIES AND TASKS
1	Introduction. Course expectations. IT English: why?	Synchronous (Zoom)	Ice-breaking, course review, survey, mini-discussion
2	Basics of IT vocabulary: hardware and software	Asynchronous (Moodle)	Video + dictionary + terminology exercises
3	Operating Systems: Comparison	Synchronous	Group discussions, OS comparisons, MindMap
4	Vocabulary Quiz + Listening task	Asynchronous	Quiz + Listening (TechTalk podcast)
5	Work with user interfaces	Synchronous	UI/UX analysis, description of interface elements
6	Writing a User Manual	Asynchronous	Writing a short instruction for the program, peer-review
7	Commands in Git, repositories	Synchronous	Teamwork scenarios, dialogues
8	Vocabulary Builder: Version Control	Asynchronous	Glossary + interactive exercises (Quizlet)
9	Writing README.md	Synchronous	Analyzing examples, creating student's own README
10	Grammar Focus: Passive voice in documentation	Asynchronous	Theory + practice
11	Teamwork: Email & Chat communication	Synchronous	Role-playing games, email templates
12	Self-check + peer assessment	Asynchronous	Checking the material, mutual evaluation
13	Presentation of the IT product	Synchronous	Pitch structure, video analysis
14	Creating slides for presentation	Asynchronous	Google Slides + Vocabulary
15	Listening: IT Product Reviews	Synchronous	Working with YouTube videos + discussion
16	Listening Quiz + Reflection	Asynchronous	Test + filling out Google Forms
17	Prototyping and description of functionality	Synchronous	Figma (or Canva) tasks, activity descriptions
18	Writing: describing an app	Asynchronous	Working with the template
19	Preparation for the final task (FAQ + Dialogue)	Synchronous	Consultations, structuring the material

20	Grammar Revision: Modal verbs for advice	Asynchronous	Exercises, videos, self-test
21	Final lesson: defense of the mini-project	Synchronous	Presentations, feedback
22	Written part: IT FAQ	Asynchronous	Individual task
23	Post-test (language + ESP tasks)	Synchronous	Formal assessment
24	Questionnaire + reflection	Asynchronous	Google Form+ Short Essay

Source: Elaborated by the author (2025).

The proposed methodology provided for the purposeful use of digital tools in terms of developing each CFC. Table 2 shows the relationship between the platforms and the respective language goals.

Table 2. Impact of the utilized tools on CFCs

ONLINE TOOL	CFC	IMPACT
Moodle	Linguistic, strategic	Grammar, vocabulary testing, self-examination, task planning
Zoom	Discursive, sociolinguistic	Role-playing, discussions, presentations, real-time dialogues
Google Docs	Strategic, discursive	Collaborative editing of instructions, FAQs, app descriptions
Trello	Strategic, sociocultural	Organization of teamwork, distribution of responsibilities in multicultural teams
GitHub	Linguistic, sociolinguistic	Writing READMEs, technical instructions, communication in a professional environment
Figma/Canva	Sociocultural, discursive	Prototyping interfaces, presentations, description of culturally dependent design elements
Google Forms	Strategic	Reflection, self-assessment, mastering formulation patterns

Source: Elaborated by the author (2025).

The course was conducted in English, which is not the native language of the participating countries. Students possessed a basic level of English proficiency (A2–B1), a standard typically observed among Computer Science undergraduates. The assignments were international in nature, thereby independent of any specific national context.

To mitigate language barriers, scaffolded materials were employed, incorporating visual aids, subtitled videos, and contextual examples. All resources were presented in English, ensuring an equitable learning environment. Support was facilitated through asynchronous consultations with mentors via chats and forums, which further fostered immersion in the linguistic context. The methodology is grounded in competency-based, activity-oriented, and communicative approaches, catering to distance English for Specific Purposes (ESP) training tailored for students in IT specialties.

