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ELT in Pharmaceutical Education: Integrating Language Skills with Research and Drug Delivery Studies

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Abstract
English has become the dominant medium of instruction, research dissemination, and professional communication in pharmaceutical education worldwide. Proficiency in English is therefore essential not only for academic success but also for effective participation in global pharmaceutical practice. However, a persistent gap exists between students' technical knowledge and their ability to communicate that knowledge clearly and accurately in English. This disconnect often limits learners' performance in academic writing, presentations, patient communication, and professional documentation. The present study aims to examine the relationship between English language proficiency and technical competence among pharmacy students, and to identify specific linguistic challenges that hinder their academic and professional communication. The study adopts a mixed-method approach, combining quantitative data from proficiency assessments and academic performance scores with qualitative insights gathered through surveys, interviews, and classroom observations. Preliminary findings suggest that while students may demonstrate adequate conceptual understanding of pharmaceutical subjects, many struggle with domain-specific vocabulary, coherence in writing, and confidence in oral communication. These limitations can negatively impact both learning outcomes and employability. The study highlights the need for integrating English Language Teaching (ELT) with discipline-specific content, advocating for a more contextualized and needs-based approach such as English for Specific Purposes (ESP). The findings have important implications for curriculum design, suggesting that targeted language support within pharmaceutical education can enhance both communicative competence and overall academic success.
Keywords:English Language Proficiency, Pharmaceutical Education, Technical Communication, English for Specific Purposes (ESP), Academic Writing Skills, Communication Competence

1.Introduction

English functions as the primary language of communication in the global pharmaceutical industry, shaping how knowledge is created, shared, and applied across borders [1]. From multinational collaborations to regulatory submissions, English enables scientists, researchers, and healthcare professionals to engage in a unified discourse. Organizations such as the World Health Organization and regulatory bodies like the U.S. Food and Drug Administration rely heavily on English for documentation, guidelines, and international coordination. As a result, pharmacy graduates are expected not only to possess strong technical knowledge but also to communicate effectively in English within diverse professional contexts.Communication plays a critical role in key pharmaceutical processes, including research, clinical trials, and drug delivery systems [2]. In research, clarity in writing is essential for publishing findings, securing funding, and contributing to scientific advancement. During clinical trials, precise communication ensures ethical compliance, accurate data recording, and effective collaboration among multidisciplinary teams [3]. Similarly, in drug delivery systems, professionals must convey complex information regarding dosage, administration routes, and patient safety in a clear and accessible manner. Ineffective communication in these areas can lead to misunderstandings, reduced efficacy, or even serious health risks.Despite the recognized importance of English, pharmacy students often face multiple challenges in acquiring the necessary language skills. One major difficulty lies in mastering technical vocabulary, which is often dense, specialized, and derived from Latin or Greek roots [4]. Students may understand concepts theoretically but struggle to articulate them accurately in English. Academic writing presents another significant hurdle, particularly in structuring research papers, maintaining coherence, and adhering to formal conventions. Additionally, many learners lack confidence in oral communication, which affects their ability to deliver presentations, participate in discussions, or interact with patients and healthcare professionals effectively. These challenges highlight a critical need to integrate English Language Teaching (ELT) with subject-specific learning in pharmaceutical education. Traditional language instruction, which often focuses on general English, may not adequately address the specialized needs of pharmacy students [5]. Approaches such as English for Specific Purposes emphasize contextualized learning, where language skills are developed in alignment with disciplinary content. By incorporating real-life tasks such as writing lab reports, analyzing case studies, and simulating patient interactions, educators can create more meaningful and relevant learning experiences [6].The present study is guided by the following objectives: to examine the extent to which English language proficiency influences academic and professional performance in pharmaceutical education; to identify specific linguistic challenges faced by pharmacy students; and to explore effective strategies for integrating language instruction with technical coursework. Accordingly, the study seeks to answer the following research questions: (1) What is the relationship between English proficiency and students' technical competence in pharmacy? (2) What are the key language-related difficulties encountered by pharmacy students? (3) How can ELT approaches be adapted to better support subject-specific communication needs in pharmaceutical education?

