# NOVEL NEPALI WORD LEARNING IN ADULTS- INFLUENCE OF MODALITIES AND CONTEXTS

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**ALL INDIA INSTITUTE OF SPEECH AND HEARING**

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**SEPTEMBER 2023**

# Certificate

This is to certify that this dissertation entitled **"Novel Nepali Word Learning In Adults- Influence Of Modalities And Contexts"** is a bonafide work submitted in part fulfillment for the degree of Masters of Science Speech–Language Pathology) of the student Registration Number: P01II21S009. This has been carried out under the guidance of the faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysuru

September 2023

**Dr. M. Pushpavathi**

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Mysuru

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## Declaration

This is to certify that the dissertation entitled **"Novel Nepali Word Learning In Adults- Influence Of Modalities And Contexts"** is the result of my own study under the guidance of Dr. Abhishek. B.P, Assitant Professor in Language Pathology, Department of Speech Language Pathology, All India Institute of Speech and Hearing, Mysuru, has not been submitted earlier to any other University for another Diploma or Degree award.

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September 2023

Registration number: P01II21S009

*MY WORK IS DEDICATED TO MY*

*FAMILY,*

*TEACHERS,*

*FRIENDS,*

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# Chapter 1

## Introduction

Language is a medium to communicate. Language is a purely human and non-instinctive method to communicate ideas, emotions, and desires (Sapir 1939). Language comprises phonology, morphology, syntax, semantics, and pragmatics. The phonology component deals with the sound system and its combination, whereas the morphology deals with recognizing the smallest meaningful unit and adding units to change meaning subtly and vastly. Syntax, on the other hand, deals with combining words to form a complex sentence; semantics deals with the meaning aspects of words and sentences, lastly pragmatics deals with the appropriate use of language in the context. Learning a language involves mastering these five components and using that knowledge fluently like a native speaker.

Language acquisition is a subconscious process of gaining knowledge of the language, especially the first language (L1), while language learning is a process of active learning that often deals with a second language (L2) (Kramina, 2001). The first language learning is intrinsic, where an individual receives an unconstraint naturalistic input in their mother tongue, so the language is learned in depth. On the opposite, second language learning is explicit. For learning a second language, an individual is usually taught by providing language input of unnatural and formal nature, so the second language is not learned in depth.

Developing neuronal structure and connections is considered the hardware of language, using which language learning is constructed behaviorally. Several factors may constrain this “language hardware” and cause constraints in language acquisition.

Age is the primary factor; when the child grows and reaches neuronal maturation, the plasticity is minimal to ensure language learning. Another variable influencing language is cognition- higher executive functioning skills and critical evaluating ability yield better language learning outcomes.

The difference in first language (L1) and second language (L2) learning is well supported by neurological evidence of hemispheric lateralization, where for L1, the left hemisphere is activated, and for L2, the right hemisphere gets activated. On the condition of simultaneous bilingualism where both languages are exposed to a child at a time, L2 is found activating the left hemisphere. Similarly, in the case of highly proficient L2 learners, activation is also evident in the left hemisphere. So, the more the brain specializes in language, the more lateralization will occur.

A critical period is a time frame during which language can be picked up quickly, followed by a reduced capacity to do so with the same rapidity. Crossing the critical period tends to constrain language learning. The critical period hypothesis (CPH) proposes that native-like proficiency is obtained only within a finite period- from early infancy to puberty. A milder version of the similar thought is explained with the concept of a sensitive period, which states that language acquisition may occur even after this period but not as rapidly or fully. The lack of plasticity of the brain at a cellular and molecular level and decreased behavioral flexibility is the reason for this stability for learning after the critical period (Newport,2018). The developmental pattern for the first language consists of the period of rapidity in acquisition called- “word boom,” which is mainly experience-driven, followed by the decline period of rapidity for acquisition called- “a trough.” The period before the trough is similar to the critical period (Dale & Fenson, 1996). Many other variables can affect the critical period and influence language learning.

The actual time frame of the critical period is a highly debated topic. Lennenberg states that this period starts from two years and lasts until puberty (Lennenberg 1967). The decline of rapidity in learning begins at 10-12 years of age (Pinker 2018) and stops near 17 years. The critical period time is six years (Hyltenstam and Abrahamsson, 2003; Ruben, 1997), 3-4 years (Meisel (2008), 9 years ( Dollman et al. 2020), and 17 years ( Hartstone et al. 2018). The acquisition of different language components - phonology, semantics, and syntax was found to have a difference in timing. So a "Multiple critical periods" concept was put forward to explain this variance across language components. Granena and Long (2013) gave the three critical periods for phonology, lexis, and syntax. Similarly, the critical period of syntax was stated as 17.4 (Hartshorne et al., 2018; Dollmann et al., 2020) and 17 years by (Pinker ,2018).

The existence of a critical period for the first language is well accepted. However, there is controversy regarding critical development for the second language. Growing evidence shows the difference between the critical period of L1 and L2. Some author states that L2 cannot ever have native-like proficiency, so the critical period concept may not apply to the second language. Mayberry (2001) states that the critical period influences L1 learning but not L2 learning (Mayberry & Kluender, 2001). In opposition, other authors support such a sensitive period, even for the second language, during which native-like proficiency can be achieved.

L2 proficiency depends upon many factors; one of the important is age (Newport,2018). Many studies have shown that L2 proficiency declines after early childhood, proving the child has a better chance of attaining native-like proficiency than the adult learner. Seliger et al. (1975) found the existence of unnatural foreign accents when the language exposure was late, i.e., the phonology was unnatural for the L2 exposure after 16 years, while the phonology was undifferentiated when L2 exposure

was provided after nine years. Hyltenstam (1992) found more lexical and syntactic errors for L2 when the second language exposure was after seven years.

The other variable influencing L2 proficiency is language similarity; the more the similarity between L1 and L2, the better the learning of a second language. Language similarity eases learning because of some commonality of phono tactics, semantics, and syntax. Meanwhile, there is a deep interrelation between language similarity and age. i.e., L2 similarity can result in a ceiling down and neutralize the impact created by the high age factor on language proficiency (Newport, 2018). The Energy Conservation Theory for L2 acquisition supports the geometric relation of CPH/L2A with an age of acquisition (AOA). It states that the five parameters learner motivation, learner aptitude, the resemblance of L2 with L1, the linguistic environment of the richness of input, and age will interact at various levels, ultimately influencing the L2 proficiency.

A word is the fundamental unit of meaning from which larger structures like sentences, paragraphs, and entire texts are constructed (Read, 2000). Goldstein has identified four hierarchical vocabulary levels during learning: passive recognition, active recognition, passive recall, and active recall. Language learning studies focus on how a word is learned and have tried exploring the mechanism of word learning in L1 and L2 (Laufer, 2004). For vocabulary of L2, studies have shown active recall causes an increase in word recall and fluency accuracy (Shintani, 2013). A mixed finding has been observed regarding the significance of context in learning a new language in literature. One view believes exposure to L2 through rich context will result in deeper processing and help in better retention of L2 words (Grace, 1998; Hulstijn, 1992), in a similar manner it does for a young child who naturally picks up their first language from a stimulating language environment. However, another view contends that

exposure to rich context can result in unneeded semantic-lexical activation, making the process more complex and intricate to comprehend (Choi et al., 2014).

It is still unclear whether ways of recall: active and passive, and grade of context: rich context or low context, will result in effective long-term retention and better learning. A literature review found a gap in the study of the impact of context on the acquisition of foreign languages. Some studies were conducted on Dutch-English bilingualism (van den Broek et al., 2018) and Iranian elite learners (Brooks & Tomasello, 1999), but no research was performed on Indio-Nepali language bilingualism. The current study will examine this gap between the quantity of retention and the various levels of context in L2 learning. It can also be explored whether the teaching-learning process should involve rich contextual information through sentence exposure against reading word translation as a glossary via orthography modality or whether it is better via hearing modality.

**Aim of the Study**

The study aims to explore more on how new word learning occurs. Also, the effect of contexts and modalities on retention and word learning will be examined.

**Objectives:**

1. To compare the total number of words learned across auditory, visual, and auditory visual modalities on immediate and delayed recall tasks.
2. To compare the total number of words learned across low and high semantic contexts on immediate and delayed recall tasks.

# Chapter 2

# Review of literature

## 2.1. Word Learning

Word learning is the process of acquiring the meaning of a word. It is an associative process that links a symbolic linguistic term to its environmental referent. Word learning is not only a crucial aspect of semantic development but also the foundation skill of language. Word learning is an associative process of linking symbolic words to the referent in a real environment. During this process of association, whenever the exposure of words to the learner is done frequently and in multiple contexts, the connection of the correct word to its referent is strengthened while the incorrect connection to referents is pruned (McMurray, Horst & Samuelson, 2012a). This phenomenon of pruning and strengthening occurs for both novel words as well as words learned prior. These word association tasks can be of either three: a clang nature association- focusing on the phonology of two-word form; syntagmatic relation association- focusing on a word to the function; and paradigmatic association-focusing on associations of words of the same class cognates. Word learning is an essential part of semantic development and the central foundation of language. During word acquisition, the simultaneous process of building up word by word occurs to develop advanced language, and the chunking process of breaking the flow of speech to comprehend key concepts occurs. (Lieven, Pine & Baldwin, 1997)**.**

There is a disparity in duration in word comprehension and word expression in young children. It creates a conundrum of stating when a word is precisely learned- should learning achievement be considered on the ground of receptive or expressive

vocabulary? The proponent states that the expression should be considered to learn words because expression requires both phonology and the semantic referent, while comprehension can occur only with phonological identification (Lieven, 1997).

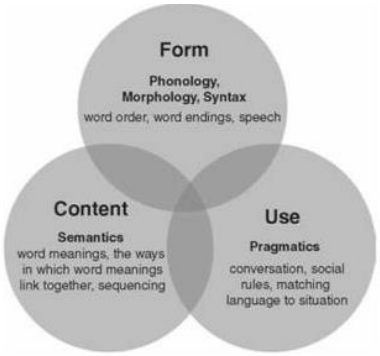
### *2.1.1. Models of Word Learning*

Word learning is a complex process, and the attainment of words by children of even 8-9 months adds questions to the mechanism of the word learning process. Some approaches to analyzing word learning include- the referential and constraint approaches. (McMurray et al., 2012). The referential approach helps identify probable referent for the linguistic word, while the constraint approach helps refine and narrow the referent, causing the sudden vocabulary spurt. Thus, the word-referent association is strengthened with multiple exposures, and the incorrect candidate link will be weakened.

Many models have been put forth to express word learning. A view of word learning as a stage- where learning happens first, and all the possible semantic neighbor activations happen eventually, identical to fast and slow mapping processes. Similarly, there are other models proposed to explain the word learning.

