TRENDS IN DIGITAL TRANSFORMATION OF EDUCATION IN MODERN CONDITIONS

April 11, 2025

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Калифорния университеті, Дейвис
Калифорния Университетінің Дэвис Халықаралық Орталығы
Халықаралық ғылыми-практикалық ғонференция

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The collection presents the materials of an International scientific and practical conference, which addressed topical issues of digital transformation of education in the context of the rapid development of information and communication technologies. The relevance of the topics discussed is due to the transition of modern society to the digital economy and the knowledge society, where the education system plays a key role. The authors consider the problems and prospects of introducing digital technologies into the educational process, identify the main directions and principles of digital transformation, including the formation of a unified digital educational space. The collection substantiates the need to create a modern digital infrastructure and a regulatory and methodological framework that facilitates the implementation of priority projects in education.

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THE INTEGRATION OF AI AND MNEMONICS TO IMPROVE LONG-TERM MEMORY RETENTION

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Abstract. The article provides a comprehensive exploration of mnemonic techniques and Artificial intelligence in the context of vocabulary acquisition, emphasizing their significance in language learning and cognitive development. Mnemonic devices, recognized for their cognitive benefits, are increasingly explored as tools to facilitate vocabulary retention and recall. Drawing from a diverse range of studies, this article provides an in-depth synthesis of existing research, identifying patterns, and implications for both researchers and educators. The study employs Quizlet flashcards with AI-generated mnemonics to assess their impact on vocabulary recall. As educators and learners continue to explore innovative approaches to language acquisition, the integration of mnemonic techniques and AI technologies into pedagogical practices remains a valuable endeavor. By addressing the key questions surrounding the utilization of mnemonic techniques in vocabulary learning, this article aims to contribute insights that can inform and optimize language learning strategies in diverse educational settings.

Keywords: Mnemonics, Artificial intelligence, vocabulary enrichment

Introduction

Vocabulary acquisition plays a crucial role in language learning and cognitive development. As learners navigate the complexities of mastering a new language, effective strategies are essential to enhance the retention and recall of vocabulary. Although vocabulary is essential for mastering a language, learners may struggle with understanding new concepts and memory retention. Traditional memorization techniques such as rote learning, repetition, and passive reading have long been used to bolster memory retention, yet these methods often prove inefficient and time-consuming. In contrast, mnemonic techniques that enhance recall through association, visualization, and structured patterns offer a more effective way to commit information to long-term memory. Mnemonic devices, cognitive tools designed to aid memory processes, have emerged as potential facilitators in this realm.

The development of artificial intelligence technologies has also facilitated the learning process as an auxiliary educational tool. The use of AI in education technologically improves teaching and learning methods due to its wide functionality. This study aims to explore how the integration of both technology and mnemonics can help enhance memory recall and consolidate knowledge.

The integration of Artificial Intelligence (AI) with mnemonic strategies presents a promising approach to enhancing long-term memory retention. By leveraging AI's ability to analyze learning patterns and optimize mnemonic techniques, individuals can improve recall efficiency and overall cognitive performance.

Literature review

Mnemonic techniques encompass a range of strategies, including visualization, songs and rhymes, and mnemonic keyword. These methods can be applied to remember lists, facts, foreign language vocabulary, and complex information. Memory enhancing techniques are grounded in

principles of cognitive psychology, such as dual coding theory (Palvio, 1971), which highlights the power of visual imagery in memory, and the levels of processing theory (Craik, & Lockhart, 1972), which emphasizes the depth of processing as a factor in memory retention. As researchers have delved into the cognitive mechanisms underlying memory, studies suggest that mnemonic devices offer promising avenues for optimizing language acquisition (Baddeley, 1990).

The keyword method, a frequently employed mnemonic technique for vocabulary acquisition, transforms unfamiliar information into more meaningful and tangible forms, thereby enhancing memorization. In the implementation of a keyword strategy, it is advised to adhere to the principles of reconstructing, relating, and retrieving, commonly known as the 3 R's (Bakken & Simpson, 2011). Initially, learners are required to establish an auditory connection between a known word in their first language and the intended word in the target language, ensuring that the two words share a similar sound.