2. Literature Review: Research in English for Specific Purposes highlights the importance of aligning language instruction with disciplinary needs in pharmaceutical education. Studies show that learners often struggle with technical vocabulary, academic writing, and oral communication despite strong subject knowledge. Scholars emphasize integrating language learning with content through task-based and contextual approaches. Work on Content and Language Integrated Learning further supports combining subject teaching with language development to improve comprehension and communication. Overall, literature indicates that targeted language support enhances both academic performance and professional readiness in pharmacy students.

2.1 English Language Teaching (ELT) in Higher Education: English Language Teaching (ELT) in higher education has undergone significant transformation over the decades, evolving from traditional grammar-translation methods to more communicative, learner-centered, and context-based approaches. Early models focused primarily on memorization and structural accuracy, but modern ELT emphasizes functional language use, critical thinking, and real-world communication. Scholars such as Tom Hutchinson and Alan Waters introduced the concept of English for Specific Purposes (ESP), which advocates tailoring language instruction to the specific academic or professional needs of learners. Similarly, Ken Hyland expanded the scope through English for Academic Purposes (EAP), focusing on skills required for academic success such as essay writing, research communication, and critical reading. Contemporary approaches also integrate task-based learning and digital tools, making language learning more interactive and relevant. In higher education, ELT is no longer seen as a standalone subject but as a support system that enhances disciplinary learning. This shift is particularly important in technical fields, where students must not only understand subject content but also communicate it effectively. Thus, ELT plays a crucial role in preparing students for both academic achievement and professional engagement.

2.2 ELT in Medical and Pharmaceutical Contexts: In medical and pharmaceutical education, ELT plays a vital role in bridging the gap between theoretical knowledge and professional practice. Healthcare professionals operate in high-stakes environments where clear and precise communication is essential for patient safety and effective collaboration. Discipline-specific language learning helps students understand complex terminologies, interpret clinical data, and communicate with colleagues and patients. Studies such as those by [7] [8] demonstrate that innovative teaching methods like flipped classrooms and e-learning improve conceptual understanding; however, they often do not adequately address students' linguistic challenges. Many pharmacy students struggle with technical vocabulary, comprehension of scientific texts, and the ability to articulate ideas clearly in English. This issue is particularly relevant in multilingual contexts, where English may not be the first language. Additionally, research highlights difficulties in understanding professional discourse, including case reports, prescriptions, and clinical guidelines. Without sufficient language support, students may find it challenging to fully engage with course material or perform effectively in clinical settings. Therefore, integrating ELT into pharmaceutical curricula is essential to ensure that students develop both technical expertise and communicative competence required in the healthcare field.

2.3 Language Skills in Scientific Research: Language proficiency is a fundamental component of scientific research, as it enables scholars to communicate findings effectively and participate in global academic discourse. Key language skills include academic writing, reading comprehension, and oral communication. Writing research papers requires clarity, coherence, and adherence to established conventions, as emphasized by John Swales and Christine Feak, who highlight the importance of structure and genre awareness. Reading scientific literature is equally important, as researchers must interpret complex texts, analyze data [9], and synthesize information from multiple sources. Vocabulary knowledge plays a critical role in this process; according to I. S. P. Nation, mastery of specialized

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vocabulary significantly enhances comprehension and communication. Oral communication skills, including presentations and seminars, are also essential for sharing research and engaging with academic communities. Furthermore, John Flowerdew emphasizes the importance of English proficiency in research publication, as many high-impact journals require submissions in English. Without strong language skills, researchers may struggle to publish their work or gain recognition. Therefore, developing comprehensive language competencies is crucial for success in scientific research and academic careers.

2.4 Drug Delivery Studies and Communication Needs: Effective communication is particularly critical in the study and application of drug delivery systems, where precision and clarity directly influence patient outcomes and research validity. Drug delivery involves complex processes such as formulation, testing, dosage calculation, and administration routes [10], all of which require accurate documentation and explanation. Miscommunication in these areas can lead to errors in medication use, reduced therapeutic effectiveness, or potential harm to patients. In research settings, scientists must clearly describe methodologies, results, and interpretations to ensure reproducibility and credibility. Clinical contexts also demand effective communication, as healthcare professionals must explain treatment plans and medication instructions to patients in an understandable manner. Studies like [11] highlight how discourse and communication practices are closely linked to risk management in healthcare environments. Additionally, emerging technologies and innovations in drug delivery further increase the need for precise and standardized language. As pharmaceutical science becomes more interdisciplinary and globally connected, the ability to communicate complex information accurately becomes even more essential. Therefore, integrating communication training into drug delivery studies is crucial for both academic success and professional competence.