Emergentist coalition model: This model tries to explain word learning by a child through a process of deduction, where the child actively relies on the contexts of communication to identify the word and its referent by the active use of his attention, pragmatics and his cognition (Hollich et al., 2000). Constructivist learning theories also support this model by stating that a child learns from and reflects on experiences (Tomasello, Garagnani, Wennekers & Pulvermüller, 2017). A phonological learning model found equivalent response in learning by a stimulus with a sequence of phonemes and even the non-word (Norris, Page & Hall, 2018).

The constructivist model of word learning states child uses cognition to learn words. Child actively participates in finding a meaning and solving the problem during word learning (Lin, 2015). The interrelation of form, content, and use is the source of word learning. (L. Bloom, 2000).




The neurogenic model of word learning states activation of different brain areas for processing and learning words. According to the model, word processing occurs in two stages; the initial phonologic form processing results in activation in the hippocampus area, followed by a later semantic stage of word learning that causes activations in the hippocampus, neocortex, and sub-cortex and eventually leads to long-term storage (Edelman & Gally, 2001; McClelland et al., 1995). Evidence of learning was explored with the help of electrophysiological tests like EEG and N400. Electroencephalogram (EEG) studies on novel words showed some interesting findings. First, the brain activation pattern of novel words differed for novel and non-novel words. Secondly, after three exposures to novel words, the activation pattern was similar to that of non-novel words, indicating words were learned over three repetitions (Mestres, Rodriguez & Münte, 2007). Batterink & Neville (2011) EEG study also showed the novel word brain activation pattern resembling known word brain activation after ten repetitions. The N400 study showed memory traces in passive

listening tasks after ten repetitions, indicating memory built up for phonological forms for novel words (Partanen, Leminen, de Paoli, Bundgaard, 2017).

A computational model of word learning postulates a model of an artificial neural network that mimics the primary computer program for statistically identifying the synonym, word meaning, or formulation of a new area for the novel word with new meaning without removal of older words (Westermann & Twomey, 2018).

The multimodal model of word learning focuses on the modality has been given by (Plaut, 2002). Using the Hub and soake architecture, the "word referent model," where the information from the gestural cues, phonology cues, prosody cues, and semantic cues from all modalities is integrated into an unconstrained fashion in the integrative layer. Later, Plunkett(1997) put forward the simplified version of the same model named "connection modelling of non-linear word learning." Here, Images are fed through one channel at the retina, while the labels are fed through the other channel, and an "auto-association link" occurs. He added that an individual must create an image at the output when the label is presented at the input for comprehension of words. Similarly, for the expression, an individual must produce a label at the output when an image is sent as input. This model explains the non-linear trend of vocabulary growth and highly focuses on experience-driven learning (Plunkett, 1997).

The dynamic associative and statistical models of cross-situational word learning explain the associative learning process (Yu & Ballard, 2007). The dynamic associative model explains word learning by appropriate referent selection from the competing referents using hebbian learning and increasing synaptic connections for the correct pair (Hebb, 1949). The statistical model of cross-situation word learning states that with multiple inputs of words from multiple situations, accumulated input will go

through a process of reflection to identify the patterning of input (Yu & Smith, 2012). The word will be stored and updated with the most appropriate word referent, and statistically appropriate decisions will be made based on aggregated statistics. This phenomenon of statistical inference happens over trials with cognitive constraints of memory, prior knowledge, and attention (Smith, Suanda & Yu, 2014).

### *2.1.2. Stages in word learning –Fast Map and Slow Map*

Word learning is believed to occur in three stages. First is the "triggering stage," where an individual identifies a novel word and depicts attention to it (Hoover, Storkel, & Hogan, 2010). The second stage, "fast mapping," is where an individual tries to link the word form with the referent in the first few exposures. The third stage, the "extended mapping stage," is where an adult-like understanding of meaning is learned from overtime exposure (Carey, 2010; Carey & Bartlett, 1978) . Some proponent supports the similar phenomenon of extended mapping and uses the term "configuration and engagement," where an individual learns phonology, meaning, and the syntactic form in depth (Leach & Samuel, 2007). A term was introduced QUIL," QUick Incidental Learning" , to refer to children's partial understanding of word meaning in context without ostensive parental reference and prompts (Oetting, Rice & Swank, 1995). QUIL is similar to fast mapping, in which only surface knowledge is obtained.

There is rapidity in word learning around 18 months, called a vocabulary spurt in comprehension and expression. The cause of this spurt is suspected to be a result of linguistic development, cognitive development, improved categorization abilities, conceptual development, and the development of constraints on word learning.

### *2.1.3. First Language Learning and Second Language Learning*

The first language (L1) is the language that is acquired within three years (Sinha, Banarjee & Shastri, 2009). At the same time, a second language (L2) is the language acquired after the first language. While acquiring the first language, an individual will develop a knowledge of the world along with knowledge of words. In contrast, for a second language, an individual learns to express concepts through another medium of language, skipping the stage of developing lexical principles again (Lia et al., 2009a). Either the learner links the L2 word with the referent or, as an equivalent to the L1 word (Winney & Alsaedi, 2008).

Learning an L2 word with an existing L1 category is relatively easier than developing an entirely new L2 category (Gullberg & Mccafferty, 2008). Another contradictory finding in the literature is L1 causes interference in the learning of L2. A learner of L2 over-relies on the first language structure, accent, phonology forms, and co-ordinated word vocabulary for reading, writing, and speaking purposes, leading to immature development of L2 (Glennen, Rosinsky & Tracy, 2005). However, Selinker (1983) states that positive and negative transfers can happen (Selinker, 1983).

### *2.1.4. Similarities in L1 and L2*

Lexical development in L1 begins around a year, and with the development of categorization abilities, a vocabulary spurt occurs at 17-19 months (Nelson, 1973) and 25 months (Kern & Gayraud, 2007). Such spurts are also present in L2 for early bilinguals (Ellis & Beaton, 1993) .

The similar properties of first and second language learning is that mapping forms to words and building the lexicon is necessary. The proficiency of both languages relies on their individual lexicon sizes. The universal grammar concept supports using a preliminary grammar generator as a foundation to lay both L1 and L2 language. In

addition, for acquiring words in both languages, three principles of biases are used by an individual to map the correct form to referent –whole object assumption, mutual exclusivity assumption, and taxonomic assumption (Markman & Hutchinson, 1984). Both language user relies on prosody to some extent to learn the words (Ellis & Beaton, 1993).

The major difference between the first and second languages is that L2 acquisition is that it has an already established concept and foundation of one language. This L1 foundation becomes an advantage for L2 learners. In contrast, the L1 has an advantage in the quality and quantity of input from the naturalistic environment in the varied contextual exposures. The quality and quantity of language input also vary for L1 and L2 (Lia et al., 2009b). Naturalistic exposure with scaffolding, child-directed speech from a caregiver, contextual learning, depth of the concept, and informal teaching are four myriads experienced for L1 learning (Brooks & Tomasello, 1999). L2 proficiency is highly influenced by multiple learning situations and individual differences, including age, proximity, memory, and individual difference motivation; however, L1 does not depend on those factors. A child learning L1 uses a different pragmatic approach and social interaction to learn the violation of the contradictions of natural word learning biases (Brooks & Tomasello, 1999). This learning of rule violation and contraindications is not commonly found in the second language.

### 2.2. Variables in Word Learning

In the study carried out by Gray (2020) to identify factors involved in word learning, the word structure did not affect word learning, nor found any difference and separability of expressive and receptive vocabulary. However, he found the role of neuron linking and quick activation by the later semantic word referent and phonologic

word forms with multiple exposures (Gray, Lancaster, Alt, Hogan, Green, Levy & Cowan, 2020). Hebbian learning also supported neuron linkage and faster reaction time with multiple repetitions of words. Gray also found a stronger memory link when participants had to encode all the phonemes by retelling words during the training task versus when participants had just to identify words during the training task. In the early stage, the influence of phonology was found to be more than semantic and, later, visa-versa (Gray et al., 2020). Another study by the same author identified word exposure frequency, neighborhood density, phonotactics and phonological similarity, contexts, and learner factors as variables in word learning (Gray et al., 2014).

### *2.2.1. Participant related variables in word learning*

**Age.** Young children have supreme abilities in learning words by utilizing contextual information to guess the meaning, ignoring variation in word form due to multi-speaker variability. A comparative study revealed child learning the highest number of words than adults despite the wide disparity of mental lexicon for L1. A child's response to cues during learning indicated better associative learning for novel words, while an adult relies on phonological memory for learning novel words (Service & Craik, 1993). The difference in processing a word /language might be the neuroanatomical differences between the mature and developing brain. Children are found to learn the words from the environment by using a "statistical learning approach" using the principle of "associationism" (Bloom & Markson, 1998). Plunkett stated that children are built with a natural bias to learn words, despite numerous words and infinite referents. They can strip the word from the flowing conversation and link the word to the exact referent by solving referential uncertainty (Quine, 2019). So, according to natural bias, a child maps a word to a whole object, not its parts, color, environment, or other. A child develops a complicated network and uses environmental statistical

analysis to learn new words (Plunkett, 1997). The total word vocab of 2 years is around 200 words, six years is around 9000 words, 18 years is around 40000, and adulthood is 80,000 (Templin 1957, Miller 1991).

**Sleep**. Studies show that sleep helps to word learning in the consolidation process (Davis & Gaskell, 2009), especially in children (Bloom, 2000; Weighall et al., 2017).The systematic review study done by analyzing 25 studies shows sleep benefitted in word acquisition and consolidation compared to wakefulness, thus facilitating word learning (Schimke, Angwin, Cheng & Copland, 2021).

### *2.2.2. Linguistic variables in Word Learning*

**Grammatical category.** It is stated that grammatical categories like prepositions and conjunctions are learned better contextually- from the sentences, while the nouns words can also be learned with the isolation word presentation (Quine, 2019). Children are sensitive to the perceptual cue of objects, enabling them to learn concrete nouns better.

**Imageability.** Words are the referent to abstract and concrete concepts of action, nouns, and modifiers, so words may not always be picturable. The typical example of the word apple is likely to create an accurate depiction of an image of red color fruits, but the same may not be expected for the words such as "Animal" and" snow," which may be open for multiple images, or, the word like "hate" which is strongly abstract may not be represented by pictures. The frequency of words, exposure to words, and lexical quality determine imageability. So, the more imageable, the better the word learning (Fliessbach, Weiss, 2006).

**Context.** Words are often taught in a rich contextual environment, which further adds to building a solid semantic foundation for long-term memory consolidation.

However, there is a trade between rich contextual learning and cognitive strain. The richness of using multiple informative words may overuse working memory resources, and cognitive processes had to be fragmented on multi-words. On the other hand, non-rich context-i.e., just a word may create a poor foundation of information, but since utilizing fewer resources, entire cognitive processes may be deployed on a single word to ensure effective learning. In addition to this, the "lexical legacy hypothesis" suggests that encountering words in diverse linguistic contexts leads to better semantic processing (Schimke et al., 2021). Words with strong lexical quality may be accessed easily without context.

