AI-Driven EduFlipp Learning Model: Enhancing ESP for Undergraduates

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Abstract

This study investigates the impact of AI-supported tools on learner engagement, autonomy, and performance in English for Specific Purposes (ESP). Conducted with 50 Biomedical informatics bachelor's students at the University of Žilina, Slovakia, during the winter term 2024/25. The study compares two groups (n = 25 each) that used the same three AI-supported tools—Socrative (immediate feedback and formative assessment), Yoodli (AI-driven presentation feedback), and StudyFi (self-paced learning). Group B additionally followed the EduFlipp model (Flexible learning environment, Learner autonomy, Integrated AI tools, Practice orientation, and Personalisation), applying the tools within a structured flipped-classroom sequence of home-based preparation and in-class application, whereas Group A used the same three tools within a traditional, non-flipped ESP course structure. The study is grounded in the TPACK-AI (Technological Pedagogical Content Knowledge for Artificial Intelligence – focusing on how AI tools are meaningfully integrated into teaching) and MCC (Multimodal Communicative Competence – addressing verbal, non-verbal, and digital communication skills) frameworks, using a mixed-methods design. Quantitative data included pre-/post-tests, AI usage analytics, and structured questionnaires measuring tool usability, motivation, and communication confidence. Qualitative data from journals and interviews were thematically coded using NVivo. Post-intervention results confirmed all four hypotheses. Both groups showed statistically significant gains after using the three AI-supported tools ($p < .001$), with Yoodli producing the largest improvement in multimodal communicative performance ($d \approx 0.88–0.90$); Group B, which combined the tools with the full EduFlipp framework, achieved consistently larger effect sizes than Group A across all measured domains, alongside greater multimodal competence and improved motivation and self-regulation. The findings demonstrate that integrating AI within a student-centred FLIPP framework enhances ESP instruction through a sustainable, feedback-rich, and digitally responsive environment well-suited to preparing learners for 21st-century market needs.

Keywords: ESP, AI-supported tools, EduFlipp, TPACK-AI, MCC

Introduction

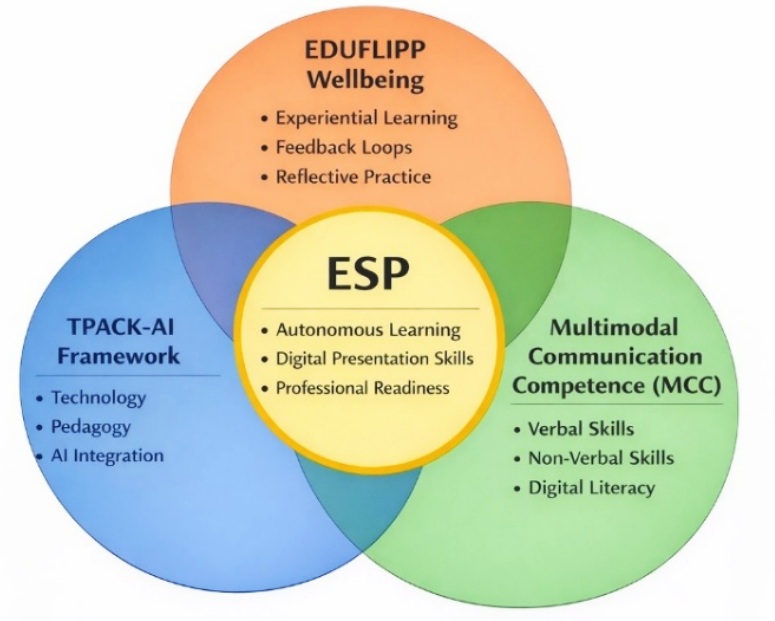
In today's digital era, the demand for professionals with strong English communication skills is growing, especially within English for Specific Purposes (ESP), where effective instruction combines linguistic competence with presentation skills, confidence, non-verbal communication, and digital literacy relevant to the workplace. At the same time, education increasingly promotes learner autonomy and self-regulated learning, encouraging students to take responsibility for their development both in class and independently, which supports motivation, communicative competence, and sustained engagement.

