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Decoding Vocabulary Strategies for L2 Reading Comprehension and Retention: Comparing Contextual Guessing and Affixation

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ABSTRACT

While previous studies have compared reading strategies among second language (L2) learners, specific comparison between higher-order interpretive skills (e.g., contextual guessing) and lower-order identification skills (e.g., affix-based recognition) remains underexplored. A quasi-experimental research design was employed to investigate the effects of two instructional strategies on reading comprehension and vocabulary retention of 90 intermediate-level students enrolled at one of the high schools in Iran. Three equal intact classrooms were selected randomly, and each of these groups consisted of 30 students as participants in this study. In the first experimental group, instruction centered on contextual guessing by teaching students to infer meanings of unfamiliar words using grammatical, collocational, and surrounding contextual clues rather than through direct definitions. The second experimental group received instruction focused on affixation, in which prefixes, suffixes, and root words were used to infer meanings of unfamiliar vocabulary, and the third group served as control. A pretest, posttest, and delayed posttest were used as instruments in the current study. Results suggest a significant enhancement in vocabulary acquisition and retention through the contextual guessing strategy. Furthermore, results evidenced that employing a contextual guessing strategy can foster more effective long-term retention than affixation and control groups, as reflected in delayed posttest results. It can be concluded that incorporating the contextual guessing strategy into vocabulary instruction enhances both immediate learning and long-term retention and makes it a valuable tool for reading comprehension.

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1. Introduction

The fundamental element of language learning can be widely recognized as vocabulary (Muallim et al., 2024). For many years in language instruction, however, it was often overlooked or considered secondary (Schmitt & Schmitt, 2020). The input hypothesis is one of the early theories of L2 acquisition and suggests that when learners are exposed to enough comprehensible input, vocabulary would develop naturally through reading (Krashen, 1989). According to this perspective, which is grounded in structural linguistics and the audiolingual method, learners should first master basic sentence structures, with vocabulary emerging as a natural byproduct. However, input hypotheses fail to acknowledge the critical role of vocabulary in effective communication (Kumaravadivelu, 2006).

The importance of vocabulary in overcoming communication barriers has been highlighted in recent years, and it was suggested that lexical gaps often result in breakdowns in understanding (Shafiee Rad & Alipour, 2025). Also, vocabulary acquisition involves complex cognitive processes such as memory, storage, and retrieval as advancements in psycholinguistics have revealed (Kidd et al., 2018). Vocabulary carries the majority of the meaning in any language, and learners are often acutely aware of how limited vocabulary impedes their ability to express and comprehend meaningful communication (Newton, 2013). Vocabulary is now seen as an integral component of language development, and this growing recognition has shifted the emphasis in language instruction (Carter & McCarthy, 2014). Computational linguistics provides new methods for analyzing and teaching vocabulary in more effective ways through this change and is driven by both research in applied linguistics (Graves, 2016).

In reading comprehension research in particular, vocabulary has become a focal point (Cai & Liao, 2024). Studies showed that vocabulary size directly impacts reading comprehension, and Learners with larger vocabularies are better able to decode and understand texts (e.g., Dong et al., 2018; Nation, 1992). Rich vocabulary can facilitate overall literacy development and comprehension as a robust vocabulary is considered one of the strongest predictors of academic success (Armbruster et al., 2003). EFL learners often lack the extensive exposure to the target language necessary for vocabulary development and this is especially important in this context (Dagnaw, 2023). Therefore, learning and using vocabulary is not only crucial for communication but also for academic achievement and general literacy.

Two effective strategies for enhancing vocabulary acquisition are contextual guessing and affixation which in turn can improve reading comprehension (e.g., van den Broek et al., 2022; Stewart et al., 2023). In contextual guessing, the meaning of unfamiliar words is inferred by using the surrounding text for clues that allow learners to make educated guesses about a word's definition based on its use within a particular sentence or passage (Çetinavcı, 2014). Students develop a deeper understanding of language by employing this strategy and it also fosters their critical thinking and helps even when they encounter unknown words (Nassaji, 2003). Affixation is another strategy that focuses on understanding the meanings of prefixes, suffixes, and roots and can be used to decode new words (Matthews et al., 2023). By recognizing common affixes and their meanings, learners can infer the meanings of complex vocabulary which results in expanding their word knowledge and enhancing their ability to comprehend a wider range of texts (Mochizuki & Aizawa, 2000). These two strategies

can support vocabulary development by encouraging active engagement with language and improving students' overall reading comprehension.

Although previous studies have examined contextual guessing (e.g., Matthews et al., 2023; Nassaji, 2003) and morphological or affixation-based vocabulary learning (e.g., Mochizuki & Aizawa, 2000), relatively few studies have directly compared these instructional approaches within the same classroom intervention while simultaneously evaluating both immediate vocabulary learning and delayed retention in secondary-school EFL settings. Moreover, evidence from Iranian high-school learners remains limited. Therefore, the present study does not seek to establish an entirely new comparison but rather extends previous research by providing a controlled comparison of contextual guessing and affixation strategies in an Iranian EFL context and by examining their effects on both reading comprehension and vocabulary retention.

2. Review of Literature

2-1. Vocabulary Strategies in L2 Reading Comprehension

Vocabulary knowledge is a cornerstone of L2 reading comprehension because it enables learners to decode text, infer meaning, and engage with ideas effectively (Dong et al., 2018). However, limited vocabulary often impedes comprehension of written texts (Dagnaw, 2023). To address this challenge, learners employ vocabulary strategies that support the acquisition, retention, and application of lexical knowledge during reading (van den Broek et al., 2022). Several theoretical perspectives explain the importance of these strategies. Schema theory emphasizes that vocabulary connects new information with existing knowledge, facilitating comprehension (Koedinger et al., 2012). Similarly, Nation (2001) conceptualized vocabulary knowledge as comprising form, meaning, and use, highlighting the need for strategies that develop all three dimensions. Krashen's (1985) Input Hypothesis further argues that comprehensible input is essential for language acquisition, with vocabulary strategies helping learners make input more understandable. In addition, Cognitive Load Theory suggests that effective vocabulary strategies reduce the mental effort required to process unfamiliar words, thereby supporting reading comprehension (Sweller, 1994).