Additionally, it was confirmed that mnemonics have a positive effect on retention of information for both short-term and long-term memory as students practice word learning by merging concepts from their native and foreign languages (Amoli & Karbalaei, 2012).

Songs and rhymes are engaging way of learning new information by memorizing lyrics. Music in education is confirmed to be effective as it increases motivation, reduces stress and establishes friendly environment (Cools et al, 2023). As a result, participants found this AI technology very helpful as it clearly explained the meaning of terms without any complexities.

However, mnemonic strategies depend on person's creativity and wit in order to make a catchy memory aid. Mnemonics require experience and practice in order to write a suitable mnemonic phrase. Consequently, such complexity may be challenging for novice learners, because it is time consuming in contrast to traditional methods of memorization which often include root learning.

Introduction of AI in education became a revolutionary intervention that led to the development of adaptive learning. The term 'Artificial Intelligence' is still considered to be hard-to-define as it incorporates various technologies and processes such as data mining, natural language processing, machine learning, and an algorithm (Zawacki-Richter et al, 2013). Combining the above processes, it is possible to say that AI is a kind of imitation of the human mind, since they are similar in that they are constantly learning and developing.

The use of AI in education raises the question of where and how to use it. Baker and Smith (2019) divided AI tools in education into three types: learner-facing, teacher-facing and system-facing. Learner-facing tools are designed to facilitate learning process by adapting to their educational needs, while teacher-facing tools reduce workload of educators by completing tasks such as monitoring students' academic performance, assessment, checking homework, and providing feedback. System-facing AI instruments provide information to administrators about an institution.

Learner-facing AI tools can be considered as personal tutors, since they provide scaffolding and support students in accordance with their interest, level of readiness, and learning style. As mentioned above, mnemonic strategies may seem foreign and difficult for learners, who lack practice of dealing with mnemonics, but AI is able to solve this inconvenience by generating memory aids.

Materials and methods

Recently, AI-based mnemonic devices are being actively studied in the field of education to create effective individual learning environment. One of such AI-based tools is ChatGPT that is based on OpenAI (2023). ChatGPT is a chatbot which is capable of generating textual and visual materials by following a command. As it has an open access and wide range of functions, it is considered to be the most popular AI technology in education. Combination of ChatGPT with other digital educational resources contributes to learner's memory retention and overall understanding of a concept in contrast to traditional methods. For example, in the study conducted

by Anu Baisel and Ramachandran (2024), Anki flashcards and ChatGPT were used to improve vocabulary recall through mnemonic keyword method.

Qualitative method was used in order to evaluate the AI-generated mnemonics' quality, clarity, and contextual relevance through ***content analysis***. AI-generated mnemonics are systematically analyzed for patterns, linguistic accuracy, creativity, and usability. Specific criteria such as coherence, conciseness, and relevance to target vocabulary words are applied.

In this research paper, Quizlet is used to create flashcards. Digital flashcards with spaced repetition algorithms will serve as a control tool to measure the effectiveness of AI-enhanced mnemonics. Each flashcard consists of a target word, definition and mnemonics. Definitions were generated by ChatGPT and compared with the Oxford Dictionary.