In response to these demand, AI-based applications have made ESP instruction more adaptive and learner-centred (Son et al., 2025). The use of AI tools can improve fluency, vocabulary, and learner engagement (Son et al., 2025). However, excessive reliance on AI may reduce interpersonal interaction, highlighting the need for teacher-guided integration.

Therefore, this study examines the development of communication skills in ESP through the guided use of three AI-supported tools—Yoodli, StudyFi, and Socrative—implemented in an undergraduate setting at the University of Žilina, Slovakia. Each tool targets a different aspect of professional communication training aligned with current ESP demands.

- **Yoodli** supports presentation competence by offering simulation-based feedback on fluency, pacing, filler words, and non-verbal delivery, thus fostering reflective and self-regulated improvement.
- **StudyFi** enhances autonomous learning through interactive study resources such as flashcards, mind maps, and podcasts, facilitating content retention and independent preparation.
- **Socrative** complements these tools by enabling real-time formative assessment, immediate feedback, and increased learner engagement through interactive classroom features, including the *Space Race* mode.

Figure 1
Integrative Frameworks EduFLIPP, TPACK-AI and MCC



Source: Authors

To assess the pedagogical value of these tools, the study employs the student-centered EduFLIPP approach grounded in TPACK-AI and the Multimodal Communicative Competence (MCC) framework. By examining professional communication development, the study aims to identify which tool most effectively supports autonomy, reflection, and multimodal competence while also contributing to students' motivation and well-being in language learning.

Literature Review

English for Specific Purposes and Artificial Intelligence

English for Specific Purposes (ESP) represents a specialised domain of language education focused on developing communicative competence required in specific professional and academic contexts (Dudley-Evans & St John, 1998; Hyland, 2006). Unlike General English, ESP prioritises authentic language use in discipline-oriented environments, with particular emphasis on discourse practices, pragmatic competence, and interactional strategies (Bhatia, 2004; Hyland, 2006). Communication in ESP is therefore not limited to linguistic accuracy but involves the ability to operate effectively within professional discourse communities.

The integration of AI into ESP language learning has transformed traditional approaches to technology- enhanced communication training. AI-based tools provide analytical, data-driven feedback and real-time evaluation of learners' verbal and non-verbal performance (Derakhshan et al., 2025; Ngo et al., 2024; Shadiev & Liu, 2023; Son et al., 2025; Wu et al., 2025). They deliver professional communicative competence using chatbots, speech analytics, and video feedback to enhance fluency and multimodal awareness.

Platforms such as Yoodli, StudyFi and Socrative exemplify this new generation of AI-supported systems designed to strengthen both linguistic and paralinguistic skills essential for professional success. For undergraduate students, communication skills include pronunciation, language accuracy, fluency, body language, and audience engagement—core ESP outcomes. These tools provide instant personalised feedback that enables learners to analyse, reflect, and adjust their performance in simulated or authentic professional settings.

Previous research indicates that AI systems can enhance personalised learning, learner agency, and communicative development when pedagogically guided (Deng et al., 2023; Holmes et al., 2019; Li et al., 2024; Luckin et al., 2016). Effective feedback, particularly when timely and specific, remains one of the strongest influences on learning outcomes (Hattie & Timperley, 2007). Nicol and Macfarlane-Dick (2006) emphasise that high-quality feedback fosters self-regulated learning and metacognitive awareness.

However, despite these technological advantages, language development remains fundamentally social. Contemporary research in AI and education similarly cautions that technology-mediated communication should complement rather than replace human interaction (Holmes et al., 2019). Pedagogically guided integration of AI is therefore essential to preserve authentic communicative practice while leveraging technological affordances.

EduFLIPP

Within this shift toward technology-enhanced and learner-centred communication training, flipped learning (here as EduFLIPP) emerges as a pedagogical model that integrates these

principles. In flipped instruction, learners engage with instructional content independently outside the classroom through digital resources, promoting self-regulated learning, planning, reflection, and progress monitoring (Bergmann & Sams, 2012).