Yet another study (Hoffman & Woollams, 2015) has shown highly diverse contexts leading to semantic activation variability and slower synonym judgment. Similar results were replicated in another study on adults where the task was to learn ten pseudo-word in a passage context, where for five words less diverse passage was provided, and for the rest five pseudo-word, a highly diverse passage was provided. Thus words from highly diverse passages had slower recognition scores with higher synonym generation scores (Johns, Dye & Jones, 2016).

**Phonology**. After extended exposure to language by a caregiver, infants can categorize native-like sounds from non-native sounds and prosody (Lia et al., 2009b). "Prosodic bootstrapping " enables a child to learn the separate word and word boundary along with key stressed words to acquire words better (Doughty 2003). A study conducted using the infant's head-turning task showed that the new words were learned rapidly when the novel words resembled old learned phonological forms (Tincoff & Jusczyk, 1996). This can be postulated due to the memory of phono tactics patterns encoding and storing. Vocal production abilities, increased consonant inventory, and sub-vocal rehearsal was found to assist word learning. (Majorano et al., 2019). The

increasing length of the word and unfamiliar phonotactic rules creates a load on the phonology system, resulting in poor word learning (Papagno & Vallar, 1992).

**Orthography**. The traditional way of word learning, especially for a second language, is through formal reading. The orthography of the print is converted to phonics, along with generating the semantic representation of meaning. The lexical quality hypothesis suggests how a reader can identify words accurately through multiple readings.(Schimke et al., 2021). In a cross-sectional comparative study (Zhang, 2017), the students with L2 as the Chinese language with English and Singaporean L1 language showed familiarization with the word print was correlated higher with word learning.

**Frequency of word.** Multiple repeated exposure to words creates a strong association. This association enables better learning and fast retrieval. High-frequency words also have the property of being exposed to many diverse contexts, which is the actual reason for better learning rather than just repetition (Adelman et al., 2006).

### *2.2.3. Exposure Modality conditions*

Canalization and degeneracy are the processes that enable better structuralize of the language and words. Canalizing is a consequence of learning, which ensures resistance to variation and enables uni-perception despite having variations. Degeneracy, on the other side, is the ability of differential input to yield a common output (Edelman & Gally, 2001). So, the richness of language exposure with multi-source input, linguistic richness, modality richness (Monaghan, Kalashnikova & Mattock, 2018), prosody richness, and redundancy of information in multiple situations will help in the canalization of language (Monaghan, 2017).

## 2.3. Extraneous process related to memory

Memory is a process of consolidation of information into long-term memory. The stage theory of memory classifies memory into three stages, sensory memory (SM), short-term memory (STM), and long-term memory (LTM) (Malmberg et al., 2019). Sensory memory is where the sensory stimuli, i.e., echoic and visual, are first registered. Then in the STM stage, information is temporarily stored, and finally, in the stage of LTM, the information is permanently kept. Working memory (WM) was later added under the type of memory (Baddeley, 2010). Working memory is a powerful cognitive tool for learning, and the attribute of memory is highly individualistic, i.e., memory cannot be compared just based on simple measures of age, intelligence quotient, or language. The fundamental factors underpinning individualistic memory differences are unknown (Baddeley, 2010). However, probable factors contribute to holding information memory and removing the information traces from memory, like the strength of stimulus and time of recall.

### *2.3.1. Types of memory*

A primary way to view a memory would be short-term memory holding the information for a short time, while long-term memory holds the information for a longer time. Besides, the significant difference between LTM and STM is in terms of temporal decay and chunk capacity (Cowan, 2008). In addition, the quality of information is also different in these two memories. STM chunks the essential information and can retain 6-7 numbers, five words, and six alphabets for a retention capacity span of 30 seconds (Millar G, 1956). The LTM holds an indefinite amount of information for a relatively permanent time. This retention in this memory relies on frequency of recall, depth of information, and linkage to old information. Working memory is considered similar to a temporary scratch pad for processing information. Working memory acts as a connector between long-term memory and short-term memory. Working memory has

a phonological loop and sketchpad as a ‘slave system’ controlled by the central executive. The role of WM is significant for the processing of the novel stimulus (Nie et al., 2019).

Neurological evidence of different types of memory was shown using animal studies. A study on rats showed three separate region actions, differential involvement of neurotransmitters, and three separate mechanisms for working memory, long-term memory, and short-term memory (Izquierdo et al., 1998). A similar finding was found in humans in an MRI study with 22 participants using memory tasks; results showed different brain regions' activation for working memory, long-term memory, and short-term memory (Nie, Zhang, Wang, Xu & Wu 2019).

### *2.3.2. Intrusion, Forgetting, Attrition and Interference*

Learning is never a plateau state. The strength of the storage of information varies. The recall task assesses storage in the memory. Immediate recall is defined as the task of recalling within 10 min of stimulus presentation, whereas delayed recall is when a recall is expected after 30 minutes. Increased word length decreases the immediate recall, while the sub-vocal rehearsal improves the recall.

Specific language impairment (SLI) is a language disorder with poor expressive skills despite good IQ and no other co-morbid conditions. The phonology of language is primarily affected in these populations, proven by the poor results on the repetition task for strings of non- words syllables. Novel word studies on this population showed difficulty learning novels of lengthier nature and words of a foreign language. Researchers implied that the phonological loop and phonological sketchpad used temporary storage and processing of words would have been affected, causing poor

word learning by referencing Baddleys's model (Baddeley, 2010). Forgetting is likely a cause than interference for poor STM recall (Vallar, 2007).

Learning and forgetting come together. For the word learning, two time periods are often stated in the literature- situation and developmental time. The "situation time" refers to the period within the context of a single naming event. External cues, modalities, and gestures will assist the learning at this time. The "developmental time" refers to the period beyond the first instance of presentation, even when word and meaning are linked. The older cues are almost ineffective in this period, which may last from days to months. The recall of residual information is permanent at this time. Furthermore, the older information is forgotten.

Interference occurs when the new stimulus can impact the old information or vice versa. Early studies of forgetting and acquisition were done in the 1800s using non-sense syllabic stimuli and found that the fleeting grasp of immediate memory did not ensure storage in the longer. Another study also found similar findings and named the retention abilities as primary memory for the temporary trailing edge memory and the "secondary memory" for the one that rests longer (Evans, 1990).

### 2.4. Literature related to current study

Prior to the 90s, language studies were explored, but less was focused on the word learning phenomenon. Word learning studies have been focused only after the late 90s. Novel word learning studies have been conducted in children, adults, bilingual, and clinical populations. The oldest study was mentioned around the late 90s. An investigation was done to investigate if the processing of novel words using the short-term phonological store and if transference to the long-term memory occurred when words' length and phonological similarity were manipulated. The study was conducted

in healthy adults, and novel words were borrowed from another language with lengths varying from 1 to 5 syllables. The result showed that ineffective word learning was imposed by increasing the length of the word, phonological dis-similarity, and increased timing between the presentation and recall (Papagno & Vallar, 1992).

Another old study tries to explore learning differences between children and adults with English language as L1, using novel words in French (Service & Craik, 1993). The results showed younger children learned many words with cues that adults indicated more use of associative learning in children. Meanwhile, the adult relied highly on phonological working memory than the child.

Recent studies include word learning using Event Related Potentials (Mangardich & Sabbagh, 2022). Word learning involving word referent association was assessed with ERP potentials on forty 4-year-old children. On condition 1, for the experimental group, words were trained by providing pictures and words in the beginning, and later, the concurrent and incongruent pictures were presented during testing. For the control group, pre-training was not performed. The robustness of N400 in the experimental group indicated the rapid semantic encoding of words. An associative word learning study using N400 and Late positive component (LPC) showed N400 to be a sensitive marker of pre-activation during word learning (Elmer et al., 2022) .

Similar studies were also performed in adults (Schimke et al., 2021). Cross-situational Statistical word learning was assessed in adults by exposing the ambiguous word-object occurrences assessed with EPP potential. After training the word with the objects in alternating pairs, the recognition task was done, and lastly, the semantic judgment task was done post-training with two stimuli (congruent and incongruent) for

the novel word. Robust N400 was elicited for unrelated word pair. Also, novel words activated the right hemisphere, and familiar ones activated the left hemisphere.

Some studies also tried to compare word learning abilities in bilingual and monolinguals (Alt, Arizmendi, Gray, Hogan, Green, & Cowan, 2019). 76 Spanish-English bilingual Second-grade children and 167 monolingual children were taken for study. Participants link novel words with object, make accuracy/inaccuracy decisions, and produce novel names and semantic features. Results showed bilingual children were less likely to detect mispronunciations and semantic features and more likely to accept many phonological variations.

Studies have been done on a clinical population to explore the deviation in the mechanism of word learning in PWA like aphasia , SLI, and ID. Quick-incidental learning was done by teaching the novel words through stories, and a comparison was made with SLI children (n=28) was done with healthy children(n=60). Words used comprised object category, attribute category, affective words, and action words. Results showed SLI exhibited word-learning ability but lesser than the normal peer group (Oetting et al., 1995).

A more in-depth study to explore the variables in word learning is also present in the literature (Norman et al., 2022). A study compared the learning outcome in young adults (n=239) by introducing eight novel words with ten sentences for each. For four pseudo words, diverse sentences were given, and non-diverse sentences were provided for the four stimuli. After training, the results showed diverse situations providing more learning and flexibility to generalize the meaning to new contexts. The non-diverse stimuli favor the context-bound representations.

A similar study on children shows that the frequency of word usage predicted better learning and word decision. So, frequency and repetition were kept constant, and contextual sentences were provided for naming and lexical decision task. High-frequency words also have the property of being exposed to many diverse contexts, which was the actual reason for better learning rather than just repetition (Adelman, Brown, & Quesada, 2006).

Gesa Van Broek has continuously explored the phenomena of word learning. In the 2018 study, she took 45 adult students 1(Median age= 23.8) without experience in the Swahili language (van den Broek, Wesseling, Huijssen, Lettink & van Broek, 2022). 104 Novel Swahili words were taught in three situations- Retrieval, Context- Inference, and retrieval context combined. In experiment 1 of retrieval, an uninformative sentence was used to train the words. In experiment 2 of retrieval, two conjoined informative sentences were used to train the words, where meaning could be guessed from context. In experiment 3 of retrieval and contexts combined, non-contextual sentences were presented at first, and the contextual sentences were presented later.

Moreover, word learning was assessed through recognition tasks and word form recall tasks. Two recall task was carried out - an immediate test was carried out on the training day, and a delayed test was carried out after seven days. Correct- incorrect feedback was given for the first two experimental groups and corrective feedback for the third group. Results showed no difference in the two recall tests. Words were highly recalled in the retrieval condition with non-contextual sentences than in the other two conditions with contextual sentences. The author re-conducted.

