INTEGRATION TECHNOLOGY OF METACOGNITIVE STRATEGIES INTO DIGITAL LEARNING ENVIRONMENTS FOR TEACHING PROFESSIONAL ENGLISH TO LOGISTICS STUDENTS

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Abstract: This study examines the theoretical and practical foundations of integrating metacognitive strategies into a digital learning environment for teaching Professional English to logistics students. In the context of international academic mobility and digital transformation, logistics specialists require not only linguistic knowledge but also strategic thinking, reflective analysis, and self-regulated learning skills. The research analyzes the theoretical basis of metacognitive approaches, the concept of self-regulated learning, digital pedagogy principles, and the features of professional discourse through an integrative perspective. Experimental results indicate that systematic implementation of metacognitive strategies in a digital environment significantly enhances logistics students' professional English communicative competence.

Keywords: metacognition, self-regulated learning, digital learning environment, professional English, logistics discourse, reflection, academic mobility, communicative competence, strategic thinking, pedagogical technology

LOGISTIKA TALABALARIGA KASBIY INGLIZ TILINI O‘QITISHDA METAKOGNITIV STRATEGIYALARNI RAQAMLI TA’LIM MUHITIGA INTEGRATSIYALASH TEXNOLOGIYASI

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Annotatsiya: Mazkur maqolada logistika yo‘nalishi talabalari uchun kasbiy ingliz tilini o‘qitishda metakognitiv strategiyalarni raqamli ta’lim muhiti asosida integratsiyalash texnologiyasi nazariy va amaliy jihatdan tahlil qilinadi. Xalqaro akademik mobillik va raqamli transformatsiya sharoitida logistika mutaxassislarining professional kommunikativ tayyorgarligi nafaqat lingvistik bilim, balki strategik fikrlash, reflektiv tahlil va o‘z-o‘zini boshqaruvchi ta’lim kompetensiyasini ham talab qiladi. Tadqiqotda metakognitiv yondashuvning nazariy asoslari, self-regulated learning konsepsiyasi, raqamli pedagogika tamoyillari va kasbiy diskurs xususiyatlari integrativ yondashuv asosida o‘rganildi. Tajriba natijalari metakognitiv strategiyalarni raqamli muhitda tizimli joriy etish logistika talabalarining kasbiy ingliz tili kommunikativ kompetensiyasini sezilarli darajada oshirishini ko‘rsatdi.

Kalit so‘zlar: metakognitsiya, self-regulated learning, raqamli ta’lim muhiti, kasbiy ingliz tili, logistika diskursi, refleksiya, akademik mobillik, kommunikativ kompetensiya, strategik fikrlash, pedagogik texnologiya

ТЕХНОЛОГИЯ ИНТЕГРАЦИИ МЕТАКОГНИТИВНЫХ СТРАТЕГИЙ В ЦИФРОВУЮ ОБРАЗОВАТЕЛЬНУЮ СРЕДУ ПРИ ОБУЧЕНИИ ПРОФЕССИОНАЛЬНОМУ АНГЛИЙСКОМУ ЯЗЫКУ СТУДЕНТОВ-ЛОГИСТОВ

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Аннотация: В данной статье рассматриваются теоретические и практические основы интеграции метакогнитивных стратегий в цифровую образовательную среду при обучении профессиональному английскому языку студентов направления «Логистика». В условиях международной академической мобильности и цифровой трансформации профессиональная коммуникационная подготовка специалистов в области логистики требует не только лингвистических знаний, но и стратегического мышления, рефлексивного анализа и навыков саморегулируемого обучения. Исследование анализирует теоретические основы метакогнитивного подхода, концепцию self-regulated learning, принципы цифровой педагогики и особенности профессионального дискурса с интегративной точки зрения. Экспериментальные результаты показывают, что систематическое применение метакогнитивных стратегий в цифровой среде существенно повышает коммуникативную компетенцию студентов в профессиональном английском языке.