Classroom time is then dedicated to interactive and communication-oriented activities such as discussions, professional simulations, teamwork, and problem-solving tasks (Bergmann & Sams, 2012; Bishop & Verleger, 2013). This structure enables learners to apply specialised language in authentic interaction and systematically develop professional communication skills.

Technological Pedagogical Content Knowledge – Artificial Intelligence

The Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006) provides a comprehensive model for evaluating technology use in educational contexts. By integrating technological, pedagogical, and content knowledge, TPACK enables systematic assessment of whether digital tools genuinely support communicative and disciplinary goals. The AI-oriented extension of the TPACK framework (TPACK-AI) is based on AI-specific dimensions, including algorithmic feedback, learner autonomy, and the ethical use of data. It analyses how technology (AI platforms), pedagogy (presentation training), and content (ESP communication) interact to enhance learning (Ning et al., 2024).

Multimodal Communication Competence

In this study, Multimodal Communication Competence (MCC) is used as a construct that complements TPACK-AI by evaluating multimodal communication across verbal, paralinguistic, and nonverbal dimensions, including eye contact, speech rhythm, intonation, facial expression, and gesture, informed by recent work on AI-supported multimodal language learning (Son et al., 2025). Integrating these constructs with the TPACK-AI dimensions (Ning et al., 2024) enables a holistic evaluation of how AI tools support performative aspects of ESP communication. By linking individual preparation (e.g., terminology development, pronunciation practice) with classroom-based professional dialogue, the EduFLIPP pedagogical model supports the development of MCC. Within this framework, the teacher acts as a facilitator of communication and mediator of technological support (Bergmann & Sams, 2012).

By integrating the EduFLIPP (Bergmann & Sams, 2012), TPACK-AI (Ning et al., 2024), MCC (Son et al., 2025) models, this study views AI tools not merely as technologies but as pedagogical partners that foster autonomous and reflective learning in ESP.

This approach is particularly relevant in university ESP settings, where learners must transition from academic English to discipline-specific professional communication, requiring both linguistic precision and confident delivery.

Finally, research suggests that flipped learning positively influences motivation and engagement (Zainuddin & Halili, 2016). When combined with AI tools, it creates a supportive environment that reduces communication anxiety and enhances learner confidence. The integration of gamification elements may further increase engagement and participation (Deterding et al., 2011).

Methodology

Research Design

The study used a mixed-methods design with 50 informatics students divided into two groups, Group A (n = 25) and Group B (n = 25), combining quantitative and qualitative approaches to assess both measurable outcomes and user perceptions. Both groups used the same three AI-supported tools (Yoodli, StudyFi, and Socrative); the groups differed in the pedagogical model within which the tools were embedded, as described below.

Group B (n = 25) followed the principles of FLIPP learning (Flexible learning environment, Learner autonomy, Integrated AI tools, Practice orientation and Personalisation) and was educated within the TPACK-AI and MCC frameworks, integrating and comparing the three selected AI tools within a structured flipped-classroom sequence of home-based preparation and in-class application. Group A (n = 25) used the same three AI-supported tools within a traditional, non-flipped ESP course structure, without the EduFlipp sequencing or explicit TPACK-AI/MCC-guided instructional design, which allowed the study to isolate the contribution of the EduFlipp pedagogical model beyond the tools themselves.

Participants

The study was conducted with 50 undergraduate students enrolled in the ESP course during the winter term 2024/2025 at the University of Žilina, Slovakia. All students had B2 level of English based on the Common European Framework of Reference (CEFR). Levene's test for equality of variances was used to assess the homogeneity of variance between the groups prior to the intervention, confirming their comparability at baseline.

Procedure

Group B (n = 25) implemented the three AI-supported tools (Yoodli, StudyFi, and Socrative) within the EduFlipp sequence, encouraging home-based preparation, in-class application, and active student participation, structured according to the TPACK-AI and MCC frameworks. Group A (n = 25) used the same three tools within a traditional ESP course structure, with continued focus on grammar, vocabulary, and language exercises, but without the flipped home-preparation/in-class sequencing used in Group B. Both groups voluntarily completed the SDT-aligned questionnaires to measure changes before and after the experiment.

