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Technologies for using interactive artificial intelligence tools in the teaching of foreign languages and translation

Технології Використання Інтерактивних Засобів Штучного Інтелекту у Викладанні Іноземних Мов та Перекладу

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Abstract

The article explores the potential of artificial intelligence technologies in teaching foreign languages and translation. It explores the advantages and possible challenges of using such technologies in language education and provides practical examples. The article also discusses perspectives on the future development and use of interactive artificial intelligence tools in the field of language teaching and translation. The integration of artificial intelligence into higher education has ushered in a new era of transformation in educational processes, reforming various aspects of the educational experience. The advantages of introducing artificial intelligence into higher education are numerous, ranging from personalized learning paths to intelligent assessment tools. The tools are classified into categories for students,

Анотація

У статті досліджено потенціал технологій штучного інтелекту у навчанні іноземних мов та перекладу. Він досліджує переваги та можливі проблеми використання таких технологій у мовній освіті та надає практичні приклади. У статті також обговорюються перспективи майбутнього розвитку та використання інтерактивних засобів штучного інтелекту у сфері навчання мов та перекладу. Інтеграція штучного інтелекту у вищу освіту започаткувала нову еру трансформації в освітніх процесах, реформуючи різні аспекти освітнього досвіду. Переваги впровадження штучного інтелекту у вищу освіту численні, від персоналізованих шляхів навчання до інтелектуальних інструментів оцінювання. Інструменти класифіковано за категоріями для студентів, викладачів і системи освіти. Він

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teachers, and the education system. It identifies key results of such processes and examines various technologies, including Linguatech Learning Assistant, Linguatech Translation Tool, and Linguatech Language Lab, which help students improve their language and translation skills. The research examines the effectiveness of interactive tools in education, comparing their use in classroom and distance learning formats. The article's conclusions are significant for the development and improvement of language and translation education programs that use innovative artificial intelligence technologies.

Keywords: identity, ethnicity, societal ideal, state-building, national consciousness.

визначає ключові результати таких процесів і вивчає різні технології, зокрема Linguatech Learning Assistant, Linguatech Translation Tool і Linguatech Language Lab, які допомагають учням покращити свої мовні та перекладацькі навички. Дослідження вивчає ефективність інтерактивних інструментів в освіті, порівнюючи їх використання в аудиторних і дистанційних форматах навчання. Висновки статті мають важливе значення для розробки та вдосконалення мовних і перекладацьких освітніх програм, які використовують інноваційні технології штучного інтелекту.

Ключові слова: ідентичність, етнічність, суспільний ідеал, державотворення, національна свідомість.

Introduction

Artificial intelligence is widely used in various sectors of society, including the economy, finance, marketing, medicine, industry, and education. Machine learning reflects linguistic intelligence in the context of artificial and human intelligence. It is often confused or equated with artificial intelligence. From a technical perspective, machine learning is a subfield of artificial intelligence. The primary objective of artificial intelligence is to enable computers to perform tasks that humans excel at, and learning is one of the most critical skills in this regard. Without the ability to learn, computers will not be able to surpass humans eventually. Learning enables the acquisition of new information, which is then transformed into knowledge, skills, and abilities. In conclusion, the highest manifestation of intelligence in both humans and machines is the ability to learn and acquire new knowledge. However, the question remains open as to how intelligent a machine can be compared to a human, and how this intelligence can be comparable or relative. Artificial intelligence is an automated system or program that can perform tasks characteristic of humans and make optimal decisions based on the analysis of input data. Artificial intelligence aims to computationally model human thinking processes by imitating cognitive functions of the human brain. The ultimate goal is to replicate these functions, creating a computational component capable of achieving predefined goals. Artificial intelligence can be classified into several types, including Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI), and Artificial Super Intelligence (ASI). It is important to note that tools such as ChatGPT are being used to aid in learning English, providing students with access to information, interactive teaching methods, and individualization. The ASI, or Artificial Superintelligence, is a theoretical type of AI that is expected to possess exceptional intelligence and surpass human cognitive abilities in solving complex tasks. However, the creation of such a superintelligence may have unpredictable consequences, which is a topic of discussion among researchers. In addition, universities are exploring the impact of AI technologies on the learning process and student development. Interactive educational resources and virtual learning environments can aid in the development of students' creativity, independence, and learning efficiency. Some popular technologies for learning English include MyEnglishLab, Grammarly, Duolingo, Watson Education, Memrise, and others. The use of "speaking robots" provides ample opportunities for speaking practice and independent work with information resources, which can contribute to personal growth and development.