2.5 Research Gap: Despite extensive research in both ELT and pharmaceutical education, there remains a significant gap in the integration of language instruction with technical training. While studies have explored innovative teaching methods and curriculum improvements in pharmacy education [12 [13] , they often focus on content delivery rather than communication skills. Similarly, ELT research has developed effective approaches such as ESP and EAP, but these are not consistently implemented within pharmaceutical programs. This disconnect results in students who may possess strong technical knowledge but lack the ability to communicate it effectively in academic and professional contexts. Furthermore [14], limited research has been conducted on developing interdisciplinary frameworks that combine language learning with subject-specific content in pharmacy education. Existing studies tend to address language skills in isolation rather than as an integral part of disciplinary learning. As a result, there is a need for more comprehensive and context-specific models that incorporate language development into pharmaceutical curricula. Addressing this gap can enhance students' overall competence, improve learning outcomes, and better prepare graduates for global professional environments.

3. Theoretical Framework: The present study is grounded in multiple complementary theories that explain how language learning can be effectively integrated with disciplinary knowledge, particularly in pharmaceutical education. The foundation of this framework lies in English for Specific Purposes (ESP), which emphasizes tailoring language instruction to the specific academic and professional needs of learners. ESP moves beyond general language teaching by focusing on domain-specific vocabulary, genres, and communication practices. In pharmaceutical education, this includes skills such as writing lab reports, interpreting clinical data, and communicating with healthcare professionals. ESP theory supports the idea that language learning becomes more meaningful and effective when it is directly مرتبط to students' field of study.Closely related is Content and Language Integrated Learning (CLIL), which integrates subject content with language instruction. Rather than teaching language separately, CLIL promotes learning through content, allowing students to develop both linguistic and conceptual understanding simultaneously. In the context of pharmacy, this could involve teaching drug mechanisms, case studies, or drug delivery systems while simultaneously enhancing English proficiency. This dual-focused approach helps students apply language in real academic and professional situations. The framework also draws on Constructivist learning theory, which posits that learners actively construct knowledge through experience and interaction. In pharmaceutical education, this translates into task-based learning, problem-solving activities, and collaborative projects where students engage with real-world scenarios. Such environments encourage deeper understanding and promote the use of language as a tool for learning rather than merely a subject of study. Additionally, Communicative Language Teaching (CLT) underpins the emphasis on functional and interactive language use. CLT prioritizes communication, fluency, and the ability to convey meaning effectively in various contexts. For pharmacy students, this includes presenting research findings, participating in discussions, and interacting with patients and colleagues. By focusing on real-life communication, CLT helps learners develop confidence and practical language skills.

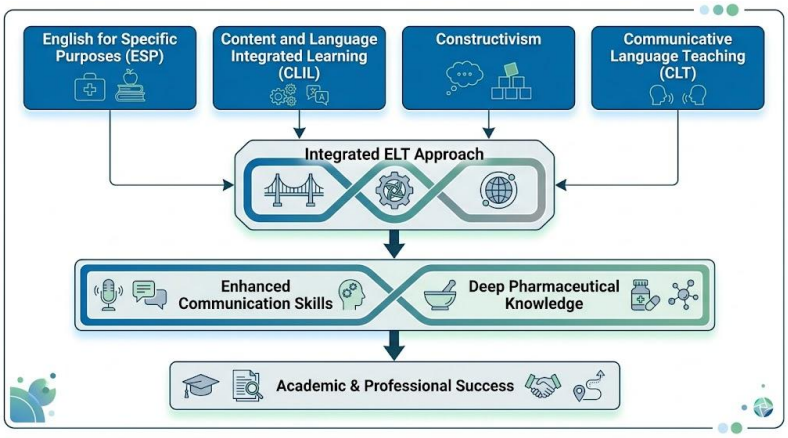

Figure 1: Conceptual Framework for Integrating English Language Teaching with Pharmaceutical Education

Together, these theoretical perspectives provide a comprehensive framework for integrating language and content in pharmaceutical education. They highlight the importance of contextualized, learner-centered, and communication-oriented approaches, ensuring that students not only acquire technical knowledge but also develop the linguistic competence required for academic success and professional practice in a globalized healthcare environment.