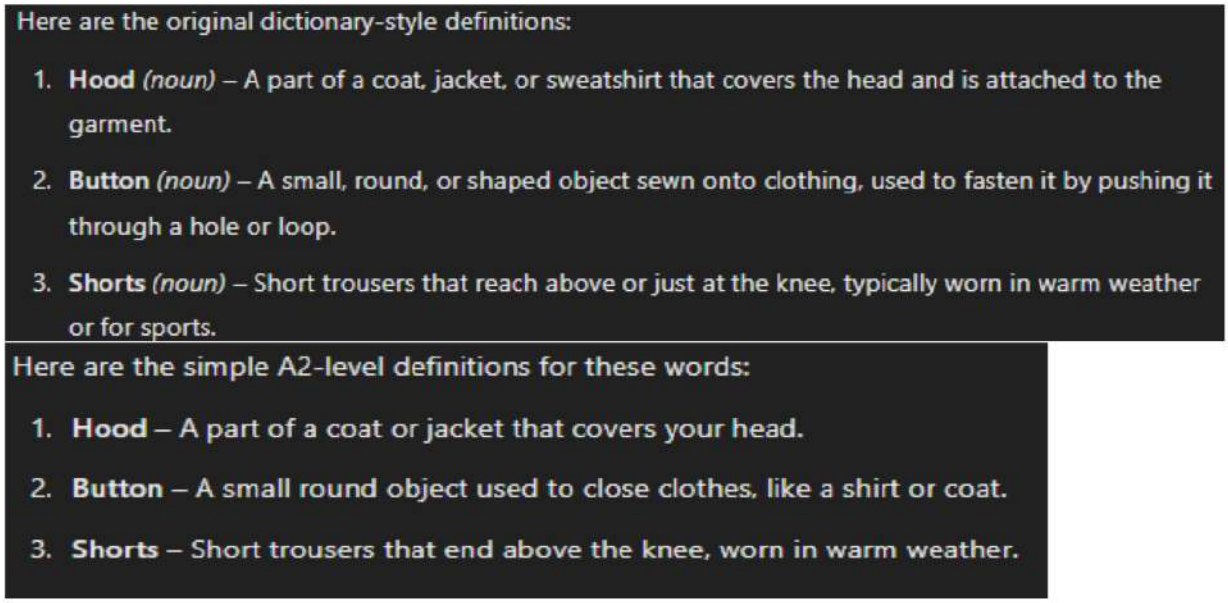
Mnemonic keyword and rhymes were used to create a vivid image and memorable phrases to comprehend definitions and recall them.

ChatGPT was used to generate mnemonic keywords and rhymes as it is able to generate texts quickly in contrast to creating mnemonics independently due to the peculiarities of building mnemonics based on creativity and resourcefulness.

Vocabulary list regarding the topic "Clothes" was provided with definitions and mnemonic strategies. 5 words were explained with mnemonic keywords in Russian, while another half in rhymes in English. In order to improve the effectiveness of AI-based mnemonics, ChatGPT was also used to generate pictures. In Quizlet, 1 module with testing and gamification was created to memorise words and practice understanding, using flashcards. Overall, 30 mnemonic associations and 10 pictures were generated by AI.

Consideration

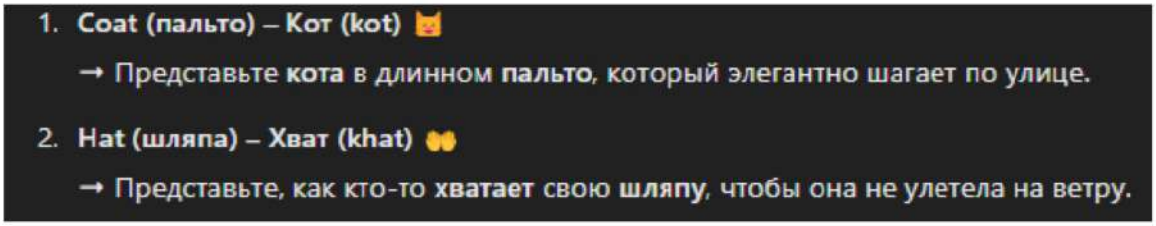
Before developing mnemonics for specific vocabulary, it is essential to first analyze the definition of each term in order to establish meaningful and comprehensible associations. To evaluate ChatGPT's ability to generate accurate definitions, its outputs were systematically compared with those provided by the Oxford Dictionary. This comparison aimed to determine the precision, clarity, and contextual relevance of AI-generated definitions, thereby assessing the extent to which ChatGPT can serve as a reliable linguistic resource. To illustrate, AI was capable of defining words semantically accurately, and even could adapt the definitions in accordance with learners' proficiency level (Picture 1).