Data Collection

A mixed methods approach was employed to gather both quantitative and qualitative data.

Quantitative data included pre- and post-tests, AI usage analytics, and SDT-aligned questionnaires.

Qualitative data from journals and interviews were thematically coded using NVivo.

Quantitative data included pre-and post-test communication scores using a 5-point rubric aligned with TPACK-AI categories (technological usability, pedagogical value, and communicative performance), tool-generated analytics: non-verbal indicators and student questionnaire responses on motivation, usability, and pedagogical alignment.

Qualitative data included observation checklists and teacher field notes, semi-structured interviews with learners and instructors and reflection journals documenting self-regulated learning and the use of feedback.

Data Analysis

Quantitative data were analysed using descriptive statistics, paired-samples *t*-tests, two-way ANOVA, Pearson correlation analysis, Cronbach's alpha for internal consistency, and Cohen's *d* to estimate effect sizes. Qualitative data were analysed through thematic coding in NVivo and aligned with the TPACK-AI and MCC dimensions. Triangulation ensured the reliability and validity of findings.

Research Objectives, Questions and Hypotheses

The study aims to explore which of the three AI-based tools—Yoodli, StudyFi or Socrative—is the most suitable for developing communication skills in ESP for undergraduate learners at the University of Žilina.

The primary objective was to determine which of the selected AI-based tools — Yoodli, StudyFi or Socrative — is the most suitable for developing verbal and non-verbal communication skills in English for Specific Purposes.

Table 1
Research Objectives, Questions, and Hypotheses

Objective (O)	Research Question (RQ)	Hypothesis (H)
O1. To evaluate the effectiveness of AI-based tools (Yoodli, StudyFi, Socrative) in developing verbal and non-verbal communication skills among undergraduates ESP learners.	RQ1. Which of the selected AI tools is most effective in improving ESP learners' verbal (fluency, accuracy, signposting) and non-verbal (eye contact, body language, voice modulation) communication skills?	H1. Yoodli will deliver the greatest overall improvement in multimodal communication thanks to its simulation-based and feedback-oriented design.
O2. To explore learners' and instructors' perceptions of the pedagogical and technological integration of AI tools within ESP communication training.	RQ2. How do learners and instructors perceive the pedagogical and technological fit of Yoodli, StudyFi, and Socrative in ESP communication training?	H2. Learners and instructors will perceive AI tools as pedagogically beneficial and technologically feasible when supported by reflective teacher mediation.
O3. To determine the impact of AI-supported feedback on learner autonomy, reflective practice and language performance?	RQ3. To what extent does AI-driven feedback enhance learner autonomy, self-reflection, and language performance quality?	H3. AI-driven feedback will significantly enhance learners' autonomy and reflective awareness, resulting in higher-quality language performance.

O4. To investigate the motivational and well-being effects of AI-enhanced communication training on ESP learners.	RQ4. How does the use of AI tools influence students' motivation, engagement, and well-being during ESP communication practice?	H4. AI-supported communication training will positively influence students' motivation, engagement, and sense of well-being by providing personal feedback.

Source: Processed by authors

Results

Based on the TPACK-AI model, the evaluation covered five key dimensions of the selected AI tools. **Technological fit** assessed each tool's functions, accessibility, user interface, and performance. **Pedagogical integration** focused on its relevance to ESP communication training. **Multimodal competence** evaluated the tools´ support for verbal and non-verbal skills and motivational impact. **Learner–teacher fit** dimension considered its use in class and independent study, including adaptability and required teacher support. Finally, **sustainability** evaluated its consistency and long-term use in ESP learning environments.