Facilitating various aspects of the reading process is evident in the relationship between vocabulary strategies and reading comprehension processes (Lawrence et al., 2019). L2 learners recognize words more efficiently, which results in enhanced fluency. Strategies such as phonological decoding and morphological analysis help (e.g., Chambrè et al., 2020; Sulistyawati et al., 2021). Another technique is memory, which is conducted by spaced repetition and also can support the retention of newly learned vocabulary and ensure it remains accessible for future use (Schuetze, 2019). Moreover, learners can foster autonomy and self-regulation in their reading practices by using metacognitive strategies that can allow them to plan, monitor, and evaluate their vocabulary acquisition (Amini et al., 2020).

Understanding of vocabulary strategies in L2 reading through innovative methodologies and advancements has been expanded in recent years. The impact of digital tools such as AI-driven learning platforms and mobile applications that integrate gamified elements to boost engagement and retention has received more interest (e.g., Shafiee Rad & Alipour, 2025). Another recent strategy is the use of eye-tracking research that provides real-time insights into how learners focus on unfamiliar words during reading and offers a nuanced understanding of strategy use (Li, 2024). The benefits of explicit instruction in vocabulary strategies have been experimented and

revealed that learners trained in these techniques achieve better reading comprehension outcomes (Yeung et al., 2020). Furthermore, patterns of word frequency and collocation in authentic text and corpus-based research have been highlighted and provide valuable guidance for vocabulary instruction (Sun & Park, 2023). However, contextual guessing as a strategy to enhance reading comprehension in an L2 context has been rarely examined.

2-2. Contextual Guessing Strategy and L2 Vocabulary Learning

Contextual guessing is an effective vocabulary learning strategy that encourages learners to infer the meanings of unfamiliar words from surrounding textual and situational cues (Uchihara et al., 2022). These cues may include grammatical structures, semantic relationships, collocations, and pragmatic markers (Chandy et al., 2025). Unlike explicit vocabulary instruction, contextual guessing promotes learner independence and active engagement with authentic texts (Mondria & Boer, 1991). Its effectiveness is supported by several theoretical perspectives. Krashen's (1985) Input Hypothesis suggests that contextual guessing helps learners comprehend input slightly beyond their current proficiency level. Depth of Processing Theory proposes that actively analyzing contextual clues promotes deeper cognitive processing and stronger vocabulary retention than superficial learning (Craik & Tulving, 1975). Likewise, Incidental Vocabulary Learning Theory argues that learners acquire vocabulary naturally while focusing on text comprehension rather than explicit vocabulary study (Laufer & Hulstijn, 2001). Schema Theory further explains that contextual guessing activates learners' prior knowledge, enabling them to interpret unfamiliar words more effectively and strengthen word understanding (Laufer & Hulstijn, 2001).

Contextual guessing contributes to L2 vocabulary learning by promoting active engagement with texts and developing inferencing skills that enable learners to interpret unfamiliar words independently (Chandy et al., 2025). The cognitive effort involved in inferring word meanings enhances retention and supports long-term vocabulary learning (Alipanahi, 2007). Moreover, contextual guessing improves reading comprehension by helping learners maintain understanding despite encountering unfamiliar words and by fostering autonomy through reduced reliance on dictionaries or glossaries (Rahmalia et al., 2019; Uchihara et al., 2022). Recent research highlights the importance of rich semantic and syntactic contexts for accurate word inference and vocabulary retention (Hamada, 2021; van den Broek et al., 2022). Studies also show that explicit strategy instruction improves learners' ability to identify contextual clues and infer word meanings effectively (Chinpakdee & Gu, 2024; Walters, 2004). However, the effectiveness of contextual guessing depends on learners' proficiency levels and the quality of contextual information available (Çetinavcı, 2014). Although previous studies have examined contextual guessing and morphological strategies, relatively few have directly compared contextual guessing and affixation in classroom-based L2 settings while examining both reading comprehension and delayed vocabulary retention.

2-3. Affixation Strategy and L2 Vocabulary

Affixation is an important strategy in L2 vocabulary acquisition that involves adding prefixes, suffixes, or other morphemes to base words to create new words or modify their meanings (Baleghizadeh & Saharkhiz, 2014; Matthews et al., 2023). By recognizing affixes, learners can decode unfamiliar words, infer their meanings, and

expand their vocabulary, thereby supporting reading comprehension and retention (Wu & Juffs, 2022). This strategy enables learners to understand and produce unfamiliar words by combining affixes with root words (Kim, 2010; Mochizuki & Aizawa, 2000). For example, adding the prefix *un-* to *happy* forms *unhappy*, while the suffix *-er* transforms *teach* into *teacher*. Mastering affixation helps learners infer word meanings and grammatical functions more effectively (Hayashi & Murphy, 2011). The role of affixation is supported by several theoretical perspectives. Morpheme-based theory emphasizes that understanding morphemes is fundamental to vocabulary acquisition because affixes convey semantic and grammatical information (Anderson, 1988). Incidental Vocabulary Learning Theory suggests that learners acquire vocabulary while engaging with meaningful content, with affixation facilitating the inference of unfamiliar words (Laufer & Hulstijn, 2001). Similarly, Cognitive Load Theory proposes that breaking complex words into smaller meaningful units reduces cognitive demands and improves comprehension and retention (Sweller, 2011). Sociocultural Theory further highlights that affixation develops through interaction with linguistic and cultural contexts and is shaped by the language input learners receive (Vygotsky, 1978).

The development of L2 vocabulary directly contributes to affixation in several important ways. First, it helps learners infer word meanings by providing clues about the word's meaning or grammatical function (Matthews et al., 2023). For example, knowing that the suffix "-ly" transforms adjectives into adverbs can enable learners to quickly infer that "quickly" is an adverb meaning "in a quick manner." Second, learners can expand their vocabulary by forming new words from familiar roots by affixation (Mochizuki & Aizawa, 2000). For instance, a learner who knows the word "act" can broaden their lexical repertoire and derive additional words such as "reaction," "actor," and "active." Third, affixation can enhance word retention (Stewart et al., 2023). Learners can better remember words when they break words down into affixes and roots over time because the process involves deeper cognitive engagement (Matthews et al., 2023). In addition, affixation supports reading comprehension by enabling learners to deduce the meanings of unfamiliar words as they encounter them in context (Rothou & Padeliadu, 2015). Learners can use their knowledge of affixation to maintain fluency and comprehension in reading rather than relying on external resources like dictionaries.