Picture 1. – Definitions of terms by ChatGPT

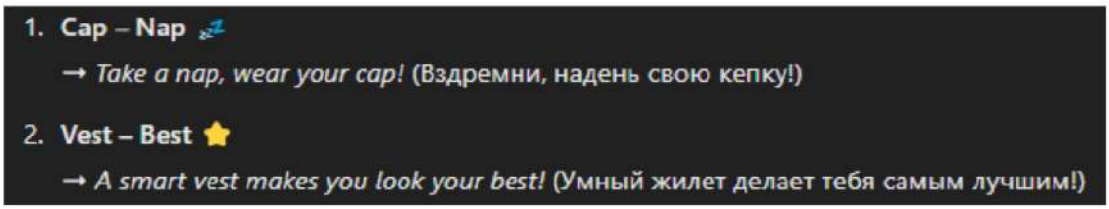
To create mnemonics, the AI tool needed a clear command to understand how mnemonics work. AI model was able to carefully process 5 words based on the explanations and create

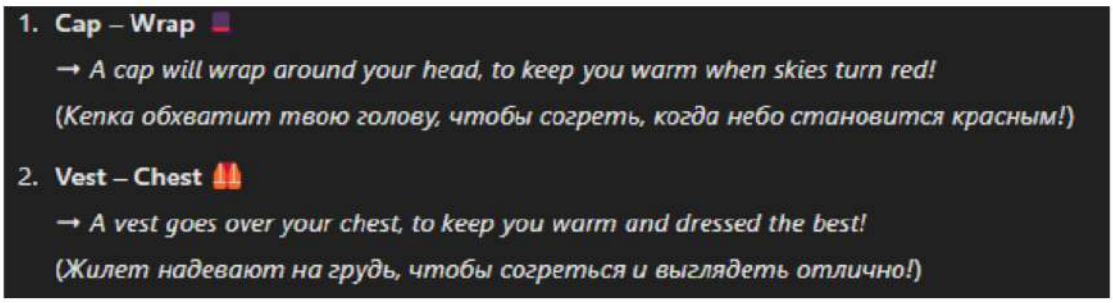
corresponding associations in Russian, taking into account that the words in English and Russian should be similar in pronunciation (Picture 2). However, some associations sounded too long and needed adjustment. To illustrate, a word 'sock' is similar to Russian word 'сок', which means juice, was associated with warmness of sock and juice. To solidify the connection between the sound and its meaning, learners are encouraged to create a mental image, such as envisioning 'сок в носке' or 'a juice in a sock'. This version is more simple and easy to remember as it sounds ludicrous and funny.



Picture 2. – ChatGPT explains target words, using mnemonic keyword

Rhyme generation also required editing due to the fact that the language model formed phrases without the purpose of explaining the meaning of the word. In this case, the rhyme should determine the meaning of the word in order to present it in a mental picture. For this reason, the query for the AI model was changed, explaining in detail the purpose of the rhyme and how to construct it for English language learners. After the new query, the rhymes became clearer in the context of memorizing the meaning and the word itself in order to understand how to use the given word (Picture 3).