The objective of this methodology is to cultivate functional foreign language competence aligned with the specific needs of students within the information technology field: comprehending technical documentation, crafting professional texts, and engaging in digital environment in English. The course integrates ESP content, digital tools, and an intercultural framework to effectively develop the IT students' English-speaking competence. In Table 3, the characteristics of the innovative nature of the proposed educational model are delineated.

Table 3. The characteristics of the methodology's innovativeness

ASPECT	NOVELTY
Professional orientation	The course is designed specifically for students of the IT field, taking into account industry terminology and tasks.
Remote implementation	A single course platform for students from three countries provides an equitable environment and an authentic digital experience.
Intercultural component	The participation of students from diverse countries facilitates the creation of a multicultural language environment.
Digital collaboration	Utilizing GitHub, Trello, and Google Docs for collaborative pair and group endeavors serves as a simulation of authentic IT teams.
Adaptability	Scaffolded materials support students with different levels of language proficiency without translation.
Language immersion	The entire course is conducted in English, minimizing reliance on the native language – even in an online environment.
Evaluation	It combines external, internal and self-assessment of students' language production.

Source: Elaborated by the author (2025).

The final stage included post-testing, questionnaires and reflection surveys with further results' analysis.

3.2. Research methods

The following principal methods were employed in the study:

- A pedagogical experiment facilitated the assessment of the methodology's efficacy by juxtaposing the indicators of EG and CG across three countries.

- Quantitative methods, specifically statistical analysis, were utilized to process the results of Pre/Post-testing. A paired t-test was conducted, enabling the identification of statistically significant changes ($p < 0.05$) and the calculation of Cohen's coefficient. The evaluation of foreign language proficiency was conducted based on five essential components, which were adapted to the remote learning format in accordance with the CEFR recommendations. In developing the assessment tools, fundamental criteria for evaluating learning outcomes in the context of English for Specific Purposes (ESP) for IT industry professionals were considered.

- Content analysis of open-ended responses was employed to explore student reflections upon course completion, highlighting the categories and frequency of key themes.

- A questionnaire was designed, covering both closed and open-ended questions to elicit qualitative feedback regarding the course effectiveness.

3.3. Sample

The study involved 180 students pursuing a major in Computer Science across three nations – Ukraine, Poland, and Kazakhstan. From Ukraine, participants were from Alfred Nobel University and Ivan Franko National University of Lviv; from Poland – the University of Łódź and Wrocław University of Technology; and from Kazakhstan – Satpayev Kazakh National Technical University and Kazakh University of International Relations and World Languages. The total sample consisted of 60 students from each country. Within each country, experimental (n=30) and control (n=30) groups were formed. The selection criteria included: identical specialty, basic level of English proficiency (A2–B1), absence of participation in international programs, as well as access to digital resources. This sample size facilitated the reliability of statistical conclusions and enabled meaningful comparisons between the countries (Table 4).

Table 4. Study sample

COUNTRY	UNIVERSITY	GROUP	QUANTITY
Ukraine	Alfred Nobel University	Experimental	30
Ukraine	Ivan Franko National University of Lviv	Control	30
Poland	University of Łódź	Experimental	30
Poland	Wrocław University of Technology	Control	30
Kazakhstan	KazNTU	Experimental	30
Kazakhstan	Kazakh University of International Relations and World Languages	Control	30
Total			180

Source: Elaborated by the author (2025).

Note: all participants in the experimental groups completed only the distance English course tailored for IT specialties, developed by the authors of this study, irrespective of the overarching educational framework employed by their respective higher education institutions.

The selection of Ukraine, Poland, and Kazakhstan is predicated upon their shared academic traditions, the advancement of the IT sector, and the burgeoning necessity for professional proficiency in English. That being said, these nations exhibit notable disparities in their levels of digitalization, international integration, and the stability of their educational environments. This diversity of context serves to evaluate the methodology's adaptability and enhances the validity of the findings.

