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DEVELOPING ENGLISH LEXICAL COMPETENCE OF MEDICAL STUDENTS THROUGH MALL-BASED MULTIMODAL LEARNING: AN EXPERIMENTAL STUDY

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Annotation. This article examines the effectiveness of MALL-based multimodal learning in developing English lexical competence among medical students. Lexical competence is considered as an integrated ability that includes knowledge of medical terminology, word-formation awareness based on Greek and Latin term elements, collocational and contextual accuracy, the ability to switch between professional and lay registers, and the use of effective vocabulary learning strategies. Using a quasi-experimental design with experimental and control groups, the study assesses changes in these components before and after the intervention. The results indicate that the integration of mobile technologies with textual, auditory and visual input contributes to deeper and more durable acquisition of professional vocabulary.

Keywords: lexical competence, medical English, English for Specific Purposes (ESP), medical terminology, Mobile-Assisted Language Learning (MALL), multimodal learning, vocabulary learning strategies, medical students

Introduction. The internationalization of medical education and healthcare has made English the main language of scientific publications, clinical guidelines, international conferences and professional communication among physicians. For medical students, a sufficient command of English is no longer an additional skill but a prerequisite for access to up-to-date professional knowledge. Within this command, lexical competence occupies a central position: a future doctor must understand and correctly use a large body of specialized terms, recognize their morphological structure, combine them with appropriate words in context, and explain the same concepts in plain language when communicating with patients. Errors in medical vocabulary may lead not only to communicative failure but also to misunderstanding of clinical information.

At the same time, medical vocabulary presents particular difficulties for learners. A considerable part of it is formed from Greek and Latin roots, prefixes and suffixes; many terms have both a technical and an everyday equivalent (e.g., myocardial infarction – heart attack, pyrexia – fever); and the meaning of a term often depends on its typical collocations (to take a history, to prescribe medication, acute onset). Traditional approaches, which rely mainly on memorizing bilingual word lists, rarely provide sufficient repetition, contextual exposure and opportunities for productive use. Consequently, students may recognize terms in a text but fail to use them accurately in speech and writing.

Mobile-Assisted Language Learning (MALL) offers new opportunities for overcoming these difficulties. Mobile applications allow students to review vocabulary regularly through spaced repetition, to hear the correct pronunciation of terms, and to encounter them in authentic contexts such as short clinical videos, anatomical images, case descriptions and patient dialogues. When such resources are combined in a multimodal format, vocabulary is processed through several channels simultaneously, which supports both understanding and long-term retention.

Literature review. The theoretical basis of the study is formed by research on vocabulary acquisition, English for Specific Purposes and technology-enhanced learning. I.S.P. Nation described word knowledge as a multidimensional construct that includes form, meaning and use, and

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distinguished between receptive and productive knowledge of words. This view implies that knowing a medical term involves more than recognizing its translation: the learner must also know its spelling, pronunciation, word family, grammatical behaviour and typical collocations. N. Schmitt further emphasized the importance of incremental learning and repeated encounters with words in varied contexts. M. Lewis, in his Lexical Approach, showed that language consists to a large extent of multi-word units and collocations, which is especially relevant to medical discourse, where fixed expressions carry precise professional meaning.

From the perspective of English for Specific Purposes, T. Hutchinson and A. Waters argued that course content should be determined by learners' target needs, which, for medical students, include reading professional literature and communicating in clinical situations. Corpus-based research, in particular the Medical Academic Word List developed by J. Wang, S. Liang and G. Ge, identified the most frequent academic vocabulary in medical research articles and provided a basis for selecting lexical material. B. Laufer and J. Hulstijn proposed the Involvement Load Hypothesis, according to which words are retained better when tasks create need, search and evaluation; this supports the use of tasks in which students actively work with terms rather than passively memorize them.

In the field of multimodal and mobile learning, A. Paivio's Dual Coding Theory and R. Mayer's Cognitive Theory of Multimedia Learning explain that information presented both verbally and visually creates more retrieval routes in memory. This is particularly relevant for anatomical and clinical vocabulary, which can be linked to images, diagrams and videos. J. Sweller's Cognitive Load Theory warns that multimodal materials must be designed carefully so as not to overload learners. A. Kukulska-Hulme demonstrated that mobile technologies support learner autonomy and learning beyond the classroom, while E. Deci and R. Ryan's Self-Determination Theory explains how autonomy, competence and relatedness foster intrinsic motivation – an important factor in sustained vocabulary study.

