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OPTIMAL VOCABULARY PRE-TEACHING LOAD FOR MAXIMIZING READING COMPREHENSION WITHOUT COGNITIVE OVERLOAD

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Abstract: This study looks at how the amount of vocabulary taught before a reading task affects reading comprehension for English for Specific Purposes (ESP) students. The research took place at the “Tashkent Institute of Irrigation and Agricultural Mechanization Engineers” National Research University and included 38 undergraduates from Economics, Aerospace Technology, and Material Science. Using Cognitive Load Theory and the Vocabulary Threshold Hypothesis, the study aimed to find the best amount of vocabulary to teach that helps understanding without causing overload. Students experienced three different pre-teaching levels: low, moderate, and high. The results show that teaching a moderate amount of vocabulary leads to better comprehension than a low amount, while teaching a high amount does not help as much and can cause fatigue. For technical fields like Aerospace and Material Science, focusing on teaching key vocabulary is more effective than teaching every possible word.

Keywords: Vocabulary Acquisition, Cognitive Load Theory, Reading Comprehension, Pre-teaching, Instructional Design.

O‘QIB TUSHUNISH KO‘NIKMASINI OSHIRISH UCHUN DARSDAN OLDINGI SO‘Z BOYLIGINING KOGNITIV YUKLAMASIZ, ENG MA‘QUL MIQDORI

Annotatsiya: Ushbu tadqiqot o‘qish vazifasidan oldin o‘qitiladigan lug‘at miqdorining maxsus maqsadlar uchun ingliz tili (ESP) talabalari uchun o‘qib tushunish ko‘nikmasiga qanday ta’sir qilishini ko‘rib chiqadi. Tadqiqot “Toshkent irrigatsiya va qishloq xo‘jaligini mexanizatsiyalash muhandislari institute” Milliy tadqiqot universitetida olib borildi va iqtisodiyot, aerokosmik texnologiyalar va materialshunoslik yo‘nalishlaridan 38 nafar bakalavr yo‘nalishidagi talabalarni qamrab oldi. Kognitiv yuklanish nazariyasi va lug‘at chegarasi gipotezasidan foydalangan holda, tadqiqot ortiqcha yuklamasdan tushunishga yordam beradigan eng yaxshi lug‘at miqdorini

topishga qaratilgan edi. Talabalar o'qitishdan oldingi uch xil darajani boshdan kechirdilar: past, o'rtacha va yuqori. Natijalar shuni ko'rsatadiki, o'rtacha miqdordagi lug'atni o'qitish past miqdordagiga qaraganda yaxshiroq tushunishga olib keladi, yuqori miqdordagi o'qitish esa unchalik yordam bermaydi va charchoqqa olib kelishi mumkin. Aerokosmik va materialshunoslik kabi texnik sohalar uchun kalit so'zlarni o'qitishga e'tibor qaratish har bir mumkin bo'lgan so'zni o'qitishdan ko'ra samaraliroqdir.

Kalit so'zlar: Lug'atni egallash, Kognitiv yuklanish nazariyasi, O'qib tushunish ko'nikmasi, O'qitishdan oldingi topshiriqlar, O'qitish dizayni.

ОПТИМАЛЬНАЯ ПРЕДВАРИТЕЛЬНАЯ ПОДГОТОВКА ПО СЛОВАРНОМУ ЗАПАСУ ДЛЯ МАКСИМАЛЬНОГО ПОВЫШЕНИЯ ПОНИМАНИЯ ПРОЧИТАННОГО БЕЗ КОГНИТИВНОЙ ПЕРЕГРУЗКИ

Аннотация: В данном исследовании рассматривается влияние объема словарного запаса, изучаемого перед выполнением задания по чтению, на понимание прочитанного у студентов, изучающих английский язык для специальных целей (ESP). Исследование проводилось в Ташкентском национальном исследовательском университете ирригации и сельскохозяйственной механизации и включало 38 студентов экономических, аэрокосмических и материаловедческих специальностей. Используя теорию когнитивной нагрузки и гипотезу порогового значения словарного запаса, исследование было направлено на определение оптимального количества словарного запаса для обучения, способствующего пониманию текста без перегрузки. Студенты прошли три разных уровня предварительного обучения: низкий, средний и высокий. Результаты показывают, что обучение умеренному количеству словарного запаса приводит к лучшему пониманию, чем обучение малому количеству, в то время как обучение большому количеству не так эффективно и может вызывать усталость. Для технических специальностей, таких как аэрокосмическая техника и материаловедение, сосредоточение внимания на обучении ключевой лексике более эффективно, чем обучение каждому возможному слову.