3.4. Tools

3.4.1. Tools for assessing foreign language competence

The evaluation of the development of foreign language competence was conducted in accordance with five key components as delineated by the CEFR (Table 5).

Table 5. Instruments for evaluating the development of foreign language competence.

COMPONENT	EVALUATION CONTENT
Linguistic	Test tasks in grammar, spelling, professional vocabulary
Discursive	Analysis of written and oral expressions (coherence, structure)
Sociolinguistic	Role situations, communicative scenarios in the professional environment
Sociocultural	Tasks for the interpretation of cultural norms, accompanied by videos featuring subtitles.
Strategic	Tasks for overcoming communication difficulties, using templates

Source: Elaborated by the author (2025).

The assessment was carried out twice (before and after the course) on a 100-point scale. Each participant's results were recorded broken down by the components, after which the average value for the groups was calculated.

3.4.2. Course implementation tools

The following tools were used to implement the course:
- Moodle – placement of materials, tests, forum
- Zoom – synchronous classes
- Google Forms – questionnaires, reflections
- Trello, GitHub – Teamwork
- Figma/Canva – project tasks

The methodology combined scaffolded materials, ESP content, digital collaboration, as well as an intercultural component.

4. Results and discussion

Following the main stages of the experimental study, which included the introduction of the author's innovative distance English language training program for students specializing in "Computer Science," the level of formation of foreign language competence was assessed. At this juncture, particular emphasis was placed on a comparative analysis of the outcomes between the experimental group (EG) and the control group (CG) across three nations. The pre- and post-intervention indicators facilitate an assessment of the methodology's impact on language education quality. The evaluation adhered to the standards set forth by the Common European Framework of

Reference for Languages (CEFR), with results presented on a 100-point scale. For the analysis, the average values of each subgroup were utilized (Table 6).

Table 6. Changes in CFC levels in EG and CG students in Ukraine, Poland and Kazakhstan (Pre/Post)

Group	Ling., Pre	Ling., Post	Discur., Pre	Discur., Post	Socioling., Pre	Socioling., Post	Sociocult., Pre	Sociocult., Post	Strat., Pre	Strat., Post
Ukraine										
EG	60	82	58	80	58	80	55	78	62	84
CG	61	65	59	64	59	64	56	62	60	66
Poland										
EG	62	85	60	83	60	83	58	81	64	86
CG	63	67	61	66	61	66	59	64	62	68
Kazakhstan										
EG	59	80	57	78	56	78	53	75	61	82
CG	60	64	58	63	58	63	54	61	59	65

Source: Elaborated by the author (2025).

As evidenced by the study findings, the linguistic component, encompassing proficiency in vocabulary, grammar, and spelling, exhibits the most pronounced advancement in the experimental group (EG) across all participating countries. Notably, the average score increase in Poland reached +23, while Ukraine recorded +22, and Kazakhstan +21 accordingly. In contrast, the control group (CG) achieved an average increase of +4 points. This disparity underscores the efficacy of systematically structured engagement with grammatical structures and lexical elements, facilitated through tailored exercises, assessments, and tasks aimed at the automation of linguistic material.

A remarkable enhancement across all communicative functional competencies (CFCs) was observed within the EG: discursive (+22–23 points), sociolinguistic (+22), sociocultural (+22–23), and strategic (+21–22). The highest results were noted in Poland, where there were favorable technical conditions and the guidance of mentors played a pivotal role. Conversely, the control groups displayed minimal progress (ranging from +5 to +7 points), highlighting the constrained effectiveness of traditional methodologies devoid of interactive support. The advancements in the EG can be attributed to the implementation of scaffolded materials, role-playing activities, authentic content, and structured feedback mechanisms.

Overall, the EG across all nations demonstrated a higher dynamics of improvement, particularly in Poland, a phenomenon correlated with stable educational conditions. The high results of Ukrainian students indicate the adaptability and efficacy of the employed methodology. To further substantiate

these findings, the Cohen effect coefficient (Cohen's d) was computed, illustrating the magnitude of the experimental methodology's influence on the enhancement of foreign language competence. The indicators are delineated separately for the experimental groups in each country (Table 7).

