STUDENTS' PERCEPTIONS OF DIGITAL TOOLS IN PHARMACY ESP EDUCATION- A STUDY CONDUCTED IN NORTH MACEDONIA

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Abstract: *Digital transformation in higher education has profoundly reshaped the teaching and learning of discipline-specific languages, particularly within English for Specific Purposes (ESP). The growing adoption of digital technologies has created new opportunities for enhancing language instruction, enabling more interactive, flexible, and learner-centered approaches. In pharmacy education, digital tools are increasingly integrated to support the development of professional communication skills that are essential in technologically mediated healthcare contexts, where accurate and effective communication can directly impact patient care and professional practice. This study investigates pharmacy students' perceptions of digital tools used in ESP instruction, focusing on multiple dimensions including perceived usefulness, learner engagement, language development, and potential barriers to adoption. A mixed-methods design was employed, involving 120 pharmacy students (67 female and 53 male) who completed a structured survey to provide quantitative data, complemented by semi-structured interviews that offered qualitative insights into students' experiences, attitudes, and challenges. The findings reveal that students generally hold positive attitudes toward the use of digital tools, emphasizing their pedagogical value, capacity to increase motivation and engagement, and effectiveness in supporting the acquisition of specialised pharmaceutical vocabulary. At the same time, the study identifies challenges that may limit optimal outcomes, such as uneven levels of digital literacy among students, limited access to certain technologies, and inconsistencies in instructional implementation across courses. Overall, the study highlights the importance of thoughtfully designed, pedagogically informed integration of digital tools in ESP courses and provides practical guidance for enhancing digitally supported language instruction in pharmacy education, contributing to broader discussions on technology-enhanced learning in professional contexts.*

Keywords: *pharmacy; ESP; students; digital tools; North Macedonia*

1. Introduction

Rapid technological developments have transformed healthcare systems worldwide. As digital solutions become increasingly embedded in clinical practice, the competencies required of modern pharmacists extend beyond traditional dispensing and counselling roles. These innovations reshape not only how pharmacists access and interpret information but also how they communicate with patients, colleagues, and other healthcare professionals. Furthermore, English for Specific Purposes (ESP) pedagogy seeks to align language instruction with learners' real communicative and professional needs. Within pharmacy education,

this involves preparing students to understand and use specialised terminology, navigate digital interfaces, and engage in professional scenarios that mirror authentic workplace communication. Integrating digital tools into Pharmacy ESP courses offers opportunities to expose students to realistic clinical tasks, interactive simulations, and practice-based scenarios, bridging the gap between classroom learning and professional practice. However, the successful integration of technology depends heavily on students' perceptions, readiness, and confidence in using digital tools. If learners perceive digital resources as confusing, irrelevant, or overly demanding, the potential benefits may not be fully realized. Understanding students' attitudes is crucial for designing learning environments that support both language development and discipline-specific skills. Research on digital tools in ESP has mostly focused on Western or highly resourced contexts, leaving a gap in emerging digital learning environments like North Macedonia.

This study examines pharmacy students' perceptions of digital tools in ESP instruction, evaluates their effectiveness in enhancing engagement, specialised vocabulary, and communication confidence, and identifies barriers to implementation to provide evidence-based recommendations for improving digitally supported ESP curricula.

The study is guided by the following research questions:

How do pharmacy students perceive the usefulness, engagement potential, and language-learning benefits of digital tools employed in ESP instruction?

What barriers and challenges do pharmacy students identify in the effective use of digital tools within ESP courses?

2. Literature Review

Advances in digital technology have fundamentally transformed educational practices across disciplines, particularly in language education, by expanding opportunities for input, interaction, and output. Within the theoretical framework of Technology-Enhanced Language Learning (TELL), digital tools support learner autonomy, motivation, and engagement by providing flexible access to multimodal and authentic language resources (Hockly, 2020).

Recent meta-analyses reinforce the positive impact of digital tools on language proficiency, noting that technology-enhanced environments contribute to improved outcomes when embedded within structured pedagogical designs (Nurmal-a et al., 2025). Systematic reviews also highlight the growing integration of digital resources into ESP curricula, identifying the shift toward immersive, interactive, and learner-centered materials that align with contemporary learning needs (Rachmawati & Irawan, 2025).