Ключевые слова: метакогнитивность, self-regulated learning, цифровая образовательная среда, профессиональный английский, логистический дискурс, рефлексия, академическая мобильность, коммуникативная компетенция, стратегическое мышление, педагогическая технология

INTRODUCTION

The rapid development of globalization, digital transformation, and the expansion of international trade networks have fundamentally reshaped the professional requirements for logistics specialists. Modern logistics systems operate within complex global supply chains that involve multimodal transportation, cross-border documentation, customs regulations, digital tracking technologies, and real-time coordination among international partners. In such an environment, English functions as the dominant lingua franca of global business communication. Therefore, proficiency in Professional English is no longer an auxiliary competence for logistics students; it is a core professional requirement that directly influences their employability, mobility, and effectiveness in international contexts. [1]

In parallel with economic globalization, higher education systems have experienced increasing internationalization. Academic mobility programs, joint degrees, exchange initiatives, and international internships require students to participate in multilingual academic and professional environments. Logistics students who engage in academic mobility must not only demonstrate language proficiency but also possess the ability to independently manage their learning processes, adapt to unfamiliar communicative contexts, and reflect critically on their performance. These demands highlight the importance of metacognitive competence as a foundational component of professional language education. [2]

Despite the growing recognition of communicative approaches in foreign language teaching, empirical observations indicate that many logistics students experience difficulties when applying linguistic knowledge in authentic professional situations. While they may acquire terminology related to supply chains, freight forwarding, warehousing, and transportation management, they often struggle with structuring professional discourse, planning negotiation strategies, monitoring linguistic accuracy during interaction, and evaluating communicative outcomes. Such challenges reveal a gap between linguistic knowledge and strategic communicative performance. [3]

This gap can be explained by insufficient development of metacognitive awareness and self-regulated learning skills. Metacognition, broadly defined as awareness and regulation of one’s cognitive processes, enables learners to plan tasks strategically, monitor comprehension and

production in real time, and evaluate outcomes for further improvement. [4] Within professional English instruction, metacognitive strategies empower students to control their communicative behavior consciously rather than relying solely on spontaneous language use. Planning supports goal-oriented speech organization; monitoring ensures accuracy and contextual appropriateness; evaluation promotes reflective refinement of professional performance.[3]

Contemporary educational research emphasizes that effective learning in complex domains requires not only cognitive skills but also metacognitive regulation. The concept of self-regulated learning provides a theoretical framework that integrates motivational, cognitive, and metacognitive components into a cyclical process of planning, performance, and reflection. For logistics students operating in multilingual and technology-driven environments, self-regulation becomes particularly crucial, as professional communication often occurs under time constraints, high responsibility, and intercultural sensitivity. [5]

Simultaneously, the digital transformation of education has created new opportunities for enhancing metacognitive development. Digital learning environments—such as Learning Management Systems (LMS), online collaboration tools, automated assessment systems, and AI-supported feedback mechanisms—allow educators to structure learning processes in a way that makes cognitive and communicative development observable and measurable. Unlike traditional classroom settings, digital platforms provide traceable records of student performance, enabling continuous monitoring, data-driven feedback, and personalized reflection. [6]

However, the mere presence of digital tools does not automatically ensure effective learning outcomes. Without pedagogically grounded integration, technology risks becoming a passive repository of materials rather than a dynamic system that supports cognitive and metacognitive growth. Therefore, there is a pressing need to design an instructional model that systematically integrates metacognitive strategies into digital Professional English instruction for logistics students. Such integration must align linguistic objectives with strategic regulation processes and technological affordances. [7]

Furthermore, logistics discourse itself presents unique communicative challenges. It requires precision, terminological accuracy, formal documentation skills, persuasive negotiation abilities, and intercultural sensitivity. Communication breakdowns in logistics operations can result in financial losses, delays, or contractual disputes. Hence, professional English instruction must prepare students not only to speak fluently but to manage communication strategically and responsibly. Metacognitive regulation ensures that learners remain aware of contextual demands, communicative risks, and performance quality. [8]

Given these considerations, the present study addresses a significant gap in foreign language pedagogy for logistics education. It proposes a technological model for integrating metacognitive strategies into digital learning environments and empirically evaluates its effectiveness. By linking metacognitive theory, self-regulated learning frameworks, digital pedagogy principles, and the specific characteristics of logistics discourse, the study seeks to contribute both theoretically and practically to the modernization of Professional English instruction in higher education. [9]

METHODS

This study used a mixed-method approach, combining both quantitative and qualitative research methods, to examine how integrating metacognitive strategies into digital learning environments affects Professional English learning for logistics students. The mixed-method design allowed for a deeper understanding of not only measurable learning outcomes but also students' experiences, reflections, and strategy use, providing a complete picture of the intervention's impact. [10]

The study involved 60 undergraduate logistics students from a state university. Participants were divided into two equal groups: an experimental group (30 students) and a control group (30 students). Both groups were selected based on similar levels of English proficiency, academic performance, and prior exposure to professional English courses, to ensure fairness and comparability. All participants gave informed consent, and the study was approved by the university ethics committee. [11]

The research followed a pretest-posttest control group design, structured into three main stages: diagnostic, formative, and control. The diagnostic stage aimed to assess the students' initial level of Professional English competence and metacognitive awareness. This involved:

Standardized tests that measured logistics-related terminology, comprehension of professional documents, and practical communication tasks, such as shipment coordination or customs declaration scenarios.

