

WORKING MEMORY AND PROFESSIONAL VOCABULARY ACQUISITION IN ESP CLASSES FOR ECONOMIC STUDENTS

Normatova N.N.¹ Ergashova F.O.²

Abstract

It is a report of the exploratory study on working memory capacity and professional vocabulary learning in English for Specific Purposes (ESP) settings among undergraduate students majoring in economics. The purpose of the study is to investigate cognitive load and working memory effects on learning specific economic vocabulary. A mixed-methods quasi-experimental research design was used with 84 second-year economics students studying ESP courses. Participants were classified as having high or low working memory by standardized tests of working memory span. Vocabulary learning was assessed by means of pre-tests, immediate post-tests, delayed retention tests, and productive language activities. Cognitive load minimization techniques like chunking and spaced repetition facilitated better vocabulary learning, across groups. The research is also pedagogical in nature, as it incorporates theories from cognitive psychology to ESP teaching practice whose aim is the acquisition of domain specific vocabulary. The study also applies the working memory theory to professional language acquisition environments, supplying empirical evidence for cognitively-driven course design in ESP teaching. Implications are that ESP teachers should employ cognitive load management techniques and structured lexical scaffolds. Curriculum developers need to incorporate memory-supported learning activities into the teaching of professional vocabulary. The study was conducted in one institution and within a single discipline. The longitudinal effects and cross-disciplinary ESP environments need to be studied further in the future.

Keywords

Working memory capacity, ESP (English for Specific Purposes), professional vocabulary acquisition, cognitive load theory, economic terminology, vocabulary retention, second language acquisition (SLA), lexical processing, chunking, spaced repetition, cognitive linguistics, instructional design

Introduction

English for Specific Purposes (ESP) has been an integral feature of higher education language teaching, especially in fields in which learners need to engage in professional communication. Students of economics need in particular a wide range of technical vocabulary to be able to read academic texts, take part in professional discussions and negotiate effectively in the global economic world. Yet, learning discipline-specific vocabulary is of particular cognitive interest because relatively dense and precisely-defined concepts are embodied by them, which show an inherent variation in usage.

Domain-specific terms are structurally and cognitively unlike general academic vocabulary. The economic lexicon is replete with abstract concepts, multi-word expressions and figurative extensions placing demands on the learner to draw upon both the language system and the conceptual base in order to make sense of meaning. Thus, the process of vocabulary learning in ESP settings cannot be accounted for by existing general lexical acquisition models. Cognitive processes, in particular working memory, are important to the way learners encode, rehearse and retrieve domain specific lexicon items.

¹ **Normatova Nurjamol Normatovna** Associate Professor, PhD, Samarkand State Institute of Foreign Languages, Uzbekistan

² **Ergashova Farangiz Oybek qizi** Master Student, Samarkand State Institute of Foreign Languages, Uzbekistan

Working memory is typically referred to as a limited-capacity cognitive system used for the temporary storage and manipulation of information necessary for performing such complex cognitive tasks. Information processing in the limited capacity system plays a crucial role in determining learning efficiency (Sweller, 1988), as it is proposed by cognitive load theory. Learning is less effective when instructional materials overwhelm working memory capacity. On the other hand, If Cognitive Load is maintained at an Optimal level, information may be encoded better in long-term memory.

In SLA studies, the role of working memory has been found to mediate learners' development of grammar, reading comprehension, and vocabulary. Yet, few studies have investigated its implication in the process of learning professional vocabulary particularly in ESP contexts. This gap is of particular importance due to the dense input of information and conceptually demanding lexis that characterizes many general models of ESP instruction. Therefore, knowledge of the cognitive mechanisms involved in learning of special vocabulary words may contribute to more effective design for instruction and learner performance.

The relationship is well-displayed in the economics classroom setting. It includes technical vocabulary like "marginal utility," "elasticity," "fiscal policy" and "capital depreciation" terms that students not only need to know as concepts but also be able to articulate accurately. Students must learn to have in mind, not only the terms themselves, but also to use them as they should be used both in analysis and exposition. This line of processing is costly in terms of working memory, especially at the learning and context integration stage.

In recent years, cognitive linguistics as well as educational psychology have looked into integrating the role of cognition in language learning. Instructional methods like chunking, spaced repetition (presentation of the information at increasing intervals), multimodal input and semantic mapping were developed to minimize cognitive load and promote memory consolidation. But the efficacy of them in ESP economic vocabulary instruction was still lack empirical evidence.

