

Innovations in ESP teaching and learning practices

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Abstract. The informatisation of society and the rapid development of technology significantly outpaces its implementation, including in education. The use of the latest technologies reduces the dependence of teaching and learning on students' physical location, enhances the structure and content of the educational process, and improves its efficiency, personalisation and student engagement. Artificial intelligence tools facilitate more effective information presentation and assimilation. This research aimed to examine how technologies can be implemented in education to enhance efficiency and student-centred learning. This article presented experiences in using technologies for teaching English for Specific Purposes, with a particular focus on the application of artificial intelligence and the Internet of Things. Their role in increasing student motivation and ensuring that the educational process remains aligned with current trends was explored. Theoretical research methods, including analysis, synthesis, comparison, generalisation, and concretisation, alongside scientific methods such as chronological analysis and cause and-effect examination, enabled an investigation of the challenges associated with integrating emerging technologies into education. The current state of the problem, along with the benefits and challenges of using innovations in education, was analysed through content analysis. This article compared the definitions of artificial intelligence and highlighted its transformative potential in personalised learning. Key applications of AI in education, including natural language processing (NLP) and chatbots, which enhance learning experiences, were examined. Ethical considerations regarding AI usage in education were also discussed. The advantages of using AI-powered learning platforms for both students and teachers were explored. Particular attention was to AI's ability to analyse students' strengths, weaknesses, and preferences, ensuring that content is relevant and appropriately challenging for each individual. Continuous evaluation adjusts question difficulty based on student performance, ensuring they are challenged without being overwhelmed. Instant feedback enables students to identify mistakes immediately, which fosters rapid learning and improvement. Solutions to identified challenges were suggested

Keywords: artificial intelligence; Internet of Things; English for Specific Purposes; ethical principles; educational AI

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Introduction

Language learning was once a tedious process, involving the memorisation of long vocabulary lists, learning grammar rules, and completing numerous monotonous exercises. Technology is making English for Specific Purposes (ESP) teaching and learning increasingly engaging and enjoyable. While technology is no longer a novelty, it continues to astonish with its limitless potential. Technological advancements are occurring at such a rapid pace that the primary challenge lies not in a lack of tools or resources for improving the educational system but in the difficulty of keeping up with constant innovations. Despite extensive research in the field, ongoing attention is required.

The field of ESP has evolved significantly in recent years, adapting to the changing demands of global communication, technological advancements, and the increasing specialisation of various professional domains. Innovations in ESP teaching and learning are essential for preparing students to navigate both academic and professional challenges. The following studies reflect the latest developments in this field. H. Basturkmen (2022) examines the transition from traditional models to more dynamic, learner-centred approaches, particularly in blended and online learning environments. He underscores the importance of aligning English courses with professional linguistic and communicative requirements. Furthermore, his research explores how ESP fosters critical thinking and problem-solving through task-based learning.

R. Candrasari *et al.* (2024), investigating the potential benefits of innovative methodologies in ESP teaching, argue that educators can create dynamic and interactive learning environments to enhance student motivation and participation. This is achieved through the integration of the latest technologies, including virtual reality simulations and gamified learning platforms, which cultivate critical thinking and adaptability. J. Tang (2023) explores the ways to build “Artificial Intelligence English for Specific Purposes (AI ESP)”. He differentiates between academic and

professional needs and identifies how information technology should be integrated into ESP teaching and which tools should be utilised. His research highlights the necessity of teacher development support to enhance educators’ proficiency in AI-driven ESP instruction.

O. Melnychuk *et al.* (2024) highlight “the key reasons why using mobile apps for learning English is considered topical: accessibility, convenience, interactive and engaging content, personalised learning, variety of learning materials, social and community features, progress tracking”. D. Milosevic (2023) examines the use of information technologies, particularly the Internet of Things (IoT), in teaching a foreign language to IT students. As IoT continues to evolve and become more prevalent worldwide, the author emphasises the importance of gathering data in this field. Given that IoT is studied by IT students, its integration into foreign language classes is inevitable, aligning with the programme curriculum. ESP teachers often struggle to stay up to date with contemporary technologies and integrate ongoing innovations into their teaching methods. This challenge is particularly pronounced when they lack professional expertise in these and related fields, making it difficult to effectively communicate technical content to students, who have high expectations regarding their lecturers’ technical and digital literacy. These studies demonstrate that innovations in ESP teaching practices focus on adapting to the specific needs of different professional fields while also embracing technological advances, learner-centred pedagogies, and interdisciplinary approaches. Although common themes exist – such as task-based learning, communicative competence, and technology integration – each study offers distinct insights and practical applications within diverse ESP contexts, thereby making valuable contributions to the field.