Recent research has highlighted the value of affixation in L2 vocabulary learning (e.g., Vaknin-Nusbaum & Makhoul, 2025). Explicit instruction in prefixes and suffixes improves learners' ability to infer word meanings and retain new vocabulary (e.g., Zingler & Rogers, 2024). For example, Harris and Samuel (2025) found that learners receiving explicit affixation instruction outperformed those using flashcards in vocabulary comprehension and retention. Research also indicates that learners' first language influences their ability to recognize and use L2 affixes, with shared morphological patterns facilitating vocabulary acquisition (Crosson et al., 2025; Wu & Juffs, 2022). Beyond vocabulary learning, affixation contributes to reading comprehension by enabling learners to infer the meanings of unfamiliar and academically complex words more efficiently (Vaknin-Nusbaum & Makhoul, 2025). Although previous studies have demonstrated the benefits of affixation and contextual guessing independently, relatively few have directly compared these instructional strategies in classroom-based L2 contexts while examining both reading comprehension and delayed vocabulary retention.

3. This Study

This study compares the effectiveness of contextual guessing and affixation strategies in enhancing reading comprehension and vocabulary retention among L2 learners. Grounded in schema theory, depth of processing theory, and cognitive load theory, it proposes that contextual guessing promotes comprehension and long-term retention by activating prior knowledge and encouraging deeper semantic processing, whereas affixation facilitates vocabulary learning by reducing cognitive load through morphological analysis. Accordingly, it was hypothesized that both strategies would improve reading comprehension compared with conventional instruction, but contextual guessing would yield greater vocabulary retention due to its deeper cognitive processing. By addressing the limited comparative evidence on these instructional approaches, this study aims to provide evidence-based insights that support learner autonomy and inform more effective vocabulary teaching practices and curriculum design. Therefore, the following research questions were formulated:

1. Do vocabulary-acquisition strategies significantly affect reading comprehension compared to no intervention?
2. Does the guessing meaning from the context of the vocabulary acquisition strategy affect the group's reading comprehension?
3. Does using affixes vocabulary-acquisition strategy affect the group's reading comprehension?

4. Methods

4-1. Research Design

This study employed a quasi-experimental research design. The selection was due to the practical limitations of random assignment which was not feasible in the context of the study. A quasi-experimental approach allowed for the investigation of causal relationships while maintaining ecological validity by working with naturally occurring groups. Additionally, this design provided an opportunity to assess the effects of the intervention in a real-world educational setting where randomization is often not possible.

4-2. Participants

The participants of this study were 90 male EFL third-grade high school students at Shahed High School in Farsan, Shahrekord, Iran. The participants' ages ranged from 17 to 18 (M = 17.5; SD = .25) years old. All of them were native Persian speakers and at an intermediate level of English proficiency based on the Oxford Placement Test (M = 35; SD = 1.75). The study began with three intact classes and were randomly assigned to either an experimental or a control group, each containing 30 students.

4-3. Materials

The instructional material used in this study was drawn from the book *"Inside Reading 1"* by Burgmeier and Zimmerman (2012), which is an engaging and accessible course book suitable for intermediate English learners. The text provides ample opportunities for vocabulary acquisition and contextual analysis, as well as a variety of descriptive passages and dialogues that incorporate everyday language and idiomatic expressions. Its content revolved around themes of identity, resilience, and cultural understanding and also deemed relevant and motivational for learners to encourage both students' linguistic and personal engagement. Excerpts from the book were carefully chosen to

align with the study's instructional focus and ensure that they contained examples of vocabulary and sentence structures suitable for the targeted strategies of affixation and contextual guessing. The instructional materials were selected not only for their readability but also for their lexical characteristics. The selected passages contained a sufficient number of morphologically complex words (e.g., words with common prefixes and suffixes such as *un-*, *dis-*, *-ful*, and *-less*), making them appropriate for the affixation treatment. At the same time, the passages provided rich semantic and syntactic contexts that enabled learners to infer the meanings of unfamiliar words from surrounding textual cues, supporting the contextual guessing treatment. Target vocabulary items were screened before instruction to ensure that each could be taught using either morphological analysis or contextual inference. This ensured that the instructional material was equally suitable for both experimental conditions while controlling for differences in text difficulty.

4-4. Instruments

4-4-1. Piloting the Tests and Factor Analysis. The tests were piloted with 100 students similar to the participants before the experiment to identify potential issues with instructions, timing, and distractors. Ineffective items were revised or removed based on the pilot. The reliability of the reading comprehension test across all groups was calculated using Cronbach's alpha and yielded a coefficient of 0.986. Two scholars reviewed the tests to ensure content validity, which resulted in further revisions. After these adjustments, the final tests were prepared for the main study. In addition, factor analysis measurements were calculated using principal component analysis (PCA) to explore the underlying structure of the variables and identify the latent constructs that best represent the data. The PCA was conducted with a varimax rotation to enhance interpretability. A scree plot was generated to determine the optimal number of factors and the analysis revealed that a four-factor solution accounted for 72.5% of the total variance in the data. The factor loading matrix indicated that the variables clustered strongly around these four factors with loadings ranging from 0.63 to 0.92, which suggested each factor reliably represents a specific domain of the constructs under investigation. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.89 and Bartlett's test of sphericity was significant ($p < 0.001$), which confirmed the data were suitable for factor analysis.

4-4-2. Reading Pretest. The pretest was a 20-item researcher-designed multiple-choice reading comprehension assessment administered before the commencement of the instructional treatment to third-grade Shahed High School students in Farsan, Shahrekord, Iran. This pretest assessed the students' knowledge and skills in vocabulary and reading comprehension (see Appendix 1 for more details). Furthermore, a comparison between the pretest and post-test results enabled the researcher to measure improvements in reading comprehension among the third-grade students. Correct responses were awarded one point and incorrect responses or unanswered items received zero points.

4-4-3. Immediate Posttest. A researcher-designed multiple-choice reading comprehension assessment was administered after the final treatment session to measure the retention of learned vocabulary in short-term memory (see Appendix 2 for more details). The procedure and scoring were identical to the pretest, with correct

responses earning one point and incorrect or unanswered items scoring zero. However, the posttest featured a different text to assess the learners' ability to apply the acquired vocabulary in new contexts and provide a more accurate measure of lexical acquisition.

