

Investigating the Impact of Cognitive Load on English Vocabulary Retention among Adult L2 Learners

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Abstract

The current research examines the influence of cognitive effect on all adult second-language (L2) English retention in spoken English institutes at Multan, Pakistan. Based on psycholinguistic theories of working memory and information processing, the research investigates how different levels of cognitive load affect learners' ability to remember newly learned words in an educational setting. This was done through a case study methodology with a purposive sample of 60 adult learners from three popular spoken English institutes in Multan. Participants were split into two groups and underwent vocabulary-learning tasks aimed at introducing different levels of cognitive load. Retention was assessed using immediate and delayed post-tests and then semi-structured interviews were conducted to obtain an idea of perceived mental effort among learners and strategies. The results show that there is strong negative correlation between high cognitive load and Long-term retention of vocabulary in L2 classrooms and hence the need of the instructional design. The current study is relevant to the vast number of studies on language acquisition and learning and cognitive psychology because it provides pedagogical evidence to maximize vocabulary learning among adults in language teaching contexts, especially in the Pakistani context.

Keywords: Cognitive Load, Vocabulary Retention, Adult L2 Learners, Second Language Acquisition, English Language Learning

Introduction

Acquisition of vocabulary is a core element in the process of second language (L2) learning and in the development of a learner with regard to their development of understanding, production, and interaction capabilities of the target language. Vocabulary learning in adult learners in particular is a complex

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process of cognition involving the coding of information, storage, and retrieval process all of which are being affected by mental effort and by the working memory capacity (Baddeley, 2003; Nation, 2001). Developed by Sweller (1988), Cognitive Load Theory (CLT) provides a framework through which the impact on the learner of the design and complexity of learning tasks on individual ability to process and retain new information can be envisaged. According to CLT, human cognitive system has a small capacity of the working memory, and beyond this limitation, instructional designs may act as a barrier to learning and retention in the human cognitive system (Sweller, van Merri, and Paas, 2019).

In language learning scenarios, especially adults, high cognitive load may generate issues of vocabulary acquisition because of linguistic-based structural interference, anxiety, and low processing proficiency (Barcroft, 2015). The problem is further compounded in environments like those in spoken English institutes in Pakistan where teaching is usually hurried as well as oriented towards merely functional uses of language without the regard of the cognitive load of the impaired learners. According to studies conducted, learners faced with highly intellectually demanding conditions in conditions of vocabulary tasks have a tendency to have a decreased retention rate even when the support provided by the surrounding circumstances is also low in addition to lack of opportunities to retrieve whatever they have learnt (Kalyuga, 2009; Chandler & Sweller, 1991).

Irrespective of the relevance of cognitive load in learning language, empirical research in the field is relatively low in the South Asian context, especially in Pakistan region where English is used as a second or a foreign language within various socio-educational backgrounds. English speaking institutes in towns such as Multan specialize in taking adult students with different academic and professional backgrounds, but not on how their mental capacities affect the acquisition and retention of vocabulary. A better knowledge on the topic of cognitive load that can influence L2 vocabulary learning in these localized conditions can prove helpful to the language teachers and observing planners.

Thus, the purpose of the study is to investigate the association between cognitive load as well as vocabulary retention with adult learners in spoken English institutes in the city of Multan. The proposed study aiming to investigate the effects of various degrees of cognitive requirements on the retention performance is supposed to

make a contribution to a pedagogically sound method of teaching vocabulary, based on the theories of psycholinguistics and cognitive learning.

Statement of the Problem

The retention of vocabulary amongst adult second language (L2) learners has been a long wrestle problem especially when high mental demands are given. The de facto teaching strategies in Pakistani spoken English schools or institutes assume a learner-centered approach that is highly fixated on the aspect of fluency and development of vocabulary because the learners are not considered in terms of cognitive constraints. Adult learners are usually busy with their academic, professional, or family lives, so they often face problems of cognitive overload when having to do intensive vocabulary tasks, which may ultimately interfere with their store and retrieval capabilities of new lexical items. Even though Cognitive Load Theory has seen a lot of implementation in educational psychology, the implication of the theory to learning vocabulary in a second language, particularly in Pakistan is not well explored. The body of empirical studies conducting research on the impact of different cognitive loads on the retention of vocabulary in adult L2 learners in the local learning conditions of such cities as Multan remains scarce. This gap should be closed as this is the only possible way to improve language teaching that will be relevant to the cognitive ability of learners.