Table 7. Cohen's coefficient (Cohen's d) for experimental groups in three countries

COUNTRY	AVERAGE VALUE (PRE)	AVERAGE VALUE (POST)	COHEN'S COEFFICIENT (COHEN'S D)
Ukraine	58.6	80.8	9.06
Poland	60.8	83.6	10.75
Kazakhstan	57.2	78.6	7.57

Source: Elaborated by the author (2025).

A value of d > 0.8 signifies a substantial effect. In this study, the Cohen coefficient across all nations exceeds 7, indicating an extremely strong influence of the pedagogical methodology on the level of foreign language competence.

To assess the statistical reliability of the changes in the development of foreign language competence, a paired samples t-test was conducted for both the experimental group (EG) and the control group (CG) separately across three countries, namely Ukraine, Poland, and Kazakhstan. The following table delineates the t-statistics, corresponding p-values, and interpretations of significance levels (Table 8).

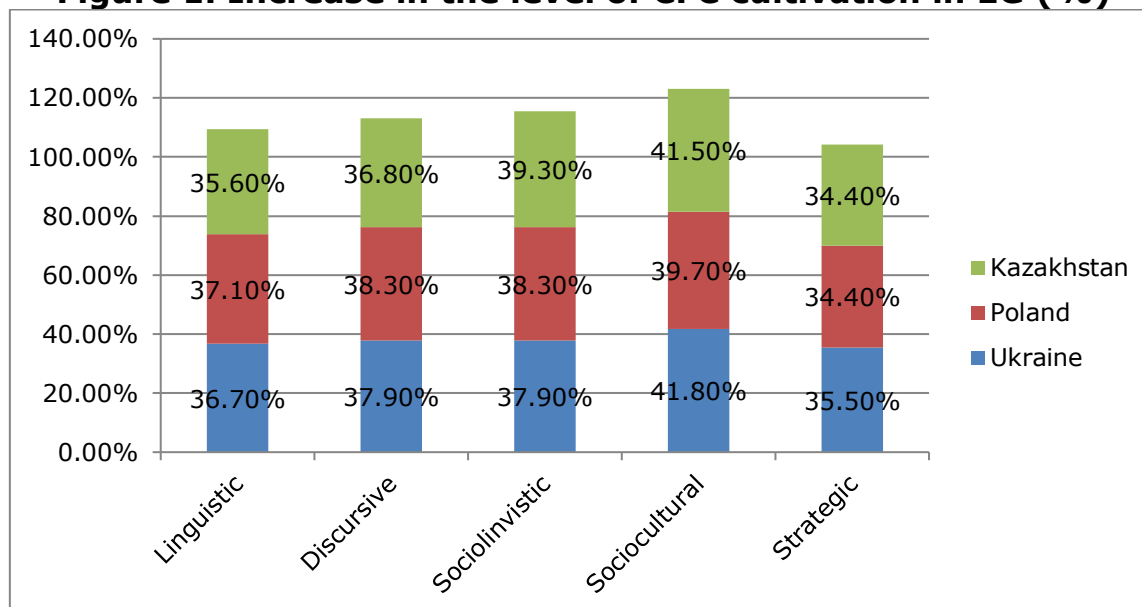**Table 8. T-test results for experimental and control groups**

COUNTRY	GROUP	T-STATISTICS	P-VALUE	SIGNIFICANCE LEVEL
Ukraine	ED	111.000	0.0000	p < 0.05
	CG	13.898	0.0002	p < 0.05
Poland	ED	114.000	0.0000	p < 0.05
	CG	15.811	0.0001	p < 0.05
Kazakhstan	ED	87.365	0.0000	p < 0.05
	CG	10.590	0.0004	p < 0.05

Source: Elaborated by the author (2025).