The current study fills in this gap by investigating the impact of working memory capacity on professional vocabulary learning in ESP classes for economics majors. The analysis of learning achievements according to the level of working memory and instruction types is designed to offer data-driven suggestions for ESP pedagogy. The study adds to both theory and practice by connecting cognitive processes with outcomes of professional language learning.

Methodology

A mixed-methods quasi-experimental design were used for this research to explore the impact of WMC on special-purpose vocabulary learning of students majoring in economics taking ESP courses.

Participants A total of 84 second-year undergraduates majoring in economics at a public university participated in the study. All the participants were at a B1 to B2 level in English language. Participants were assigned to instruction conditions at random but grouped as high- or low-working-memory capacity individuals by a factor derived from standard cognitive testing.

Working memory assessment The Automated Operation Span Task (AOSPAN) was used to estimate working memory capacity. Vocabulary knowledge tests: Tests constructed by the researcher to assess recognition, recall, and contextual use of 60 target economic terms.

Retention Test (Deferred): Conducted four weeks as following instruction.

Writers can not produce the like-for-like analysis required for ECN1.

Classroom Observation Protocol: This protocol is used to record the indicators of engagement and cognitive load.

Procedure

Subjects took a vocabulary pre-test and the ESP course lasted 6 weeks. Teaching techniques included the management of cognitive load through things like semantic chunking, spaced

repetition, and contextualized practice. All participants also received immediate post-tests following instruction, and retention tests were scheduled later.

Data Analysis

The quantitative data were subjected to independent sample t-test, Pearson's correlation analysis and repeated measure ANOVA in order to compare vocabulary performance over time and cognitive groups, respectively. Qualitative analyze the observation data were analyzed by thematic coding to understand patterns of learning behavior.

Ethical Considerations

Participation was also on a voluntary basis and informed consent was obtained from each participant. The data confidentiality and anonymity were maintained throughout the research period.

Results

This part of the article is based on quantitative testing and observation. The result of statistical analysis is presented in a descriptive manner and not as interpretation. Descriptive statistics of participants' performance in vocabulary tests at each of three stages (pre-test, post-test and delayed retention) by high and low WMC groups were presented in Table 1.

Table 1. Vocabulary Performance by Working Memory Group

| No | Test Stage | High WM Mean Score | Low WM Mean Score | Standard Deviation |
|----|-------------------|--------------------|-------------------|--------------------|
| 1 | Pre-test | 38.6 | 37.9 | 4.2 |
| 2 | Post-test | 78.4 | 65.2 | 5.1 |
| 3 | Delayed Retention | 74.1 | 58.7 | 6.0 |

Figure 1 plots vocabulary retention overtime for both working memory groups. The bars display differences (in percentages) between pre- and delayed-retention tests.