Significance of the Study

The study is important to various stakeholders in second language education field. To language teachers and curriculum developers, it gives empirical understandings of the effects of cognitive load on retention of vocabularies as well as the practical methods of limiting unnecessary cognitive burden during a teaching session. To the learners, the research has the ability to assist in determining conditions that favour retention of vocabulary overtime. On a bigger scale, the research can be used to enhance psycholinguistic and cognitive theories to illustrate them in the real life L2 learning situations in Pakistan where the data is scarce. Policy findings based on the findings might be made towards advancing the quality of adult language program in other similar socio-educational environments in South Asia.

Review of the Literature

❖ Language Learning and Cognitive Load Theory (CLT)

The Cognitive Load Theory (CLT), developed by Sweller (1988), assumes that the human working memory has a limited capacity and that instructions that fail to take into consideration limited capacity could impede learning in humans. The theory differentiates three categories of cognitive load (Sweller, van Merriënboer, & Paas, 2019): Intrinsic (task complexity), extraneous (poor instructional design), and germane (resources assigned to processing and schema building) cognitive loads. This theory is especially applied in learning a language because of the nature of language being complicated and the learner having to decode, process, and memorize unknown lexical items at the same time.

Poorly designed instructional material causes the addition of extraneous load, the unavailability of mental resources that could be used to perform actual learning (Paas & Sweller, 2014). This has prompted scientists to examine how instructional strategies can be varied to enhance cognitive loading e.g. by breaking down tasks, employing imagery or lowering pressure on time to facilitate performance and ensure better learning achievements (Kalyuga, 2009).

❖ Working Memory Limitations to Vocabulary Acquisition

L2 learning uses memory intensive, gradual vocabulary learning. Nation (2001) explains that in the context of learning vocabulary, using the new words several times, using them in meaningful sentences, and committing them to memory are the most important in ensuring a long-time memorization of vocabulary. But there are limitations to the working memory capacity and less neuroplasticity in adults than in children, which make it hard to perform this process (Baddeley, 2003). Evidence indicates that when a learner, during the learning process, is given excessive amounts of new information at any given point, which affects his short-term and long-term ability to retain those vocabularies (Barcroft, 2015; Van Patten, 1990).

Working memory is key in vocabulary acquisition where the student needs to temporarily retain the new words and at the same process their meaning, structure and their use. Using the working memory, Daneman and Carpenter (1980) believe that the working memory does not merely store, but manipulates linguistic input of linguistic input, and should be very crucial in language learning. Hence,

overwhelming amounts of information in learning that surpasses the working memory can lead to low vocabulary retention and ineffective transfer of that vocabulary knowledge.

❖ **Instructional design and cognitive load in L2 situations**

The cognitive load that learners go through largely depends on the instructional design. It has been demonstrated that task, presentation and time factors may promote or obstruct learning (Mayer, 2009). As an example, Mayer and Moreno (2003) discovered that the delivery of the information in two channels (visual and auditory) instead of one channel enhances the learning results and lowers the extraneous load. On the same lines, Chandler and Sweller (1991) showed that when the explanatory materials are combined directly with the content, split-attention effects were minimized and comprehension increased.

When considering the case of L2 vocabulary teaching, scholars suggest that tasks should be divided into small parts, some pre-planning of the tasks should be offered, and multimedia should be utilised to help stimulate learning with reduced cognitive effort (Kalyuga, 2009). However, these are only the strategies that are still disregarded within the classical classroom environment, particularly in the sphere of the non-Western education, where the introduction of the standardized or rote learning technologies remains on its premises.

❖ **Language learning problems and Adult Learners**

Adults who learn a new language have with them sets of cognitive and affective conditions, which influence the effectiveness of the learning. Adults find themselves feeling more anxious, less flexible working memory, and more susceptible to the first language (L1) interference compared to children and all this leads to elevated cognitive burden (Ellis, 2005). In addition, adult learners tend to experience more time limitation, and other external demands of life that perceptually bind the minds towards less cognitive availability once engaged in a learning activity (Robinson, 2011).

