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Exploring the Cognitive Processes of Preparation for a Spelling Bee Game to Enhance Vocabulary Learning in a Foreign Language

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ABSTRACT

This study investigates the cognitive processes associated with preparation for a spelling bee game to enhance vocabulary learning in a foreign language. It draws upon the Information Processing Theory, which involves attention, perception, and memory processes. During their freshman year of college in the Department of English, a group of 30 Saudi learners, at the same level of English, ranging in age from 18 to 20 years old, were provided with a weekly set of words to memorize as part of their Reading Course. Following twelve weeks of practice, memorization, and oral performance, a spelling bee was organized for the ten students who achieved the highest scores in the spelling tests. Subsequently, individual interviews were conducted with each of the ten participants in order to understand the cognitive mechanisms underlying their preparation and memorization for the event. The study's findings reveal that most participants in the spelling bee game actively engage in key stages of information processing, including encoding, storing, and retrieving information. Additionally, learners were observed to evolve from merely acquiring factual vocabulary knowledge to applying it practically through repeated practice and memorization for the spelling bee. By engaging multiple senses—such as visual and auditory perception—alongside verbal memory, most participants develop the procedural knowledge needed to spell words accurately and effortlessly, effectively transferring words from short-term to long-term memory.
Keywords: Information Processing Theory; Long Term Memory; Short Term Memory; Spelling Bee

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1. Introduction

In the 1970s and early 1980s, researchers primarily concentrated on studying syntax and morphology to investigate the underlying principles and developmental patterns of language acquisition. They believed that analyzing error patterns and developmental sequences in these areas could potentially uncover universal aspects of language and shed light on the process of language learning[1]. Over time, researchers recognized the significant role of vocabulary in language acquisition in comprehension, communication, and overall language proficiency. As a result, there has been a growing realization that investigating vocabulary acquisition can provide valuable insights into language development and learning. Ever since, there has been an explosion of research in the area of vocabulary learning. Studies have explored various aspects of vocabulary acquisition, including the mechanisms of word learning, factors influencing vocabulary growth, effective vocabulary teaching strategies, and the relationship between vocabulary knowledge and other language skills[1].

Learning vocabulary is crucial when learning a language because it is the foundation of communication in any language. Without vocabulary knowledge, learners cannot understand or express themselves effectively in the language they are learning[2]. Without an understanding of the meaning and use of vocabulary items, learners cannot understand the meaning of sentences or texts[3]. Vocabulary knowledge is also essential for reading and writing in the target language. Reading comprehension requires an understanding of the vocabulary used in the text, while writing requires the ability to use vocabulary items effectively and appropriately[2].

There is a difference between the acquisition of vocabulary in the first language and second language. First language learners acquire their initial set of one or two thousand words primarily through natural exposure to meaningful language input provided by caregivers and the surrounding environment with little intentional effort[1]. They are immersed in a linguistic community that consistently offers rich language input. In contrast, second language learners may receive language input through formal instruction, immersion programs, language classes, or exposure to the target language in different contexts. The input they receive in second language acquisition is often more structured and purposeful, with a deliberate focus on language learning that needs attention

and effort as they lack the natural exposure to meaningful language contexts[1].

Incorporating the spelling bee games into vocabulary learning activities in a foreign or second language can provide students with a dynamic and enjoyable way to engage with words, enhance their spelling skills, expand their vocabulary, and cultivate a deeper appreciation for language and its intricacies[4].

This study, based on information processing theory, aimed to investigate the specific cognitive processes underlying the preparation for participation in a spelling bee, a game that enhances vocabulary acquisition in a foreign language. It entails several innovative aspects as it delves into the cognitive processes involved in preparing for a spelling bee, which is a novel approach to understanding how learners internalize and retain vocabulary in a foreign language. By focusing on these processes, the study explores how memory, recall, and language processing interact during the learning phase. In addition, spelling bees are traditionally used to test knowledge, but this study explores their potential as a preparatory and educational tool, rather than just an evaluative one. It could contribute to a deeper understanding of how engaging, competitive activities like spelling bees can be used not just for assessment but as powerful tools for learning in foreign language education. The findings of this study could potentially contribute to the development of more effective instructional strategies and materials for foreign language learning, specifically focusing on vocabulary expansion.