Within English for Specific Purposes (ESP), pedagogy is theoretically grounded in needs analysis, genre theory, and discourse community membership, emphasizing the development of discipline-specific communicative competence and lexical knowledge (Hyland & Hamp-Lyons, 2023). Tools such as interactive simulations, multimedia case studies, and adaptive digital content enhance genre awareness and support technical vocabulary acquisition by situating language use within realistic professional contexts.

Evidence from virtual content interventions shows significant improvements in technical vocabulary retention among ESP learners, further validating the

effectiveness of digital materials designed for specialised language tasks (Saeedi & Najjarpour, 2025). However, scholars consistently highlight that the effectiveness of digital ESP instruction relies on instructors' ability to integrate technological affordances with expertise and pedagogical intent.

At the same time, pharmacy education is undergoing rapid digital transformation driven by digital health initiatives, telepharmacy, and simulation-based training. Both international frameworks and empirical evidence position digital health competencies at the core of contemporary pharmacy curricula, identifying digital literacy as an essential professional competency for future pharmacists (FIP, 2021, 2024; WHO, 2023). These advancements have direct implications for ESP instruction, as pharmacy students are required to engage with digital genres such as electronic health records, online patient-counseling platforms, and interprofessional digital communication tools. Evidence suggests that pharmacy students generally value video-based clinical simulations, terminology-focused mobile applications, and interactive digital modules for improving specialised vocabulary knowledge and communicative confidence (Meštrović & Staničić, 2021; Hou et al., 2022).

Nevertheless, recurring challenges – such as uneven access to digital infrastructure, limited familiarity with specialised applications, and insufficient institutional support – have been reported across diverse educational contexts. These findings align with broader TELL research, which emphasizes the critical role of learner attitudes, contextual variables, and digital literacy in shaping successful technology adoption within language learning environments (Gumartifa et al., 2025).

Despite the growing literature on digitalisation in pharmacy education and ESP, few empirical studies investigate pharmacy students' perceptions of digital tools specifically within ESP courses, particularly in under-researched contexts such as North Macedonia. Addressing this gap, the present study adopts a student-centred approach to explore pharmacy students' perceptions of digital tools in ESP instruction at a tertiary institution in North Macedonia, aiming to identify factors that facilitate or hinder effective implementation and to inform the pedagogically grounded integration of digital technologies in Pharmacy ESP courses.

3. Recent studies

Recent research highlights the growing role of digital literacy and technology-enhanced learning in health-professional education. Studies indicate that digital tools not only support general learning but also play a critical role in developing the specific competencies required for modern healthcare practice. For instance, Alowais, Shah, and Tolley (2023) conducted a comprehensive scoping review of undergraduate pharmacy programs worldwide, examining the integration of digital-literacy training, including health informatics, electronic health records, and other digital-health technologies. Their review of 57 studies identified common pedagogical strategies, such as theoretical modules on informatics, technology-familiarization activities, and applied digital-skills development through telehealth and interprofessional collaboration. In addition, Gaffas (2024), explored the use of the social-media platform X within a Medical English ESP course and found that structured social-media integration can enhance engagement, provide authentic professional communication contexts, and facilitate language development relevant

to clinical and academic tasks.
Such studies illustrate how digital tools can bridge the gap between language instruction and real-world professional practice. Focusing on pharmacy education, Alowais, Nazar, and Tolley (2024) examined UK pharmacy programs to assess how digital-literacy competencies are embedded in curricula. All in all, these studies demonstrate both the increasing importance of digital literacy in health-professional education and the challenges associated with its effective implementation. Although digital tools and technology-supported learning are increasingly embedded in curricula, persistent inconsistencies in practice, assessment, and alignment with professional standards reveal a gap in understanding how digital-literacy initiatives function within Pharmacy ESP courses, particularly in under-researched contexts.