This research aimed to explore how technologies can be implemented in education to enhance efficiency and improve student engagement.

As a result of this study, the article sought to share the substantial insights gained throughout the research process. The article primarily examined the use of artificial intelligence and the Internet of Things in education, as well as their application in ESP teaching, and learning to increase student motivation and optimise the learning process. Achieving the aim of the research involved the following objectives:

- to examine how artificial intelligence and the Internet of Things can be applied in education;
- to analyse existing definitions of the terms “artificial intelligence” and “Internet of Things”;
- to investigate which online resources can be effectively used in ESP training;
- to provide examples of the latest technologies used in ESP teaching and learning.

Materials and Methods

The research on innovations in English for Specific Purposes (ESP) teaching and learning employed a combination of theoretical and applied methods to explore how advanced technologies can transform educational processes. Theoretical methods, such as analysis, synthesis, comparison, generalisation, and concretisation, enabled the formulation of initial provisions and the identification of the study's key ideas. The research integrated existing literature and case studies to understand the transformative potential of technology in ESP teaching. Scientific methods, namely chronological and cause-and-effect analysis, facilitated the examination of challenges associated with integrating the latest technologies into educational practices. Using content analysis, the study characterised the current state of the issue, identifying both the advantages and challenges of AI implementation in education. Surveys and questionnaires are widely recognised as cost-effective tools for collecting diverse opinions and experiences, offering insights into the practicalities of implementing innovations in ESP teaching. In this study, no original surveys were conducted; instead the research drew upon the findings of other scholars (Candrasari *et al.*, 2024; Nikolić

et al., 2024). Their surveys investigated teachers' and students' perceptions of innovative practices as well as their attitudes towards new teaching tools and methods.

To illustrate the ethical principles of artificial intelligence usage, a graphical method was employed. A tabular method was applied to construct tables, while dimensional analysis provided a comprehensive perspective on the phenomenon under study. Additionally, analytical and interpretative methods were used to examine the definitions of “artificial intelligence” and “Internet of Things” in academic literature. At one stage, the comparative method was used to evaluate and contrast various internet resources for their effectiveness in ESP teaching. Systematisation and generalisation contributed to the formulation of the study's conclusions. Ethical challenges associated with AI adoption in education, such as data privacy concerns and potential biases in AI algorithms, were critically examined. The research underscored the importance of responsible AI implementation in fostering trust and inclusivity. By integrating these methods, the study provided a comprehensive understanding of how innovative technologies can enhance ESP education, optimising its efficiency and aligning it more closely with students' needs.

Results and Discussion

Artificial intelligence in education and its definition

To better understand how AI can be used in the educational process, its various definitions have been examined. Despite the existence of numerous definitions, studies by the Netherlands Council for Government Policy indicate that there is no universally accepted definition of the AI concept (Sheikh *et al.*, 2023). The term “artificial intelligence” was first mentioned in the 1950s. Later, D. Dobrev (2013) and J. Schuett (2019) presented three of the most widely recognised definitions: (1) “Artificial intelligence means any computer that passes the Turing test” (based on Alan Turing's test); (2) “Artificial intelligence means the

science and engineering of making intelligent machines” (John McCarthy) – this definition does not reference human intelligence; and (3) “Artificial intelligence means an intelligent agent” (definition by Stuart Russell and Peter Norvig). L. Chen *et al.* (2020) define artificial intelligence as “a field of study and the resulting innovations and developments that have culminated in computers, machines, and other artefacts having human-like intelligence characterised by cognitive abilities, learning, adaptability, and decision-making capabilities”.