2. Literature Review

Learning vocabulary in a second language involves acquiring, storing, and using new words and phrases in a language that is not the learner's first language[2]. It is a complex process that requires a range of cognitive and linguistic processes and effective vocabulary learning strategies[5]. Learners must first encounter new vocabulary items and then process and store them in their memory. Once learners have stored new vocabulary items in their memory, they must retrieve and use them appropriately in context. This involves semantic and syntactic processes, as learners must understand the meaning and use of the vocabulary items and use them correctly in sentences or discourse[5]. Effective

vocabulary learning in a second language requires a range of strategies, including explicit instruction, the use of context, repetition, and memory techniques[3].

Cognitive psychologists who adopt an information processing approach to human learning and performance view second language acquisition as the gradual development of knowledge that eventually becomes automatic. According to Richard Schmidt[6], learners initially need to direct their attention toward various aspects of the language they are trying to learn or produce. Lightbown and Spada[1] indicate that paying attention means "using cognitive resources to process information, but there is a limit to how much information a learner can pay attention to." They add that "gradually, through experience and practice, information that was new becomes easier to process, and learner become able to access it quickly and even automatically." Consequently, learners in the early stages of acquisition tend to allocate most of their cognitive resources to understanding the main words in a message. During this period, they may not notice the grammatical morphemes attached to certain words.

According to the Information Processing Theory, the human mind processes information through a series of cognitive processes involving the encoding, storage, and retrieval of information[7]. The encoding process helps learners create mental representations of the words in their memory[8]. DeKeyser[9] points out that the process of learning, including language learning, typically begins with acquiring declarative knowledge, which learners are consciously aware of possessing. Once having acquired declarative knowledge, learners are required to hold and manipulate information in their working memory, which is responsible for temporary storage and processing. This cognitive load strengthens working memory capacity and improves the ability to handle linguistic information effectively[10]. Through repeated practice, declarative knowledge can become procedural knowledge, which is the ability to apply and use that knowledge effectively. As learners continue to practice, procedural knowledge can become automated, to the point where the learner may no longer consciously recall the initial stages of learning it as declarative knowledge[1]. Practice, particularly through repetition and memorization, plays a crucial role in moving information from declarative knowledge to procedural knowledge[11].

Researchers are currently increasingly emphasizing un-

derstanding the specific mechanisms through which practice facilitates the conversion of declarative knowledge into automatic performance. This line of inquiry aims to uncover the underlying processes and factors that contribute to the transformation of explicit knowledge into effortless and unconscious application. By examining the relationship between practice, skill development, and automaticity, researchers seek to shed light on the cognitive processes involved in this conversion. The factors investigated in such studies include the quantity and quality of practice, the role of feedback and reinforcement, the timing and spacing of practice sessions, and the impact of individual differences on the acquisition of automaticity[12].

A growing body of research has examined the relationship between memory processes and the effectiveness of vocabulary learning strategies. One key study indicated that engaging students in repeated retrieval attempts, such as flashcard practice or fill-in-the-blank exercises, led to significantly better long-term retention of new vocabulary words compared to passive study methods[13]. Another study, published in 2011, investigated the impact of spaced repetition on vocabulary learning. These findings suggested that spacing out the review of new vocabulary words over time, rather than massing the practice in a single session, improved learners' ability to recall and apply the words in the long run[14]. This aligns with the principles of the spacing effect, which indicate that distributed practice is more effective for durable learning than concentrated practice. In 2024, Ayana et al. found that learners who engaged in activities that encouraged them to make deeper semantic connections with new vocabulary words, such as generating sentences or associations, demonstrated better retention and comprehension of the terms compared to rote memorization techniques[15]. A study published in 2006 suggested that targeted spelling strategies improve both spelling accuracy and overall literacy. The study advocates for incorporating structured spelling methods in adult education programs to foster improved literacy outcomes[16]. These results suggest that varied practice can enhance the flexibility and durability of vocabulary knowledge. Finally, Wang[17] concluded that individuals with higher working memory abilities tend to demonstrate more efficient vocabulary acquisition, likely due to their enhanced capacity for storing and manipulating new lexical information. These studies highlight the

importance of incorporating evidence-based memory principles, such as retrieval practice, spaced repetition, semantic elaboration, and interleaving, into vocabulary instruction to optimize learning and retention.