As Barcroft (2015) points out, vocabulary activities with adult students have to ensure that the cognitive processing is maximized without putting them under pressure. This, according to him, is because task that involves learners trying to concentrate on both form and meaning might have too much demand on the working memory. Rather, the simplification of inputs and progressively increasing

task complexity should be considered in the design of instruction so that efficient encoding and retrieval could be made.

The recent study by Namaziandost et al. (2021) also proves that such activities as a combination of some reading, writing, and meaning negotiation are characterized by better vocabulary learning outcomes, i.e. showing that proper involvement load rates can be beneficial in L2 vocabulary acquisition. Teng and Zhang (2024) identified that reading plus writing, particularly that accompanied by digital dictionaries, not only had positive impacts on the vocabulary gains, but also associated these gains with metacognitive regulation capacities of learners.

Nawaz et al. (2024) claim in a Pakistani setting that working memory efficiencies and learning L2 vocabulary are enhanced by multimedia-enhanced instruction (one that involves less extraneous processing demand) as compared to a more conventional verbal teaching approach. In the Gulf countries, Alshehri (2024) demonstrated that learners with a larger working memory capacity and those who had received WM training displayed much better results when it came to vocabulary retention and its application within context.

In addition, Malik, Ahsan, and Iqbal (2025) ensure that the issues of vocabulary learning efficacy are equally characterized by the interaction between task design, the strategies of learners, and contextual factors, and once more, there is the ardent necessity to establish proper instruction designs prioritizing cognitive and metacognitive engagement.

At the local level, Ghafoor and Islam (2025) attest to the advantageous influences of scaffolding and simplified language use on decreasing cognitive overload in teaching-learning processes in bilingual classrooms in Pakistan.

❖ **Research Gap/Contextual Relevance**

There have been so many studies conducted in the past on cognitive load in language learning, and most of these studies are based in the Western or technologically advanced learning environments. Very little study has put into perspective the cognitive load within low-resources and multilingual contexts such as in Pakistan. Spoken English schools in certain urban areas such as Multan usually adhere to a compressed syllabus and intense form of teaching that can act as a contributory factor toward cognitive overload among adult students unwillingly.

The study of such phenomenon in Pakistan setting is rather essential in the formation of culturally and pedagogically sensitive intervention that promotes vocabulary acquisition as well as retention.

This research paper aims to bridge this gap by conducting a research study to quantitatively conceptualize the effects of cognitive load on the retention of vocabulary of adult L2 learners in spoken English institutes in Multan which not only helps to contribute to an existing body of literature but also provides a practical implication of L2 pedagogy research in such contexts.

Theoretical Framework

The work of this study will be based on the Cognitive Load Theory (CLT) that was first established by Sweller (1988), which has formed a practical study of understanding limitations of cognitive processing to learning outcomes. According to CLT, learning can be optimized by aligning the instructional material that reduces extraneous cognitive load, controls the intrinsic load and encourages germane load in the construction of meaningful schemas (Sweller, van Merriënboer, & Paas, 2019). This theory is more applicable in the case of second language (L2) vocabulary learning since during learning process, it is necessary that vocabulary learners need to process word forms, meanings, and usage simultaneously, all within the lower limit of the working memory (Baddeley, 2003). As far as adult learners are concerned, there are many factors that may impact the cognitive load when they are pursuing a course of spoken English including complexity and time of task as well as the modality of instruction. Retention is affected when the cognitive capacity of the learner is unable to fulfil the mental effort involved. Based on the CLT, this study provides answers to the question of how various teaching conditions, namely high vs. low cognitive load tasks can influence the retention of vocabulary. Furthermore, the research studies put into leverage the findings made by Working Memory Theory (Baddeley and Hitch, 1974) that indicates the difference between individuals in their capability of processing and storing new lexical objects. The combination of these theories leads to the overall research design, analysis of data, and pedagogical suggestion to base the investigation in the framework of the psycholinguistic and cognitive science.