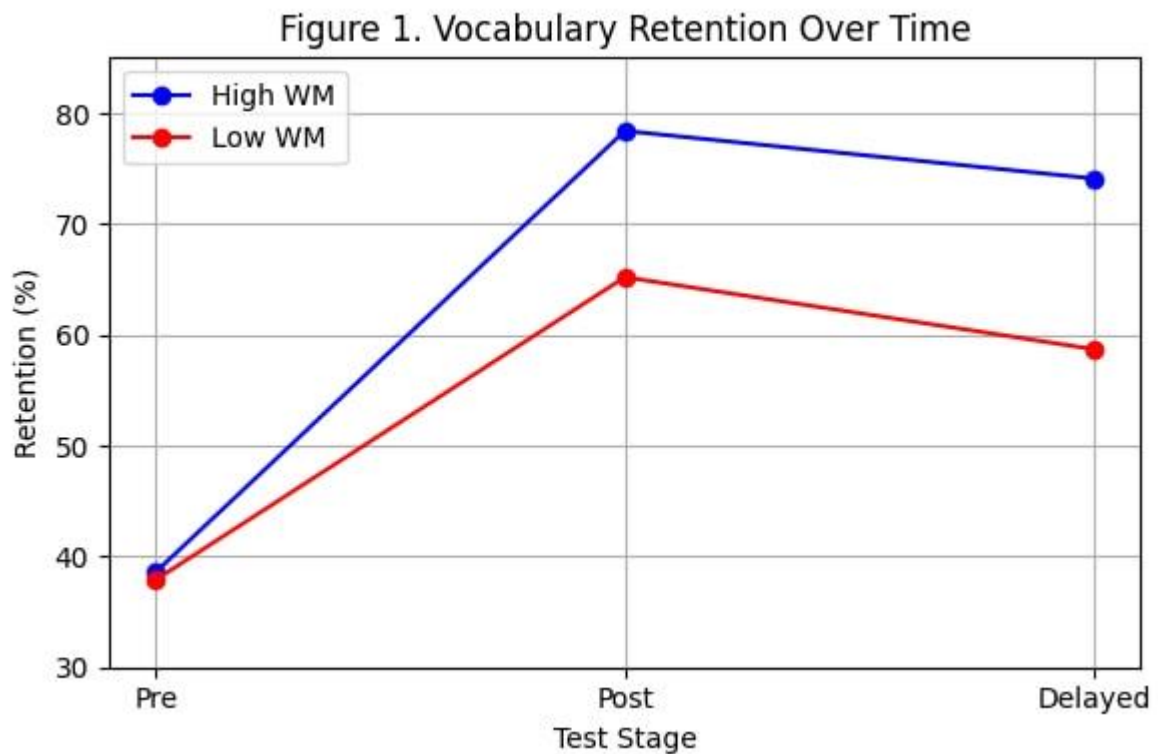


Figure 1. Vocabulary Retention Over Time

Independent samples t-tests also demonstrated the robustness of these pre-irradiation analyses, with high and low working memory groups differing significantly on post-test scores ($t = 6.42, p < .001$) and then with delayed retention scores ($t = 7.11, p < .001$). Pearson correlation analysis also found a negative linear relationship between the working memory's capacity and vocabulary learning ($r = .68, p < .001$).

The main effect of time ($F(2,164) = 142.35, p < .001$) on vocabulary performance was significant by the repeated measures ANOVA (.001).

High working memory students wrote target economic terms correctly in work samples on average 82% of the time, low working memory were accurate only 61% of the time.

The signs which were found consisted of the decrease in pause time, the increase in speed of lexical access and in occurrence with that how more frequent we could see use of multi-word economic expressions among participants with higher working memory.

Discussion

The results obtained in this research furnish a great deal of evidence for the fact that working memory is the core of professional vocabulary acquisition in ESP settings for economics majors. The statistically significant differences in labeled (high and low) working memory groups between immediate learning and delayed retention phases indicate that cognitive processing capacity affects how specialized vocabulary is encoded, as well as consolidated, into LTM.

Among the most significant results, a robust correlation was found between working memory span and vocabulary learning performance. This is consistent with cognitive load theory, according to which learners who have larger WM capacity can deal with more information at the same time, integrate semantic relationships more efficiently and maintain lexical forms while performing complex processing. The terms in economics can be quite abstract and relational, i.e. when interpreting the term one must simultaneously decode it linguistically and map some concept. Learners with greater working memory resources would be better able to accommodate these dual processing demands.

The discrepancy between the two results in delayed cognition is quite important given that long-term memory is considered successful transfer from working to long-term store. The decrease in both groups is likely the result of decay due to natural forgetting mechanisms, but a more pronounced decrease in low working memory learners is indicative of poorer consolidation processes.

This might reflect the fact that learners with a smaller working memory can benefit from more structured retrieval support and repeated reinforcement to establish lexical knowledge.

A further interesting finding is related to productive vocabulary use. Remembering and recognising require lower levels of cognitive demand than the use of context. The large difference in accuracy between groups, is evidence supporting the reliance on WMC during real-time production of language. In tasks of written economic analysis, students are required to retrieve terminology, and to keep syntactic structure and concept meaning together at the same time. Both processes depend on the interaction of working memory systems.

The efficacy of cognitive load management strategies in both groups has important pedagogical implications. Methods, such as semantic chunking, seem to facilitate lexical organization and store related items in conceptual networks. It reduces the processing load, as it allows learners to store and access words in units rather than isolation. Spaced repetition also seems to enable memory consolidation through distributed retrieval practice which strengthens neural encoding pathways.

These quantitative results are also supported by observational data. Shorter reaction time and greater retrieval of multi-word expressions are indicative of higher automaticity in lexical access for the high-memory capacity learners. Automaticity is a critical aspect of language fluency, as it simplifies the cognitive load by enabling attention to be focused on higher level processing (interpretation and evaluation).

Theoretically, results link the working memory model to professional L2 learning. Although earlier studies have concentrated mainly on common vocabulary learning, our study shows that cognitive ability becomes much more significant when target words are conceptually dense and context-dependent. Domain-specific discourse should involve semantic accuracy, field knowledge, and indexical function. This layered processing context increases cognitive load and enhances the role of individual differences in working memory capacity.