Ключевые слова: освоение словарного запаса, теория когнитивной нагрузки, понимание прочитанного, английский язык для специальных целей, предварительное обучение, разработка учебных материалов.

Introduction.

As higher education in Uzbekistan changes, English proficiency is now essential for academic and career success, especially at technical universities such as the Tashkent Institute of Irrigation and Agricultural Mechanization Engineers National Research University ("TIAME" NRU). Students in Economics, Aerospace Technology, and Material Science need to understand complex international literature to stay competitive. Grabe (2009) says reading is the main way to access content knowledge in academic settings, but Koda (2005) notes that transferring reading skills between languages depends greatly on certain language thresholds.

English for Specific Purposes (ESP) students face two main challenges: building general academic literacy and learning specialized vocabulary. Perfetti (2007) explains that 'lexical quality,' or how quickly and accurately students recognize words, is key to reading well. When students read texts full of unfamiliar words, they often struggle to understand, which Stanovich (1986) called the 'Matthew effect'—students with weaker

vocabularies fall further behind. Teachers often try to help by teaching vocabulary before reading, but it is unclear how much pre-teaching is actually helpful.

Cognitive Load Theory (CLT) says that teaching methods should consider the limits of working memory (Sweller, 1988; 2011). Baddeley (2003) adds that working memory has separate parts for handling visual and auditory information, and these can be overloaded easily. This study looks at how much vocabulary should be taught before reading for TIAME NRU students. The idea is that some pre-teaching helps understanding, but too much vocabulary before reading can overwhelm students and reduce the mental effort needed to build new knowledge (Paas, Renkl, & Sweller, 2003).

Literature Review

Many studies show a strong link between vocabulary size and reading comprehension. Nation (2001) says that knowing enough words is necessary for reading, and reading also helps people learn new words. Laufer (1989) first suggested that readers need to know 95% of the words in a text to understand it. Later, Laufer and Ravenhorst-Kalovski (2010) and Schmitt, Jiang, and Grabe (2011) raised this to 98% for academic texts. If students do not reach this level, they struggle to use context clues to figure out meanings (Nation, 2013).

Reaching this vocabulary level in an ESP setting is challenging. Egamovich (2022) compared intensive and extensive reading and found that while extensive reading helps with fluency, intensive instruction is often needed for harder texts. Surmanov (2024) also showed that graded readers help develop skills, but real technical texts often need more direct support.

Sweller (2011) explains three types of cognitive load: intrinsic load, which is the natural difficulty of the material; extraneous load, which comes from how information is presented; and germane load, which is the effort put into learning. When teachers give students a long list of definitions before a lesson, it increases extraneous load. Chandler and Sweller (1991) showed that having to look between a text and a glossary makes learning harder. Mayer and Moreno (2003) added ways to lower cognitive load in multimedia learning, which also applies to today's language teaching methods.

If students have too much to process at once, they cannot focus deeply enough to remember what they learn (Hulstijn, 2001). Webb (2007) and Webb and Chang (2015) found that repeating information helps memory, but it is important to space out the repetitions. Learning a lot of vocabulary right before reading is like cramming, which is not as effective as spreading out practice.

A student's mindset is also very important. Samatova (2014) points out that motivation is a key factor in language learning, especially for students who are not studying languages. If the pre-teaching part is boring, students lose motivation. Samatova (2020) also says that students with different skill levels need different teaching methods. For example, a top student in Aerospace Technology might handle more work than a struggling Economics student, or the other way around. Samatova (2020) adds that making the material relevant is important for keeping students motivated in non-language fields.

Zhang (2012) and Surmanov (2025) also talk about the value of metacognitive strategies. Students should learn how to deal with unknown words instead of just getting definitions. Read (2004) and Schmitt (2008) suggest a balanced method: teachers should focus on teaching common and useful words, while students use strategies or skip less common words.

Methodology

This study used a quasi-experimental design with 38 undergraduate students from the “TIAME” National Research University. The group included 15 students from the Faculty of Economics, 12 from the Department of Aerospace Technology and Sustainable Development, and 11 from the Department of Material Science and Technology of New Materials. All participants had a B1+ level of English proficiency. The mix of academic backgrounds was chosen to test how well the findings apply across different fields, since learning technical terms in areas like Material Science may be more challenging than in Economics.