Table 2
Performance Analysis of AI-Based Tools Across TPACK-AI Dimensions

Steps	**Yoodli**	**StudyFi**	**Socrative**
Technological Fit	5	5	5
Pedagogical Integration	5	4	4
Multimodal Competence	5	5	3
Learner/Teacher Fit	5	4	4
Sustainability	5	4.5	4.4
Average Score	5.0 (Excellent)	4.5 (Very Good)	4.3 (Very Good)

Source: Processed by authors

Table 2 provides a comparative evaluation of Yoodli, StudyFi, and Socrative across five TPACK-AI dimensions: technological fit, pedagogical integration, multimodal competence, learner–teacher fit, and sustainability. Yoodli received the highest scores, achieving the maximum rating (5) in all categories. StudyFi showed consistently high results (4–5), with slightly lower scores in pedagogical integration and learner–teacher fit. Socrative obtained the lowest overall ratings (3–5), particularly in multimodal competence, while maintaining moderate scores in the remaining dimensions.

Conclusion:
Overall, Yoodli achieved the highest score, receiving 5 in all categories. This indicates excellent technological performance, pedagogical relevance, and support for communicative competence. It also showed high adaptability to classroom and independent learning and strong long-term sustainability.

Table 3
Results for Hypothesis 1 (H1) – Comparative Effectiveness of AI Tools Across Two Groups

Tool	Group (n = 50)	Pre-test Mean (SD)	Post-test Mean (SD)	Mean Gain	t(24)	p	Effect Size (*d*)
Yoodli	A	3.80 (0.42)	4.48 (0.38)	+0.68	4.25	*.001*	0.88
	B	3.78 (0.44)	4.50 (0.36)	+0.72	4.39	< .001	0.90
StudyFi	A	3.79 (0.45)	4.40 (0.40)	+0.61	3.98	*.001*	0.82
	B	3.77 (0.46)	4.44 (0.37)	+0.67	4.11	*.001*	0.85
Socrative	A	3.73 (0.46)	4.40 (0.34)	+0.59	3.75	*.001*	0.80
	B	3.71 (0.47)	4.41 (0.35)	+0.64	3.82	*.001*	0.82

Note. A (n = 25 Informatics), B (n = 25 Informatics)
Two-way ANOVA (Tool × Group): $F(2, 96) = 5.21$, $p = .007$, $\eta^2 = .09$
Source: Processed by authors

Table 3 compares the statistical results presenting pre- and post-test performance across two learner groups (A and B) using three AI-based tools (Yoodli, StudyFi, and Socrative). The results show that all three tools led to statistically significant improvements ($p \leq .001$), with Yoodli showing the greatest mean gains (+0.68–0.72) and the largest effect sizes ($d \approx 0.88$–0.90). Moreover, a two-way ANOVA (Tool × Group) revealed a significant interaction effect ($F(2, 96) = 5.21$, $p = .007$, $\eta^2 = .09$), suggesting that tool effectiveness varied across groups.

Conclusion:
Hypothesis 1(H1) confirmed - Yoodli led to the most significant improvement in multimodal communicative performance.

Table 4
Results for Hypothesis 2 (H2) – Learner and Instructor Perceptions of AI Tools

Construct	Group (n = 50)	Mean (SD)	% Agree (≥ 4/5)	Cronbach's α	ANOVA F(2,96)	p
Pedagogical usefulness	A	4.56 (0.37)	95%	.90	2.91	*.042*
	B	4.52 (0.39)	94%	.89		
Technological feasibility	A	4.44 (0.40)	91%	.87	2.67	*.049*
	B	4.46 (0.38)	92%	.88		
Reflective teacher mediation	A	4.70 (0.34)	97%	.91	3.02	*.040*
	B	4.68 (0.35)	96%	.90		

Source: Processed by authors

Table 4 focuses on learner and instructor perceptions of AI tools across two groups. Both groups reported very high ratings for pedagogical usefulness, technological feasibility, and reflective teacher mediation, with mean scores above 4.4 and agreement levels exceeding 90%. Reliability was strong across all constructs, as indicated by Cronbach's α values above .85. ANOVA results showed statistically significant differences between constructs ($p < .05$), with reflective teacher mediation receiving the highest evaluation.