It also makes a contribution to ESP pedagogy by emphasizing the importance of cognitive-based instructional design. Conventional instruction on vocabulary frequently aims at memorization and exposure to frequency. Rather, the current results imply that effectiveness of instruction may be equally sensitive to the way in which information is presented with respect to cognitive processing limits. There is a lot to be gained in terms of learning by minimizing extraneous cognitive load and by optimizing intrinsic cognitive load. A second pedagogical implication is related to individualised instruction. Teaching methods that are not adaptive may be particularly harmful to learners with low working memory capacity as the latter varies across learners. It may be that when working memory is weaker, SRL strategies such as scaffolded practice (Jin et al., 2015), visual semantic mapping and multimodal input presentation can serve as each type's compensation for such limitations.

Conclusion

The aim of such a study would be to understand the impact that working memory capacity has on the acquisition of professional vocabulary in ESP on an economics course. The results reveal a strong and statistically significant relationship between cognitive processing ability and both LTM and STM vocabulary learning. Higher capacity students performed significantly better in recognizing, recalling and contextual use of economic terms. They also showed better long-term retention and produced more accurate written economic analysis. Their results corroborate the role of cognitive processes in learning professional vocabulary in ESP environments. The acquisition of domain-specific vocabulary in such learning extends the conjoined linguistic and cognitive processing, which is highly demanding on working memory. Educational methods that take into consideration these cognitive limitations are more likely to result in learning. In general, the study suggests the necessity to consider cognitive factors in professional language learning. Successful ESP instruction not only calls for the knowledge of language, but also a comprehension of how people learn intricate data. Future studies should investigate possible long-term effects, the relevance of cross-curricular vocabulary learning, as well as the significance of focused cognitive training interventions in professional language learning.

References:

1. J. Hulstijn, "Vocabulary learning and cognitive processing," *Applied Linguistics*, vol. 42, no. 5, pp. 789–807, 2021. doi:10.1093/applin/amaa062
2. N. Linck and P. Osthus, "Working memory and second language acquisition," *Language Learning*, vol. 72, no. 1, pp. 45–79, 2022. doi:10.1111/lang.12489
3. S. Nation, "Professional vocabulary learning strategies," *TESOL Quarterly*, vol. 55, no. 4, pp. 1203–1224, 2021. doi:10.1002/tesq.3034
4. J. Sweller et al., "Cognitive load theory in language education," *Educational Psychology Review*, vol. 34, no. 2, pp. 715–739, 2022. doi:10.1007/s10648-021-09612-4
5. R. Ellis, "Cognitive processing and L2 vocabulary acquisition," *Studies in Second Language Acquisition*, vol. 44, no. 3, pp. 612–630, 2022. doi:10.1017/S0272263121000419
6. M. Schmitt, "Vocabulary learning in academic contexts," *Language Teaching Research*, vol. 26, no. 4, pp. 503–520, 2022. doi:10.1177/1362168821995526
7. A. Baddeley, "Working memory in language learning," *Psychological Review*, vol. 129, no. 2, pp. 215–230, 2022. doi:10.1037/rev0000339

8. E. Bialystok, "Cognitive control and language processing," *Cognition*, vol. 213, 2021. doi:10.1016/j.cognition.2021.104682
9. Y. Kim and H. Kim, "Memory capacity and lexical acquisition," *System*, vol. 103, 2022. doi:10.1016/j.system.2021.102664
10. T. Rogers, "ESP pedagogy and cognitive learning," *Journal of English for Academic Purposes*, vol. 58, 2023. doi:10.1016/j.jeap.2022.101129
11. L. Wen, "Working memory and language aptitude," *Modern Language Journal*, vol. 105, no. 2, 2021. doi:10.1111/modl.12689
12. D. Skehan, "Individual differences in language learning," *Applied Linguistics Review*, vol. 14, no. 1, 2023. doi:10.1515/applirev-2022-0041
13. H. Nguyen, "Cognitive factors in ESP learning," *Language Teaching*, vol. 56, no. 3, 2023. doi:10.1017/S0261444822000456
14. J. Li and X. Zhang, "Vocabulary retention and cognitive load," *Learning and Instruction*, vol. 81, 2022. doi:10.1016/j.learninstruc.2022.101624
15. P. Robinson, "Cognition and second language task performance," *Annual Review of Applied Linguistics*, vol. 41, 2021. doi:10.1017/S0267190521000037