A similar study in 2022 with 105 Dutch adults using the retrieval condition and inference condition using stories. Results showed that the story reading condition had

better word recall than the retention condition, thus stating that context is a better source for learning (van den Broek et al., 2022).

Another study exploring the effect of context and morphemes was carried out on children using Dutch words (Raudszus, Segers, & Verhoeven, 2021). 166 children were divided into groups of bilingual and monolingual, and a comparative study was done to see the inferencing skills to learn words from contextual sentences and in isolation with words that emerged with morphemes. Results showed an equal response from monolingual and bilingual students to learning to infer the meaning of words from morphemic cues. For contextual inferencing, bilinguals performed better than monolinguals.

A study on the importance of contextual information for word learning, with 60 Turkish participants and three grades of context (zero, medium and high) showed better scores with high contexts in both receptive and receptive vocabulary and even better retention (Raudszus et al., 2021).

For assessing the influence of modality in novel word learning, a longitudinal study was done in 2 young twins of 22 months. Each child was exposed to sign (visual mode) and verbal( auditory mode). The results indicated modality to be a personal preference. Also, for complex words, both gestural and visual modes were required (Hakuta, Fredman & Diaz, 1987). Similar results were found in other studies (Maher & Elizabeth 2004).

In the Indian scenario, a novel word learning study was conducted in 2019 to explore the word animacy effect (animacy and non-animacy) with 64 individuals with temporal lobe impairment using 24 novel words in fast mapping and explicit encoding conditions. The explicit encoding used direct encoding of words to meaning, while fast

mapping utilized yes-no questions to link novel words to old concepts. For the animacy words, there was better word learning and fast mapping when compared to non-animacy words (Mohan, Menon, Goswami, Thomas, Cherian & Radhakrishnan, 2022).

Few comparative studies on novel word learning comparing bilingualism benefits were done. A study was carried out on 40 bilingual teens of 15-18 years with Tulu, English, Malayalam, and Kannada by introducing Hithero Novel words. Results showed individualistic variation among individuals regarding the proficiency, degree of exposure, and language usage opportunities to influence novel word learning (Nair et al. 2011). Other studies performed on monolingual English children and Hindi-English bilinguals were done and found superior verbal working memory in bilinguals to enable better learning (Mishra, 2019).

There is a wide gap between the literature to explore all mechanisms of novel word learning. Some studies have been done to explore the effect of context in the Dutch and English languages, but similar studies have not been done on Indian and Nepalese language speakers. The effect of modality, i.e., visual stimulus with pictures and auditory stimulus with spoken word presentation, on word learning has not been explored in older studies. This variable is included in a current study.

# Chapter 3

# Method

The study aimed to explore the phenomenon of word learning when the contexts and the modalities are varied. Twenty novel Nepali words were chosen, and the experiment was conducted on sixty non-Nepali speakers. Participants were divided into three groups, and several stimuli were used to train the words through different modes. To investigate the effect of context on word learning, three levels of contexts: low, mid, and high, were used to teach words. Similarly, to investigate the effect of modality on word learning, the stimulus was presented via three modes- audio, visual, and audio-visual mode during the training phase. Word learning was tested twice, three days apart, to study the influence of testing time on test results. This allowed researchers to determine whether memory interference had occurred, indicated by discrepancies in the word learning scores of immediate and delayed recall. The scores of total words learned were compared across all groups to identify which stimuli and modes were superior for word learning.

## 3.1. Participants

A google form was generated to collect the information on three major sections: demographics, language backgrounds, and language competency. In the demographics section, questions related to name, age, and gender were included. In the section on language backgrounds: questions related to the native language, the number of languages known, and the history of exposure to the Nepali language were included. Under the section on language competence, competence was assessed for both English and Nepali languages. Since the medium of instruction was planned to be provided in

English and some of the test stimuli were built in English with Roman script, English language competence was carried out to avoid English incompetency as an extraneous variable. For English language competence, a section of the LEAP –Q test was included in the form, where participants had to fill in the English proficiency level in each domain of understanding, speaking, reading, and writing by rating their skill on a scale of 1,2,3, and 4. Forty pictures were provided for the Nepali language informal competency assessment, and participants had to name pictures in Nepali if participants knew the Nepali language from any exposure.

The online form was circulated through different platforms, and participants were requested to fill in the information. After collecting all the information filled in by participants, the responses were tabulated in an Excel sheet and analyzed to select candidates for the study using the already set inclusion and exclusion criteria. Participants without prior exposure to the Nepali language were taken for the study. Participants with Nepali nationality, having the Nepali language as their mother tongue, or having a history of acquiring the Nepali language as a first or second language were excluded from the study. After reviewing all the responses, sixty participants were finally chosen for the study.

The collected response from the sixty participants showed all participants were within the range of 18-30 yrs. Of the 60 individuals, 15 participants had Indo-Aryan language roots with stronger Hindi competence; 2 had Tibeo- Burma root of language; and 43 had Dravidian language roots. Fifteen percent of the participant were bilingual, with knowledge of their native language and English, whereas eighty-five percent of participants knew more than two languages. On English competency rating, 70% of participants gave themselves a moderate proficiency rating of 3-4, 30% gave themselves a mild proficiency rating of 2, and 10% gave themselves an excellent

proficiency rating of 4. None of the participants were aware of Nepali words or the Nepali language.

**Figure 3.1**

*Bar Graph showing the English proficiency of participants*

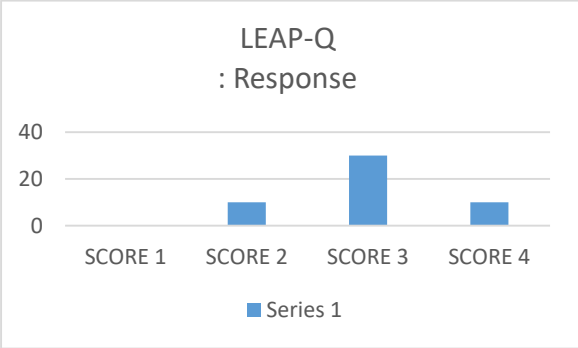
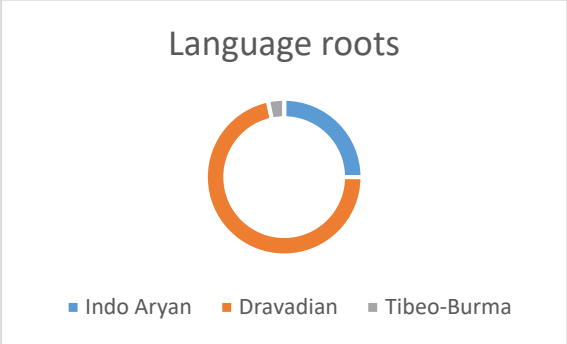



**Figure 3.2**

*Pie chart showing language roots of participants*




Following the selection of sixty volunteers, participants were requested their c onsent to participate in the study and to allow the researcher to use their information for the same purpose only. The researcher ensured that participants avoided discussing their personal information, the test stimulus, or the test

results with each other or other groups. After getting consent, the sixty individuals were randomly divided into three groups of 20 individuals and assigned to Cohort 1, Cohort 2, and Cohort 3.

### 3.2. Stimuli

Thirty Nepali words that were commonly used and picturable were chosen from the noun list of the Nepali dictionary. Two native Hindi speakers were taken as volunteers. Each word was named from a list, and volunteers were asked to say the meaning or guess the probable meaning based on some similarity with the Hindi words. Tallying these words was done to ensure the words, or word roots, do not resemble words in Hindi and Sanskrit languages to prevent familiarity as a variable affecting true learning after training. Some words like 'baluwa' and 'kharayo' were eliminated following tallying because of the maximum resemblance and being guessable, like 'baluwa vs. balu: sand' and 'kharayo vs. kargos: rabbit.' Following the word elimination, twenty words were chosen as the final stimuli word with various syllable structures. Selected stimulus words were of monosyllabic, bisyllabic, and trisyllabic nature with CVC [Ex: Kham], CVCV [Ex: Bhada], CVCVC [Ex: Sirak], CVCVCV [Ex: Kukhura], and CVCCV [Ex: Sikri] as syllable structure.

Different audio and visual materials were made with the final twenty-word set. The list of final words as test stimuli is listed in Appendix A.

#### Type of stimulus

##### *Visual stimulus*

a. **Visual Images.** The colored photograph image of the novel Nepali words was taken from Google. Three judges were instructed to rate the picture as "Representative- if the picture was appropriate and able to represent the word correctly" and "Non-

Representative- if the picture was inappropriate for the words because of ambiguity or unnecessary backgrounds." Until uniform acceptance response was obtained from all three judges, stimuli pictures were continually refined to the more realistic and word-representing pictures. Lastly, 20 pictures were selected as the final visual test stimulus. (Appendix B)

**b. Visual Text/ Orthography.** The Nepali language is usually written in Devanagari scripts. English was only a common language among participants, so the novel Nepali words were written in the Roman script using a broad transcription. For illustration, the word "Chicken," whose Nepali equivalent word is written in Devanagari script as [ कुखुरा ], in IPA as [kuk$^{h}$ura], and using the broad translation as [kukhura]. For the study, each Nepali novel word stimulus was written using a Roman script and broad transcription, as above mentioned example. For sentences, the whole sentence was written in Roman script. Wherever embedded novel words have to be written in sentences, broad translation was used to write words in a Roman script using phoneme-grapheme correspondence (Appendix C).

***Audio stimulus***

Each Nepali word was used in three ways to make three audio materials. Twenty Nepali words were recorded separately in isolation for the first kind of audio material. Each Nepali word and its equivalent English word were recorded in a pair for the second kind of audio stimuli. For the third kind of audio stimuli, three different informative sentences were recorded for each Nepali word. All the audio stimulus was recorded priorly instead of presenting live voice to prevent discrepancy across participants. The stimuli were recorded using PRATT version 6.3 using the voice of a Nepali female speaker in an audio-treated room.

**Testing material**

Twenty colored photograph image representing novel Nepali words (Appendix B) was provided in a random sequence to participants, both prior to training and after the training. Participants were instructed to name the picture. Participants' responses were separately recorded at the pre-training stage, post-training day one, and post-training day three.