4.Research Methodology

The study uses a mixed-method approach, combining quantitative surveys and language assessments with qualitative interviews and classroom observations. Data are analyzed using statistical tools and thematic analysis to examine relationships between English proficiency and technical competence among pharmacy students, ensuring comprehensive, reliable insights into communication challenges and learning outcomes.

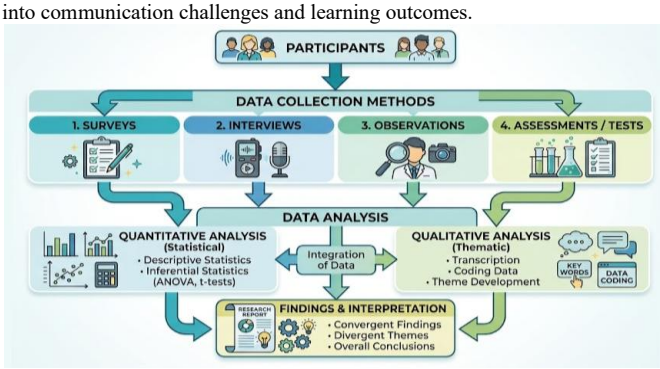

Figure 2: Mixed-Method Research Design for Studying Language and Technical Competence

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4.1 Research Design: The study adopts a mixed-method research design, combining both quantitative and qualitative approaches to provide a comprehensive understanding of the relationship between English language proficiency and technical competence in pharmaceutical education. The quantitative component focuses on measurable data such as students' scores in language assessments, academic performance, and survey responses. This allows for identifying patterns, correlations, and trends between language skills and subject knowledge. The qualitative component complements this by exploring participants' experiences, perceptions, and challenges through interviews and classroom observations. A mixed-method design is particularly suitable for this study because it captures both numerical evidence and contextual insights, ensuring a more holistic analysis. The integration of these methods helps validate findings through triangulation, increasing the reliability and depth of the research. Additionally, this design allows flexibility in addressing complex educational issues, such as communication barriers and learning difficulties, which cannot be fully understood through a single approach. Overall, the mixed-method framework strengthens the study by providing both empirical evidence and interpretive understanding, making the findings more applicable to real-world educational settings.

4.2 Participants: The participants in this study include pharmacy students, faculty members, and academic researchers involved in pharmaceutical education. Pharmacy students form the primary group, as they are directly affected by the integration of language and technical learning. They are selected from different academic levels to capture a range of language proficiencies and subject expertise [15]. Faculty members are included to provide insights into teaching practices, curriculum design, and observed student challenges related to communication skills. Their perspectives help in understanding how language instruction is currently incorporated into pharmaceutical education. Researchers and academic professionals contribute additional viewpoints on the broader academic and professional requirements of the field. A purposive sampling technique is used to ensure that participants have relevant experience and knowledge related to the study objectives [16]. Efforts are made to include participants from diverse linguistic and educational backgrounds to enhance the validity of the findings. Ethical considerations, such as informed consent and confidentiality, are strictly maintained throughout the study. This diverse participant base enables a well-rounded analysis of both learner and educator perspectives.

4.3 Data Collection Methods: Data for this study is collected using multiple methods to ensure depth and reliability. Surveys are administered to pharmacy students to gather quantitative data on their language proficiency, learning experiences, and perceived challenges. These surveys include both closed-ended and Likert-scale questions to facilitate statistical analysis. Semi-structured interviews are conducted with selected students, faculty members, and researchers to obtain qualitative insights into their experiences and perspectives on language use in pharmaceutical education. Classroom observations are carried out to examine real-time interactions, teaching methods, and the integration of language and content in instructional settings [17]. Additionally, language assessment tasks are designed to evaluate students' abilities in academic writing, reading comprehension, and oral communication within a pharmaceutical context. These tasks provide direct evidence of students' language competence. The use of multiple data collection methods allows for triangulation, enhancing the credibility and validity of the findings. This comprehensive approach ensures that both objective data and subjective experiences are captured effectively.