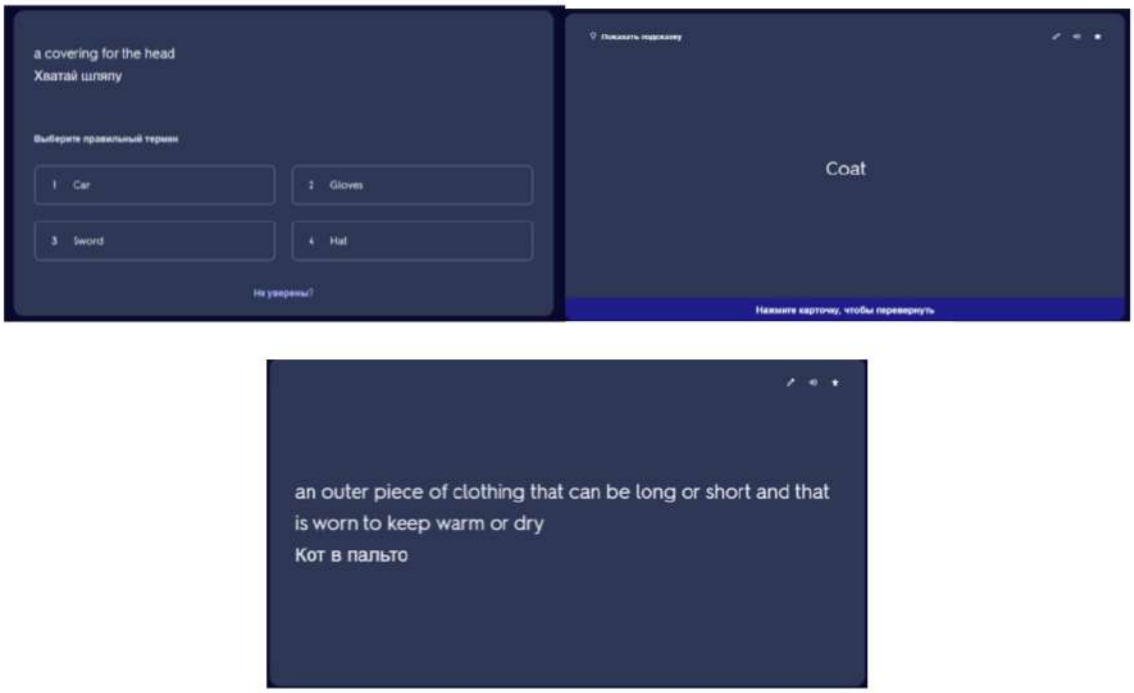


Picture 3. – ChatGPT suggesting rhymes

Additionally, AI was utilized for the generation of visual mnemonics, employing advanced image-generation algorithms to create contextually relevant illustrations corresponding to vocabulary terms. This integration of AI-generated imagery aligns with dual-coding theory, which emphasizes the advantages of combining verbal and visual representations for enhanced memory retention. Since the ChatGPT has a limited amount of memory, the image generation request was created in a separate chat section with improved versions of mnemonic keyword and rhymes to avoid confusion. One of the advantages of ChatGPT is ability to create images in various styles either cartoon or realistic ones (Picture 4).

Picture 4. – ChatGPT generates images in accordance with mnemonics

Finally, mnemonics were transferred to Quizlet to create flashcards with activities. It allows learners not only remember information, but practice their knowledge in a form of self-testing (Picture 5).



Picture 5. – Illustration of activities on quizlet

ChatGPT is a highly useful tool for generating mnemonic aids quickly, saving time for educators and learners alike. Its ability to produce creative associations, acronyms, and memory-enhancing phrases makes it an invaluable resource for those seeking efficient ways to enhance memory retention. However, while ChatGPT can generate mnemonics with remarkable speed, it does not always ensure complete clarity or contextual appropriateness. Some phrases it produces may be confusing, abstract, or difficult to relate to the target material, requiring manual editing and refinement. Users must critically evaluate the generated mnemonics, adjusting or rewording them to improve comprehension and usability. Additionally, the effectiveness of ChatGPT-generated mnemonics depends on individual learning preferences, and not all users may find AI-generated content equally helpful. As a result, it is essential to view ChatGPT as a supportive tool rather than a replacement for human input. By combining AI-generated mnemonics with human oversight and personalized modifications, learners can optimize their study methods while ensuring the clarity and relevance of their memory aids.

Conclusion

In conclusion, the integration of AI and mnemonic techniques represents a groundbreaking shift in how individuals learn, retain, and recall information. By leveraging AI's analytical capabilities, adaptive learning algorithms, and immersive technologies, mnemonic strategies can be optimized to enhance long-term memory retention. From personalized study plans to interactive memory palaces, AI-driven mnemonics hold the potential to revolutionize education, professional training, and cognitive health. As research in this field continues to evolve, it will be essential to explore innovative applications while addressing ethical considerations, ensuring that AI serves as an empowering tool for human cognitive development.