The objective of this study is to examine the effectiveness of practice prior to the spelling bee game on facilitating the conversion of declarative knowledge into procedural knowledge. This project focuses on analyzing the cognitive processes involved in this transformation by utilizing participants' insight, experiences, and feedback. By examining the impact of the spelling bee game on skill development, the study aims to understand how this specific practice activity contributes to the acquisition of automatic performance.

According to Wahyuningtyas[18], the spelling bee game plays a significant role in learning vocabulary by providing an engaging and interactive platform for students to practice spelling and expand their words. Participating in a spelling bee game requires students to visually recognize and accurately spell words, thereby developing their orthographic awareness[19]. Through regular exposure to a wide range of words in the spelling bee game, students enhance their word recognition skills and become more familiar with word patterns and spelling conventions[20]. Furthermore, the game exposes students to a diverse range of words, expanding their vocabulary repertoire and enhancing their overall vocabulary acquisition[18]. The spelling bee game also promotes accuracy in spelling, leading students to pay close attention to word structure and spelling rules, which improves their spelling skills and contributes to their overall language proficiency[20]. Moreover, engaging in the spelling bee game allows students to demonstrate their language competence and build confidence in their vocabulary skills, thereby positively impacting their motivation[19]. Additionally, the contextual understanding provided by the game, such as using words in sentences or providing definitions, helps students develop a deeper understanding of word meaning and usage[18]. The spelling bee game serves as an effective tool for vocabulary learning, complementing other strategies and activities to promote a well-rounded approach to vocabulary acquisition[20]. The competitive nature of the spelling bee game can motivate students to expand their vocabulary knowledge to succeed at the game. The desire to outperform their peers encourages them to actively seek out new words, study their meanings and spellings, and build a broader vo-

cabulary repertoire[18]. This competitive element fosters a sense of challenge and achievement that can drive students to deepen their vocabulary learning efforts. The spelling bee game can boost students' confidence in their written expression. As they become more proficient in spelling and gain mastery over a wider range of words, students feel more self-assured in their ability to communicate effectively in writing[18]. This confidence in spelling contributes to overall written language competence and encourages students to use more sophisticated vocabulary in their written work.

Various studies have explored the effectiveness of spelling bee games in learning vocabulary. Wahyuningtyas[18] explored the impact of spelling bee participation on vocabulary learning. The research found that students who participated in spelling bees demonstrated significant improvement in vocabulary knowledge and retention compared to non-participants. The competitive nature of the game motivated students to actively engage with words and expand their vocabulary. The spelling bee game provided a structured and engaging platform for vocabulary practice and improved their overall language proficiency. Ehri[21] explored the role of spelling instruction, including spelling bees, in promoting word learning and literacy skill development. The study highlighted that spelling bee games can enhance students' orthographic knowledge and contribute to their word recognition and reading comprehension abilities. By practicing spelling words in a competitive context, students actively engaged with vocabulary and developed a deeper understanding of word structure. Snow et al.[22] investigated the relationship between phonemic awareness and early spelling abilities. Their study revealed that spelling activities, such as those found in spelling bee games, can foster phonemic awareness skills. By breaking down words into sounds and selecting corresponding letters, students developed a better understanding of the sound-symbol correspondence, which positively impacted their spelling and reading skills. Sari[23] examined the impact of a spelling bee game on the mastery of students' vocabulary using a pre-experimental design involving second-year junior students in a boarding school in Indonesia. The study revealed that the students' mean score on the post-test was higher compared to the pre-test, indicating a positive effect. The students' responses to the questionnaire further supported these findings, as they explained that the spelling bee game facilitated

easier retention and memorization of vocabulary, while also boosting their motivation to learn English. Wedhanti, Ratminingsih and Samiyanti[24] found that students who were taught using the spelling bee game demonstrated a positive attitude throughout the learning process. The spelling bee game had three distinct advantages: first, it facilitated better word retention among students; second, it provided an enjoyable learning experience; third, it fostered a higher level of student engagement and activity.

These studies collectively suggest that spelling bee games can be effective in promoting vocabulary learning, improving spelling skills, enhancing phonemic awareness, and fostering overall language proficiency. The competitive and interactive nature of the spelling bee game motivates students to actively engage with words, leading to increased vocabulary acquisition and retention.