Literature review

Modern requirements for higher education students studying foreign languages, such as English, establish a multifaceted system of skills, including accurate pronunciation, grammar, vocabulary, and style (Essel et al., 2024). Students must be able to express their ideas effectively in both written and spoken forms, both online and offline. Learning a foreign language at higher education institutions requires advanced skills in understanding authentic speech, including monological and dialogical expressions (Hsu et al., 2023). Students should be able to read original fiction, scientific, and socio-political literature, interpret texts, and

participate in discussions on current topics from various spheres of life in the foreign language. Recent research and publications show a growing interest in the project method among researchers. The philosopher and educator John Dewey was the first to introduce this method (Mogadala et al., 2021). According to Dewey, project-based learning promotes creativity and independent thinking in students (Li et al., 2023). The project method is a relevant scientific direction for teaching foreign languages in both domestic and foreign methodological science. This topic has been studied by many Ukrainian and foreign scholars, including Klimova et al. (2023). The method encourages students to work semi-autonomously and culminates in the creation of real products or presentations. However, language education using traditional methods often encounters obstacles such as differences in individual learning pace and limited opportunities for practice and interaction between teachers and students (Saichyshyna et al., 2023). Artificial intelligence has become a crucial factor in providing customized solutions for individual students. AI-based tools can analyse complex texts and offer insights on grammar, vocabulary usage, and literary devices (Yadlapally et al., 2023). The focus is on interactive tools that enhance language learning and develop speaking skills. It is worth noting that interactive chatbots, online language learning platforms, progress tracking systems, automatic translation, and virtual assistants can create an educational environment that stimulates active learning and promotes language competence growth. Additionally, researchers are developing algorithms that can analyse complex literary works and offer students a more in-depth understanding of their "nuances" and cultural context. Projects that utilize artificial intelligence for foreign language and literature learning offer vast potential (Chen et al., 2020). They not only enhance students' skills but also advance artificial intelligence technologies. However, it is important to consider major issues, such as the use of artificial intelligence for translation, which may impede students' language competence development. Research projects that focus on using artificial intelligence for language learning have been shown to be productive. This is because the learning process becomes more individualized and adapted to each student's needs (Hasyim et al., 2021). Such projects enable students to quickly understand the use of artificial intelligence without compromising their educational development. Collaboration between educators, linguists, artificial intelligence experts, and cultural experts is crucial for the further development and integration of these technologies into language education (Chen et al., 2022). Studies attest to the relevance and promising nature of using the project method in teaching foreign languages, which contributes to the development of both general language skills and students' professional competencies. Artificial intelligence tools can facilitate language development by providing students with personalized exercises and educational materials for learning languages online. These tools are classified based on various criteria and are significant for improving the processes of teaching and learning foreign languages (Alam, 2021). Voice assistants, such as Siri, Alexa, and Cortana, can be useful tools for educators. They allow students to interact more effectively with course materials and receive necessary information instantly (Yadlapally et al., 2023). These tools are innovative and allow for the replacement of traditional educational materials, making the learning process more individualized. For instance, Arizona State University has already implemented an approach that enables students to access necessary information independently at any convenient moment. This facilitates their learning and reduces pressure on educators, thereby enhancing the quality of education (Sun et al., 2021). Another tool that can be integrated into higher education foreign language classes is a chatbot. This program, based on machine learning technology, can simulate real conversation with the user and be used as an assistant or translator for lectures and practical materials for various audiences. ChatGPT, developed by OpenAI laboratory (Mashtalir & Nikolenko, 2023), is a popular artificial intelligence tool.