Artificial intelligence (AI) has the potential to significantly transform teaching and learning processes (Derevyanko & Zalevska, 2023). These processes are becoming increasingly personalised due to the AI algorithms that analyse data, identify patterns, and make predictions (Harry & Sayudin, 2023; Kamalov *et al.*, 2023; Su & Yang, 2023). Students have already benefited from the ability to learn at their own pace and in a way that best suits their learning style, while teachers save time through intelligent learning and tutoring systems, automated assessment systems, Personal Learning Environments (PLEs), Learning Management Systems (LMS), and a diverse range of teaching resources. M. Nikolić *et al.* (2024) argue that speaking and listening skills experience the most significant improvements through the use of information and communication technology. M. Waugh *et al.* (2021) conducted content analysis to examine how textbooks and teaching materials incorporate new approaches to language teaching. The authors assert that content analysis of ESP materials determines the extent to which innovations, such as task-based learning or the integration of professional jargon, are embedded within the materials used by teachers and students.

Natural Language Processing (NLP) is one of the primary applications of AI. It enables intelligent systems to understand and process human speech and text. J. Su & W. Yang (2023) examined the potential advantages and disadvantages of using ChatGPT in education and referred to it as “educative AI”. They define ChatGPT as “a form of

generative AI that uses algorithms to generate new text similar to what a human might write. It is a language model that uses deep learning to generate human-like responses to natural language queries. ChatGPT is designed to be used in a conversational setting, allowing users to interact with the model naturally and intuitively. As a powerful AI application, ChatGPT can answer questions, write stories, summarise documents, and compose essays”. Chatbots are also increasingly used in education to enhance students’ learning experiences and facilitate their learning (Wollny *et al.*, 2021).

M. Sharples (2023) concludes that “building social generative AI for education will require the development of powerful AI systems that can converse with each other as well as humans, construct external representations such as knowledge maps, access and contribute to internet resources, and act as teachers, learners, guides and mentors”. With the emergence of AI in education, issues such as security, data privacy, teacher-student relationships, and ethics have come to the forefront. Extensive research is being conducted on the ethical implications of AI in education, as these concerns continue to generate widespread discussion. Ethical considerations must be addressed when designing and implementing trusted AI systems for education. A. Nguyen *et al.* (2023) propose a set of ethical principles (Fig. 1). The authors state that “no universal consensus has been reached on the best ethical theory in general”. In 2024, UNESCO introduced two new AI competency frameworks: one for students, developed by F. Miao & K. Shihira (2024), and another for teachers, developed by F. Miao & M. Cukurova (2024). The AI competency framework for teachers is designed to assist educators in implementing artificial intelligence “responsibly and thoughtfully, ensuring that AI contributes positively to society and the environment” (UNESCO, 2024). Thus, AI enhances education by making it more effective, inclusive, and engaging, while also preparing students for a world driven by technology.

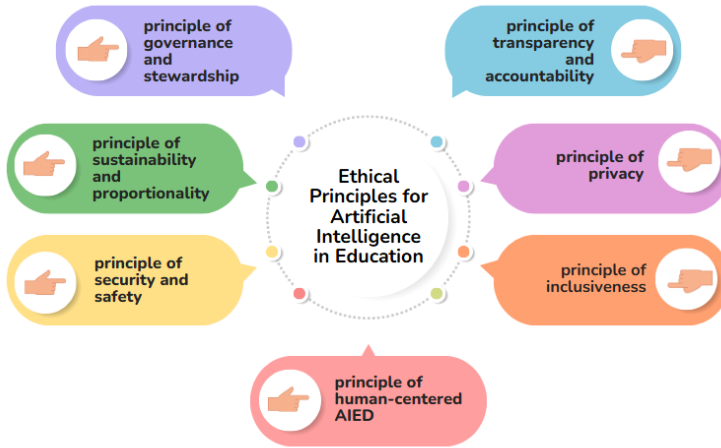


Figure 1. Ethical principles for artificial intelligence in education

Source: developed by the author based on the research by A. Nguyen et al. (2023)

Internet of Things technologies in education

The application of Internet of Things technologies in education aims to simplify teaching and learning processes while also improving the quality and enhancing the efficiency of educational systems. Discussions regarding the use of

IoT in education remain ongoing. Researchers such as T. Todorov & P. Vela (2023), and A. Mohanty et al. (2023) highlight various advantages and disadvantages of its application. Table 1 presents some typical benefits, challenges, and possible solutions identified in different studies.