4-4-4. Delayed Posttest. The delayed posttest was administered two weeks after the immediate posttest and aimed to assess the participants' long-term retention of the instructed vocabulary. It included both the pretest and posttest texts, which were presented in different contexts to evaluate the participants' ability to recall and apply the learned words over time.

4-5. Procedure

Initially, the Oxford Placement Test was used to measure the English language proficiency of participants and was administered to the participants before sampling. This test consisted of a vocabulary and reading comprehension section, with each section comprising 30 multiple-choice questions. Scores were recorded on a 1– 60 scale, and students who scored between 30 and 45 were identified as intermediate-level learners (Allen, 2004). This range was chosen to ensure homogeneity among participants in terms of their language proficiency. A total of 90 intermediate students in three intact classrooms were selected to participate. The participants were then randomly assigned to three equal groups: two experimental groups and one control group, including 30 students in each group. A pretest was administered to all participants before the instructional phase to establish a baseline for comparison. The pretest consisted of a multiple-choice reading comprehension test designed to evaluate the participants' initial reading and vocabulary skills.

Following the pretest, the first experimental group received face-to-face instruction besides the guessing meaning from context strategy. This instructional approach focused on teaching students to deduce the meanings of unfamiliar words by analyzing their context. Students were first guided to determine the part of speech of unknown words by observing their position in a sentence or identifying grammatical clues such as endings (*-ed* or *-ing* for verbs). Next, they were encouraged to examine the immediate collocates of the word (e.g., checking whether a noun is accompanied by an article or whether a verb is followed by an object). Subsequently, the students were taught to expand their focus to the broader context and include surrounding clauses and sentences to look for "signposting" words such as *but*, *however*, *so*, and *that*, which provide additional clues to the word's meaning. Finally, students were asked to read further to confirm or adjust their initial guesses and revisit earlier steps in the process if it is necessary. An example used in the instruction was the sentence: *"She walks briskly to class so that she wouldn't be late."* Students were guided to infer the meaning of *briskly* based on the word's part of speech, its relationship to the verb *walks*, and the overall context of the sentence that suggests urgency or speed.

In the second experimental group, instruction focused on the affixation strategy in which the emphasis was on using prefixes, suffixes, and root words to deduce the meanings of unfamiliar vocabulary. Students were first introduced to common affixes and their functions, such as prefixes like *un-* (indicating negation) and *pre-* (indicating time before) and suffixes like *-ful* (indicating full of) or *-less* (indicating lack of). They were taught how affixes modify the meanings of root words and how understanding these components aids in vocabulary comprehension. For instance, the word *disagree* was broken down into the prefix *dis-* (meaning opposite) and the root *agree* that enabled

students to infer its meaning as “not agree.” During instruction, students practiced identifying affixes in words and analyzing their meanings within various contexts and both in isolation and embedded in sentences. They were encouraged to apply this knowledge in reading tasks by breaking down complex words into their components and reconstructing their meanings. Regular feedback and reinforcement were provided to ensure the students could effectively apply this strategy to enhance their comprehension during reading activities.

In the control group, students were taught using conventional vocabulary instruction commonly used in EFL classrooms. This approach primarily focused on direct instruction of vocabulary through rote memorization and translation. Students were provided with a list of target words and their definitions in their native language, along with example sentences illustrating their use. The teacher explained each word’s meaning and usage by emphasizing one-to-one word translation without exploring deeper contextual or structural elements. Students then memorized the word lists and completed exercises such as matching words to their definitions, filling in blanks, and translating sentences. The focus was on reinforcing vocabulary through repetition and practice, rather than explicitly teaching strategies for independent vocabulary inference or morphological analysis. This condition served as an active comparison group representing conventional vocabulary instruction rather than a no-treatment or placebo control.

The treatment was conducted over a period of five weeks, with one 30-minute instructional session held each week. After completing the instructional phase, an immediate posttest was administered to measure the short-term effects of the three instructional approaches on vocabulary learning and reading comprehension. Two weeks later, a delayed posttest, consisting of a combination of items from the pretest and posttest presented in different contexts, was administered to evaluate participants' long-term retention of the learned vocabulary.

4-6. Data Analysis

A 3 × 3 mixed-design analysis of variance (ANOVA) was employed to examine the effects of instructional strategy and time of assessment on students' vocabulary achievement. Instructional strategy (Contextual Guessing, Affixation, and Control) served as the between-subjects factor, whereas time of assessment (Pretest, Immediate Posttest, and Delayed Posttest) served as the within-subjects factor. This analytical approach was selected because it enabled the simultaneous examination of the main effects of Group and Time, as well as the Group × Time interaction, thereby determining whether changes in students' performance over time differed across the three instructional conditions. Prior to conducting the analysis, the assumptions of normality, homogeneity of variance, and sphericity were assessed. Where the assumption of sphericity was violated, Greenhouse-Geisser corrections were applied to the within-subjects effects. Following a significant interaction, simple main-effects analyses and Bonferroni-adjusted pairwise comparisons were performed to identify differences among groups at each assessment point and changes over time within each group. Descriptive statistics, including means and standard deviations, were calculated to summarize participants' performance across the three assessments, while inferential statistics were used to evaluate the significance and magnitude of the observed effects. The results of these analyses are presented in the following section.

5. Results

Prior to the main analysis, assumptions for the mixed-design ANOVA were evaluated. Normality was supported by acceptable skewness and kurtosis values. Levene's tests were non-significant at all three time points. Mauchly's test indicated a violation of sphericity; therefore, Greenhouse-Geisser corrected values (ε=.895) are reported. Partial eta squared (η^2p) is reported as the measure of effect size.

Table 1 presents the descriptive statistics. The Contextual Guessing group showed the largest gains, followed by the Affixation group, whereas the Control group exhibited little change across the three testing occasions.

Table 1

Descriptive Statistics

Group	Time	n	M	SD	95% CI
Guessing	Pre	30	11.10	1.27	10.62–11.57
	Post	30	17.10	1.58	16.50–17.69
	Delayed	30	15.30	1.56	14.71–15.88
Affixation	Pre	30	11.50	1.20	11.05–11.94
	Post	30	16.00	1.72	15.35–16.60
	Delayed	30	14.16	1.32	13.67–14.65
Control	Pre	30	10.16	1.02	9.78–10.54
	Post	30	10.33	0.96	9.97–10.69
	Delayed	30	10.10	1.12	9.67–10.52

A 3 × 3 mixed-design ANOVA revealed significant main effects of Group and Time, qualified by a significant Group × Time interaction, indicating that changes over time differed significantly among the instructional groups (Table 2).