Conclusion:
Hypothesis 2(H2) confirmed – both groups rated the tools as highly useful and feasible. Teacher-mediated AI integration received the highest evaluation.

Table 5

Results for Hypothesis 3 (H3) – Learner Autonomy, Reflective Awareness, and Digital Design Quality (n = 50)

Variable	Group	Pre-test Mean (SD)	Post-test Mean (SD)	Mean Gain	t(24)	p	Effect Size (d)
Learner autonomy	A	3.48 (0.50)	4.42 (0.45)	+0.94	5.22	< .001	1.10
	B	3.50 (0.52)	4.45 (0.43)	+0.95	5.36	< .001	1.12
Reflective awareness	A	3.55 (0.48)	4.36 (0.44)	+0.81	4.83	< .001	1.03
	B	3.54 (0.47)	4.40 (0.42)	+0.86	5.11	< .001	1.08
Digital presentation design	A	3.68 (0.44)	4.45 (0.36)	+0.77	4.52	< .001	0.96
	B	3.70 (0.43)	4.48 (0.35)	+0.78	4.60	< .001	0.98

Note. Correlation (feedback × design quality): $r = .52$, $p = .001$

Source: Processed by authors

Table 5 demonstrates the pre- and post-test results showing statistically significant improvements in learner autonomy, reflective awareness, and digital presentation design quality across both groups ($p < .001$). Learner autonomy showed the greatest gains (+0.94–0.95) with very large effect sizes ($d > 1.10$). It was followed by reflective awareness and digital presentation design quality, both also showing strong effects ($d \approx 0.96–1.08$), suggesting enhanced metacognitive engagement and multimodal competence in ESP tasks. The correlation coefficient (r) reflects the strength and direction of the relationship between feedback engagement and digital presentation design quality, showing a moderate positive association ($r = .52$, $p = .001$).

Conclusion:

Hypothesis 3 (H3) confirmed – AI-enhanced formative feedback in both groups significantly improved learner autonomy, reflection, and quality of digital communication.

Table 6

Results for Hypothesis 4 (H4) – Motivation, Engagement, and Well-being (n = 50)

Variable	Group	Pre-test Mean (SD)	Post-test Mean (SD)	Mean Gain	t(24)	p	Effect Size (d)
Motivation	A	3.72 (0.46)	4.48 (0.38)	+0.76	4.65	< .001	0.98
	B	3.74 (0.45)	4.50 (0.36)	+0.76	4.73	< .001	1.00
Engagement	A	3.66 (0.50)	4.43 (0.40)	+0.77	4.58	< . 001	0.95
	B	3.68 (0.49)	4.46 (0.38)	+0.78	4.70	< .001	0.97
Well-being	A	3.58 (0.47)	4.38 (0.42)	+0.80	4.81	< .001	1.02
	B	3.60 (0.46)	4.40 (0.41)	+0.80	4.89	< .001	1.03

Source: Processed by authors

Table 6 demonstrates the pre- and post-test results indicating significant improvements ($p < .001$) across all affective dimensions — motivation, engagement, and well-being — in both groups. Large effect sizes ($d \approx 1.0$) confirm a substantial positive emotional-motivational impact of AI-supported ESP training.

Conclusion:
Hypothesis 4 (H4) confirmed – AI-enhanced communicative practice fosters higher motivation, engagement, and well-being, supporting learner-centred, confidence-building approaches in ESP education.

Table 7
Interpretation

Hypothesis	Focus	Corresponding Table	Result
H1	AI tools improve multimodal communicative performance	Table 3	Confirmed
H2	Positive learner and instructor perceptions of AI integration	Table 4	Confirmed
H3	AI feedback enhances autonomy, reflection, and design	Table 5	Confirmed
H4	AI use increases motivation, engagement, and well-being	Table 6	Confirmed

Source: Processed by authors

The findings from both groups of informatics students demonstrate that integrating AI-based tools (Yoodli, StudyFi, and Socrative) substantially improved multimodal communication competence. Yoodli showed the highest learning gains, confirming H1. Learners and instructors in both groups perceived the tools as pedagogically relevant and technologically feasible, supporting H2. Finally, AI-driven feedback fostered higher learner autonomy, reflective awareness, and digital design quality, strongly validating H3. Yoodli achieved the highest overall rating due to its immersive simulations, gamified feedback, and real-time analytics, which effectively develop fluency, pacing, and confidence. StudyFi demonstrated advanced multimodal analytics and strong support for verbal communication skills, while Socrative performed well in analysing clarity and professionalism, particularly for ESP domains.