4.4 Data Analysis: The data analysis process combines quantitative and qualitative techniques to provide a thorough interpretation of the findings. Quantitative data obtained from surveys and language assessments are analyzed using statistical tools such as descriptive statistics, correlation analysis, and, where applicable, inferential tests. These methods help identify relationships between language proficiency and academic performance, as well as patterns in students' responses. Qualitative data from interviews and classroom observations are analyzed using thematic analysis, which involves coding responses, identifying recurring themes, and interpreting patterns related to communication challenges and learning experiences. This approach allows for a deeper understanding of participants' perspectives and contextual factors influencing language use. The integration of both analytical methods ensures that numerical trends are supported by detailed explanations and real-life examples. Data triangulation is employed to cross-validate findings from different sources, increasing the reliability of the results. Overall, this combined analysis approach provides a balanced and comprehensive understanding of the research problem [18].

4.5 Limitations: Despite its comprehensive design, the study has certain limitations that must be acknowledged. One limitation is the sample size, which may be restricted to a specific institution or region, potentially affecting the generalizability of the findings to other contexts. Additionally, the reliance on self-reported data in surveys may introduce bias, as participants might overestimate or underestimate their language abilities. Time constraints may also limit the duration of classroom observations and the depth of qualitative data collection. Another limitation is the variability in participants' educational backgrounds and language exposure, which can influence the consistency of the results. Furthermore, language assessment tasks may not fully capture all aspects of communicative competence, particularly in real-world professional settings. The mixed-method approach, while comprehensive, also requires careful integration of data, which can be complex and time-consuming. Despite these limitations, efforts are made to ensure reliability and validity through triangulation and systematic analysis. Acknowledging these constraints helps in interpreting the findings more accurately and provides direction for future research.

5. Integration of ELT with Pharmaceutical Education: Integrating English for Specific Purposes with pharmaceutical education enhances students' ability to communicate technical knowledge effectively [19]. Approaches like Content and Language Integrated Learning promote simultaneous language and content learning, improving academic writing, comprehension, and professional communication, thereby preparing pharmacy graduates for global research, clinical practice, and industry demands.

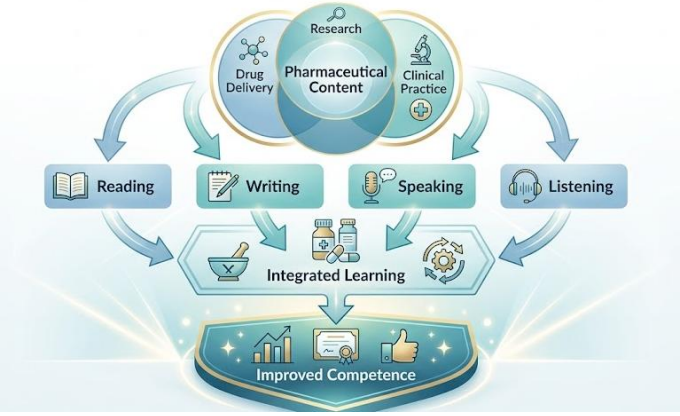

Figure 3: Model of Integrating Language Skills with Pharmaceutical Content Learning

5.1 Teaching Language through Pharmaceutical Content: Teaching language through pharmaceutical content is a highly effective strategy for bridging the gap between linguistic competence and technical knowledge. Instead of learning English in isolation, students engage with authentic materials such as research articles, case studies, and technical reports. Using research articles helps students become familiar with discipline-specific vocabulary, academic tone, and scientific structure. It also enhances their ability to interpret data, understand methodologies, and critically evaluate findings [20]. Case studies related to drug delivery systems further support contextual learning by presenting real-world scenarios that require both conceptual understanding and effective communication. Through guided reading, discussions, and writing tasks based on these materials, students learn how language functions within their field [21-24]. This approach aligns with content-based instruction, where language learning is embedded in subject matter. It also encourages active learning, as students analyze, interpret, and present information rather than passively receiving it. By integrating language with pharmaceutical content, learners develop practical communication skills that are directly applicable to academic and professional contexts, improving both their confidence and competence [25].

5.2 Developing Reading Skills: Reading skills are essential for pharmacy students, as they must engage with a wide range of complex texts, including research journals, clinical reports, and regulatory documents. Developing these skills involves more than basic comprehension; students must learn to interpret data, identify key arguments, and critically evaluate sources. Exposure to authentic materials such as journal articles helps students become familiar with scientific writing conventions, including structure, terminology, and citation styles. Reading clinical reports further enhances their ability to understand patient information, treatment

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plans, and diagnostic data. Instructional strategies such as guided reading, annotation, and summarization can support students in processing dense and technical information. Additionally, teaching students how to use context clues and infer meaning can improve their ability to handle unfamiliar vocabulary. Reading tasks can also be integrated with discussions and writing activities to reinforce comprehension and encourage deeper engagement [26-31]. By developing strong reading skills, pharmacy students are better equipped to stay updated with advancements in their field and to apply knowledge effectively in both academic and professional settings.