**Training material**

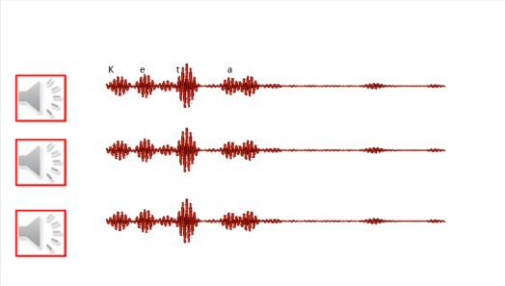
Three materials were made in an audio, visual, and audio-visual format and were combined to create "three sets," each different set for each cohort. The audio stimuli contained PRATT-recorded Nepali words, the Nepali words and their equivalent English pairs, and rich sentences using Nepali words. Similarly, the visual stimuli contained written words orthography in Roman script and colored pictures. The audio-visual material contained a combination of both audio stimuli and visual stimuli. All stimuli were combined into three unique sets: Set 1 for Cohort One, Set 2 for Cohort Two, and Set 3 of stimulus for Cohort Three and displayed over a computer screen.

***Stimuli- Set 1***

The first set of stimuli included 20 words of the Nepali language with their equivalent words in English. Nepali words with their equivalent English words were presented via auditory modes. Visual pictures and orthography were not provided. For example, the Nepali word "Keta" means Boy. So a pair of Nepali and its equivalent English words were recorded as a single audio. i.e., [Keta boy]. Each audio was played thrice during the training phase, as shown in Figure 3.3.

**Figure 3.3**

*Representation of training material "Set 1" used for Cohort 1*

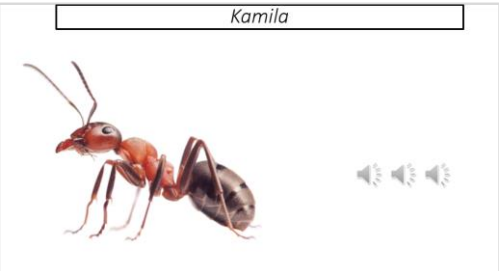


***Stimuli –Set 2***

The second set consisted of 20 Nepali words in audio format and pictures selected through representativeness rating in a visual format. For example, the Nepali word "Kamila" means ant. So, the picture of the ant was shown, the word *Kamila* was displayed in Roman script, and the audio of "Kamila" was played three times, as shown in Figure 3.4.

**Figure 3.4**

*Representation of training material "Set 2" used for Cohort 2*



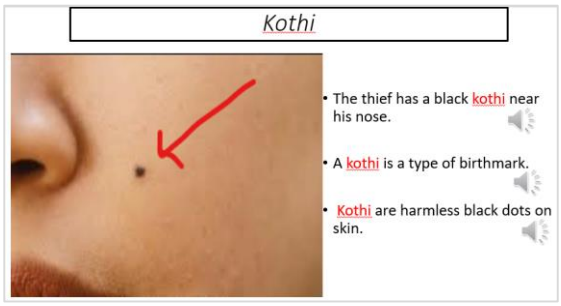
***Stimuli- Set 3***

The third set included 20 target words in three forms. Three semantically rich sentences of English were selected, and a noun in a sentence was replaced with a Nepali word. Thus, meaningful English sentences with embedded Nepali words, following English grammar structure, were created and displayed in Romanized script. The picture for word was also shown in the visual mode. The same sentences were played in auditory form too.

For example, the Nepali word "*Kothi*" means mole. So, the picture of a mole was shown, the word *Kothi* was displayed in Roman script, three sentences related to *Kothi* were displayed, and all three audio sentences related to the word 'mole' were played one after the other, as depicted in Figure 3.5.

**Figure 3.5**

*Representation of training material "Set 3" used for Cohort 3*




### 3.3. Procedure

Due to variations in the stimuli used for each cohort, the instruction, timing, training method, and data-collecting procedure varied with each three cohorts.

**Procedure for Cohort 1**

***Pre-training stage :***

Twenty colored photograph images representing novel Nepali words were provided to participants during the pre-training stage to obtain the baseline of words. The participants were instructed to tell the name of the displayed picture. Responses provided by participants were recorded. A score of "1" was given for correct naming, and a score of "0" for incorrect.

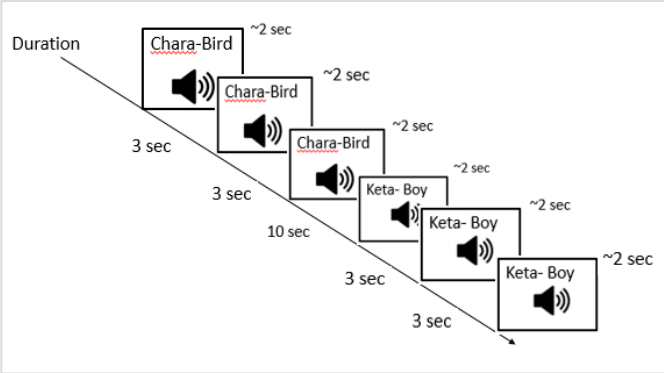
***Training stage:***

Set 1 stimulus was used for cohort one for the training phase. A pre-recorded audio of every keyword in Nepali and their English equivalent word was presented three times. The presentation duration of each word and its meaning was around 2 seconds. Following ~3 seconds, the same word was again repeated. After completing all three trials for a word pair, a ~ 10-second break was given before introducing the second word and its meaning. The same process is continued for all twenty words. After every five words, a 30-second break window was provided for participants to process and assimilate the learned material in memory. Extra information was not provided during the training phase.

Within ~10 minutes, the total "words training phase" was completed for 20 novel words for Cohort 1.

**Figure 3.6**

*Schematic representation of the duration of stimulus and type of stimulus for cohort 1*




***Post training day 1:***

After the completion of word training, the testing phase commenced immediately. Pictures representing the training words were shown, and responses were collected. The pictures were shown randomly to avoid the "sequencing memory" variable influencing true word learning. Participants were instructed to say the exact names of the pictures shown. Audio recording of the naming response was done to analyze correct and incorrect responses later.

Participants were instructed to avoid any self-learning strategy until the third day of testing was completed. They were instructed not to relearn the words themself by referring to Google, by discussing with friends, or by making notes to memorize the learned word in the time interval of three days.

***Post-training day 3:***

Information was collected to ensure participants did not use any self-learning strategy to learn the words after the training day. On the third day of testing, instruction

was provided to say the exact names of the pictures shown. Pictures were shown one by one in random order. Audio recording of participants' responses while naming was recorded. The recorded response was later used for analyzing correctness and incorrectness.

**Procedure for Cohort 2**

***Pre-training stage:***

Twenty colored photograph images representing novel Nepali words were provided to participants during the pre-training stage to obtain the baseline of words. The participants were instructed to tell the name of the displayed picture. Responses provided by participants were recorded. A score of "1" was given for correct naming, and a score of "0" for incorrect.

***Training stage***

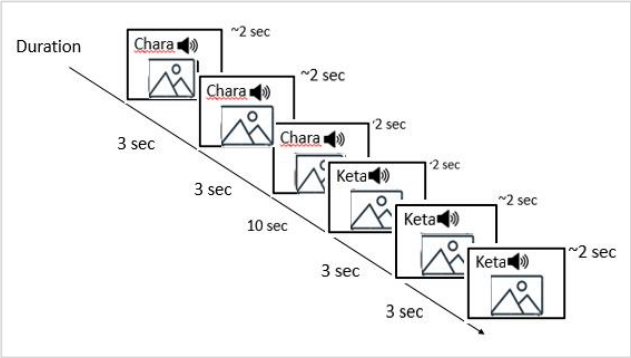
Set 2 stimulus was used for cohort two in the training phase. For training single novel words, a pre-recorded audio of the word was presented three times via headphones. The recorded audio of each Nepali word lasted ~ 1-2 seconds. The audio of the first word was played once. The same audio of the first word was re-played twice with a gap of ~3 seconds.

Along with audio, a picture of words of 12* 12 dimension and broad transcription orthography was displayed on the screen for 15 seconds. After completing each Nepali word training with three audio presentations, a ~ 10-second break was given before introducing the other word. A similar process was used to train the other 19 words. After every five words, a 30-second window break was provided for participants to process and assimilate the learned material in memory. Extra information was not provided during the training phase.

Within ~12-13 minutes, the total "words training phase" was completed for 20 novel words for Cohort 2.

**Figure 3.7**

*Schematic representation of the duration of stimulus and type of stimulus for cohort 2*




***Post training day 1:***

After the completion of word training, the testing phase commenced immediately. Pictures representing the words were displayed, and the response was recorded. The pictures were shown in a random order to avoid the sequencing memory affecting true word learning. Participants were instructed to say the exact names of the pictures shown. Audio recording of the naming response was done to analyze correct and incorrect responses later.

Participants were instructed to avoid any self-learning strategy until third-day testing was completed. They were instructed not to relearn the words by themself by referring to Google, by discussing with friends, or by making notes to memorize the learned word in the time interval of three days.

***Post-training day 3:***

Information was collected to ensure participants did not use any self-learning strategy to learn the words after the training period. On the third day of testing, instruction was provided to say the exact names of the pictures shown. Pictures were shown in random order. Audio recording of participants' responses while naming was recorded. The recorded response was later used for analyzing correctness and incorrectness.

**Procedure for Cohort 3**

***Pre-training stage:***

Twenty colored photograph images representing novel Nepali words were provided to participants during the pre-training stage to obtain the baseline of words. The participants were instructed to tell the name of the displayed picture. Responses provided by participants were recorded. A score of "1" was given for correct naming, and a score of "0" for incorrect.

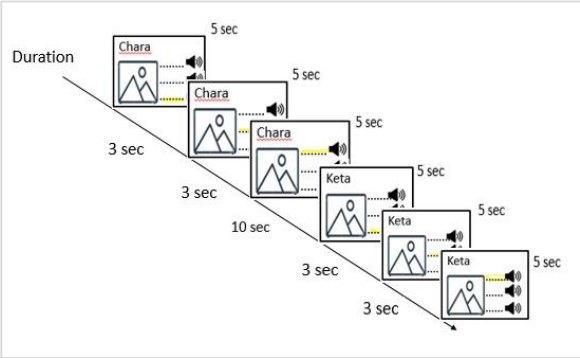
***Training stage***

Set 3 stimulus was used for cohort two in the training phase. For cohort 3, three pre-recorded audio of unique sentences in English with Nepali words embedded in between were presented via headphones. Along with audio, a picture of 12* 12 dimensions representing a word and broad transcription orthography of novel words and sentences was displayed on the screen. Audio recording of each sentence lasted for 3 to 5 seconds. Three different sentences were played one after the other with a gap of ~2 seconds between them. After completing word training for a single word, marked by completing three sentence presentations, a ~ 10-second break was given before introducing the other word. A similar process was used to train the other nineteen words. A 30 seconds window gap was provided to process and assimilate the learned

material in memory. Extra information was not provided during the training phase. Within ~ 17-18 minutes training phase was completed for all 20 words.