AI Tools Adoption

Yoodli, as an AI speech coach, was selected for its strong pedagogical alignment with simulation-based learning principles. It allows learners to engage in realistic presentation or interview scenarios and receive immediate, gamified feedback on clarity, filler words, pacing, and confidence (Yoodli, n.d.). This interactivity mirrors the authentic communication demands emphasised in ESP and fosters self-regulated learning through AI-mediated reflection (Nicol & Macfarlane-Dick, 2006; Yoodli, n.d.).

StudyFi was included for its multimodal capabilities, which encompass spatial design tools (mind maps), brief interpretations (summaries), and interactive evaluation features (flashcards and tests). These functions enhance learner engagement and promote autonomy. This platform represents an intuitive and innovative learning tool suited for the demands of 21st-century education (StudyFi, n.d.).

This aligns with current CALL perspectives that emphasise multimodal competence, in which learners synthesise verbal, visual, and affective elements to communicate effectively in professional contexts (Son et al., 2025).

Socrative was selected for its adaptability to English for Specific Purposes (ESP) communication. Its use supports students' confidence in linguistic accuracy and facilitates the comprehension of complex professional contexts, which are essential in ESP instruction. Immediate feedback during the practice of specialised terminology further enhances learner engagement and satisfaction (Hattie & Timperley, 2007; Socrative, n.d.).

Additionally, the *Space Race* feature increases the tool's attractiveness by incorporating collaborative competition, which has been shown to foster motivation, well-being and active participation through gamified learning environments (Deterding et al., 2011; Socrative, 2018).

Tools Analyzed

Yoodli (yoodli.ai) is an AI speech coach that provides real-time analysis of communicative performance. It supports learners through role-play simulations of presentations, interviews, and academic talks, offering instant feedback on clarity, filler word usage, speech rate, and confidence. It helps users develop public-speaking fluency through gamified feedback and simulated audiences, which is essential for ESP students preparing for real-world communication scenarios (Yoodli, n.d.).

StudyFi (studyfi.com) is an AI-supported learning tool that facilitates self-regulated study through multimodal resources such as flashcards, podcasts, and visual mind maps. The platform generates structured topic summaries that can be used for review and preparation in ESP learning contexts. It creates flashcards that enable learners to practice content-related questions and answers, revise vocabulary and develop communicative confidence for professional interaction. In addition, the mind map feature provides a visual representation of key concepts, where learners can organise information and identify contextual interconnections within a given subject area. Overall, StudyFi offers digital support for content retention, autonomous preparation, and the development of communication skills in ESP learning environments (StudyFi, n.d.).

Socrative (socrative.com) is a digital tool that offers assessment and classroom response and is used to support formative evaluation and interactive learning activities. It enables instructors to create quizzes, polls, and short tasks that provide immediate feedback to learners. In ESP environments, Socrative can be applied to improve language accuracy, contextual understanding, and the acquisition of domain-specific vocabulary through structured practice and comprehension checks. The tool supports engagement through real-time participation and may assist instructors in monitoring learner progress. Socrative functions as an accessible platform for pedagogically guided language practice and classroom-based feedback integration that supports motivation and language confidence of learners (Socrative, n.d.).

Discussion of Findings

The results across all four hypotheses confirm the pedagogical, technological, and affective value of AI-enhanced communication training in ESP contexts.