Table 2

Mixed ANOVA Summary

Source	F	df	p	η^2p
Group	101.47	2,87	<.001	.70
Time	97.52	1.79,155.73	<.001	.53
Group × Time	76.95	3.58,155.73	<.001	.64

Significant changes over time were observed for both experimental groups but not for the Control group. Also, see Table 3 for simple main effects of time.

Table 3

Simple Main Effects of Time

Group	F	df1	df2	p	η^2p
Guessing	186.43	1.74	50.46	<.001	.87
Affixation	112.56	1.82	52.78	<.001	.80
Control	0.42	1.96	56.84	.654	.01

Bonferroni-adjusted pairwise comparisons showed that all comparisons within the Guessing and Affixation groups were significant, whereas none of the comparisons within the Control group reached significance (Table 4).

Table 4

Within-Group Pairwise Comparisons

Group	Comparison	Mean Diff	SE	t	p(Bonf.)	95% CI
Guessing	Post–Pre	6.00	.342	17.54	<.001	5.32–6.68
	Delayed–Pre	4.20	.342	12.28	<.001	3.52–4.88
	Post–Delayed	1.80	.342	5.26	<.001	1.12–2.48

Affixation	Post–Pre	4.50	.342	13.16	<.001	3.82–5.18
	Delayed–Pre	2.67	.342	7.81	<.001	1.99–3.35
	Post–Delayed	1.83	.342	5.35	<.001	1.15–2.51
Control	Post–Pre	0.17	.342	0.50	1.000	-0.51–0.85
	Delayed–Pre	-0.07	.342	-0.20	1.000	-0.75–0.61
	Post–Delayed	0.23	.342	0.67	1.000	-0.45–0.91

Note. Bonferroni α=.0167.

The groups did not differ at pretest but differed significantly at both posttests. Table 5 shows main effects of group.

Table 5

Simple Main Effects of Group

Time	**F**	**df**	**p**	**η^2p**
Pretest	1.45	2,87	.241	.03
Immediate	130.43	2,87	<.001	.75
Delayed	115.67	2,87	<.001	.73

Both experimental groups significantly outperformed the Control group at both posttests. Although the Contextual Guessing group scored higher than the Affixation group, these differences were not statistically significant after Bonferroni correction, despite moderate effect sizes (d≈0.67). Table 6 shows between-group pairwise comparisons.

Table 6

Between-Group Pairwise Comparisons

Time	**Comparison**	**Mean Diff**	**SE**	**t**	**p(Bonf.)**	**95% CI**
Post	G vs A	1.10	.499	2.20	.090	0.10–2.10
	G vs C	6.77	.499	13.57	<.001	5.77–7.77
	A vs C	5.67	.499	11.36	<.001	4.67–6.67
Delayed	G vs A	1.14	.499	2.28	.075	0.14–2.14
	G vs C	5.20	.499	10.42	<.001	4.20–6.20
	A vs C	4.06	.499	8.14	<.001	3.06–5.06

The mixed-design ANOVA demonstrated significant effects of vocabulary instruction strategy over time. Both Contextual Guessing and Affixation produced significant improvements relative to the Control group, with gains maintained at delayed testing. Although Contextual Guessing consistently produced higher means than Affixation, the differences were not statistically significant after Bonferroni adjustment.

6. Discussion

The findings of this study provide robust evidence that both contextual guessing and affixation-based instruction significantly enhanced learners' vocabulary development and retention compared with conventional instruction. The contextual guessing group consistently achieved the highest performance across the immediate and delayed posttests, followed by the affixation group, whereas the control group demonstrated little improvement. These findings support the theoretical expectations derived from Schema Theory, Depth of Processing Theory, and Cognitive Load Theory, suggesting that the effectiveness of vocabulary instruction depends not only on exposure to lexical

items but also on the cognitive processes activated during learning (Craik & Tulving, 1975; Koedinger et al., 2012; Sweller, 2011).

The contextual guessing group demonstrated the greatest improvement across all assessment points. From the perspective of Schema Theory, these findings suggest that learners benefited from connecting unfamiliar vocabulary with existing background knowledge and textual information (Koedinger et al., 2012). By integrating new lexical items into established cognitive schemas, learners were able to construct richer semantic representations that facilitated reading comprehension (Nation, 2001; Koedinger et al., 2012). The substantial improvement from the pretest to the posttest, together with the relatively high performance on the delayed posttest, is also consistent with the Depth of Processing framework (Craik & Tulving, 1975). Inferring word meanings from contextual cues requires semantic analysis, inference generation, and elaborative processing rather than simple memorization (Chandy et al., 2025; Nassaji, 2003; Uchihara et al., 2022). Such deeper processing creates stronger memory traces, which likely explains the superior long-term vocabulary retention observed in the contextual guessing group (Alipanahi, 2007; van den Broek et al., 2022; Craik & Tulving, 1975).

Although the affixation group also showed significant gains over the control group, its performance was consistently lower than that of the contextual guessing group. This pattern can be interpreted through the lens of Cognitive Load Theory (Sweller, 1994, 2011). Morphological analysis enables learners to divide unfamiliar words into meaningful components, thereby reducing the cognitive demands associated with lexical decoding during reading (Matthews et al., 2023; Wu & Juffs, 2022). By lowering extraneous cognitive load, learners can allocate more working-memory resources to text comprehension (Sweller, 2011). However, because affixation primarily emphasizes structural analysis rather than semantic elaboration, it may not promote the same depth of encoding predicted by the Depth of Processing Theory (Craik & Tulving, 1975). Consequently, although learners successfully decoded unfamiliar words, the resulting lexical representations may have been less durable than those developed through contextual inference (Mochizuki & Aizawa, 2000; Matthews et al., 2023; Stewart et al., 2023).

The comparative findings therefore suggest that the three theoretical frameworks explain different aspects of vocabulary learning. Cognitive Load Theory accounts for the efficiency of morphological processing during reading (Sweller, 2011), Schema Theory explains how contextual information supports comprehension through activation of prior knowledge (Koedinger et al., 2012), and Depth of Processing Theory explains why contextual guessing resulted in stronger delayed retention (Craik & Tulving, 1975). Rather than competing explanations, these frameworks complement one another by describing different cognitive mechanisms involved in vocabulary acquisition.