3. Methodology

This study is meant to analyze the cognitive processes involved in the preparation for the spelling bee, such as memory recall, word analysis, and language production, in order to understand how these processes facilitate vocabulary acquisition in a foreign language context. The research design involved conducting an experiment where a group of students was prepared for a spelling bee contest over a 12-week period. Following this, a qualitative method was employed to gather in-depth insights from the participants on how they used their memory capabilities to recall and reproduce correct spellings.

3.1. Participants

The participants were first-year students enrolled in the English Department at the University of Jeddah in the Course of Reading 1, a total of 30 Saudi students. The selected age range for the participants is between 18 and 20 years old, because individuals within this age group possess a greater capacity to articulate and elucidate their cognitive processes than younger age groups. Their score in IELTS is about 4.5, the lowest score approved by the department for enrolment; this score indicates that they have only basic competence of the language.

3.2. Experimental Procedures

Teaching vocabulary was one of the major components of the Course of Reading 1. Different techniques were used to teach the new words, such as using context clues within the reading passages to infer the meanings of unfamiliar words; providing the part of speech, definition, and any helpful mnemonics or associations; creating visual representations or "maps" of new vocabulary words, including their relationships to synonyms, antonyms, and related concepts to establish more robust mental associations with the new terms; and applying the new words in their own reading, writing, and discussion activities to help them understand the usage of these words in meaningful contexts.

The objective of encouraging students to participate in the spelling bee was to engage them actively in the learning process. The spelling bee took place in week 14 of the semester according to the following procedure:

Pre-spelling bee:

- Over a period of 12 weeks, all 30 participants were given a weekly set of 25 new words to memorize.
- Students were expected to practice spelling these words aloud.
- On Mondays of each week, participants were required to verbally spell one of the assigned words and provide a definition of the word, or a meaningful sentence to reinforce contextual understanding.
- After a 12-week period, the top 10 high achievers were selected based on their performance in word memorization, spelling, and sentence construction, and were invited to participate in the spelling bee contest.

Spelling bee contest:

- The 10 chosen students were divided into two teams.
- The contest consisted of five rounds, with each round involving the teams spelling 15 words of similar difficulty.
- In each round, a different moderator from each team would participate.
- Participants had only 15 seconds to think before spelling the word and constructing a sentence.

Scoring and Winner Determination:

- The final score was based on the number of correct answers in each round. A committee of three instructors from the department of English provided the evaluation.

● The team with the higher cumulative score at the end of the five rounds was declared the winner.

This study aimed to understand the cognitive mechanisms underlying the participants' memorization and preparation for the spelling bee by interviewing the ten participants who took part in the spelling bee. Interviewing participants plays a crucial role in empirical research, particularly in qualitative studies, by providing researchers with a direct means of gathering rich and in-depth data by engaging in a structured conversation with participants. Interviews provide several key roles in and benefits for empirical research. First, interviews allow researchers to gather firsthand information directly from participants. They provide platforms for participants to share their experiences, perspectives, and insights related to the research topic. The interactive nature of interviews enables researchers to probe further, seek clarifications, and explore specific areas of interest[25]. Second, interviews allow for more comprehensive explorations of participants' thoughts, feelings, and behaviors. Through open-ended questions and prompts, researchers can delve deeply into participants' experiences, motivations, decision-making processes, and cognitive strategies. This enables a thorough understanding of the phenomena under investigation[26]. Third, interviews value the perspectives and voices of participants, offering them the opportunity to express their experiences and provide insights into their cognitive processes. This approach recognizes learners as active agents in the research process and acknowledges the importance of their subjective viewpoints[27]. Finally, interviews provide an opportunity for researchers to establish rapport and build a trusting relationship with participants. Through active listening, empathy, and respect, researchers can create a comfortable and safe environment for participants to share their experiences openly. This rapport contributes to the quality and depth of the data collected[26], and generates rich and detailed data that can capture the complexity and nuances of cognitive processes[28].