Table 1. Benefits and challenges of the Internet of Things in education

Benefits	Challenges	Proposed solutions
<ul style="list-style-type: none"> ➤ facilitates communication between learners and teachers worldwide; ➤ reduces gender inequality; ➤ enhances students' engagement and trainers' effectiveness; ➤ promotes teamwork and creative thinking; ➤ provides better access to data; ➤ enhances safety; ➤ optimises the training process; ➤ contributes to efficient lesson planning; ➤ enables unprecedented real-time data collection. 	<ul style="list-style-type: none"> ➤ lack of financial resources; ➤ ethical challenges; ➤ unlawful access; ➤ privacy and data security concerns; ➤ difficulties in maintaining smooth functionality; ➤ limited availability of computers and equipment; ➤ harmful environmental impacts; ➤ utilisation of limited global resources; ➤ high energy consumption associated with the production of electronic devices; ➤ insufficient research on sustainability and long-term effects. 	<ul style="list-style-type: none"> ➤ setting strict security standards; ➤ investing in teacher training; ➤ monitoring and evaluating rapid technological development from an environmental perspective; ➤ ensuring responsible utilisation of limited global resources; ➤ careful investigation of potential environmental footprints; ➤ improving recycling rates; ➤ managing secure e-waste.

Source: developed by the author based on the research by M. Safdar et al. (2019)

S. Al-Taai et al. (2023) identify “smart education, smart classes, proof of attendance, text

message alerts, emergency management in educational institutions, improving operational

efficiency in educational institutions, educational applications” as the most significant IoT applications in education. These applications “relying on electronic devices, equipment, and software, including smartphones, handheld devices, smart boards, electronic classes, and high-definition television”. The authors assert that IoT helps students “to overcome the barriers of time and space and enables them to successfully control the learning management from a distance”. Unfortunately, the Internet of Things has yet to be fully integrated into traditional education (Badshah *et al.*, 2023). The following section outlines some examples of tools that leverage the extensive capabilities of artificial intelligence.

One of the AI-driven differentiation tools that can transform AI-generated content into different

formats is Diffit. It provides teachers with quickly generated resources. Diffit creates customised resources for ESP lessons, saving time and ensuring that all students can access content appropriate to their level. It can generate or adapt texts for any reading level, provide teachers and students with automatically generated summaries and comprehension exercises, extract vocabulary from any context, edit texts of varying complexity, create discussion questions, dialogues, and letters, identify quotes for any topic, and build a wide range of exercises. The self-paced course helps teachers learn how to use this versatile tool. Another similar, and even more popular, AI-powered tool for English teachers is Twee. Figure 2 illustrates the extent to which AI tools can support teachers’ work and enhance teaching efficiency (Twee, n.d.).



Figure 2. Capabilities of AI tools

Source: developed by the author using Twee.com education technology (Twee, n.d.)

AI-powered mobile applications are transforming ESP training by providing personalised and interactive learning experiences. These tools leverage cutting-edge technologies to cater to the unique needs of learners in various professional fields. AI algorithms analyse individual learning styles, strengths, and weaknesses, allowing for tailored content and practice exercises that align with each learner's needs. Through real-time feedback, mobile applications provide instant assessments and corrections

to help learners understand their mistakes and improve their speaking skills efficiently. Interactive features such as gamification, chatbots, and speech recognition keep learners motivated and engaged, making the learning process more effective and enjoyable. AI tools simulate real-world scenarios relevant to specific industries, allowing learners to practice language skills in context. They provide flexibility and convenience for learners with demanding schedules. Task examples are presented in Table 2.

Table 2. AI-based English learning tools

Answering questions about yourself	Reading aloud	Giving opinion
You will hear 8 questions. Listen to each question, then answer. For questions 1-4, you have 10 seconds to respond. For questions 5-8, you have 20 seconds.	You will see 8 sentences. You have 10 seconds to read and record each sentence.	You have 1 minute to talk about a topic. First, read the task and prepare your answer. Then, speak for one minute.
Giving a presentation about a graphic	Give advice or make a recommendation	Answer questions about a topic
You have 1 minute to discuss a visual representation of data. First, examine the information and prepare your response. Then, speak for 1 minute while continuing to view the graphic.	You will hear five questions about a topic. First, read the task. Listen to each question, then respond. You should speak for 20 seconds.	You have 1 minute to talk about a visual representation of data. First, examine the information and prepare your response. Then, speak for 1 minute while continuing to view the graphic.