The integration of AI-powered tools, such as ChatGPT, with mnemonic strategies presents a promising approach to enhancing vocabulary acquisition and long-term memory retention. By leveraging AI's ability to generate mnemonic keywords, rhymes, and other memory aids, learners can benefit from creative and engaging study methods that streamline the memorization process. However, while AI-generated mnemonics offer efficiency and accessibility, they still require human oversight to ensure contextual clarity and meaningful associations. The findings of this study highlight that AI, when used in conjunction with traditional mnemonic techniques and personalized modifications, can significantly improve vocabulary learning outcomes. Future research could explore further refinements in AI-generated mnemonics, examining their effectiveness across diverse learner profiles and languages. Ultimately, the combination of AI and cognitive learning strategies holds great potential for revolutionizing language education, making vocabulary acquisition more effective and engaging.

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Интеграция искусственного интеллекта и мнемоники для улучшения долговременного запоминания

Аннотация. Статья представляет всестороннее исследование мнемонических техник и искусственного интеллекта в контексте усвоения словарного запаса, подчеркивая их важность для изучения языков и когнитивного развития. Мнемонические приемы,

признанные за их когнитивные преимущества, все чаще рассматриваются как инструменты для облегчения запоминания и воспроизведения слов. Основываясь на широком спектре исследований, данная сатья предлагает глубокий анализ существующих научных работ, выявляя закономерности и их значение как для исследователей, так и для преподавателей. В исследовании используются карточки Quizlet с ИИ-сгенерированными мнемоническими приемами для оценки их влияния на запоминание слов. По мере того как преподаватели и учащиеся продолжают исследовать инновационные подходы к изучению языков, интеграция мнемонических техник и технологий ИИ в педагогическую практику остается перспективным направлением. Рассматривая ключевые вопросы, связанные с использованием мнемонических методов в обучении лексике, статья направлена внести ценные идеи, которые помогут оптимизировать стратегии изучения языков в различных образовательных средах.

Ключевые слова: Мнемотехника, искусственный интеллект, обогащение словарного запаса

Ұзақ мерзімді есте сақтауды жақсартудағы жасанды интеллект пен мнемониканының интеграциясы

Андатпа. Мақала сөздік қорды дамыту бағытында мнемоникалық әдістер мен жасанды интеллекттің өзара байланысын жан-жақты қарастырады, олардың шет тілін оқыту мен когнитивтік дамудағы маңыздылығы атап көрсетеді. Когнитивтік артықшылықтарымен танымал мнемоникалық құрылғылар сөздерді есте сақтау мен қайта еске түсіруді жеңілдету құралы ретінде кеңінен зерттелуде. Әртүрлі зерттеулерге сүйене отырып, берілген мақала ғылыми жұмыстарға терең талдау жасап, зерттеушілер мен оқытушылар үшін маңызды заңдылықтар мен тұжырымдарды анықтайды. Зерттеу барысында Quizlet платформасындағы ЖИ жасаған мнемоникалық карточкалар қолданылып, олардың сөздерді есте сақтауға оң әсері бағаланды. Білім берушілер мен оқушылар тіл үйренудің инновациялық әдістерін зерттеуді жалғастырып жатқанда, мнемоникалық әдістер мен ЖИ технологияларын педагогикалық тәжірибеге енгізу маңызды қадам болып қала бермек. Сөздік қорын дамытуда мнемоникалық әдістерді қолдануға қатысты негізгі сұрақтарды қарастыра отырып, берілген мақала әр түрлі білім беру ортада тіл оқыту стратегияларын оңтайландыруға ықпал ететін маңызды факторларды анықтауды мақсат етеді.

Тірек сөздер: Мнемотехника, жасанды интеллект, сөздік қорын байыту

PROMPT ENGINEERING IN THE WORK OF THE ENGLISH LANGUAGE TEACHER: A PRACTICAL GUIDE TO USING AI IN TEACHING AND LEARNING

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Abstract. The article is devoted to the research of possibilities of using prompt engineering technology in teaching English as a second language (ESL). The theoretical foundations of the phenomenon are analysed, practical methods of query formulation are proposed, and examples of AI implementation in educational activities are considered. A case study of a lesson using AI-based task generation is presented. Ethical and methodological aspects of AI application in school practice are considered. The paper is aimed at teachers, researchers and methodologists interested in the integration of digital technologies in linguodidactics.