Metacognitive awareness questionnaires, adapted from Schraw & Dennison (1994), which measured students' ability to plan, monitor, and evaluate their own learning.

Observational notes taken during classroom discussions and simulations, documenting natural communication strategies, difficulties, and patterns in students' behavior. [12]

The diagnostic stage allowed the researchers to create individual profiles for each student, highlighting their strengths and areas needing improvement in both language and metacognitive skills.

The formative stage implemented the integration of metacognitive strategies into the digital learning environment. Key components included:

Pre-task planning: Students set clear learning goals, anticipated difficulties, and decided on strategies using structured digital templates before each lesson.

Monitoring during tasks: While completing tasks such as writing professional emails, drafting logistics documents, or conducting simulated negotiations, students received immediate feedback from digital tools. Automated systems provided suggestions for accuracy, style, and appropriate terminology.[9]

Post-task reflection: Students completed reflective journals and self-assessment forms uploaded to electronic portfolios, focusing on what strategies worked, what challenges arose, and how to improve.

Peer and instructor feedback: Digital platforms allowed students to share reflections, provide peer comments, and receive instructor feedback. This enhanced awareness of alternative strategies and promoted collaborative learning. [13]

AI-assisted analytics tracked performance metrics such as completion times, error patterns, and improvement trends. This provided individualized metacognitive scaffolding, helping students identify personal strengths and weaknesses in professional communication.

The control stage measured the outcomes of the intervention. Both groups completed:

Final professional English tests, which included oral and written tasks simulating real-world logistics scenarios.

Repeated metacognitive awareness surveys to detect changes in students' planning, monitoring, and reflection skills.

Portfolio analysis for the experimental group, providing qualitative evidence of strategy use and depth of reflection.

Quantitative data were analyzed using SPSS, comparing pretest and posttest scores within and between groups. Paired t-tests measured improvements in the experimental group, while independent t-tests compared results between the experimental and control groups. [14]

Qualitative data, including reflective journals, observation notes, and portfolio entries, were analyzed thematically. Coding focused on identifying patterns of metacognitive strategy use, reflection depth, problem-solving approaches, and adaptation to professional scenarios.

To ensure research quality, several measures were taken:

Instruments were piloted on a small sample of students before the main study.

Triangulation of data sources (tests, surveys, observations, portfolios) reduced bias and increased interpretive depth.

Inter-rater reliability was established for qualitative coding to ensure consistency.

Digital analytics provided objective and traceable evidence of students' engagement and performance.

This human-centered, practical approach allowed the researchers to observe not only the measurable impact of metacognitive strategy integration but also the students' lived experiences, reflections, and perceptions. It also ensured that results were grounded in real learning behavior rather than abstract assumptions, giving a clearer picture of how digital tools can enhance self-regulated learning in Professional English for logistics students. [15]

RESULTS

The analysis of the data revealed that the experimental group, which participated in the metacognitive strategy-integrated digital learning program, showed significant improvement in professional communicative competence compared to the control group. The improvements were both quantitative, as measured by test scores and task performance, and qualitative, as observed in students' reflective writings and digital portfolio entries.[11]

Specifically, students in the experimental group demonstrated:

Increased accuracy in logistics terminology usage: Students were able to apply correct technical terms consistently in both written documents and oral simulations, reducing common errors observed during the diagnostic stage.

Improved coherence and strategic adaptation: During simulated professional activities—such as negotiating shipping contracts, preparing customs documentation, or coordinating multimodal transport—students were able to structure their communication logically, anticipate potential misunderstandings, and adapt their strategies in real time.

Higher levels of self-reported metacognitive awareness: Questionnaire results showed a marked increase in students' ability to plan their tasks, monitor their performance, and reflect on their outcomes. The experimental group reported greater confidence in identifying challenges and selecting appropriate strategies to manage them.