**Figure 3.8**

*Schematic representation of the duration of stimulus and type of stimulus for cohort 3*




***Post training day 1:***

After the completion of word training, the testing phase commenced immediately. Pictures representing the training words were shown, and responses were collected. The pictures were shown randomly to avoid the "sequencing memory" variable influencing true word learning. Participants were instructed to say the exact names of the pictures shown. Audio recording of the naming response was done to analyze correct and incorrect responses later.

Participants were instructed to avoid any self-learning strategy until the third day of testing was completed. They were instructed not to relearn the words by themself by referring to Google, by discussing with friends, or by making notes to memorize the learned word in the time interval of three days.

***Post-training day 3:***

Information was collected to ensure participants did not use any self-learning strategy to learn the words after the training day. On the third day of testing, instruction

was provided to say the exact names of the pictures shown. Pictures were shown one by one in a random order. Audio recording of participants' responses while naming was recorded. The recorded response was later used for analyzing correctness and incorrectness.

### 3.4. Analysis and scoring

This Quasi-experimental study used the stimulus type, time duration, and modalities as an independent variable and the total number of words recalled as a dependent variable.An accurate recall of words and the word form while testing was considered a "correct response," and a score of 1 was given. Conversely, a participant unable to recall the exact words or substitute one word for another was considered an "incorrect response," and a score of 0 was given. Response resulting in unintelligible words due to substitutions, additions, distortions, and phoneme deletions was considered incorrect. However, a subtle phonemic discrepancy of phonemes was still considered a correct response to account for participants' accents and dialectal differences.

### 3.5. Statistical Analysis

The collected case details from the case files were systematically segregated and tabulated in Microsoft Excel and Statistical Package for the Social Sciences (SPSS Version 25), and descriptive analysis was carried out. The data were analyzed further to find the learning outcome across different degrees of context. The word learning across modality and across time intervals were also analyzed. Paired t-test, One-way ANOVA test, and Turkey HSD tests were carried out for inferential statistics to investigate the probability of association between context, modality, and time interval.

# Chapter 4

## Results

Sixty non native participants were considered for the study to investigate novel word learning Nepali words and were randomly divided into Cohorts 1, 2, and 3. Cohort One was exposed to low-context auditory stimulus consisting of Nepali words and their equivalent English words through audio-only mode. The second cohort was exposed to visual mid-context stimulus consisting of the picture, the written words in orthography, and auditory words through visual modality. Furthermore, the last cohort was exposed to high context stimulus with three sentences, a picture, auditory words, and written orthography presented via audio-visual modality. Participants of each cohort learned the words and recalled them afterward. The recall was carried out in two phases: immediate recall (I.R.) was carried out on day one immediately after the training phase ended, while the delayed recall (D.R.) was carried out on the third-day post-training phase. Independent variables considered for the study are three levels of contexts ( high, mid, low), Three modes of stimulus presentation ( audio, visual, and audio-visual), and two recall timing (I.R. and D.R.) were taken as the independent variables for the study. In contrast, the total number of words recalled was taken as the dependent variable for the study.

The study aimed to determine the influence of three independent variables- context, modality, and duration- on the dependent variable of word recall. For the first level of analysis, to assess the influence of contexts on word learning, the total number of words learned using the low-level contexts was compared with the total words learned in mid and high levels contexts. On the second analysis level, to examine

modes' influence on word learning, the total number of words learned with the auditory modality was compared with those learned with the visual and audio-visual modalities. For the third level of analysis, to examine the influence of immediate and delayed recall time on word learning, the total number of words retained over three days was compared with the total number of words retained on the first day. The statistical package for the social sciences (SPSS Version 25) was used to analyze the data, assess the normality of raw data, and compare the scores across and within a group.

**Objective of study**

1. To compare the total number of words learned across auditory, visual, and auditory visual modalities on immediate and delayed recall tasks.
2. To compare the total number of words learned across low and high semantic contexts on immediate and delayed recall tasks.

**4.1 Inference Based on Descriptive Statistics**

20 pictures were shown to all the participants for the naming task. The correct response was scored as one, and the incorrect naming as zero. Total scores for each participant were obtained by adding the raw scores. The group average was secured by adding the average scores as the numerator and diving against the number of participants as the denominator. The word recall scores of participants were tabulated in separate sheets under the respective cohort names. Mean, median and standard deviation scores were calculated separately for I.R. and D.R. values for all three cohorts.

**Table 4.1**

*Descriptive values for the number of novel words learned across and within cohorts*

| Parameter | Cohort 1 | | Cohort 2 | | Cohort 3 | |
|---|---|---|---|---|---|---|
| | I.R. | D.R. | I.R. | D.R. | I.R. | D.R. |
| Mean | 8.95 | 8.70 | 12.20 | 11.25 | 13.80 | 12.45 |
| SD | 3.804 | 3.466 | 4.262 | 4.115 | 3.381 | 3.776 |
| Median | 9 | 8 | 12.50 | 12 | 14.20 | 12 |

**Figure 4.1 a**

*Mean of the number of novel words learned by different cohorts on immediate and delayed recall.*

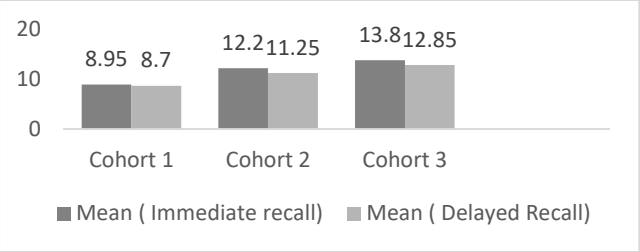
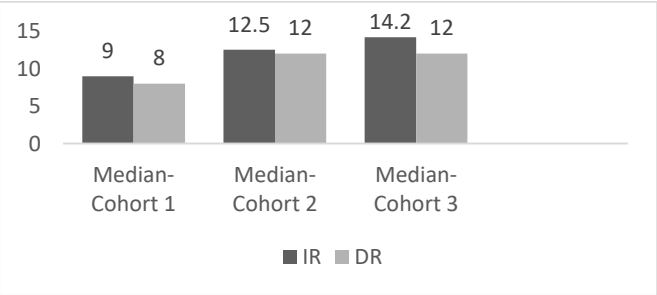



**Figure 4.1 b**

*Median of the number of novel words learned by different cohorts on immediate and delayed recall.*



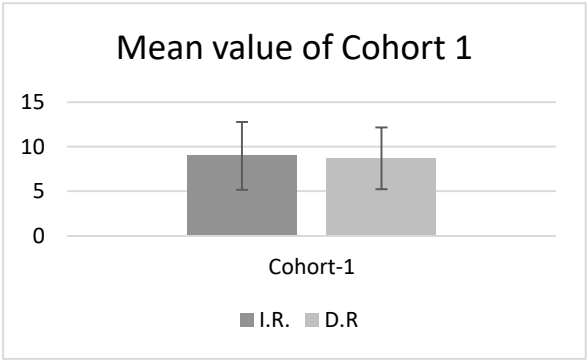
The mean value for the immediate recall was 8.85, 12.20, and 13.80 for cohorts 1, 2, and 3, respectively, and for the delayed recall, the scores were found to be 8.70, 11.25, and 12.45 for cohorts 1, cohort2 and 3, respectively. So as depicted in Table 4.1a and Figure 4.1 a, the mean values were higher for cohort three than cohorts one and two. The same results were observed even on the delayed recall.

The standard deviation was 3.804, 4.262, and 3.381 for cohorts 1, 2, and 3, respectively, for immediate recall and 3.466, 4.115, and 3.776 for cohorts 1, 2, and 3, for delayed recall. As depicted in Table 4.1 the standard deviation values were higher for cohort two than cohorts one and three in delayed recall and immediate recall tasks.

The median was found to be 9, 12.50, and 14.20 for cohort 1, cohort 2, and cohort 3, respectively; in the task of immediate recall, similarly, on the delayed recall, scores were found to be 8, 12, and 12 for cohorts 1, cohort 2 and 3, respectively. So as depicted in Table 4.1a and Figure 4.1b, the median values were higher for cohort three than cohorts one and two. The same results were observed even on the delayed recall.

**Figure 4.1 c**

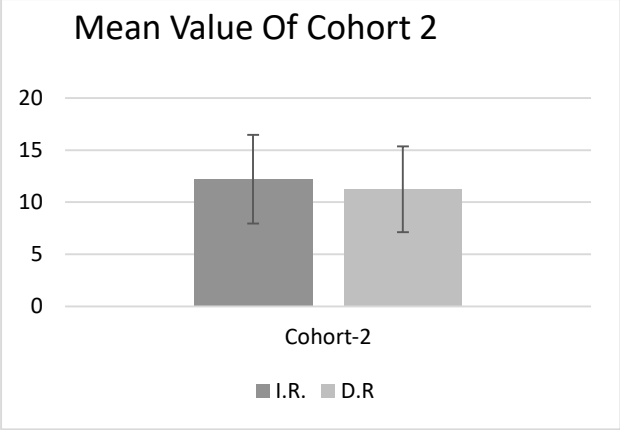
*Mean of the number of novel words learned by cohort- 1 on immediate and delayed recall*



Cohort one used auditory mode and low contextual stimuli for learning novel words. As shown in Figure 4.1 c, the I.R.'s mean value was 8.825 with an SD of 3.804, and D.R.'s mean value was 8.70 with an SD of 3.46, indicative the highest number of words were learnt by cohort 3, followed by cohort 2 and the total amount of words learned was lowest in the cohort 1.

**Figure 4.1 d**

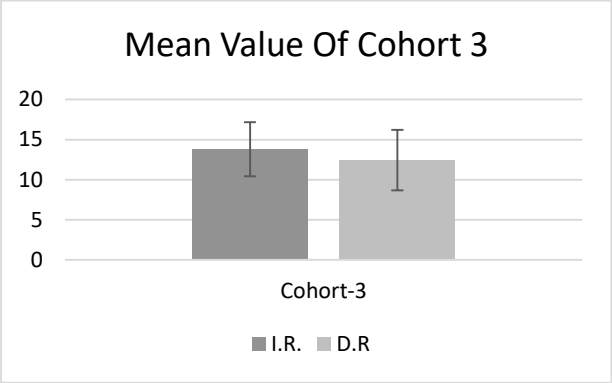
*Mean of the number of novel words learned by cohort- 2 on immediate and delayed recall*




The cohort two participants used visual mode and mid-contextual stimuli for learning words. As shown in Figure 4.1 d, the I.R.'s mean value was 12.20 with an SD of 4.262, and D.R.'s mean value was 11.25 with an SD of 4.115. The mean of word learnt was higher than cohort 1 but lower than cohort 3, and the frequency of word learned was highly variable and scattered with the highest S.D. value as shown in table 4.1.

**Figure 4.1 e**

*Mean of the number of novel words learned by cohort- 3 on immediate and delayed recall.*




Likewise, the cohort three participants used audio-visual mode and high contextual stimuli to learn words. As shown in figure 4.1 e, the I.R.'s mean value was 13.80 with an SD of 3.381, and D.R.'s mean value was 12.45 with an SD of 3.776, indicative of the highest number of words learned than cohort 1 and 3 as shown in table 4.1.