Source: Developed by the author using Course Hero education technology

Therefore, it can be concluded that the Internet of Things in education connects devices and systems to enhance learning environments and improve educational outcomes. By integrating IoT, education becomes more intelligent, efficient, and accessible, empowering both teachers and students.

Artificial intelligence-powered learning platforms

Generative AI-driven tools aim to improve students' speaking skills. One such tool is Speak & Improve (similar to Write & Improve) from the University of Cambridge (Speak & Improve, n.d.). Developed as a research project by the University of Cambridge, it evaluates students' speaking skills in an online environment. Students can practice their speaking skills with a speech robot that listens to them and assesses their pronunciation, reading, ability to express their point of view,

give advice or make a recommendation, describe a graphic, and answer questions. Accurate grading based on the internationally recognised CEFR scale serves as a powerful motivational tool. The exercises can be completed separately or as part of a full test, which is particularly useful for exam preparation. The test consists of five parts:

- Part 1: Answer questions about yourself;
- Part 2: Read aloud;
- Part 3: Give a presentation on a personal topic;
- Part 4: Give advice or make a recommendation;
- Part 5: Answer questions about a topic.

A notable aspect of Speak & Improve is that, unlike Write & Improve, it is not yet officially a product, meaning it is currently available for free. The developers state that they need learners' recordings to improve the tool itself. Thus, it serves

as a free alternative to ELSA Speak, which provides voice-enabled role-play, realistic speaking practice, a “Create Your Own Scenario” feature, a wide range of lessons on different skills and topics, daily recommended practice, progress tracking and rewards, and access to certificate courses (IELTS, Oxford, HarperCollins, EIKEN, and Pearson PTE), as well as the US Citizenship Test Preparation Course. The most noteworthy feature is the AI-generated feedback on fluency, grammar, and vocabulary, along with guided practice for interviews, presentations, and exams. Additional features such as a dynamic transcript, paraphrasing tool, and vocabulary recommendations enhance the learning experience (ELSA, n.d.).

The term “burstiness” refers to “the phenomenon where language learners repeatedly come across unfamiliar words” (Talkpal, 2024). AI facilitates language learning by tracking progress, identifying learning patterns, and potential challenges. Recently, numerous chatbots have emerged to help students enhance their speaking, listening, and pronunciation skills through voice interaction with AI that speaks English in a natural, human-like manner. Another AI-powered innovation is learning platforms such as Coursera, edX, Knewton, Duolingo, Smart Sparrow, and DreamBox. These platforms are popular as they leverage artificial intelligence to create personalised, efficient, and engaging learning experiences. The benefits of their use in education are widely discussed. Advanced technologies enable adaptation to individual students’ needs, making education more accessible and effective. AI analyses learners’ strengths, weaknesses, and preferences, ensuring that content is relevant and appropriately challenging for each student. Continuous evaluation adjusts the difficulty level of questions based on the student’s performance, ensuring that they are challenged but not overwhelmed, while instant feedback helps them identify their mistakes immediately. This process fosters quick learning and improvement.

Multimedia content, simulations, and games motivate students to learn languages. The 24/7

availability of resources and support enables students to study at their own pace and fit learning into their schedules. Teachers, in turn, benefit from AI platforms because automating assessment and analytics allows them to focus more on instruction than administrative tasks. AI platforms help teachers refine their methodology and curricula by collecting and analysing data on learners’ progress and engagement.

Another technology worth mentioning is augmented reality (AR) glasses, which help international students overcome challenges associated with language barriers and enhance their translation experiences. S. Chen’s (2024) research shows that AR technology facilitates the integration of international students into non-native learning environments. In 2022, Google announced AI-powered glasses capable of translating speech on the device’s display in real time. The Google Translate glasses can even detect American Sign Language, and project a translation in front of a user’s eyes like real-time subtitles. While the glasses remain in the prototype phase, and the company has not provided any information on their potential commercial release, they are expected to indicate the direction of the AR device market. Alphabet’s first Google Glasses faced backlash due to an integrated camera that raised privacy concerns. The design of the new translation glasses has been modified from a more sci-fi look to a traditional glasses design, demonstrating how groundbreaking innovations quickly transition from novelty to familiarity. Thus, educational platforms are increasingly becoming AI-driven. They revolutionise education by offering personalised, efficient, and engaging learning experiences, empowering both educators and learners, and making education more inclusive, adaptive, and future-ready.