3.3. Research Questions

To enhance the participants' ability to express and communicate their experiences more effectively, the interview was carried out in Arabic, their first language. Conducting the interview in Arabic was a deliberate choice made by the researcher to facilitate the participants' ability to express themselves in a language they were comfortable with, allowing for a deeper understanding of the topic. The researcher carefully designed a set of questions that would specifically target and explore the cognitive processes the participants used during their preparation for the spelling bee. These questions were aimed at gaining insights into:

● How the participants approached the task of memorizing the assigned words, their strategies for retention and recall, and any cognitive techniques they used to enhance their performance.
● The participants' thought processes while encountering challenging or unfamiliar words.
● The participants' awareness of their cognitive abilities, including their own memory strengths and weaknesses, and their adjustment of study strategies based on their perceived level of mastery.

During the interview process, the participants shared their personal stories, insights, and perspectives related to the study's subject matter. Quotations and statements provided valuable data that contributed to reaching conclusions and forming a comprehensive understanding of the topic were then extracted and translated into English, aiming to gain insights into the learners' cognitive processes.

4. Data Analysis

The study aimed to explore the cognitive aspects of vocabulary learning through students' preparation for the spelling bee. This section covers participants' insights into their vocabulary memorization strategies, vocabulary association techniques, and participants' self-awareness of their cognitive abilities.

4.1. Vocabulary Memorization Strategies

Considering the first question, which is related to the participants' approaches and strategies for memorization, retention and recall the assigned words, one of the participants (SA) indicated that "I start by reading through all the assigned words to acquaint myself with them and understand their meanings. After that, I break down each word into syllables. Next, I engage in visualizing the word, attempting to create a mental image of it in my mind. Additionally, I

utilize Google Translate to listen to its proper pronunciation and make an effort to write it down accurately." Another participant (RM) mentioned that "Typically, I begin by tackling challenging words first. I break down the word into syllables and visualize it in my mind. I then pronounce the word and make a note of it in writing. Furthermore, when I incorporate the word into a sentence, it aids in my recall of its meaning." Most of the participants discussed similar strategies in memorizing the words, such as breaking the words into syllables, which helps with pronunciation and understanding their structure. This strategy allows the students to focus on each segment of the word, making the word easier to grasp and remember. Visualizing the word by creating mental images of words can be a powerful memory aid and can help them establish a stronger connection between its form and meaning. By placing the word within a meaningful context, the learner not only remembers its meaning but also gains insight into its usage and nuances. This practice strengthens their overall grasp of the word and its application. Similarly, another participant (SS) said, "I break down each word into syllables and diligently repeat them ten times daily. Although I may find myself forgetting some of the words when I revisit them the next day, by committing to this daily repetition, the process gradually becomes easier, and I am able to pronounce the words more swiftly." It is common to experience some forgetting when learning new words. Memory consolidation takes time, and it is natural for newly acquired information to fade initially. However, by consistently repeating the process each day, the learner actively reinforces the neural pathways associated with the words, making it easier to remember them over time. Repetition plays a crucial role in memory consolidation. This increased familiarity leads to improved speed and fluency in pronouncing the words, and the brain becomes more adept at retrieving the information, allowing learners to pronounce the words more quickly and effortlessly. Using the words in a contextual manner by providing definitions and incorporating them into meaningful sentences facilitates ease of recall and enhances the overall comprehension of the word. (ZF) said, "Writing down the syllables of the word repeatedly helps the visual memory and serves as a reference for further practice." This observation reinforces the importance of practice. Physically writing the syllables also engages the motor memory, enhancing overall retention. Another par-

ticipant (RZ) indicated, "I utilize Google Translate to listen to each word and understand its meaning. Next, I break the word down into syllables and proceed to write them down. Subsequently, I engage in repetition, practicing the pronunciation of the word without referring to my notes. During this process, I mentally visualize a whiteboard in front of me, aiding in my recall and reinforcement of the word." By using Google Translate to listen to each word, the learner taps into auditory learning and gains an initial understanding of the word's pronunciation and meaning. This step helps to establish a foundation for further exploration and memorization. Breaking down words into syllables is a helpful technique for understanding their structure and pronunciation. It allows the learner to focus on smaller units of the word, making it easier to grasp and remember each syllable individually. Repeating the word without looking at notes is a vital step for reinforcing memory and improving recall. Imagining a whiteboard in front of the learner during the learning process can enhance visualization skills and aid in recall. Visual associations help create stronger connections between the word, its meaning, and its pronunciation, making it easier to retrieve the information when needed. Two participants (ZF and LH) both pointed out that "Pronouncing and writing the word involves speaking and writing the word, which reinforces their understanding and familiarity with its pronunciation and spelling." In this way, the learning process incorporates multiple senses, including auditory, visual, and kinesthetic. Engaging multiple senses simultaneously enhances memory formation and retention.