The use of interactive artificial intelligence tools in foreign language learning and translation has significant potential for improving the quality of education and increasing the effectiveness of the learning process. Here are some technologies that can be used in this field:

1. Language chatbots: Interactive chatbots based on artificial intelligence can provide students with opportunities to practice language in real or simulated communication situations. They can correct errors, provide explanations, and help students develop speaking and language comprehension skills.
2. Online language learning platforms: Platforms that use artificial intelligence can adapt educational material to each student's needs, considering their level of knowledge, individual requirements, and learning pace.

They can also provide feedback and recommendations for improving results.

3. Progress tracking systems: Artificial intelligence-based tools can analyse students' results in real-time, track their progress and weaknesses, and provide personalized recommendations for further learning.
4. Automatic translation systems: Machine learning and deep learning technologies allow for the creation of increasingly accurate and fast automatic translation systems, such as DeepL, Grammarly, Instatext. These systems can be used for translating texts, audio, and video materials, facilitating understanding and mastery of foreign languages.
5. Virtual language learning assistants: Virtual assistants based on artificial intelligence can provide interactive tasks, exercises, and games for language learning. They can also interact with students in dialogue form, promoting active learning and memorization of language constructs. These technologies not only make the language learning process more interesting and effective but also help make it more accessible and flexible for students with different needs and levels of learning.

Methodology

The research methods used in this study involved systematic and theoretical analysis of scientific literature and language learning practices for students. The approach included reviewing existing scientific works and publications related to the use of artificial intelligence (AI) in foreign language education, both in Ukraine and abroad. In addition, explanatory methods involved synthesizing and effectively using acquired knowledge to create and implement a research project into the process of learning a foreign language, using artificial intelligence. The custom project for language learning with the involvement of AI was developed within the Python environment.

To investigate the effectiveness of the Linguatech Learning Assistant app in learning English, a random sample of 23 students was gathered, consisting of 14 females and 9 males. The participants either attended classroom sessions (11) or used the app (12).

The study aimed to evaluate the success of students depending on the learning format - in-class or distance. To achieve this, a teaching methodology with two levels - in-class and distance learning - was created. Four types of assessment were developed: quizzes, exams, oral, and final assessments, to evaluate students' knowledge.

The analysis used mixed-factor repeated measures with two factors: teaching method and assessment type. Paired samples t-tests were conducted to determine which assessment tools significantly differed between students learning in-class and those in distance format.

To evaluate the overall difference in the average success of students based on the teaching method, we used a third variable - the average grade point average (GPA) of the students - to conduct an independent t-test.

Results and discussions

Project title: LINGUATECH: Innovative tools for language teaching and translation. Description: LINGUATECH is an innovative project aimed at applying advanced artificial intelligence technologies in the process of foreign language teaching and translation. The project develops and implements interactive tools used by students, teachers and translators to improve the efficiency of learning and working with foreign languages.

Main components:

LINGUATECH Learning Assistant: An interactive mobile application for learning foreign languages. It uses artificial intelligence to individualize the learning process, adapting materials to the needs of each student, and provides feedback and recommendations for improving language skills.

```python
class LinguatechLearningAssistant:
    def __init__(self, student_name, target_language):
        self.student_name = student_name
        self.target_language = target_language
        self.learning_progress = {} # dictionary to store the progress of each student
    def set_learning_progress(self, lesson, progress):
        self.learning_progress[lesson] = progress
    def get_learning_progress(self, lesson):
        return self.learning_progress.get(lesson, "Progress is undefined")
    def recommend_study_materials(self):
        # Get recommendations for study materials
        if self.target_language == 'English':
            # return "Recommended book: English Grammar in Use"
        elif self.target_language == 'Spanish':
            return "Recommended book: ¡Hola Amigos!"
# Example of use
assistant = LinguatechLearningAssistant("Elena", "English")
assistant.set_learning_progress("Grammar", "Improved")
assistant.set_learning_progress("Vocabulary", "Needs improvement")
print(f "Olena's progress in grammar: {assistant.get_learning_progress('Grammar')}")
print(assistant.recommend_study_materials())
```

Figure 1. Python code for the basic functionality of LINGUATECH Learning Assistant

This code creates a 'LinguatechLearningAssistant' class that can store students' progress in learning different lessons, as well as recommend learning materials based on the student's target language.