Conclusions

The research conducted underscores the transformative potential of innovations, particularly artificial intelligence and the Internet of Things, in enhancing ESP teaching and learning. The

findings highlight how AI-powered tools and IoT systems can create engaging, efficient, and personalised educational experiences, effectively addressing the challenges traditionally associated with language education. AI technologies, such as intelligent tutoring systems, automated assessment tools, and natural language processing applications, have demonstrated their capacity to adapt to individual learners' needs. These innovations not only facilitate tailored learning paths but also enable teachers to refine their instructional methods. Similarly, IoT technologies have shown promise in fostering smart learning environments through enhanced connectivity and real-time data collection. These advancements have been instrumental in improving student engagement, collaboration, and access to educational resources.

Moreover, the research identifies several advantages of incorporating these technologies into the ESP domain, including fostering learner autonomy, streamlining administrative processes, and bridging gaps in accessibility. However, it also identified areas requiring further attention,

such as the ethical implications of AI in education, privacy concerns, and the environmental impact of IoT systems. The study's findings align with its objectives and purpose, offering valuable insights into the practical applications of AI and IoT in ESP education. These insights contribute to the broader discourse on integrating technology into educational systems, emphasising the need for thoughtful and responsible implementation strategies. Future research should focus on addressing the identified challenges, particularly by exploring sustainable practices for implementing IoT in education and developing ethical frameworks for AI use. Additionally, further studies on the long-term impact of these technologies on learner outcomes and teacher efficacy would offer deeper insights, ensuring their responsible and effective integration into the educational landscape.

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Conflict of Interest

None.

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Інновації в практиці викладання та навчання англійської мови професійного спрямування

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Анотація. Інформатизація суспільства та темпи розвитку технологій значно випереджають темпи їх впровадження, зокрема в освіту. Застосування новітніх технологій зменшує залежність викладання та навчання від місця розташування студентів, сприяє вдосконаленню форм і змісту навчального процесу, його ефективності та індивідуалізації, а також залученості та мотивації студентів. Засоби штучного інтелекту сприяють кращому представленню та кращому засвоєнню інформації. Дослідження мало на меті пошуки шляхів впровадження новітніх технологій в освітній процес задля підвищення його ефективності. Стаття висвітлює досвід використання новітніх технологій у процесі викладання англійської мови професійного спрямування. Особливу увагу приділено використанню штучного інтелекту та Інтернету речей в освіті та їх застосуванню у викладанні англійської мови професійного спрямування для підвищення мотивації до навчання та адаптації освітнього процесу до сучасних тенденцій. Теоретичні методи дослідження, такі як аналіз, синтез, порівняння, узагальнення, конкретизація, а також наукові методи, а саме хронологічний та причинно-наслідковий аналіз, дозволили вивчити проблеми використання новітніх технологій у навчальному процесі. Сучасний стан проблеми, позитивні аспекти та виклики, пов'язані з використанням інновацій в освіті, були досліджені за допомогою методів контент-аналізу. У статті порівняно визначення штучного інтелекту та висвітлено його трансформаційний потенціал у персоналізації навчання. Було вивчено ключові застосування штучного інтелекту в освіті, включаючи обробку природної мови (NLP) і чат-ботів, які покращують навчальний досвід. Також були розглянуті етичні міркування щодо використання ШІ в освіті. У статті обговорювались переваги використання навчальних платформ на основі ШІ для студентів і викладачів. Увагу приділено здатності штучного інтелекту аналізувати сильні й слабкі сторони та вподобання студентів, щоб переконатися, що рівень контенту є відповідним і достатньо складним для кожного з них. Безперервне оцінювання регулює рівень складності запитань залежно від результатів учня, гарантуючи, що вони будуть залучені, але не перевантажені. Миттєвий зворотний зв'язок допомагає учням негайно виявити свої помилки, що сприяє швидкому навчанню та вдосконаленню. Запропоновано шляхи вирішення проблем

Ключові слова: штучний інтелект; Інтернет речей; ESP; етичні принципи; навчальний ШІ