4.2. Vocabulary Association Techniques

The participants were also asked about their thought processes while encountering challenging or unfamiliar words. One participant (SR) said, "I sometimes establish a connection between an English word and an Arabic word. For instance, I associated the word 'emphatic' with the Arabic word /fa:tic/ (you missed it). Despite the difference in meanings but both share the meaning of 'emphasis,' and both share a similar pronunciation." Another participant (LH) said that "there are instances when I relate a word to its meaning. For instance, when encountering the word "collapse," I create a mental image of something collapsing in my mind." Another point was expressed by (AH): "Occasionally, I establish associations between words and specific

events or objects. For instance, when encountering the word 'extraordinary,' I link it to a remarkable drawing done by my sister. By connecting the word to a memorable experience or visual representation, I strengthen my understanding and recollection of its meaning." When it comes to associating words with their meanings, different techniques may be employed depending on personal preferences and learning styles. Visualizing the meaning of a word can be a powerful strategy for enhancing memory retention. By creating vivid mental images related to the word's definition, the learner makes a stronger and more memorable connection between the word and its meaning. Another technique is creating associations between words and personal experiences. Finding the association techniques that work best for the learner will greatly enhance vocabulary acquisition and retention. By connecting a word like "extraordinary" to a specific drawing, learners establish a personal connection that deepens their understanding of the word's meaning. Associating a word with an event or thing that evokes strong emotions or captures their attention can profoundly influence their memory. Another participant (SH) said, "I usually seek someone's assistance to test my knowledge. This evaluation helps me identify which words require further emphasis and review. Additionally, when I break down the words, I actively search for affixes such as prefixes and suffixes. Recognizing these affixes aids in easier recall and understanding of the words." Seeking testing assistance is an effective way to gauge learners' understanding and retention of the words, and to receive feedback informing them of which words require greater focus on their part. This feedback helps learners prioritize and allocate additional emphasis to the words that require further attention. Using affixes (prefixes and suffixes) can provide valuable clues to words' meaning and aid in memorization. Affixes often contribute to the word's overall definition, can help learners make connections or associations with familiar word elements, and can simplify the process of remembering and comprehending new words.

4.3. Participants' Self-Awareness of Their Cognitive Abilities

Finally, the participants were asked about their self-awareness of their cognitive abilities, including their awareness of their own memory strengths and weaknesses, and their adjustment of study strategies based on their perceived level of mastery. A point was raised by one of the participants (RM), who said, "In the beginning, I commit the words to memory by writing them down; however, I encounter difficulty recalling them when attempting to pronounce them orally. Then I decided to Listen and practice by repeating the words out loud, and sometimes I record myself." Memorizing words in writing and recalling them later orally engages different cognitive processes. When learners memorize words by writing them down, they primarily rely on visual and motor memory. However, recalling words orally involves auditory and verbal memory, which can present a different set of challenges. Remembering how to pronounce words correctly can be challenging, especially if the learner has not had much practice with verbalizing them. Pronunciation involves coordinating various speech articulators, such as the tongue, lips, and vocal cords, to produce the correct sounds. It may take time and practice to develop fluency in pronouncing words accurately. To strengthen the ability to remember words orally, more verbal practice can be incorporated into the learning routine. Recording oneself pronouncing the words and listening to the recordings provides effective practice and solicits feedback. Gradually, with repeated practice, the learner becomes more comfortable and confident in recalling and pronouncing the words correctly. By combining these techniques, learners engage multiple senses, which can greatly enhance word learning and retention. An important point was raised by one participant (SD): "Memorizing becomes more challenging when the assigned words are delayed until the following week, or when memorizing the day before our regular assessment day, so I decided not to delay memorization." Setting aside regular time slots dedicated to reviewing the assigned words helps reinforce the habit and ensures that learners will not fall behind. When delaying reviewing and memorizing assigned words until the next week, learners create a gap in the process that can make it harder for them to recall and retain the information effectively. The human brain is wired to forget information over time if that information is not reinforced. When learners encounter new words, the brain forms neural connections to encode that information into memory. However, these connections can weaken if they are not reinforced through regular review and practice. By delaying the review of assigned words, learners miss out on the opportunity to reinforce those neural connections while they are still fresh.