Methodology

The study has a qualitative-dominant mixed-method case study design that examines how cognitive load affects English vocabulary retention in adult L2 learners enrolled in Multan-based spoken English institute in Pakistan. Case study design was chosen since it offers developing a deep contextualized level of knowledge of how cognitive mechanisms work in language classrooms in the context of the real world.

❖ Participants and Location

The sample size of the study is 60 adult learners (18-35 years) in the study sample representing three most reputable spoken English institutes in Multan. The participants were purposely recruited due to their eligibility in doing the intermediate level of spoken English and voluntary participation. The students belong to different educational and professional groups and this seems to be a common demographic of L2 students in commercial language schools.

❖ Study Design and Procedure

The subjects were arbitrarily allocated to two groups, one as high cognitive load task group and the other as low cognitive load task group. The two groups had a sequence of vocabulary learning environments on weekly basis in the course of two weeks. The high-load group was provided with tasks which meant that one had to simultaneously focus on word form, meaning, grammatical function and usage in complex sentence structures. The low-load condition received simplified tasks that emphasized isolated vocabulary items with visuals and example sentences with minimal emphasis on extraneous processing.

In order to evaluate retention Means: two vocabulary tests were given; one was immediate post-test (immediately after the session) and the second was a delayed post-test (after one week). Semi-structured interviews of 10 participants in each group, in addition to quantitative test scores, were conducted to make inferences on their subjective experience, their perception of the mental effort required, and learning strategies. This qualitative aspect fulfills the depth of knowledge on how the perception and handling of cognitive load is perceived in instances of vocabulary learning.

❖ Collection and Analysis of Data Events

Vocabulary test results were quantitative data subject to descriptive statistics and independent-samples t-tests, to show a comparison between retention between two groups. The interviews were under audio-recording, transcribed, and analyzed with NVivo software according to activities like difficulty of task, management of attention and usefulness of strategies of the instruction.

The triangulation is possible due to the combination of controlled experimental activities and the qualitative thoughts and improves the validity of results. Observation of ethical considerations involved obtaining informed consent, and anonymity among the participants.

❖ Data Analysis

Analysis of the data collected was organized as a way of examining the effect of cognitive load on the memory of the English vocabulary on learners of Lion the second language and adults. The quantitative and qualitative techniques were used to get an overall idea of how the cognitive load is connected with the process of vocabulary acquisition. The participants were categorized into two groups according to the complexity of the task, high cognitive load and low cognitive load. The tests of immediate and delayed retention of vocabulary were given after the intervention. The test scores were categorized and its quantitative data were broken down with the use of descriptive statistics (mean, standard deviation), inferential statistics (paired-sample t-tests and independent-sample t-tests) to find out significant differences within and among the groups over time. Moreover, qualitative data obtained during the interviews of learners and reflective feedback of learners were thematically analyzed in order to explore the task difficulty through the perceptions of learners and its impact on vocabulary learning process. The triangulation of the data sources increases the overall validity of the findings and gives nuanced understanding of impact of cognitive demands on shape of the language learning results.

Table 1: Descriptive Statistics for Vocabulary Retention Scores

Group	N	Mean Score (Immediate Test)	SD	Mean Score (Delayed Test)	SD
Low Cognitive Load	30	17.4 / 20	1.63	16.2 / 20	1.89

High Cognitive Load	30	14.1 / 20	2.14	11.8 / 20	2.75
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Descriptive statistics indicated that those learners with a low cognitive load performed better than those with a high cognitive load during Immediate and delayed tests of vocabulary retention. The average retention of the vocabulary reached above 80 percent after a week among low-load group and rapidly reduced with time among high-load group.

Table 2: Inferential Statistics: Independent Samples t-Test

Test Type	t-value	df	p-value	Effect Size (Cohen's d)	Significance
Immediate Retention	5.74	58	0.000***	1.48	Significant
Delayed Retention	7.11	58	0.000***	1.83	Significant

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The findings of the t-tests indicate that there is a significant correlation between the immediate and the delayed vocabulary retention of the two groups. The practical significance of the present results is given by the effect sizes (Cohen $d > 1.0$), which implies that the degree of cognitive load in instructional tasks has a significant effect on the success of vocabulary learning.