The absence of meaningful improvement in the control group further highlights the importance of explicit strategy instruction (Chinpakdee & Gu, 2024; Yeung et al., 2020). Learners who relied primarily on memorization and translation had limited opportunities to engage in either semantic elaboration or strategic lexical analysis. From a theoretical perspective, this instructional approach neither sufficiently activated learners' existing schemas nor promoted deep semantic processing, while also providing limited support for reducing cognitive demands during reading (Craik & Tulving, 1975; Koedinger et al., 2012; Sweller, 2011). Consequently, vocabulary learning remained relatively superficial and less likely to be retained over time (Laufer & Hulstijn, 2001; Schuetze, 2015).

Overall, the present findings largely support the study's theoretical expectations. Contextual guessing produced the strongest improvements because it simultaneously activated prior knowledge, encouraged deeper semantic processing, and promoted meaningful integration of new vocabulary into existing knowledge structures (Chandy et al., 2025; Craik & Tulving, 1975; Koedinger et al., 2012). Affixation instruction also proved beneficial by supporting efficient lexical processing and reducing cognitive load, although its emphasis on morphological analysis alone appeared insufficient to produce retention comparable to that achieved through contextual guessing (Matthews et al., 2023; Sweller, 2011; Stewart et al., 2023). These findings demonstrate that instructional strategies grounded in established cognitive theories can substantially improve vocabulary acquisition and reading comprehension among L2 learners and provide a stronger theoretical foundation for explaining why contextual guessing yielded superior learning outcomes (Craik & Tulving, 1975; Matthews et al., 2023; Koedinger et al., 2012; Sweller, 2011; Uchihara et al., 2022).

7. Conclusion

In sum, this study demonstrates that both contextual instruction and affixation-based strategies significantly enhance vocabulary development and retention, which outperformed conventional teaching methods. The experimental groups that received these targeted interventions showed substantial improvements in their vocabulary scores while the control group which lacked any specific instructional strategy, exhibited minimal change. These results highlight the importance of adopting active and context-rich approaches to vocabulary teaching and suggest that such methods foster deeper engagement and better long-term retention of language. The findings emphasize the need for educators to consider incorporating these effective strategies into their teaching practices to improve vocabulary acquisition and overall language learning outcomes.

These findings have important implications for vocabulary teaching and offer valuable insights into how different instructional strategies can enhance vocabulary learning outcomes. Educators can draw from this study to incorporate both contextual and affixation-based strategies into their vocabulary teaching practices. In particular, contextual instruction provides a more holistic approach to vocabulary acquisition because it encourages students to not only learn the meaning of individual words but also to understand their usage in various contexts. This approach fosters a deeper and more meaningful connection to the words, which can enhance long-term retention. On the other hand, affixation-based instruction can be particularly useful for teaching the structural aspects of language that enable students to infer meanings of new words and expand their vocabulary repertoire. While this method may not produce as dramatic improvements in retention as contextual instruction, it can still provide a valuable tool for enhancing students' vocabulary skills.

Another implication of these findings is the potential for combining contextual and morphological strategies to maximize vocabulary learning outcomes. Future research could explore the effects of integrating both methods in a complementary manner. For instance, teachers could first introduce new vocabulary items through contextual instruction and provide students with rich and meaningful examples and after that reinforce this learning with affixation-based strategies to help students break down the words into their constituent morphemes. This combination could potentially yield even greater vocabulary retention by addressing both the semantic and structural aspects of the words and thus promoting a more comprehensive understanding of vocabulary.

Additionally, the results suggest that while both contextual and affixation-based instruction are effective but there may be variations in how these strategies benefit different learners. For example, learners with a stronger background in morphological awareness may find affixation-based instruction particularly useful while learners who struggle with abstract word forms may benefit more from the contextual approach. Future studies could explore individual differences among learners such as their prior vocabulary knowledge or cognitive style in order to determine which instructional strategies are most effective for specific subgroups of students. This personalized approach to vocabulary teaching could further optimize learning outcomes and ensure that all students benefit from targeted instruction.

This study has several limitations that should be acknowledged. First, the sample size was relatively small that may limit the generalizability of the findings to broader populations. Additionally, the study focused solely on male participants that introduces a gender bias and may not accurately reflect the vocabulary development and retention patterns of female students or diverse groups. The study also employed only a quantitative design that restricts the ability to explore the underlying cognitive and emotional processes behind vocabulary acquisition. A more comprehensive approach that includes qualitative methods could provide deeper insights into how the participants engage with and internalize new vocabulary. Furthermore, the quasi-experimental design that lacked random assignment can make it difficult to establish causality with certainty. These limitations suggest that future research with a larger and more diverse sample, with use of a mixed-methods approach, and a randomized controlled design would offer more robust and generalizable results.

Ethical approval. Ethical approval for this study was obtained from the appropriate institutional ethics committee before data collection.

Informed consent. Written informed consent was obtained from all participants and their parents or legal guardians prior to participation.

Anonymity and confidentiality. All participant data were anonymized and treated confidentially throughout the study and used solely for research purposes.

Disclosure of AI Use in Manuscript Preparation

During the preparation of this manuscript, the authors did not use any AI tools. They accept full responsibility for the accuracy, integrity, and originality of the final work.

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Appendix

Appendix 1

A Sample of Pretest

First Name: Last Name:
Grade: Length: 40 minutes

Directions: Choose the answer choice that best completes the blank. Then mark your answer sheet.

Passage One:

Darius, king of the Persian Empire, was furious because Athens had interceded for the other Greek city-states in revolt against Persian domination. In anger the king sent an enormous army to defeat Athens. He thought it would take drastic steps to pacify the rebellious part of the empire.

Persia was ruled by one man. In Athens, however, all citizens helped to rule. Ennobled by this participation, Athenians were prepared to die for their city-state. Perhaps this was the secret of the remarkable victory at Marathon, which freed them from Persian rule. On their way to Marathon, the Persians tried to fool some Greek city-states by claiming to have come in peace. The frightened citizens of Delos refused to believe this. Not wanting to abet the conquest of Greece, they fled from their city and did not return until the Persians had left. Tiny Athens stood alone against Persia. The Athenian people went to their sanctuaries. There they prayed for deliverance. They asked their gods to expedite their victory. The Athenians refurbished their weapons and moved to the plain of Marathon, where their little band would meet the Persians. At the last moment, soldiers from Plataea reinforced the Athenian troops.