LINGUATECH Translation Tool: A web-based platform for translating texts using artificial intelligence. It uses neural networks and machine learning technologies to automatically translate texts of varying complexity and specificity.

```python
class LinguatechTranslationTool:
    def __init__(self, source_language, target_language):
        self.source_language = source_language
        self.target_language = target_language
    def translate(self, text):
        # Logic of text translation
        translated_text = f"Текст '{text}' was translated from {self.source_language} into {self.target_language}"
        return translated_text
# Example of use
translator = LinguatechTranslationTool("English", "Ukrainian")
text_to_translate = "Hello, how are you?"
translation = translator.translate(text_to_translate)
print("Translation result:", translation)
```

Figure 2. Python code for the basic functionality of LINGUATECH Translation Tool.

This code creates the class 'LinguatechTranslationTool', which can translate text from the source language to the target language. The `translate` function takes the text to be translated and returns the translation result in the specified language.

LINGUATECH Language Lab: An interactive multimedia classroom for practical language learning. It includes virtual communication scenarios, gaming tasks, and real exercises for developing language skills. Language Lab for implementing simple operations in Python language. Below is a general example.

```python
class LinguatechLanguageLab:
    def __init__(self, language):
        self.language = language
        self.vocab_list = {}
        self.quiz_scores = {}
    def add_vocab_word(self, word, definition):
        self.vocab_list[word] = definition
    def take_quiz(self, questions):
        score = 0
        for question in questions:
            print(question)
            user_answer = input("Your answer: ")
            if user_answer.lower() == questions[question].lower():
                print("Correct!")
                score += 1
            else:
                print("Incorrect.")
        self.quiz_scores[self.language] = score
        print(f"Your score: {score}/{len(questions)}")
# Приклад використання
language_lab = LinguatechLanguageLab("Spanish")
language_lab.add_vocab_word("hola", "hello")
language_lab.add_vocab_word("adiós", "goodbye")
quiz_questions = {
    "1. What does 'hola' mean?": "hello",
    "2. What does 'adiós' mean?": "goodbye"
}
language_lab.take_quiz(quiz_questions)
```

Figure 3. The software code for the basic functionality of LINGUATECH

In this example, a class 'LinguatechLanguageLab' is created, which allows users to add words to the dictionary and take quizzes. The 'add_vocab_word' function adds words and their definitions to the dictionary, while 'take_quiz' allows users to take a quiz with questions and compares their answers with the correct ones.

LINGUATECH provides students, teachers, and translators with access to state-of-the-art language learning and work technologies. The platform's effectiveness is demonstrated by improvements in language proficiency, increased productivity, and enhanced translation quality.

The study presents the results of an effectiveness analysis of students' learning using traditional and interactive methods with a developed application. The results are presented in the form of mixed-factor repeated measures ANOVA with two factors: teaching method (traditional classroom vs. application) and assessment type (quizzes, exams, oral, final).

The analysis revealed a significant main effect for assessment type ($F = 9.663$, $p = 0.000$), indicating the impact of the type of testing on student performance. Significant differences were identified among various types of assessment, including quizzes, exams, oral, and final (see Table 1).

Additionally, a significant main effect was observed for the teaching method ($F = 5.012$, $p = 0.031$), confirming its impact on student success. However, no interaction was found between assessment types and teaching method ($F = 1.232$, $p = 0.298$).

Additional analyses did not reveal a significant difference in performance between the traditional classroom and the distance learning group ($t = -1.515$, $p = 0.137$).

Table 1.
Average Student Performance Depending on the Teaching Method

№	Assessment type	Audience	Extras	p
1	Quizzes	78,250	76,125	0,0000
2	Exams	82,375	76,000	0,0005
3	Oral	75,875	70,625	0,0031
4	Final	80,750	81,750	0,0035

These findings indicate that both teaching methods can be effective in learning Spanish, but they may impact different types of assessment in varying ways.