As a result, the information may become less accessible in the memory, requiring more effort to recall. Additionally, accumulating a large number of words over time without reviewing may lead to the feeling of being overwhelmed by the volume of material that needed to be learned. This can further hinder learners' ability to effectively memorize and retain the words.

Nearly all of the participants share that in the beginning, memorizing the words was difficult, but later they found it easier, and it does not take much time. According to their accounts, they initially experienced difficulties in committing the words to memory. It is likely that they encountered obstacles such as unfamiliar vocabulary, complex spellings, or the sheer volume of words to learn. However, as time progressed and they continued to engage in the task of memorization, they noticed a positive shift, and they began to find the process easier. This improvement suggests that they have developed effective strategies or techniques for encoding and retaining the information.

5. Discussion and Conclusion

The data from the study provided evidence supporting a close relationship between the cognitive processes involved in the preparation for participation in spelling bee games and the Information Processing Theory, in the context of vocabulary learning. The spelling bee requires students to memorize the spelling of numerous words. This process of memorization helps students internalize the orthographic representations of words, making them more likely to recall and use them accurately in written or verbal communication [21]. By actively engaging in the spelling bee, students develop strategies for memorizing and retaining vocabulary, which can benefit their overall language learning endeavors. The study data suggested that the cognitive processes involved in memorizing vocabulary through the spelling bee game can be categorized into the following stages:

Encoding: Most participants needed to encode the visual and auditory information of the words presented to them, processing the letters, their order, and the pronunciation. Successful participants focused intently on the words being presented, listened attentively to the pronunciation, and paid close attention to the sequence of sounds and letters. This encoding process helps learners create mental representations

of the words in their memory [8]. An important finding indicated that incorporating multisensory engagement—where learners use visual, auditory, and kinesthetic modalities—enhanced the participants' ability to memorize new words. For example, learners might visualize word shapes, listen to word pronunciations, and physically write or type the spelling of the words. This multisensory approach improves memory encoding and retrieval [29]. It involves actively processing and representing the word's features, such as its sounds, letters, and spelling patterns. Nearly all participants also engaged in word analysis by breaking down words into their constituent sounds and letters. They analyzed phonetic patterns, syllable structures, and spelling rules to determine the correct spelling of the words during memorization. This process promotes phonological awareness, enabling students to better understand the sound-symbol relationship in words and improving their overall spelling and reading abilities [22]. Spelling bee games require learners to hold and manipulate information in their working memory, which is responsible for temporary storage and processing. This cognitive load strengthens working memory capacity and improves the ability to handle linguistic information effectively [10]. Many participants reported that actively manipulating words and sentences in their working memory helped them recall words more easily. This finding supports Wang's [17] conclusion that individuals with stronger working memory abilities tend to acquire vocabulary more efficiently, likely due to their increased capacity for storing and processing new lexical information.

Many participants indicated that by focusing on the word and mentally rehearsing its spelling, they were able to create stronger memory traces. Spelling bee games typically involve repeated exposure to words, and through this consistent practice, participants could reinforce the memory traces associated with those words. 'Paying attention' refers to the use of cognitive resources to process information, but there is a limit to the amount of information learners can effectively attend to at one time. Over time, with experience and practice, previously unfamiliar information becomes easier to process, allowing learners to access it more quickly and even automatically. As a result, cognitive processing resources become available to notice other aspects of the language, which gradually become automated. In this context, encountering a new vocabulary list requires practice and repetition for effective processing. Once the initial vo-

cabulary list has been sufficiently learned and consolidated, cognitive resources become available to focus on a new set of vocabulary.