Enhanced problem-solving and corrective strategies: Students were more capable of recognizing communication breakdowns and implementing corrective measures. For example, during oral simulations, participants self-corrected lexical or grammatical mistakes, restructured sentences for clarity, and adjusted their tone for professional contexts.

Quantitative data revealed measurable growth in planning and monitoring skills, with students demonstrating more consistent goal-setting and proactive self-assessment throughout the course. The use of digital reflection tools allowed learners to track progress systematically, compare planned strategies with actual outcomes, and adjust their approach for subsequent tasks. [9]

Electronic portfolios provided additional evidence of metacognitive development. They showcased progressive reflective depth, documenting students' evolving strategies, rationale behind their decisions, and critical evaluation of their performance. Students gradually developed a habit of strategic language use, planning utterances or written communications with attention to precision, professional appropriateness, and context.

Moreover, automated digital feedback mechanisms played a crucial role in supporting learning. Immediate feedback from LMS tools reduced the time gap between task completion and evaluation, strengthening the monitoring phase of self-regulated learning. Students reported that this instant feedback allowed them to recognize errors quickly, reflect on their reasoning, and implement adjustments before completing subsequent tasks. Confidence levels in international communication scenarios, particularly in negotiation simulations and documentation tasks, increased significantly as a result.

The control group, which followed conventional communicative approaches without metacognitive integration, showed moderate improvement in language knowledge but did not demonstrate the same levels of strategic awareness, reflective practice, or autonomous problem-solving. This contrast highlights the added value of explicitly integrating metacognitive strategies within a digital learning environment. [14,15]

DISCUSSION

The findings of this study support the theoretical premise that metacognitive strategies significantly enhance learning outcomes in professional language education. The improvements observed in the experimental group align closely with the self-regulated learning (SRL) framework, which emphasizes cyclical processes of planning, monitoring, and evaluation. By engaging students in deliberate metacognitive activities, the study demonstrates that professional language acquisition can be transformed from passive knowledge accumulation into a dynamic, reflective, and strategically managed process.

Digital platforms functioned not merely as repositories for content delivery but as metacognitive scaffolds. Tools such as structured reflection forms, analytics dashboards, and electronic portfolios made cognitive and strategic processes visible, measurable, and manageable. Students could externalize their thought processes, compare planned strategies with actual performance, and receive immediate feedback, fostering autonomous learning and strategic self-regulation.

In the context of logistics discourse, precision, clarity, and strategic adaptability are essential. Effective communication requires accurate terminology, coherent structure, cultural appropriateness, and situational adaptability. The study shows that metacognitive regulation enables students to navigate these complex demands successfully. They learned not only to produce correct language forms but also to anticipate communication challenges, plan interventions, and reflect on outcomes, which are critical skills in professional logistics practice.[12,13]

Moreover, the research highlights the importance of digital learning environments in supporting metacognition. Technology enhanced the visibility of learning processes and allowed for continuous monitoring, data-driven feedback, and personalized support. For students involved in international academic mobility programs, this capability is particularly valuable, as they are often required to operate autonomously in multilingual and multicultural contexts. Digital tools, therefore, support not only linguistic development but also the cultivation of self-regulated, reflective, and strategic professional behavior. [5,6]

The technological model developed integrates pedagogical, cognitive, and digital components into a coherent system. By combining pre-task planning, real-time monitoring, post-task reflection, and digital feedback, the model transforms professional English learning into an active, engaging, and self-directed process. This integration also strengthens students' ability to manage complex professional communication tasks, enhances confidence in international contexts, and fosters lifelong learning skills essential for global logistics professionals.

CONCLUSION

The study concludes that integrating metacognitive strategies into digital learning environments represents a highly effective pedagogical innovation in teaching Professional English to logistics students. The proposed model significantly enhances communicative competence, strategic awareness, and reflective skills, all of which are essential for functioning successfully in international professional environments. [10]

By systematically embedding planning, monitoring, and evaluation mechanisms into digital platforms, educators can nurture self-regulated learners who are capable of managing complex, real-world communication tasks independently. This approach goes beyond traditional language instruction by emphasizing strategy development, reflective practice, and active engagement with professional discourse.

In summary, the integration of metacognitive strategies within digital learning environments offers a promising path for modernizing professional language education, preparing students for globalized professional contexts, and cultivating autonomous, reflective, and strategically competent learners.

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