Note: despite the statistical significance of changes in CG, the growth rates in them were insignificant (within 5–7 points), which indicates the low practical effectiveness of the traditional approach compared to the experimental method.

The results demonstrated statistically significant changes in both groups (p < 0.05). However, the t-values in the experimental group were markedly higher, indicating a more pronounced effect. Coupled with a tangible increase in points, this substantiates the efficacy of the experimental methodology. In contrast, the changes observed in the control group were minimal and likely attributable to external factors rather than pedagogical influence. Figure 1 presents a comparative analysis of the increase in five key CFCs in the EG.

Figure 1. Increase in the level of CFC cultivation in EG (%)

Source: Elaborated by the author (2025).

The analysis of the results from experimental groups in Ukraine, Poland, and Kazakhstan substantiated the high efficiency of the developed methodology for distance ESP training tailored for students in computer disciplines. In all three nations, a substantial enhancement in the level of development across all CFCs was documented. Specifically, in Ukraine, the increases were as follows: linguistic component – 36.7%, discursive – 37.9%, sociolinguistic – 37.9%, sociocultural – 41.8%, strategic – 35.5%. In Poland, the most significant average increases were observed in the discursive and sociolinguistic components, each at 38.3%, followed by sociocultural – 39.7%, linguistic – 37.1%, and strategic – 34.4%. Kazakhstan also exhibited notable progress, particularly in the sociocultural component at 41.5%, sociolinguistic – 39.3%, discursive – 36.8%, linguistic – 35.6%, and strategic – 34.4%. Across all countries, the increase exceeded 34% for each component, underscoring the consistent positive impact of the author's methodology.

The most pronounced results were recorded in the sociocultural and discursive components, attributed to the implementation of authentic case studies, subtitled videos, role-playing exercises, and communicative tasks within an intercultural context.

The evaluation of students' responses gathered through online questionnaires, alongside a content analysis of open-ended questions, revealed several critical aspects that underscore the effectiveness of the proposed methodology for distance ESP learning (Table 9).

Table 9. Analysis of EG students' reflections on the effectiveness of the proposed DL methodology of ESP learning in the context of interlingual and intercultural communication

CATEGORY	%	INTERPRETATION IN THE CONTEXT OF RESEARCH	TYPICAL STUDENT QUOTES
Understanding of professional terminology (IT)	84%	Owing to the course, students have adeptly acquired the essential vocabulary requisite for effective communication within the IT environment.	"I couldn't explain what a pull request is, but now I know how to say it in English"
Improving professional correspondence and technical writing skills	81%	Tasks such as README, FAQ, instructions contributed to the development of skills necessary for real IT communication.	"I learned to write technical instructions in English, like in GitHub".
Efficiency of scaffolded materials	77%	The prompt materials contributed to better understanding, especially for students with an A2 level.	"Subtitled videos and templates are the best I ever had".
Real immersion in an English-speaking environment (full teaching in English)	72%	Students note that studying entirely in English contributed to overcoming the language barrier.	"It was difficult at the beginning, but full immersion gave a breakthrough - the brain got used to English".
Progress in interlingual communication in a professional context	68%	Students have become more confident in communicating on IT topics with peers from other countries.	"I can explain a task or a mistake in English, and they understand me – this is a new level".
Formation of intercultural sensitivity	61%	Working in an international environment helped to better understand the peculiarities of language etiquette and communication.	"I didn't know that Poles rarely write Hello in letters – it's interesting to see these differences". "Kazakh students always wrote 'Respected teacher' and it looked very polite". "I was surprised that Ukrainian students often put a lot of emojis in work chats, I'm not so used to it".
Motivation to learn the language	70%	Students highly appreciated the tasks practicality and	"It was not just an English course, but