### 4.2. Comparison across groups

Further, statistical analysis was carried out to verify if there was any significant difference within cohort 1, cohort 2, and cohort 3 on immediate and delayed recall specifically. The data were subjected to the normality test using the Shapiro-Wilx's test. The results of the Shapiro-Wilk's test showed the data was parametric as there were three independent variables; One-way ANOVA was used for the statistical analysis.

Using one-way ANOVA, the value obtained was 0.001 ($p<0.05$), indicating significant differences across the cohort. Furthermore, Pos- hoc measures were done using the Turkey HSD test to identify the exact difference value among each cohort pair. Turkey

HSD test was done across three cohorts. i.e., cohort 1 vs. 2, cohort 2 vs. three, and cohort 1 vs. 3 using the level of significance α as 0.05 for immediate recall scores.

**Table 4.2a**

*Comparison of the performance on the immediate recall for each group*

| Cohort under comparison | Test Used | Values (p-value) |
|---|---|---|
| 1 vs. 2 vs. 3 | One way ANOVA | 0.001 ($p<0.05$) |
| 1 vs. 2 | Turkey HSD | 0.26 ($p>0.05$) |
| 1 vs. 3 | Turkey HSD | 0.01 ($p<0.05$) |
| 2 vs. 3 | Turkey HSD | 0.390 ($p>0.05$) |

The Turkey HSD test results revealed that the difference statistically insignificant for cohort 1 vs. 2, with a value of 0.26 ($p>0.05$). However, significant differences were found among cohort 1 vs. 3, with a value of 0.01 ($p< 0.05$) as shown in Table 4.2 a. For cohort 2 vs. 3 the value obtained was 0.390 ($p>0.05$), thus indicative of a statistically insignificant difference as depicted in table 4.2 a.

Overall results of immediate recall across groups showed a fair difference in total word recall by cohort one participant using low-context auditory mode compared to cohort three participants using the high-context audio-visual mode, as shown in table 4.2 a. The difference in word retrieval scores was less between the participants of cohort two using mid-context visual mode when compared to cohort one and cohort three.

**Table 4.2b**

*Comparison of the performance on the delayed recall for each group*

| Parameter under comparison | Test Used | Values (p-value) |
|---|---|---|
| 1 vs. 2 vs. 3 | One way ANOVA | 0.009 ($p<0.05$) |
| 1 vs 2 | Turkey HSD | 0.094 ($p>0.05$) |
| 1 vs 3 | Turkey HSD | 0.008 ($p<0.05$) |
| 2 vs 3 | Turkey HSD | 0.508 ($p>0.05$) |

The data of delayed recall were subjected to the test of normality by using the Shapiro-Wilx's test. One-way ANOVA was used for the statistical analysis. One-way ANOVA, the value obtained was 0.009 ($p<0.05$), indicative of significant differences across the cohort. Furthermore, to identify the exact value of difference among each Cohort pair, Post hoc measures were done using the Turkey HSD test. The Turkey HSD test was done across three cohorts. i.e., cohort 1 vs. 2, cohort 2 vs. three, and cohort 1 vs. 3 using the level of significance $\alpha$ as 0.05 for delayed recall scores.

The Turkey HSD test results revealed that the difference was statistically insignificant for cohort 1 vs. 2, with a value of 0.094 ($p>0.05$) as depicted in Table 4.2b. In contrast, significant differences were found among cohort 1 vs. 3, with a value of 0.008 ($p< 0.05$), as shown in Table 4.2 b. For cohort 2 vs. 3 the value obtained using the Turkey HSD test was 0.508 ($p>0.05$), thus indicative of a statistically insignificant difference as presented in table 4.2 b.

Overall results of delayed recall among the groups showed a wide difference in total word recall by cohort one participant using low-context auditory mode compared

to cohort three participants using high-context audio-visual mode, as shown in table 4.2 b. The difference in word retrieval scores was less between the participants of cohort two using mid-context visual mode when compared to cohort one and cohort three.

### 4.3. Comparision for the performance on the immediate recall and delayed recall for each group

After examining the differences in values among groups, the paired t-test was administered to find if any difference was present within each group. So, the words recalled on day one- immediate recall (I.R.), were compared to those recalled on day three- delayed recall (D.R.) separately for each cohort by administering the paired t-test. Immediate and delayed recall values were analyzed separately in each cohort using SPSS software.

**Table 4.3**

*Comparison within cohorts using Paired-t Test*

| Parameter under comparison | Test Used | Values (p-value) |
|---|---|---|
| Cohort 1 - I.R. vs. D.R. | Paired T Test | 0.678 (p>0.05) |
| Cohort 2 - I.R. vs. D.R. | Paired T Test | 0.109 (p>0.05) |
| Cohort 3- I.R. vs. D.R. | Paired T Test | 0.025 (p<0.05) |

The analysis of data was done using paired t-test. Firstly, comparing I.R. and D.R. values for cohort 1, the value obtained was 0.678 (p>0.05), showing insignificant variability differences as depicted in Table 4c. Secondly, comparing the I.R. and D.R. scores of cohort 2, the f value obtained was 0.109 (p>0.05), thus showing a non-significant difference. Finally, For cohort 3, the value obtained was 0.025(p<0.05),

indicating a significant difference in the number of word recall on days one and three, as shown in Table 4. c.

So, there was no significant difference in words retained by participants when tested on day one versus when tested on day three if provided low contexts of auditory mode and mid context of audio-visual mode. However, if the rich context was provided to the participants through audio-visual mode, then there were significantly better scores on day one than on day three.

To summarize, the mean values of cohort 3 were highest, followed by cohort 2 and cohort 1. ANOVA test revealed significant differences of mean values among cohorts. Test of significance revealed that group scores of cohort 2 and 1; and cohort 3 and 1 was not statistically significant, while the learning scores of cohort 1 when compared to cohort 3 exhibited a significant difference. This indicated that the participants using high-context audio-visual and mid-context visual stimuli exhibited superior ability to learn words than those using low-context audio stimuli. An almost equal number of words are learned using mid-level and high-level contexts. From within-group comparison in immediate recall and delayed recall, there was no significant difference for cohort 1 and cohort 2, while there was a statistically significant difference in word recalled in IR and DR for cohort 3.

# Chapter V

## Discussion

The present study explores the effect of modality and contexts on word learning in young adults. It examines word learning through fast mapping and its retention in different time duration. The experiment included the pre-training, training, and testing phases. The sixty participants were randomly divided into three cohorts. During the pre-training phase, a baseline language competency assessment was done for English and Nepali languages. In the training phase, the first group of participants learnt the word with the auditory mode, using a low contextual stimulus consisting of Nepali words and their equivalent English words. The second group learned the novel words with the visual mode, using a mid-level contextual stimulus consisting of words in written orthography form, words in auditory form, and a picture of the words. For the third group, the participants learned the novel Nepali words in the audio-visual mode, using high contextual stimulus consisting of auditory words, their orthography, three sentences, and a picture. Three-word repetitions for fast map were kept constant over all three cohorts. Immediate recall was done after the training, and delayed recall was carried out after three days. The responses obtained from the participants were calculated and analyzed using the SPSS version 2.5.

The first objective of the study was to compare the total number of novel words learned across the low-level contexts, mid-level contexts, and high-level contexts on immediate and delayed recall tasks. The scores obtained showed differences in word learning across groups. The participants of the cohort- 3 using high contexts learned the maximum number of words, those in cohort -2 with mid contexts learned relatively

fewer words, while the participants in cohort- 1 using low contexts learned the minimum number of words, as depicted in Table 4.1 (pg 42). The statistical analysis using the Turkey HSD test revealed a significant difference in total words learned between cohorts 1 and 3, and, only minimal but statistically non-significant difference in cohorts 1 vs. 2 and cohort 2 vs. 3 as shown in Table 4.2 a ( pg 46) and Table 4.2 b (pg 47). Overall results showed a positive correlation between contexts and word recall, i.e., an increased word recall with the increasing order of context. The most plausible explanation for this positive correlation of word learning and contexts can be explained in account of two concepts: semantic activation and working memory loading.

Semantic activation refers to activating other related semantic nodes from a single-word presentation. So, the facilitation created by multiple activations leads to grasping the concepts faster and storing other diverse information related to the word in memory. By adopting this facilitation concept to explain the results in this current study, higher contexts might have activated plenty of lexemes semantic nodes, eventually enabling superior unconstraint learning. In contrast, low-context groups might have received deficient semantic information from the stimulus leading to lower learning scores. For example: to learn the word "*Kamila*- ant," the stimulus of the first cohort activated the lexical node of only ant, while the sentence stimulus of the third cohort activated nodes of ant, sugar, bite, and insect, so leading to the richer and finer conceptual learning through higher semantic activation. Another study has also favored this facilitation concept if provided high context stimuli .i.e (Huckin, 1993) 's study found context to help learn vocabulary better; (Valizadeh and Ahangari 2016) 's study found context to help learn idioms better, a study by Hunt, (Hunt, 1996) also supported context of known word facilitating learning of new words. Other authors Schouten-Van Parreren (1985), (Rodríguez & Sadowki, 2000), Mondria (1996), (Baleghizadeh &

Shahry, 2011) too found contexts helping better. An Indian study by Innaci & Sam (2017) also found contexts to facilitate learning. In contrast to studies favoring facilitation, some favor the inhibition concept from spreading activation. A study by (Beck et al., 1983) found that unnatural context did not facilitate learning.

In addition to semantic activation, cognitive loading can also be assumed to influence the results. Any learning task requires momentarily recognizing and memorizing the stimulus for future reference. The cognitive system, especially the executive system, has to balance this task of encoding the word form, spelling, pronunciations, understanding the meaning by associations, and remembering all these for a more extended period for word learning (Deconinck, Boer & Eyckmans, 2015). With this concept in the current study, for the first cohort, for learning the task, the cognitive system has to put equal effort into recollecting all information from the conceptual area by itself and then engage in strategic action for remembering. Conversely, the participants in the third cohort had to spend less effort building the concept because of already available richer conceptual stimuli, so these participants could spend time and focus on strategies to remember. The testimony of participants of cohort 1 about how relating and remembering the information simultaneously was complex also explains the same.

Based on the mean value, there was minimal difference between words learnt in mid and high context, and the difference was not significant statistically, as depicted in Table 4.2 (pg 46). Similar finding was found in other studies by other proponents like (Zarfsaz & Yeganehpour, 2021) where high context elicited equal learning as mid-context when studied on Turkish EEL learners. Similarly, the findings of (Khuwaileh, 1995), (Fukkink & de Glopper, 1998), (Mokhtar & Mohd Rawian, 2012) (Rodriguez

& Sadoski, 2000), Baumann et al., (2003), and has also proved the mid-context to be equal to high-context in facilitating word learning.