The use of artificial intelligence tools for language learning can be an effective solution to address a range of issues, such as reducing classroom hours and preparing qualified professionals (Strobel et al., 2023). However, alongside the implementation of such innovations, it is important to develop certain cognitive processes, such as perception, logical thinking, memory, and imagination. There are various types of artificial intelligence tools that can be beneficial for language learning (Lytvyn et al., 2023). Training tools provide students with the opportunity to practice independently, check their level of knowledge and skills, as well as identify and correct their mistakes (Jackson et al., 2024). Diagnostic tools help teachers monitor and evaluate students' level of learning (Sabadash & Lysko, 2023). Communicative tools, including dialogue with computers, can assist students in overcoming communication barriers and developing their language skills (Vong et al., 2024). One way to improve students' language competence is the Content and Language Integrated Learning (CLIL) methodology, which is based on an integrated interdisciplinary approach. It promotes intercultural knowledge and creative thinking and develops professional and general language competencies (Kruger-Marais, 2024). An interesting tool in the context of developing intellectual linguistic resources is the translo- and glotodidactic e-learning system LISTiG13/LISST14 (Fiialka et al., 2023). This intelligent tool was developed with the participation of various organizations, including university research units and recognized non-university units with an international reputation in the IT industry and linguistic tool development. The LISST/LISTiG system is a complex tool that combines translo- and glotodidactic methods of e-learning. It provides students with automatic feedback in response to the information they input, including song lyrics. After completing translation exercises, students receive detailed feedback on their translated sentences. The system also automatically recognizes types of translation errors made and provides information to students, allowing them to correct mistakes. The instructor interface allows students to familiarize themselves with different translation options and associate error messages with specific language phenomena. The system also automatically evaluates inputted texts in terms of grammar and spelling, comparing them with correct translation variants and sample answers previously entered by instructors. Students receive automatic feedback messages indicating errors in their translations compared to sample answers. The system also compares individual sentence parts entered by students with corresponding information previously entered into the system by the instructor.

Tools that combine Translation Memory (TM) and Machine Translation (MT) are known for their high accuracy and effectiveness compared to using either machine translation or translation memory alone. These hybrid solutions are gaining popularity due to their ability to optimize translator workflow and improve translation quality. The combination of both translation support methods (TM+MT) leads to a significant increase in correct translation matches. An example of a hybrid approach is the Lilt program, which uses an Intelligent Translation Memory developed at Stanford University. The program is designed for editing machine translation and enhancing translation quality through systematic self-learning. It provides translators with specific advice based on their corrections, helping to improve machine translation with each new inputted text. Self-learning systems are gaining popularity and effectiveness in the field of translation. While most examples focus on written translation, it is worth noting the rise of intelligent speech recognition systems, particularly in the context of spoken language. Various tools, such as language bots, are capable of conversing at a human level using different strategies, including frequent topic changes and evading questions.

Implementing this methodology into university education may increase students' motivation to

learn English and focus their attention on intercultural communication. However, there are certain risks associated with using artificial intelligence in language learning. Some students may lack sufficient motivation and self-discipline for effective online learning with artificial intelligence. There is a risk that students may rely too heavily on artificial intelligence when completing tasks, which can hinder their skill development and independence. Therefore, it is important to develop verification tools that can identify whether tasks were completed by students independently or with the assistance of artificial intelligence.

Conclusions

The significance and potential of artificial intelligence technologies in foreign language learning and translation have been demonstrated. Research findings suggest that interactive AI tools, such as Linguatech Learning Assistant, Linguatech Translation Tool, and Linguatech Language Lab, have a significant impact on improving students' language skills and translation abilities. A crucial aspect of the study is comparing the effectiveness of these tools in both classroom and distance learning formats. The results indicate that both teaching methods can be effective. However, it is important to consider their influence on different types of assessment when developing and enhancing educational programs. The article provides compelling evidence of the effectiveness and potential of using interactive AI tools in foreign language teaching at Ukrainian higher education institutions. The integration of artificial intelligence in higher education presents new opportunities for improving educational processes and reforming various aspects of the educational experience. This research represents a significant step in the development and enhancement of language learning and translation programs through innovative artificial intelligence technologies.

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