In Uzbek scholarship, N.M. Mahmudov has addressed issues of speech culture and communicative competence, emphasizing the functional and accurate use of language units. B. Xodjaev has investigated modern pedagogical technologies and student-centred, interactive approaches that increase the effectiveness of the teaching process. Uzbek researchers have also highlighted the need to integrate information and communication technologies into higher education to increase students' motivation and independent learning skills. Nevertheless, the combined effect of mobile technologies and multimodal instruction on the development of English lexical competence among medical students has not been sufficiently studied, which determines the relevance of the present research.

Methodology. The study investigated the effectiveness of a MALL-based multimodal instructional model in developing the English lexical competence of medical students. A quasi-experimental design with experimental and control groups was used, and the research was carried out in three stages: diagnostic, formative and final (control). The participants were 236 second-year students of the General Medicine (Davolash ishi) programme of Urgench State Medical Institute, of whom 120 formed the experimental group and 116 the control group.

At the diagnostic stage, the initial level of students' lexical competence was determined using a vocabulary test based on medical terminology, a term-element (word-formation) analysis task, a collocation and gap-filling test, a situational speaking task simulating a doctor–patient consultation, and a questionnaire on vocabulary learning strategies and motivation. The aim of this stage was to confirm that the groups were comparable before the intervention.

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During the formative stage, the experimental group was taught according to the MALL-based multimodal model, while the control group studied the same lexical content using traditional methods (textbook texts, bilingual word lists and translation exercises). The lexical material was selected thematically (anatomy and body systems, symptoms and diseases, diagnostic procedures, treatment and pharmacology, history taking) and supplemented with high-frequency items from the Medical Academic Word List. In the experimental group, the following components were used: digital flashcards with spaced repetition, audio pronunciation and anatomical images; analysis of Greek and Latin term elements (e.g., cardi-, gastr-, -itis, -ectomy, -logy) through interactive matching tasks; short authentic medical videos and podcasts followed by vocabulary-focused tasks; collocation exercises built around clinical case descriptions; and role-plays in which students had to explain technical terms to a "patient" in plain English.

At the final stage, both groups were reassessed with instruments parallel to those used at the diagnostic stage. Lexical competence was evaluated on the basis of five criteria: (1) knowledge of medical terminology; (2) word-formation (morphological) awareness; (3) collocational and contextual accuracy; (4) professional communicative use of vocabulary, including switching between technical and lay registers; and (5) vocabulary learning strategies and motivation. Each criterion was assessed at three levels: high, medium and low.

Table. Distribution of respondents by levels of lexical competence before (pre-test) and after (post-test) the experiment

Criteria	Groups	Assessment levels					
		High		Medium		Low	
		Pre	Post	Pre	Post	Pre	Post
Knowledge of medical terminology	Experimental	21	46	42	58	57	16
	Control	20	24	41	44	55	48
Word-formation awareness	Experimental	18	49	39	55	63	16
	Control	19	22	38	41	59	53
Collocational and contextual accuracy	Experimental	17	41	40	59	63	20
	Control	18	21	40	42	58	53
Professional communicative use of vocabulary	Experimental	19	43	41	57	60	20
	Control	20	22	39	42	57	52
Vocabulary learning strategies and motivation	Experimental	22	47	43	56	55	17
	Control	21	24	42	43	53	49
Total	Experimental	19	45	41	57	60	18
	Control	20	23	40	42	56	51

Based on the statistical values presented in the table, the results of the experimental group before and after the experiment can be illustrated by the following bar graph.