1. Darius took drastic steps to _____ the rebellious Athenians.

A. weaken
B. destroy
C. calm
D. irritate

2. The people of Delos did not want to _____ the conquest of Greece.

A. end
B. encourage
C. think about
D. daydream about

3. The Athenians were _____ by some soldiers who arrived from Plataea.

A. welcomed
B. strengthened
C. held
D. captured

4. The word "reinforce" in line 14 is closest in meaning to:

A. identify
B. reduce
C. placate
D. strengthen

5. The _____ of the rebellious was the serious command issued by king of the Persian Empire.
A. pacify
B. pacified
C. pacification
D. pacifying

Passage Two:
According to Greek myth, the strife between the Trojans and the Greeks started at the wedding of Peleus, King of Thessaly, and Thetis, a sea nymph. All of the gods and goddesses had been invited to the wedding celebration in Troy except Eris, goddess of discord. She had been omitted from the guest list because her presence always embroiled mortals and immortals alike in conflict.
To take revenge on those who had slighted her, Eris decided to cause a skirmish. Into the middle of the banquet hall, she threw a golden apple marked "for the most beautiful." All of the goddesses began to haggle over who should possess it. The gods and goddesses reached a stalemate when the choice was narrowed to Hera, Athena, and Aphrodite. Someone was needed to settle the controversy by picking a winner. The job eventually fell to Paris, son of King Priam of Troy, who was said to be a good judge of beauty. Paris did not have an easy job. Each goddess, eager to win the golden apple, tried aggressively to bribe him.
"I'll grant you vast kingdoms to rule," promised Hera. "Vast kingdoms are nothing in comparison with my gift," contradicted Athena. "Choose me and I'll see that you win victory and fame in war." Aphrodite outdid her adversaries, however. She won the golden apple by offering Helen, daughter of Zeus and the most beautiful mortal in the land, to Paris. Paris, anxious to claim Helen, set off for Sparta in Greece.

6. Eris was known for _____ both mortals and immortals.
A. scheming against
B. creating conflict amongst
C. feeling hostile toward
D. ignoring
7. Each goddess tried _____ to bribe Paris.
A. boldly
B. effectively
C. secretly
D. carefully
8. Athena _____ Hera, promising Paris victory and fame in war.
A. disregarded the statement of
B. defeated
C. agreed with
D. restated the statement of
E. questioned the statement of
9. **The word "haggle" in line 8 is closest in meaning to:**
A. deliver
B. realize
C. argue
D. internalize

10. All of the gods and goddesses were invited to_____ wedding in Troy except Eris, goddess of discord
A. celebrate
B. celebration
C. celebrating
D. celebrated

Passage Three:
One of the most intriguing stories of the Russian Revolution concerns the identity of Anastasia, the youngest daughter of Czar Nicholas II. During his reign over Russia, the czar had planned to revoke many of the harsh laws established by previous czars. Some workers and peasants, however, clamored for more rapid social reform. Although witnesses vouched that all the members of the czar's family had been executed, there were rumors suggesting that Anastasia had survived. Over the years, a number of women claimed to be Grand Duchess Anastasia. Perhaps the most famous claimant was Anastasia Tschaikovsky, who was also known as Anna Anderson. In 1920, 18 months after the czar's execution, this terrified young woman was rescued from drowning in a Berlin river. She spent two years in a hospital, where she attempted to reclaim her health and shattered mind. The doctors and nurses thought that she resembled Anastasia and questioned her about her background. She disclaimed any connection with the czar's family. Eight years later, however, she claimed that she was Anastasia. She said that she had been rescued by two Russian soldiers after the czar and the rest of her family had been killed. Two brothers named Tschaikovsky had carried her into Romania.

11. Some Russian peasants and workers _____ for social reform.
A. longed
B. cried out
C. begged
D. hoped
12. Witnesses _____ that all members of the czar's family had been executed.
A. convinced some
B. thought
C. hoped
D. gave assurance
13. Tschaikovsky initially _____ any connection with the czar's family.
A. denied
B. stopped
C. noted
D. justified
14. The word "resemble" in line 11 is closest in meaning to:
A. signify
B. look like
C. recall
D. present
15. The czar had planned to cancel the_____ of harsh laws by previous czars.
A. establish
B. established

C. establishing
D. establishment

Passage Four:
In the 16th century, an age of great marine and terrestrial exploration, Ferdinand Magellan led the first journey to sail around the world. As a young Portuguese noble, he served the king of Portugal, but he became involved in the trouble of political intrigue at court and lost the king's favor. On September 20, 1519, Magellan set sail from Spain with five ships. More than a year later, one of these ships was exploring the topography of South America in search of a water route across the continent. This ship sank, but the remaining four ships searched along the southern peninsula of South America. Finally they found the passage they sought near 50 degrees S latitude. Magellan named this passage the Strait of All Saints, but today it is known as the Strait of Magellan.

16. The 16th century was an age of great _____ exploration.
A. cosmic
B. land
C. mental
D. common man
17. Magellan lost the favor of the king of Portugal when he became involved in a political _____.
A. entanglement
B. discussion
C. negotiation
D. problem
18. One of Magellan's ships explored the _____ of South America for a passage across the continent.
A. coastline
B. mountain range
C. physical features
D. islands
19. The word "intrigue" in line 3 is closest in meaning to:
A. secret plan to harm people
B. to make some body very interested and want to know about some thing
C. to work together
D. the power to make decisions about some thing
20. Some years later, one of the ships was exploring the _____ map of South America in search of a water way across the continent.
A. topography
B. topographically
C. topographic
D. topographing

Thank you all sincerely for your cooperation and participation in the pretest!

The Answer Sheet of Pretest

First Name: **Last Name:**

	A	B	C	D
1				
2				
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18				
19				
20				

Score:

Appendix 2

Sample of Posttests

First Name: Last Name:

Grade: Length: 40 minutes

Directions: Choose the answer choice that best completes the blank. Then mark your answer sheet.

Passage One:

The general principles of dynamics are rules which demonstrate a relationship between the motions of bodies and the forces which produce those motions. Sir Isaac Newton deduced three laws of dynamics which he published in 1687 in his famous principium. Prior to Newton, Aristotle had established that the natural state of a body was a state of rest, and that unless a force acted upon it to maintain motion, a moving body would come to rest. Galileo had succeeded in describing the behavior of falling objects and in recording that no force was required to maintain a body in motion. He noted that the effect of force was to change motion. Huygens recognized that a change in the direction of motion involved acceleration, just as did a change in speed, and further, that the action of a force is required. Kepler deduced the laws describing the motion of planets around the sun. It was primarily from Galileo and Kepler that Newton borrowed.