5.3 Writing Skills Development: Writing is a critical skill in pharmaceutical education, as students are required to produce various forms of academic and professional documents. These include lab reports, research papers, and abstracts, each with its own structure and conventions. Writing lab reports helps students document experiments systematically, emphasizing clarity, accuracy, and logical organization. Research papers require more advanced skills, such as developing arguments, synthesizing information, and adhering to academic standards. Abstract writing, in particular, demands the ability to summarize complex information concisely while maintaining clarity and coherence. Instruction in writing should focus on both language and structure, guiding students in the use of appropriate terminology, grammar, and style. Peer review and feedback play an important role in improving writing quality, as they allow students to identify errors and refine their work. Integrating writing tasks with subject content ensures that students practice language in meaningful contexts. Developing strong writing skills not only enhances academic performance but also prepares students for professional communication, including documentation, reporting, and publication in scientific journals.

5.4 Speaking Skills: Speaking skills are vital for effective communication in pharmaceutical education and professional practice. Pharmacy students are often required to present their knowledge through seminars, viva voce examinations, and conference presentations. These activities demand clarity, confidence, and the ability to organize and convey information logically. Seminars provide opportunities for students to explain complex concepts, engage with peers, and respond to questions, thereby enhancing both fluency and critical thinking. Viva voce examinations test students' understanding and their ability to articulate responses under pressure, highlighting the importance of spontaneous communication. Conference presentations, on the other hand, require formal language, structured delivery, and the ability to address a wider audience. Teaching speaking skills involves activities such as role-plays, group discussions, and presentation practice, which help students build confidence and improve pronunciation and fluency. Feedback from instructors and peers is essential for identifying areas of improvement. By developing strong speaking skills, pharmacy students can communicate effectively in academic, clinical, and professional settings, contributing to better collaboration and knowledge sharing.

5.5 Listening Skills: Listening skills are fundamental for understanding and participating in academic and professional interactions in pharmaceutical education. Students must be able to comprehend lectures, webinars, and medical discussions, which often involve complex terminology and fast-paced delivery. Effective listening requires concentration, note-taking, and the ability to identify key points and supporting details. Exposure to recorded lectures and online webinars allows students to practice listening in different accents and contexts, improving their adaptability. Medical discussions, including case presentations and team meetings, further enhance listening skills by requiring students to follow detailed information and respond appropriately. Teaching strategies such as guided listening, summarization, and interactive activities can help students develop these skills. Encouraging students to ask questions and engage in discussions also reinforces comprehension. Listening skills are closely linked to other language abilities, as they support speaking, reading, and writing. By improving their listening competence, pharmacy students can better understand academic content, collaborate effectively with peers and professionals, and perform confidently in clinical and research environments

6. ELT Strategies for Drug Delivery Studies: Effective ELT strategies for drug delivery studies focus on integrating language learning with technical understanding. Vocabulary building is fundamental, as students must master specialized terminology related to drug delivery systems, including formulation processes, dosage forms, and pharmacokinetics. Structured activities such as word mapping, glossaries, and contextual usage help reinforce retention and accuracy. Task-based learning encourages students to use language in practical contexts, such as explaining drug formulations, analyzing case studies, or interpreting experimental results. This approach promotes active engagement and improves both conceptual clarity and communication skills. Similarly, problem-based learning presents real-world pharmaceutical scenarios, requiring students to collaboratively solve issues while articulating their reasoning clearly.