Spelling bee games often provide contexts for word usage, such as defining the word, using it in a sentence, or identifying its part of speech. Most participants in this study found that learning words in context enhanced comprehension and facilitated memory consolidation. The contextual cues and meaningful examples helped them link the words to their appropriate contexts, fostering a deeper understanding and retention of the vocabulary. This finding is consistent with Ayana's et al. [15] study, which revealed that learners who engaged in activities fostering deeper semantic connections with new vocabulary words—such as creating sentences or associations—demonstrated improved retention and comprehension of the terms compared to those using rote memorization techniques. This process enhances the semantic processing of vocabulary, connecting it to contextual understanding and facilitating long-term retention [30].

Storage: Through repeated exposure to words in the spelling bee context, most participants began to recognize patterns, syllables, and common letter combinations. This process of chunking helps group related words together and facilitates faster retrieval during spelling tasks [31]. Spelling bee games contribute to long-term memory consolidation through repeated practice and retrieval. When participants repeatedly engage with words, their memory traces become more stable and resistant to forgetting [32]. Practice, particularly repetition and memorization, plays a crucial role in moving information from declarative knowledge to procedural knowledge [11]. Most participants reported that repeatedly encountering and spelling words during their preparation for the game helped them strengthen their memory of correct spelling patterns and the relationships between word forms and meanings. Through this repetition, they became more aware of their spelling mistakes, allowing them to adjust and refine their spelling strategies. By learning from these errors and making corrections, they were able to reinforce correct spelling patterns and improve their procedural knowledge of spelling. Spelling bee games also involve immediate feedback, allowing learners to identify and correct errors. This feedback loop helps learners refine their understanding of spelling rules, phonetic patterns, and word meanings [33].

It was also found that during preparation for spelling bee games, participants could improve memory retention by linking new words with related concepts, visual images, or personal experiences. Creating meaningful associations helps establish stronger neural connections, making it easier for the words to transition into long-term memory. Spelling bee games also provide opportunities for metacognitive reflection, where learners monitor and reflect on their own thinking processes. They can assess their spelling strategies, identify areas for improvement, and adjust their approach accordingly. Metacognitive awareness enhances self-regulation and promotes more effective learning [34].

Retrieval: The findings also revealed that through repeated practice, most participants could retrieve the correct spelling of words from memory. This retrieval process involves accessing stored information and bringing it into conscious awareness. With repeated practice and reinforcement, the retrieval of accurate spellings becomes more fluent and automatic [11]. This retrieval practice strengthens memory recall and consolidation. Each successful retrieval of a word reinforces the memory trace and increases the likelihood of long-term retention. The effortful process of recalling and reproducing spellings contributes to the transfer of words from short-term to long-term memory. Spelling bee games often involve encountering words repeatedly over time. This spaced repetition, with intervals between encounters, optimizes memory consolidation. This finding aligns well with Sobel's et al. [14] study, which suggests that spacing out the review of new vocabulary words over time, rather than concentrating practice in a single session, enhances learners' long-term ability to recall and apply the words. Through practice and repetition, learners develop automaticity in spelling, making accurate spelling require less conscious effort [35]. By repeatedly spelling words in the game, learners strengthen the neural pathways associated with spelling, making the process more automatic and less dependent on conscious thought.

In conclusion, the findings can be summarized as follows: First, participating in spelling bee games involves learners in multiple stages of information processing, including encoding, storage, and retrieval, which aids in the acquisition and consolidation of vocabulary. Second, the interactive elements of spelling bee games foster active engagement, attention, and motivation, thereby enhancing the effectiveness of vocabulary learning. Third, the repetition

and memorization practices during spelling bee preparation facilitate the shift from declarative to procedural knowledge. This process reinforces memory traces, promotes automaticity in spelling, facilitates the memorization of word forms, improves speed and efficiency, and supports error correction. Through consistent and deliberate practice, learners develop the procedural knowledge needed to spell words accurately and effortlessly. Spelling bee games can facilitate the transfer of words from short-term to long-term memory through various cognitive processes and learning strategies. These cognitive processes work in conjunction during the preparation process, allowing learners to actively engage with vocabulary and reinforce their understanding of word forms, structures, and spelling patterns. By integrating these cognitive processes, spelling bee games provide a dynamic and interactive approach to vocabulary acquisition in foreign language learning.

Since this research focused on spelling bee games, future studies could compare the cognitive and educational outcomes of spelling bee games with other game-based learning approaches, such as language learning apps or gamified vocabulary exercises. This comparison could reveal the unique advantages and limitations of each method.

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