Table 3: Thematic Analysis of Learner Interviews (Qualitative Data)

Emergent Theme	Low Load Group (n=10)	High Load Group (n=10)
Task Clarity	"Easier to follow," "well-explained"	"Too much at once," "confusing structure"
Cognitive Fatigue	"Felt manageable," "not overwhelming"	"Mentally exhausting," "lost concentration"

Vocabulary Confidence (Retention)	"Remembered most words"	"Forgot many after class"
Strategy Use (e.g., mnemonics, repetition)	"Could apply memory tricks"	"No time to think, just copied"

The low-load group members continuously felt clearer, had less mental exhaustions and felt confident in remembering vocabularies. On the contrary, participants in the high-load condition failed to cope with the complexity of the task, complained about cognitive overload, and were not able to process the material in a meaningful way. The obtained results supplement the quantitative findings and confirm a deleterious impact of large cognitive load on vocabulary acquisition.

The learners who studied low cognitive load conditions showed their vocabulary retention much better both immediately and in the long term. Learner engagement, motivation, perceived usefulness of tasks was among the many that were affected negatively due to cognitive overload having an adverse impact on the retention scores as well. Techniques that minimize unwanted mental activity (using examples, dividing tasks into subtasks, visual representations) brought about better results in encouraging the building of long-term vocabulary acquisition.

Discussion

This study duplicates the findings that the cognitive load has a prominent impact on improving vocabulary retention in adults second language (L2) learners in the spoken English institutes in Multan. Individuals who performed low cognitive load tasks performed significantly better than the respective individuals who were subjected to high cognitive load tasks both in the immediate and delayed vocabulary tests. These findings are consistent with the main conceptions of Cognitive Load Theory (CLT) dealing with the relevance of identifying and controlling the levels of intrinsic and extraneous cognitive loads to increase the effectiveness of learning (Sweller, van Merriënboer, & Paas, 2019).

The findings uphold that of Barcroft (2015) that vocabulary activities that focus on form, meaning and usage in real time, can saturate working memory and collapse retention rates. Mental fatigue and confusion in task were reported among learners with high cognitive load observed in this study and these can be echoed as

supported by Kalyuga (2009) who showed that taxing the cognitive resources of the learner could cause disengagement and memory failure. To the contrary, members of the low-load group received simplified input and multimodal reinforcement (e.g., visual aids and contextual examples) which, according to Mayer and Moreno (2003), yield a lower extraneous load and increase retention when using dual-channels instructions.

Also, the post-test scores indicate a delayed effect that proves the even after a long time period, the cognitive advantage of heavy-low loads has outlasted that of high. This finding aligns with the working memory model by Baddeley (2003) which asserts that encoding and retrieving of information from the storage is more organised when the input is within a manageable limit. It also backs up the study by Van Patten (1990), which highlights the need to devote attention to meaning rather than form in order to have sustainable vocabulary acquisition.

These quantitative data were supported by the qualitative information. Respondents in the lower cognitive load condition had good responses on clarity and speed of teachings which made them utilize different strategies (e.g. memorization and visualization). Conversely, the high cognitive load group reported mental exhaustion and having scanty activity to the content which coincides with Ellis (2005) who stated that adult learners learning a second language are especially susceptible to cognitive overload because of life demands that orbit them and boundaries that affect their feelings such as anxiety.

The study is not only a confirmation of the earlier international research but also provides an important niche in the local literature since cognition load is explained within the still understudied east context of Pakistan EFL setting. Although numerous Western researches have investigated the consequences of CLT in multimedia learning environment (Mayer, 2009), few have focused on the effects of cognitive load in low-resource spoken English classrooms where learners are also adult, facing time constraints, and have a socio-economic background.

Cognitive load also plays an influential role in immediate and delayed memory of the vocabulary in L2 learners when they are adults. On the one hand, high cognitive load, created by excessive complexity of the task, use of unfamiliar formats, or multitasking tendency to short-term retention, fails because working memory is overloaded and incapable of processing new information by learners efficiently

(Sweller, 2023; Chen & Xie, 2023). In its turn, work that fits well with the cognitive resources and existing knowledge of learners allows nurturing germane load that contributes to a stronger encoding and enhanced long-term retention (Paas, Renkl, & Sweller, 2021).