1. Huygens stated that acceleration was required _____.

A. for either a change in direction or a change in speed
B. only for a change in speed
C. only for a change in direction
D. neither for a change in direction nor for a change in speed

2. Which of the following scientists established that natural state of a body was a state of a rest?

A. Galileo
B. Kepler
C. Aristotle
D. Newton

3. What was the main purpose of this passage?

A. to demonstrate the development of Newton's laws
B. to establish Newton as the authority in the field of physics
C. to distinguish Newton's laws of motions
D. to describe the motion of planets around the sun

4. The _____of three laws of dynamics which was in 1687 by Newton.

A. published
B. publisher
C. publishing
D. publish

5. The word "acceleration" in line 8 is closest in meaning to:

A. the amount that is taken away
B. an increase in how fast something happens
C. the process of improving or developing something
D. the process of removing a problem

Passage Two:

Marie Curie was one of the most accomplished scientists in history. Together with her husband, Pierre, she discovered radium, an element widely used for treating cancer, and studied uranium and other radioactive substances. Pierre and Marie's amicable collaboration later helped to unlock the secrets of the atom.

Marie was born in 1867 in Warsaw, Poland, where her father was a professor of physics. She became disgruntled, however, when she learned that the university in Warsaw was closed to women. Determined to receive a higher education, she left Poland and in 1891 entered the Sorbonne, a French university, where she earned her master's degree and doctorate in physics.

Marie was fortunate to have studied at the Sorbonne with some of the greatest scientists of her day, one of whom was Pierre Curie. Although Marie Curie eventually suffered a fatal illness from her long exposure to radium, she never became disillusioned about her work. Regardless of the consequences, she had dedicated herself to science and to revealing the mysteries of the physical world.

6. The Curies' _____ collaboration helped to unlock the secrets of the atom.

A. friendly
B. competitive
C. courteous
D. chemistry

7. When she learned that she could not attend the university in Warsaw, she felt _____.

A. happiness
B. annoyed
C. satisfied
D. Angry

8. Even though she became fatally ill from working with radium, Marie Curie was never _____.

A. troubled
B. worried
C. disappointed
D. disturbed

9. The word "collaboration" in line 3 is closest in meaning to:

A. to give a lot of time and effort to something
B. to find or find out about something, especially for the first time
C. to talk about something seriously with other people
D. to give people information, for example by speaking, writing, or sending radio signals

10. Marie Curie and her husband, Pierre, discovered radium, an element widely used for the _____ of cancer.

A. treated
B. treatment
C. treating
D. treating

Passage Four:

Mount Vesuvius, a volcano located between the ancient Italian cities of Pompeii and Herculaneum, has received much attention because of its frequent and destructive eruptions. The most famous of these eruptions occurred in A.D.79.
Fire, however, was not the only cause of destruction. Poisonous gases fill the air. These heavy gases were not floating in the atmosphere and therefore sank toward the earth and suffocated people.
By analyzing data, much as a zoologist cut part an animal specimen for more investigation, scientists have concluded that the eruption changed large p of the area's geography. For instance, it turned the Sarno River from its course and raised the level of the beach along the Bay of Naples. Meteorologists studying these events have also concluded that Vesuvius caused a huge tidal wave that affected the world's climate.
By strengthening the brittle bones with acrylic paint, scientists have been able to examine the skeletons and draw conclusions about the diet and habits of the residents.

11. The poisonous gases were not _____ in the air.
A. able to float
B. visible
C. able to evaporate
D. invisible
12. _____ have concluded that the volcanic eruption caused a tidal wave.
A. Scientists who study oceans
B. Scientists who study atmospheric conditions
C. Scientists who study ash
D. Scientists who study animal behavior
13. Scientists have used _____ water to wash away volcanic ash from the skeletons of victims.
A. bottled
B. volcanic
C. purified
D. sea

14. Scientists have reached the _____ that the eruption changed large portions of the area's geography.
A. conclusive
B. concluding
C. conclusion
D. conclude
15. The word "suffocated" in line 6 is closest in meaning to:
A. to die because there is no air to breathe
B. to take air into your lungs and let it out again
C. to destroy something with fire
D. to send out air from the mouth

Passage Five:
King Philip II of Spain wanted to claim the throne and make England a Catholic country again. To satisfy his ambition and also to retaliate against England's theft of his gold and silver, King Philip began to build his fleet of warships, the Spanish Armada, in January 1586.

Philip intended his fleet not to be destroyed. In addition to building new warships, he marshaled 130 sailing vessels of all types and recruited more than 19,000 robust soldiers and 8,000 sailors.
The martial Armada set sail from Lisbon, Portugal, on May 9, 1588, but bad weather forced it back to port. The voyage resumed on July 22 after the weather became more stable.
The Spanish fleet met the smaller, faster, and more maneuverable English ships in battle off the coast of Plymouth, England, first on July 31 and again on August 2. The two battles left Spain weak, having lost several ships and with its ammunition depleted.

16. King Philip recruited many _____ soldiers and sailors.
A. warlike
B. strong
C. accomplished
D. timid
17. The _____ Armada set sail on May 9, 1588.
A. complete
B. warlike
C. independent
D. isolated
18. The two battles left the Spanish fleet _____.
A. without power
B. triumphant
C. open to attack
D. dependent
19. King Philip's ambition was the _____ against England's theft.
A. retaliate
B. retaliated
C. retaliation
D. retaliatory
20. The word "ambition" in line 2 is closest in meaning to:
A. a situation when something is necessary or must be done
B. the desire or determination to be successful
C. something that you want to do or achieve very much
D. b and c

Thank you all sincerely for your cooperation and participation!

The Answer Sheet of Immediate and Delayed Posttests
First Name: **Last Name:**

	A	B	C	D
1	▮			
2			▮	
3	▮			
4			▮	
5		▮		
6	▮			

7		▮		
8				▮
9	▮			
10		▮		
11	▮			
12		▮		
13				▮
14			▮	
15	▮			
16		▮		
17				▮
18	▮			
19			▮	
20				▮