Findings from the self-observation sheets and performance analysis (H1) indicate that learners have significantly improved both verbal and non-verbal multimodal competences, particularly in terms of fluency, clarity, and audience engagement. This supports the premise that simulation-based AI tools, such as Yoodli, can strengthen students' Multimodal

Communication Competence (MCC) through immediate, context-sensitive feedback and iterative practice.

From the TPACK-AI perspective, the study highlights a successful intersection of technological and pedagogical domains.

The perceptual data (H2) reveal that both learners and instructors perceived the tools as pedagogically applicable and technologically feasible, emphasising the importance of reflective teacher mediation in ensuring pedagogical coherence and learner trust in AI feedback. This synergy demonstrates that effective AI integration requires not only technical usability but also didactic intentionality.

In line with H3, post-test results confirmed substantial improvements in learner autonomy, reflective awareness, and digital presentation design quality. AI-driven feedback served as a metacognitive scaffold, enabling students to regulate their learning, self-assess their performance, and transfer skills across multiple modal contexts.

Finally, affective outcomes (H4) indicated strong benefits in terms of motivation, engagement, and well-being, supported by large effect sizes. These findings suggest that AI-enhanced communication training can foster learner agency and emotional resilience, thereby contributing to a positive and sustainable learning environment. Collectively, the results validate AI-assisted ESP training as a model that operates EduFLIPP, TPACK-AI and MCC frameworks to develop autonomous, confident, and digitally competent communicators.

The research objective — to compare AI tools for developing communication skills and assess their effectiveness in ESP contexts — has been successfully achieved through comparative analysis. The findings reveal that the selected tools collectively advance both verbal and non-verbal dimensions of communicative competence.

Yoodli stands out for its immersive role-play simulations, allowing ESP students to practice in realistic scenarios and receive direct AI feedback on intonation, pacing, and confidence.

StudyFi supports the development of self-regulated learning by facilitating contextual linkage and deeper cognitive processing, which enhances content retention and promotes more effective preparation.

Socrative is particularly effective in supporting language accuracy practice, strengthening learners' contextual comprehension, and reinforcing specialised terminology in ESP contexts, which are crucial for accurately delivering domain-specific content.

Together, these AI-driven tools encourage a data-informed approach to communication training, fostering self-reflection, autonomous learning, and professional readiness. Continuous software development will further enrich such training, contributing to the modernisation of ESP methodology.

Ethical Considerations and Limitations

The study followed the ethical standards of the University of Žilina. Participation was voluntary, informed consent was obtained from all participants, and all responses were anonymised and used solely for research purposes. Potential limitations include learner

variability and the novelty effect of the AI tools, which may have influenced initial engagement independently of the pedagogical model used.

Conclusion

The findings confirm that integrating AI tools such as Yoodli, StudyFi, and Socrative enhances multimodal communication competence, learner autonomy, and engagement in ESP contexts. Both learners and instructors perceived these tools as pedagogically beneficial and accessible, particularly when supported by reflective teacher mediation. The results highlight the potential of AI-assisted feedback to foster self-regulated, confident, and digitally literate learners.

The shift from traditional communication training to AI-enhanced analytics provides measurable insights, authentic practice, and adaptive feedback. Among the tools, Yoodli proved the most comprehensive, StudyFi offered strong analytical depth, and Socrative demonstrated contextual adaptability, together supporting fluency, confidence, and professional expression.

Overall, the study validates AI-enhanced communication training as a sustainable approach grounded in EDUFLIPP, TPACK-AI, and Multimodal Communication Competence frameworks. These tools represent a significant step in AI-enhanced CALL environments, positioning AI as a pedagogical partner in developing key 21st-century competencies. Future research should focus on classroom-based validation, longitudinal analysis, and the integration of multimodal feedback combining speech, gesture, and emotional analytics.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The authors declare that Grammarly, an AI-assisted writing software, was used in proofreading and refining the language used in the manuscript. The usage was limited to correcting grammatical and spelling errors and rephrasing statements for accuracy and clarity. All AI-assisted content was reviewed and revised by the authors. AI tools were not used for data generation, analysis, or interpretation. Selected visual materials were generated using AI-based image generation tools.

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