through professional content		relevance related to the future profession.	really an English course for programmers".
Improvement of communication strategies (strategic component)	63%	The skills of detours, explanation of complex concepts, the use of templates and schemes were acquired.	"When I didn't know the word, I could explain differently, show a screenshot – it helped to communicate".
Technical flexibility and accessibility of the learning environment	66%	Moodle/Zoom were rated as user-friendly platforms, although some students ran into technical difficulties (connections, file format).	"It's convenient that everything is collected in Moodle, but sometimes the video would not load".
International interaction as a factor in confidence growth	58%	The participation of students from different countries strengthened their readiness to work in international teams.	"This is a mini-version of real international cooperation – this is how it should be in IT".
Psycho-emotional resilience and self-discipline	47%	DL requires autonomy, which was a challenge, but at the same time an incentive.	"It was difficult to make myself sit down for a task, but deadlines and structure helped".

Source: Elaborated by the author (2025).

Most students underscored the necessity of enhancing their professional technical writing competencies, grasping IT terminology in English, and cultivating interlingual communication within a professional context. The integration of scaffolded materials and comprehensive language immersion, which emerged as pivotal success factors, received considerable acclaim. A substantial portion of the respondents acknowledged the beneficial influence of intercultural interactions with foreign counterparts, which fostered the development of intercultural sensitivity and preparedness for collaboration in international teams. At the same time, some challenges were noted regarding self-discipline, technical impediments, and the deficiency of authentic oral communication.

The issue of inadequate foreign language proficiency among bachelor degree students in computer science is relevant not only to the students themselves but also to educators and employers. Proficiency in English language markedly enhances academic performance and employment opportunities for graduates within IT disciplines (Ishchenko et al., 2022). However, mastering a professional foreign language in non-linguistic institutions of higher education often proves challenging, particularly in the context of DL. Our study aimed to address this problem by developing the "ProLang IT" DL program and juxtaposing the results obtained with data from other studies conducted between 2020 and 2025, thereby facilitating an evaluation of the novelty and efficacy in terms of the proposed methodology.

The experimental findings revealed a substantial enhancement in the level of professional foreign language competence, exceeding the results of prior research. For instance, only 5.8% of students attained a high level in the study conducted by Kaldarova et al. (2024), while Zhaiykbay et al. (2024) identified a lack of motivation attributable to the general nature of English for Specific Purposes (ESP) courses. In our program, these shortcomings are eliminated due to the content specifically tailored to the IT sector. The data obtained corroborate the effectiveness of the professional component and the superiority of the targeted approach. Furthermore, consistent with other studies, the beneficial impact of contemporary digital platforms on the quality of language training was substantiated. Akhmetova et al. (2023), using Kazakh material, demonstrated that the integration of traditional instruction with Massive Open Online Courses (MOOCs) in English for technical disciplines yields superior outcomes compared to conventional classroom training. Our findings confirm this: in particular, the online program facilitated enhanced acquisition of professional vocabulary and communication skills. At the same time, we addressed the limitations identified in MOOC studies, particularly the lack of live interaction (Yang and Yang, 2022).

In our course, this challenge was addressed through collaborative projects and systematic feedback, which facilitated the effective integration of CLIL in a remote format. Our research is characterized by a holistic approach to the enhancement of all facets of foreign language competence within a professional context, whereas prior studies predominantly concentrated on individual aspects. For instance, Simanjuntak (2021) demonstrated the efficacy of MALL for acquiring terminology but highlighted certain limitations pertaining to the deficiency of interaction. We concur with the researcher's findings and extend them. Our course amalgamates mobile learning technologies with dynamic communication (feedback, paired tasks, discussions), thereby fostering advancement in both receptive and productive skills. Our methodology resonates with the conclusions of Ropa and Malahova (2023), who emphasize that the online format is conducive to vocabulary expansion and reading comprehension, while grammar and speaking necessitate supplementary support. In our course, these considerations were taken into account: synchronous training sessions and mentoring consultations played a pivotal role in the comprehensive development of linguistic skills. In light of the above, a blended approach was instituted that synthesizes the merits of both online and face-to-face interaction, which is a model that is actively implemented by leading universities worldwide.