4. Method

Data collection was conducted during the 2024–2025 academic year. The survey was administered electronically through the university's learning management system, ensuring both accessibility and anonymity. Participants were selected using a convenience sampling method, targeting students actively enrolled in ESP courses that incorporated digital tools. Ethical approval and all participants provided informed consent prior to participation.
To complement the survey data, semi-structured interviews were conducted with a purposive subset of 15 students, selected to ensure diversity in gender and academic year. The interview protocol focused on students' experiences with digital tools, perceived benefits and challenges encountered. Interviews were conducted individually via video conferencing, audio-recorded with participants' consent, and transcribed verbatim. Quantitative survey data were analyzed using descriptive statistics and independent-samples t-tests to examine gender-based differences in perceptions across five constructs, while qualitative interview data were analyzed thematically to identify recurring patterns, themes, and insights related to the use of digital tools in Pharmacy ESP instruction.

4.1 Participants

Participants were 120 undergraduate pharmacy students enrolled at the State University of Tetovo in North Macedonia. Participation in the study was entirely voluntary and anonymous, and students were informed that their responses would be used solely for research purposes. The sample consisted of 67 female students and 53 male students, reflecting the typical gender distribution within the faculty. All participants had previously completed at least one English for Specific Purposes (ESP) course or module focused on pharmaceutical communication, terminology development, and professional interaction in English.

4.2 Instruments

The first instrument was a 20-item questionnaire developed for this study, drawing on validated constructs from technology enhanced language learning and ESP research. Items used a 5-point Likert scale. There were five sections: Perceived Usefulness; Ease of Use; Engagement; Vocabulary Development; Professional Communication Confidence and Perceived Barriers. The survey was administered online over two weeks. Responses were exported to SPSS for descriptive analysis.

The second instrument was a semi-structured interview used with 15 students drawn from the total sample of population.

5. Results

This section presents the findings on pharmacy students' perceptions of digital tools in ESP instruction. Survey data are summarized to show trends in perceived usefulness, engagement, vocabulary development, and professional communication confidence. Insights from the semi-structured interviews complement the survey results by highlighting students' experiences, preferences, and challenges with digital tools.

5.1 Survey results

The findings from the 20-item survey administered to pharmacy students are summarized using descriptive statistics, including means and standard deviations, across key constructs are presented in Table 1.

Table 1. Means and Standard Deviations for Perception Constructs (N = 120)

Construct	Items (avg)	Mean (M)	Standard Deviation (SD)
Perceived Usefulness	*3*	*4.12*	*0.61*
Ease of Use	*3*	*3.85*	*0.76*
Engagement	*3*	*3.98*	*0.72*
Vocabulary Development	*4*	*3.76*	*0.84*
Professional Communication Confidence	*3*	*3.64*	*0.90*
Perceived Barriers (higher = more)	*4*	*3.22*	*1.02*

M =Mean; SD =Standard Deviation

Table 1 presents pharmacy students' survey results on digital tools in ESP instruction, revealing overall positive attitudes alongside notable challenges. Perceived Usefulness scored highest (M = 4.12, SD = 0.61), showing strong agreement that tools like Moodle and Quizlet enhance learning through access to authentic materials, clinical scenarios, and updated terminology.

Engagement was also high (M = 3.98, SD = 0.72), indicating that interactive tasks, simulations, and multimedia resources effectively motivate students.

Ease of Use received a moderately high score (M = 3.85, SD = 0.76), reflecting generally manageable platforms, though some students faced challenges with digital literacy or unfamiliar interfaces.

Vocabulary Development was rated moderately high (M = 3.76, SD = 0.84), suggesting effective support for specialized terminology, while Communication Confidence was slightly lower (M = 3.64, SD = 0.90), indicating that digital tools alone may not fully substitute authentic practice.

Perceived Barriers scored lowest (M = 3.22, SD = 1.02), with variability reflecting issues like inconsistent internet access, limited devices, and technical support challenges. Overall, students value digital tools for learning, engagement, and vocabulary, but barriers and variable confidence highlight areas needing further support.