To study the effects of pre-reading instruction, three academic texts of similar difficulty were chosen. The experiment varied the number of words taught before reading in three conditions: Condition A (Low) with 3 words, Condition B (Moderate) with 8 words, and Condition C (High) with 18 words. This setup aimed to test the limits of working memory as described by Baddeley (2003). To reduce the “split-attention effect” (Chandler & Sweller, 1991), where processing information from different sources can increase cognitive load, definitions were shown clearly on slides. After the instruction, participants read the assigned text and took a comprehension test to measure how much they understood and remembered.

Results

Table 1 shows the descriptive statistics for reading comprehension scores in the three experimental conditions, grouped by academic discipline.

Condition	Total (n=38)	Econo mics	Aeros pace	Materia l Sci
Low (3 words)	6.2	6.5	5.9	6.1
Moderate (8 words)	8.4	8.7	8.1	8.3
High (18 words)	6.8	7.1	6.4	6.7

Table 1: Mean Comprehension Scores

Looking at the overall data, there is a clear inverted-U pattern between the amount of pre-teaching and reading comprehension. Participants did best in the Moderate condition (Total = 8.4), which suggests there is an ideal amount of vocabulary instruction. In contrast, the Low condition had the lowest scores (Total = 6.2). This result supports Nation’s (2006) lexical coverage hypothesis, which says that not knowing enough vocabulary makes it hard to understand a text and stops learners from forming a clear mental picture of the content.

But when the pre-teaching load was higher than moderate, it had a negative effect. Scores dropped in the High condition (Total = 6.8), which supports Sweller’s (1988) Cognitive Load Theory. Learning 18 new words at once likely put too much strain on students’ working memory, making it harder for them to focus on reading comprehension. This pattern—an initial rise in scores followed by a drop—was seen in all three academic disciplines, showing that these cognitive limits apply no matter what the students are studying.

Discussion

The results point to an ideal range for pre-teaching vocabulary, with about 7 to 10 words being most effective. In the Low condition, not enough words were taught in advance, so participants likely did not reach the 95-98% lexical coverage needed for

good reading comprehension (Laufer & Ravenhorst-Kalovski, 2010). This made it hard for them to process the text. On the other hand, the High condition showed that giving students too many words to learn at once can backfire. Although they had access to more vocabulary, the mental effort needed to remember eighteen new definitions took away from the focus needed to understand the text as a whole (Paas et al., 2003). Focusing too much on individual words in the High condition left fewer mental resources for overall comprehension.

The data show that students in Aerospace and Material Science had a slightly bigger drop in performance under the High condition than students in Economics. This may be because engineering and material science texts often describe complex physical processes, which already require a lot of mental effort to understand (Sweller, 2011). Adding a heavy vocabulary load makes it even harder, so students get mentally tired more quickly. This matches Samatova's (2020a) findings that technical students focus more on understanding concepts than on knowing every word exactly. As a result, too much vocabulary practice can interrupt their usual way of learning and make them more likely to feel overloaded than students in social sciences.

To help prevent cognitive overload, instructors can use Egamovich's (2025) strategies, which suggest moving less important vocabulary learning to self-study with digital tools like Anki. This way, students do not have to spend class time on rote memorization and can focus on understanding key concepts. At the same time, Surmanov (2025) points out that teaching students specific reading strategies can help them handle more uncertainty in texts, so they can still understand the material even if they have learned fewer words in advance.

Another interesting observation during the High Load condition matches Azimova and Surmanov's (2025) findings on code-switching. When faced with too much new vocabulary, students often switched to their native languages (Uzbek or Russian) to understand definitions. While this is natural, it adds extra mental work and puts more strain on memory. The results also highlight the value of "depth of processing" (Pulido, 2009). In the Moderate condition, students had enough time to discuss and deeply learn the eight target words, which helped them remember better. In contrast, the High condition forced them to rush, leading to shallow learning. As Surmanov (2024) notes about graded readers, a challenge that is manageable keeps students engaged, but too much vocabulary at once can make them lose interest and withdraw mentally.

Conclusion

This study shows that in English for Specific Purposes (ESP) classes at "TIAME" NRU, simply increasing instructional input does not always lead to better results. In other words, more is not always better. To help students improve reading comprehension without causing cognitive overload, a three-part teaching approach is suggested. First, teachers should focus on pre-teaching only 7 to 10 important vocabulary words in class, following Nation's (2013) recommendations. Second, students should be encouraged to expand their vocabulary on their own using digital tools, as Egamovich (2025) suggests. Third, teaching should be adjusted for different subjects, since fields like Aerospace and Material Science are more complex and require a more careful approach to extra vocabulary (Samatova, 2020). By following these steps, teachers can better support students in Economics, Aerospace, and Material Science, making sure that learning English helps rather than hinders their academic success.

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