Special attention must be paid to the alignment of course content with professional needs. According to a study conducted by Nurmetov et al. (2023), students pursuing IT disciplines necessitate coursework that emphasizes professional vocabulary and adept communication skills. These requisites were addressed in the "ProLang IT" program, which was developed based on a comprehensive analysis of the target audience's needs and incorporated typical communicative scenarios reflective of the authentic IT environment. This approach not only facilitated the enhancement of language competence but has also bolstered students' confidence in their professional interactions. Basically, our methodology aligns with the conclusions of Walenta et al. (2024), which

underscore the significance of a student-centric orientation in English Medium Instruction (EMI) courses.

An important condition for DL efficacy is the integration of psychological and pedagogical considerations. As demonstrated by Farneste and Apse (2021), students appreciate the flexibility afforded by the online format yet express dissatisfaction regarding the insufficiency of feedback. Our empirical observations corroborated these findings. Thus, participants in ProLang IT required continuous support, prompting the course to include weekly Q&A sessions, forums, and detailed reviews. This strategy alleviated feelings of isolation and increased motivation. Furthermore, the sociocultural context was taken into account: through group projects and discussions about the cultural characteristics of IT, we fostered student cohesion even within the context of DL. The said approach resonates with the insights of Kassymova et al. (2021) regarding the pivotal role of the interpersonal environment in the development of language competence.

4.1. Limitations of the study

The overriding limitation of the study is the influence of external factors (in particular, military operations in Ukraine), which could affect the participants' psychological state and their involvement in the educational process. In addition, the results of the experiment could potentially be influenced by the difference in digital literacy level of students from different countries, since DL effectiveness is largely contingent on the ability to work with educational platforms, online tools and digital resources. Additionally, a factor that could amplify the positive outcomes in the experimental groups is the provision of continuous support from mentors throughout the course. Such mentorship could serve as a crucial motivational and organizational resource, which is not always accessible in conventional educational settings. All of these considerations should be taken into account when contemplating the scaling of the methodology or its application in alternative contexts.

4.2. Recommendations

It is expedient to focus further research on adapting and scaling the author's methodology onto other technical specialties.

4.3. Practical application of the proposed methodology

The proposed methodology can be adeptly applied across various educational contexts:

1. Bachelor training in IT specialties within higher education institutions, both in Ukraine and abroad, both domestically and internationally, facilitated by tailored ESP content, authentic tasks, and scaffolded support.

2. Blended learning, due to the fact that the course amalgamates synchronous and asynchronous interactions, thus fostering both autonomy and dynamic communication.

3. Adaptation to other technical disciplines (electronics, engineering, cybersecurity), achieved by substituting IT content with relevant professional material.

4. Development of ESP instructors as a paradigm exemplifying the successful integration of intercultural, digital, and interactive approaches.

5. Online courses for professionals, considering the potential for self-directed learning and flexible access to resources within Moodle.

5. Final considerations

The study corroborated the efficacy of the author's DL methodology in English for Specific Purposes (ESP) tailored for IT students within an international context. In a cohort of 180 participants from Ukraine, Poland, and Kazakhstan, a notable enhancement in foreign language proficiency was registered across all five components. The Student's t-test ($p < 0.05$) validated the significance of the observed changes, while student reflections attested to the high regard for the course and its practical relevance.

The scientific novelty of this study resides in the development and empirical validation of a comprehensive distance methodology aimed at cultivating professional foreign language competence among students in the IT sector. The applied innovative approach amalgamates the ESP framework, scaffolded materials, an intercultural environment, and professionally oriented tasks. The practical implications of this research extend to the direct application of the proposed curriculum in higher education institutions for bachelor training in technical disciplines, utilizing either a distance or blended learning format. Furthermore, there exists substantial potential for the scalability of this methodology across other fields where English serves as a key instrument for professional communication.

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