Table 2. Independent-Samples t-Test Comparing Female and Male

Construct	t	df	p	Cohen's d
Perceived Usefulness	*1.78*	*118*	*.078*	*0.28*
Ease of Use	*0.54*	*118*	*.590*	*0.08*
Engagement	*1.53*	*118*	*.129*	*0.25*
Vocabulary Development	*1.63*	*118*	*.108*	*0.28*
Professional Com/Confidence	*0.44*	*118*	*.662*	*0.08*

t=t-test; df =Degrees of freedom; p=probability; Cohen's d= A measure of effect size,

Table 2 shows the independent – samples t-test which examined whether female and male students differ in their perceptions of digital tools across five constructs: Perceived Usefulness, Ease of Use, Engagement, Vocabulary Development, and Professional Communication Confidence. The results indicated that there were no statistically significant differences between female and male students for any of the constructs (all $p > .05$). Cohen's d values ranged from 0.08 to 0.28, suggesting only small effect sizes. These findings imply that male and female students in this sample perceived and experienced the digital tools in a largely similar manner.

5.2 Semi-structured Interviews

The second phase of the study included insights from the semi-structured interviews conducted with 15 pharmacy students. The interviews explored students' experiences in using digital tools for ESP instruction, providing a deeper understanding of the survey findings. Key responses are summarized in Table 3.

Table 3: Interview responses

Question	Student Response
1. Describe a digital tool that has helped you learn pharmaceutical English. What made it effective?	S1: "Quizlet helped me memorize drug classifications faster '' ."S2: "YouTube videos from pharmacy channels made medical instructions clearer since I could replay them."S4: "Moodle glossaries helped me because everything was organized by topic."
2. How do digital tools support your understanding of pharmacy-related terminology?	S7: "Apps show pronunciation, which helped me say drug names correctly."S9: "Digital dictionaries give instant examples in pharmaceutical contexts."S10: "Interactive quizzes helped me learn the differences between similar medications."
3. What digital platforms do you prefer using in ESP and why?	S1: "I prefer Quizlet because it makes learning feel like a game." S13: "YouTube is my favorite because the animations help me understand concepts."S14: "I like Kahoot because it's fun and competitive."
4. Can you explain a situation where a digital tool	S3: "A Kahoot quiz during class made me stay alert and want to win."S4: "Watching a short animation

increased your engagement or motivation?	about antibiotics made me more curious to learn."S7: "Interactive assignments on Moodle motivated me because I could track my progress."
5. What difficulties or frustrations have you experienced when using digital tools?	S2: "Poor internet connection sometimes ruins the whole activity."S6: "Some tools feel too complicated to use at first."S12: "I get overwhelmed when there are too many platforms to follow."
6. How confident do you feel in professional communication after using digital tools?	S5: "I feel more confident writing emails after practicing with grammar apps."S11: "Simulated dialogues helped me practice giving drug instructions."S3: "Apps that correct pronunciation improved how I speak.
7. What are the main advantages of using digital tools in pharmacy language learning?	S1: "They save time because everything is easily accessible."S8: "They connect theory with real scenarios using videos."
8. What barriers prevent you from fully benefiting from digital tools?	S14: "Sometimes I don't know how to use the tool properly."S11: "Too many assignments online make me feel stressed."S6: "Technical problems discourage me from trying."S9: "Some tools don't match pharmacy content well."
9. How can digital tools be improved to support vocabulary acquisition and communication skills?	S5: "Tools should include more pharmacy-specific vocabulary lists."S12: "More speaking practice options would be helpful."S3: "Realistic case simulations would improve terminology use.
10. If you were designing the ideal digital environment for Pharmacy ESP, what would it include?	S15: "A single platform that combines vocabulary, videos, and quizzes."S10: "Virtual pharmacy simulations for practicing communication."S1: "A chatbot to rehearse real-life consultations."

The semi-structured interviews provided deeper insight into students' experiences with digital tools in Pharmacy ESP, complementing the quantitative findings. Overall, students viewed digital resources as valuable for understanding pharmaceutical terminology, accessing authentic materials, and staying engaged in learning. Many described increased confidence in written and spoken professional communication, although most still expressed a need for more authentic speaking practice and real-life simulation tasks.