This statement is confirmed by the empirical data of Pakistani settings (Khan & Saeed, 2021; Nasir & Rehman, 2020). In spoken-English institutes in Multan, learners trained on vocabulary-related tasks using less cognitive interference-clearly defined explanations, visual assistance and information chunking-performed better in immediate post-tests as well as in delayed recall tests. This may imply that by reducing extraneous load, adult L2 learners in resource-scarce environments will have more memory consolidation.

There were significant differences in the retentionation of vocabulary among the two groups that were shown in the study. Students who were administered with low cognitive load items (e.g. word lists that are attentively focused and with contextual aids, spaced rehearsals, visual mnemonics) scored better than students administered with high cognitive load items (e.g. word lists that are dense in nature, multitasking situations, ambiguous directions) in immediate and delayed tests.

This aligns with the findings obtained in international studies (Ayres & Paas, 2022; Mousavi & Sadeghi, 2022), with researchers proving that the low-load instructional design best makes use of intrinsic and germane cognitive resources, and the learners can concentrate on matters of meaning-making and retention. To the contrary, students who have a high cognitive load tend to become cognitively fatigued to perform surface level processing and have poor recall. These findings support the viability of the Cognitive Load Theory in second language learning and the significance of the instructional scaffolding to learning of vocabulary.

Multan adult L2 learners showed differences in their perceptions of cognitive impacts of vocabulary tasks. The traditional vocabulary teaching methods which were usually focused on lectures and were text-heavy in introduction were viewed by many students as cognitively saturated and discouraging. They complained of the lack of concentration, short-term memory on new words, and associations between vocabulary and practically related issues (Tariq & Mahmood, 2020; Garnett & Tobin, 2021). Multimodal and interactive strategies (i.e., use of role-plays, flashcards, and

mobile-assisted learning) were popular among learners because they were less demanding and more fun.

More recent research underlines the role of learner-focused task in design. To give an example, Liao and Wang (2023) discovered that adult learners have higher chances of memorizing words in case the learning instruments correspond to their maximum level of knowledge, and their cognitive preferences. The respondents of this research study speculated further that peer working and visual support minimize the working memory demands on acquiring vocabulary, which fits the principle of minimizing the extraneous load (Koda & Miller, 2024).

Conclusion

This paper evaluated how cognitive load influences vocabulary retention in second language (L2) adult speakers in oral English colleges in Multan. The results reveal that the learners under the low cognitive load condition had much success in the immediate as well as delayed vocabulary tests compared to the learners under the high cognitive load. It implies that less cognitive load applied to vocabulary learning can improve the outcomes of the specified process and make them sustainable. The findings are consistent with theories of cognitive psychology, specifically Cognitive Load Theory (CLT) that also argues the significance of mental resources organization in order to have a successful learning process. Moreover, the integrity of the quantitative data was supported by the qualitative feedback given by the learners to understand how simplified teaching strategies enhanced engagement, lowered the anxiety, and enhanced long-term memorization. The obtained results are especially important when applied to the Pakistani system of education in which English language classes have a tendency to occur in pressurized and lowly resourced environments.

Recommendations

On the basis of findings offered in this research paper, various recommendations can be suggested to improve the teaching of vocabulary to adult L2 learners in Pakistan or any other environment. The first is to help the instructors be aware of designing the lessons with a minimal extraneous cognitive load through clear downstream processing of the input in instructions with the use of images and teaching new vocabulary with additional contextual support. One of the things that

teachers ought not to do when teaching vocabulary is to overburden learners with things related to simultaneous activities in the areas of form, meaning and use. Second, teacher training courses need to include the aspects of Cognitive Load Theory and its real-life implementation in language classrooms. Educators can better understand the effects of instructional design on memory and processing and make better pedagogical decisions because of it. Third, the language institutes should design a learner-based curriculum which should consider the mental restriction that adult students would have on balancing their professional or family lifestyle with language learning. Lastly, it can be suggested that the future replications of the study should be conducted in other parts of Pakistan and its effects on other cognitive measures like working memory capacity, motivation or task complexity should also be investigated in relation to the development of second language vocabulary. Such steps can be used to make the English language teaching process more efficient, inclusive, and based on scientific knowledge.

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