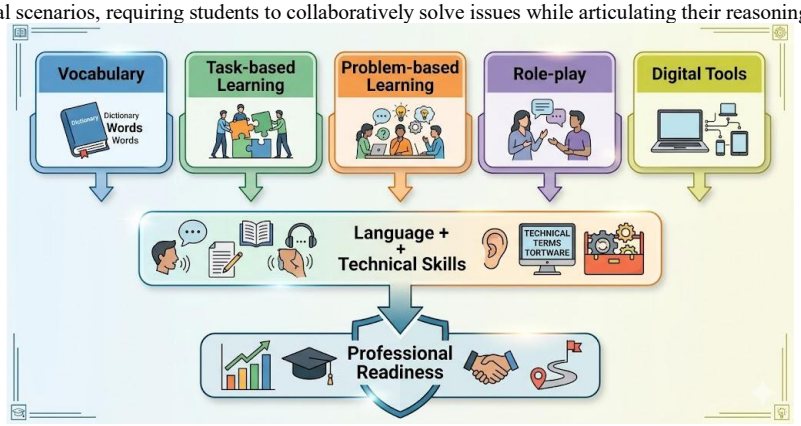

Figure 4: ELT Strategies for Enhancing Communication in Drug Delivery Studies

Role-play activities, such as doctor–patient interactions or researcher–reviewer discussions, simulate professional environments and enhance speaking and interpersonal communication skills. These exercises build confidence and prepare students for real-life situations. Digital tools, including AI-powered platforms, simulations, and e-learning systems, further support language development by providing interactive and personalized learning experiences. Together, these strategies create a comprehensive approach that strengthens both linguistic competence and technical expertise in pharmaceutical education.

7. Findings and Discussion

The findings of the study indicate a noticeable improvement in students' communication skills when English language instruction is integrated with pharmaceutical content. Students demonstrated better clarity in expressing technical concepts, improved academic writing, and increased confidence in oral presentations. This supports the effectiveness of approaches such as English for Specific Purposes, which emphasize context-based language learning. In addition to communication gains, students showed enhanced understanding of complex pharmaceutical topics, particularly in areas like drug delivery systems. The integration of language with subject content enabled learners to grasp concepts more deeply, as they actively engaged with materials through reading, writing, and discussion.

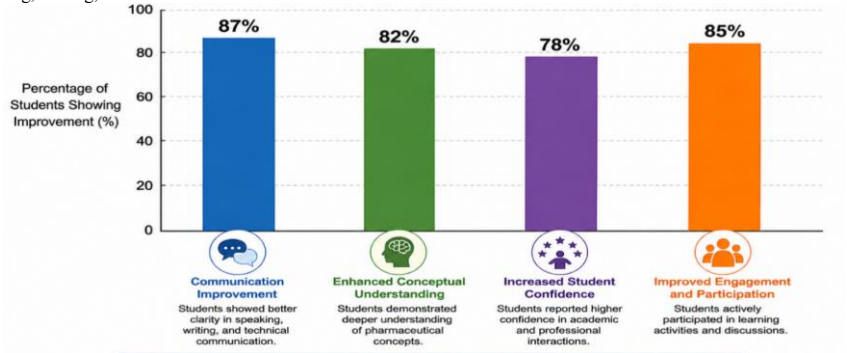

Figure 5: Summary of Key Findings: Impact on Communication, Understanding, and Engagement

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Student engagement and participation also improved significantly. Interactive strategies such as task-based learning and role-play increased motivation and confidence, encouraging learners to participate more actively in academic activities. However, several challenges were identified, including limited instructional time, curriculum overload, and insufficient teacher training in integrated approaches.

When compared with previous studies, the findings align with research highlighting the benefits of blended pedagogies in pharmaceutical education, while also reinforcing the need for structured language support within technical curricula.

8. Pedagogical Implications

The study suggests that pharmaceutical curricula should systematically integrate language development with subject content, adopting frameworks such as English for Specific Purposes to address discipline-specific communication needs. Curriculum design should include tasks like research writing, case analysis, and presentations embedded within core courses. Teacher training is essential to equip faculty with strategies for combining language and content instruction effectively. Additionally, interdisciplinary collaboration between language experts and pharmacy educators can enhance teaching practices and resource development. The integration of language labs with pharmaceutical courses can further support students' listening, speaking, and writing skills through practical, technology-assisted learning, ensuring improved academic performance and professional readiness.

9. Conclusion

This study highlights the critical role of integrating language and content learning in pharmaceutical education. The findings demonstrate that approaches such as English for Specific Purposes significantly improve students' communication skills, academic performance, and conceptual understanding. Effective use of English enhances learners' ability to engage with complex areas like drug delivery systems and professional practices.

The study emphasizes that combining ELT with pharmaceutical studies is essential for preparing students for global academic and industry demands. Future research can explore technology-driven language learning, larger cross-institutional studies, and the development of standardized integrated curricula to further strengthen interdisciplinary education.

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