6. Discussion

The findings of this study provide clear insights into pharmacy students' perceptions of digital tools in ESP instruction, directly addressing the research questions and the objectives of understanding perceived usefulness, engagement, vocabulary development, and barriers to effective use. Regarding the first research question, students generally reported positive attitudes toward digital tools, highlighting their value in facilitating access to authentic pharmaceutical materials, interactive simulations, and specialised terminology. These perceptions align with

the study's objective of evaluating the pedagogical effectiveness of digital resources, demonstrating that well-integrated tools can enhance engagement, motivation, and domain-specific language acquisition.

In response to the second research question concerning barriers and challenges, students identified technical difficulties, platform complexity, and limited opportunities for oral communication as factors that hindered optimal learning outcomes. Although the University provides students with 24-hour internet access on campus, the data collected for this study primarily reflect students' experiences with home internet connections, which can vary in speed and reliability. These insights underscore the study's aim to identify obstacles to effective implementation, suggesting that successful integration of digital tools requires both reliable infrastructure and structured opportunities for successful learning.

Overall, the results indicate that while digital tools are effective for vocabulary acquisition and learner engagement, their impact on professional communication competence—particularly speaking—remains moderate. This finding emphasizes the importance of complementing digital resources with interactive, real-world practice, supporting the study's objective of informing pedagogically grounded strategies for ESP course design. Collectively, the discussion highlights that achieving the full potential of digital tools in Pharmacy ESP depends on thoughtful pedagogical integration, attention to technical support, and alignment with authentic professional tasks.

7. Conclusion

This study provides compelling evidence that pharmacy students hold generally positive perceptions of digital tools in ESP instruction, particularly regarding their pedagogical usefulness, engagement potential, and contribution to specialised vocabulary development. Participants valued how digital platforms facilitated access to authentic pharmaceutical materials, clinical scenarios, and discipline-specific terminology, reinforcing the view that technology-enhanced tools can effectively increase exposure to domain-specific input when integrated within thoughtfully designed pedagogical frameworks. These findings align with recent ESP research, such as Kravchenko (2024), which demonstrated that digital technologies significantly enhance terminological competence. Also,

The semi-structured interviews further enriched these insights by revealing students' lived experiences with digital tools. Participants emphasized the benefits of digital resources for understanding complex pharmaceutical terminology, accessing authentic materials, and sustaining motivation, echoing findings from Yelliza (2024) on the positive impact of flexible and interactive digital technologies in ESP learning. However, the study revealed that gains in professional communication confidence – particularly in oral skills – were modest. This may be explained by the fact that current digital simulations are often designed for general or international audiences and do not adequately reflect the specific linguistic, cultural, and healthcare contexts of North Macedonian pharmacy students, limiting their effectiveness in building confidence for real-world professional communication. This underscores the limitations of digital tools alone in fully replicating real-world communicative interactions, a nuance similarly noted in Fernández-Alcántara et al. (2025), who emphasized that virtual simulations cannot entirely substitute for authentic patient-provider communication practice.

In conclusion, these findings confirm that digital tools can significantly enhance vocabulary acquisition, engagement, and motivation in Pharmacy ESP courses, while simultaneously illustrating that oral communication competence, equitable access, and pedagogical integration remain crucial considerations.

Based on the study's findings, the following recommendations are proposed to enhance the effectiveness of digital tools in Pharmacy ESP instruction: integrate digital tools purposefully with authentic pharmacy tasks; complement digital activities with interactive speaking practice and simulations; improve usability through clear instructions and platform guidance; support students' digital literacy with targeted training and technical support; and systematically collect student feedback to refine tool selection and course design.
As for the limitations, this study used convenience sampling of students already enrolled in ESP courses using digital tools, which may introduce selection bias. As a result, the findings may not fully represent the broader population of pharmacy students in North Macedonia. Consequently, thematic saturation may not have fully captured the full range and variability of perceived barriers, and future studies should include a larger qualitative sample to ensure broader representativeness. Future research should use more diverse or randomized sampling to enhance generalizability. In addition, the study relies solely on self-reported perceptions, without objective measures such as pre- and post-test scores or a control group, therefore future research should include this tool as well.

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