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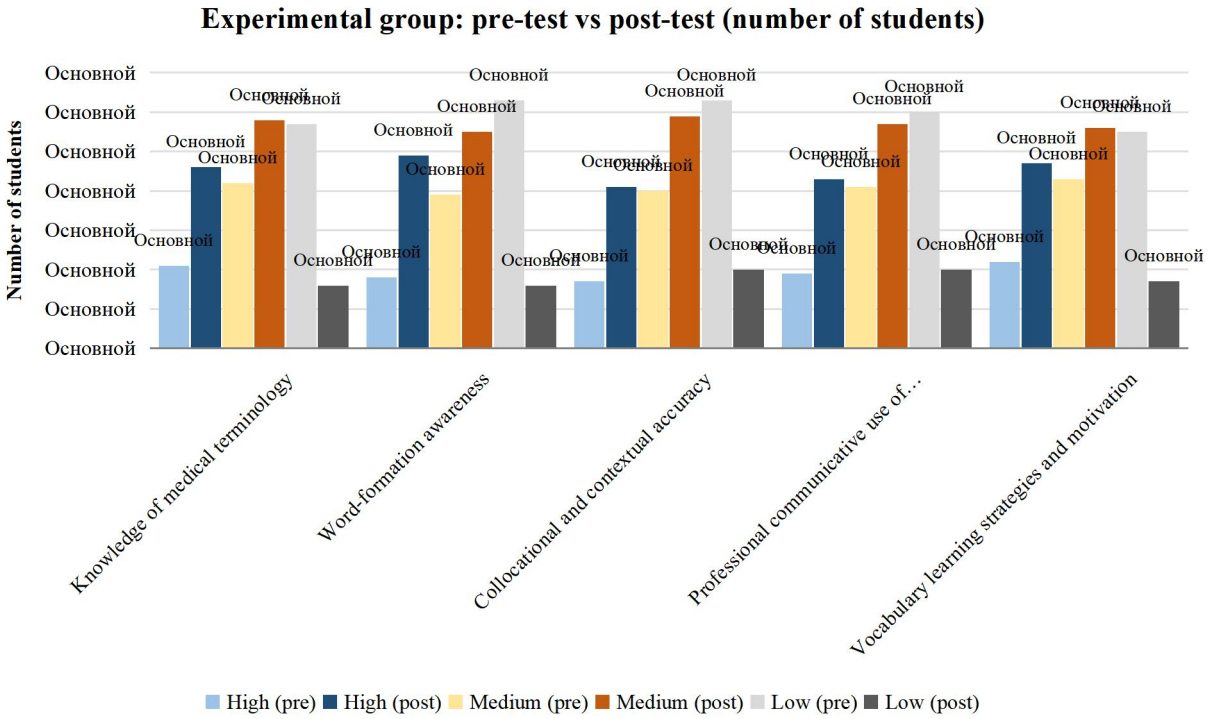


Figure 1. Comparison of the experimental group's results before and after the experiment

Results and discussion. At the diagnostic stage, the distribution of students across the high, medium and low levels was similar in the experimental and control groups, which confirmed the comparability of the samples and allowed subsequent changes to be attributed to the instructional intervention. After the formative stage, the experimental group demonstrated a marked increase in the number of students at the high level and a decrease in the number of students at the low level across all five criteria. In terms of knowledge of medical terminology, the share of students at the high level rose from 17.5% to 38.3%, while the share at the low level fell from 47.5% to 13.3%. Students became more confident in recognizing and recalling terms related to body systems, symptoms and procedures, which can be explained by the regular spaced repetition and the combination of written, audio and visual representations of each term.

The most noticeable progress was observed in word-formation awareness. Systematic work with Greek and Latin term elements enabled students to infer the meaning of unfamiliar terms (for example, interpreting gastroenteritis or nephrectomy by analysing their components), thereby turning vocabulary learning from rote memorization into an analytical process. This result is consistent with the Involvement Load Hypothesis, since such tasks required students to search for and evaluate the meaning of word parts. Improvement in collocational and contextual accuracy showed that students began to use terms in natural combinations typical of clinical discourse, which supports the Lexical Approach's emphasis on multi-word units.

Positive changes were also found in the professional communicative use of vocabulary. In role-plays, students in the experimental group were better able to explain technical terms in lay language and to choose an appropriate register depending on the interlocutor, a skill that is essential in doctor–patient communication. Furthermore, the criterion of vocabulary learning strategies and motivation showed an increase in high-level indicators: students reported using mobile tools independently outside the classroom, keeping vocabulary journals and planning their revision. This finding is in line

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with Self-Determination Theory, according to which autonomy and a sense of progress enhance intrinsic motivation.

In the control group, which was taught using traditional methods, only minor changes were observed, and the distribution of students across the levels remained relatively stable. These results suggest that bilingual lists and translation exercises alone do not provide the depth of processing and the variety of contexts required for the development of productive lexical competence. From a theoretical perspective, the findings confirm the assumptions of Dual Coding Theory and the Cognitive Theory of Multimedia Learning: linking medical terms to images, sounds and clinical situations created multiple retrieval routes and facilitated long-term retention. At the same time, the careful sequencing of tasks helped to keep the cognitive load manageable, as recommended by Cognitive Load Theory.

Conclusion. The study has shown that MALL-based multimodal learning is an effective approach to developing English lexical competence among medical students. Compared with the control group, the experimental group demonstrated considerable progress in knowledge of medical terminology, word-formation awareness, collocational accuracy, the professional communicative use of vocabulary, and vocabulary learning strategies and motivation. The integration of spaced repetition, term-element analysis, authentic multimodal materials and communicative clinical tasks transformed vocabulary learning into an active, meaningful and autonomous process. The proposed model can be applied in teaching English for medical purposes at higher medical institutions, and further research may examine its long-term effect and its applicability to other specialized fields such as pharmacy and nursing.

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