The probable assumption behind this result might be the participants' intactness of executive function and cognition. The study participants were bilingual neurotypical young adults, so they already might have known the tactics and strategies to learn a new language and word form. By analyzing the presence of stimuli and the task's difficulty, a healthy individual can tailor the tactics and strategies to learn. Similarly, the intact executive functioning of participants might have caused pre-analysis of the weaker stimuli, and they might have balanced it by employing higher cognitive tactics to overcome the degraded quality of stimulus, i.e., by cohort two. At first glance, such tactics may not be felt necessary by cohort 3 participants of rich stimulus. This could explain similar learning results by cohorts 2 and 3 with mid and high contexts. Once a word is learned, further context may not be necessary, so the participants of cohorts 2 and 3 might have equally focused on the word ignoring other unrequired semantic information, which can be another possibility resulting in an insignificant difference between cohorts second and third.

Meanwhile, the scores on delayed recall were slightly less than the immediate recall scores and were not statistically significant as depicted in Table 4.3 (pg 48). The instruction given before the task might have caused the participant to channel the information of both form, pronunciation, and meaning in long-term memory to its full potential from the beginning of the training stage and prevented information loss after days. This caused the immediate recall scores to almost equal the delayed recall scores. Some minute differences in behavior during the word recall were evident, i.e., the confidence of the retelling word form and faster reaction time of recall in immediate recall tasks that were absent in the delayed recall task, probably due to the recency

effect. However, the correct numbers of words recalled were almost similar in both immediate and delayed. The reaction time was not measured formally.

Interestingly, the immediate recall scores were significantly higher for cohort three than the delayed recall as depicted in Table 4.3 (pg 48). From this, we can infer that forgetting happened in this group more than in others. The reason that could explain the difference is that due to the rich semantic information, the participants might have focused more on the inference of the meaning and less on the phonological form during the initial encoding of day one. This resulted in effortful and erroneous word production at delayed recall task on day 3, creating a significant difference. This finding was also supported by studies by Laura (2021), (Mondria & De Boer, 1991), (Büchel, 2020), (Barcroft, 2006). A study by (Naraghizadeh & Barimani, 2013) showed learners exhibit short-term memory difficulties, repeated mispronunciations, and lack of user comprehension at delayed recall.

The second objective of the test was to compare the number of novel words learned across the auditory, visual, and audio-visual modalities on immediate and delayed recall tasks. After applying, paired tests and the turkey HSD test, it was found that the participants of cohort 1 using the auditory mode relatively learned the least words; those in cohort -2 with visual mode and minimal auditory mode learned relatively more words, while cohort- 3 with the audio-visual mode learned the highest number of words. On the statistical analysis, the pattern revealed a significant difference in total word learned of cohorts 1 and 3, while insignificant difference in cohort 1 vs. 2 and cohort 2 vs. 3 as depicted in Table 4.2 (pg 46). Though, the difference cannot be attributed solely to the modes, it is the interaction effect of modes and contexts during the task of word learning, a working memory comes in significant role

to comprehend the word and channelizing for storage in the long term memory along with its form, meaning and other associates.

The working memory comprises an orthographic buffer, phonological loop, visuospatial sketchpad, and central execution system (Baddeley, 2010). The scores obtained in the current study showed differences in word learning across groups. The modes are considered to utilize the different senses and more robust brain activation. Multi-sensory stimuli create broad activation in the brain and thus result in the connection from multiple sensory centers to the memory storage area. This might have caused cohort one with just auditory stimulus to perform the least, the second cohort to perform better, and the third cohort to perform better because of the broader range of neuronal activation to memory. The testimony of participants as remembering words after the fifth stimulus was challenging for the group of auditory modality while the same level of difficulty was felt around 15 th stimuli for the group of audio-visual modality also supports the above-stated reason.

The auditory modality group got loads on working memory from the task of self-assigning the semantic meaning and memorizing. Conversely, participants of the visual and audio-visual modality of cohorts two and three received orthographical information, pictorial information, and auditory information that activated multiple channels of input and stronger association of information. This boosted word learning in the audio-visual group better when compared to the visual or auditory mode groups. The current finding of audio-visual modality being superior to visual and auditory mode has been correlating to few articles exploring modality; the few proponents (Janfaza et al., 2014) found when lesser words were learned by using visual-only mode through the traditional reading book task; meanwhile, the group using computer-aided audio-

visual mode had learned more vocabulary. Another study (Behtash & Saed, 2018) also supported better learning with audio-visual mode.

# Chapter 6

## Summary And Conclusion

The current study investigated the novel word learning of L2 through a fast mapping process by modifying the contexts and modality. It also aimed to explore differences in word learning at separate time intervals. The study's objectives were to compare the total number of words learned across auditory, visual, and auditory visual modalities on immediate and delayed recall tasks; and the total number of words learned across low and high semantic contexts on immediate and delayed recall tasks.

The study involved a total of 60 participants; all were neuro-typical adults within an age range of 18- 30 years. Participants were chosen based on Nepali and English language competency. 20 novel Nepali words were chosen as stimuli. The experiment was conducted in three stages. Awareness and comprehension of targeted Nepali word stimuli were checked before training in the pretraining stage. The second phase was the training phase, where all 60 participants were trained to learn twenty novel Nepali words with three kinds of stimuli: low, mid, and high context stimulus, respectively presented via auditory, visual, and audio-visual modes.

Fast mapping exposure was done for all three cohorts, where every word was repeated thrice. The testing phase followed this, where pictures were shown, and participants recalled words verbally. Immediate recall commenced soon after training, while the post-training was done on the third day. A score of '1' was given for the correct response to word recall, and a score of '0' was given for incorrect responses if semantic and phonemic errors were presented. The scores were given for each of the twenty

words separately for all the participants on both days. All raw data were uploaded to the SPSS software for further statistical analysis.

On comparing the novel word learned between the cohort, one-way ANOVA was done to determine the significant difference across the groups. Furthermore, a more detailed analysis of each group was done by the Turkey HSD test. Overall tests revealed a significant difference in learning when cohort 1 was compared to cohort 3, while no significant insignificant differences was found when cohort 1 was compared to cohort 2, and when cohort 2 was compared to cohort 3.

For comparison of scores within a group in immediate and delayed recall tasks, paired t–test was administered. There was no significant difference across Cohorts 1 and 2, while there was a statistical difference in Cohort 3. The results clearly showed the possibility of learning Nepali novel words from a non native through fast mapping. Furthermore, the audio-visual mode was more beneficial than the solely auditory mode or solely visual mode. Also, the learning was facilitated by rich contextual information rather than weak contextual information.

**Implications of the study**

- The study was served as evidence for the statement, 'Second language learning was possible even after critical age.'
- Different factors like contexts can affect memory, and ultimately word learning was evident.
- The presence of high context can be useful for learning the language was evident. This information could be utilized to train the foreign language
- The semantic and phonological similarity of novel words with the known language could help in better learning the words was observed.

- Planning for the therapeutical intervention for disorder population with language impairment could be made based on the audio-visual modality and higher contexts, as it is found these two situation facilities the word learning.

**Limitation of the study**

- The current study was carried out in young adults. However, the generalization of results would not be appropriate on children and older adults.
- To prevent the risk of attrition of participants, the delayed recall task was carried out on the third day. Ideally, seven days should have been considered for delayed recall for actual phenomenon.
- Higher education was used as an indicator of normal intelligence and same was used as criteria for selection of participants. This simplified criteria might have overlooked many personal variables like individual learning capacity and their preferred modalities. This might have resulted some variations between persons.
- Variables like times of a day of exposure- morning, evening, afternoon; physical fatigues and stress prior to learning tasks was not considered to prevent deviancy from main research objective. This variables might have caused minute variations in learning.
- In Cohort 2 even if the cohort was named visual only modality, some auditory mode was also used. This was done to eradicate the chances of mis-pronounciation created by English alphabet to represents the sound of Nepali language.For example, both alveolar /ʈ/ and dental /t/ sounds are represented by same letter /t/, both aspirated /$b^h$/ and unaspirated sounds /b/ are again represented by same English letter /b/. So to avoid this confusion, the pronunciation of word was presented through auditory mode,along with presentation of written words and pictures. So, cohort two maynot be ideal example of solely visual modality.

- The preliminary attempt was made through this study to understand both mode's and context's influence on learning, and the obtained results was a composite of both contexts and modality. So, concluding separately the weightage of "x" context on learning or "y" modality on learning could not be done. Further study can resolve this weakness by modifying the research design.
- Novel Nepali words were presented to non native Nepali speakers with their own unique native language. Learning the novel words of foreign language might have been easier when the language family was similar than for participant with the distant family.For example: Nepali , Maithili and hindi shares a common Indo-Aryan family, so the native speakers of Hindi and Maithili might have extra advantage on learning over the other participants with Dravadian family background. Such analysis based on distance of native and novel language was not focused where which can stand as a variable.

**The future direction of the study**

- Future studies can be done by changing the research design to explore the separate effect of modality and context. i.e., by analyzing all three modalities under each contextual level or vice-versa.
- The future study can also include the other grammatical category, i.e., verbs and adjectives, to explore how nouns learning varies with the other word category learning.
- Qualitative analysis of the error could be done in upcoming studies to explore traces in the learning phenomenon.
- A similar study can be done by comparing different kinds of disordered population and their learning ability.i.e. Conduction aphasia's learning vs Anomic aphasia's learning, or learning of mild ASD vs mild ID to explore the difference, if any.

- Fast and slow mapping could be taken as variables in future studies.
- Future studies can be conducted by analyzing the relatedness of foreign language to the native language and its influence on language learning.
- Spaced retrieval is found to be effective in memorizing. Hence, the variable of spaced retrieval vs massed exposure can be done on the upcoming study, in addition to immediate and delayed recall to explore overall picture of memory.

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## Appendix A

## Stimulus for Cohort One

| SN | Nepali Words (IPA Transcription) | Word Meaning |
|---|---|---|
| 1 | *kapāl* | -Hair |
| 2 | *ʧarā* | -Bird |
| 3 | *keṭā* | -Boy |
| 4 | *bʰakundo* | -Ball |
| 5 | *faɹsi* | - Pumpkin |
| 6 | *maha* | - Honey |
| 7 | *giʈʈi* | -Pebble |
| 8 | *putali* | - Butterfly |
| 9 | *gudʰ* | - Glue |
| 10 | *kukʰuɹā* | - Hen |
| 11 | *killā* | - Screw |
| 12 | *koʈʰi* | - Mole |
| 13 | *kamilā* | - Ant |
| 14 | *paniyo* | - Spoon |
| 15 | *bʰādā* | - Utensils |
| 16 | *sikɹi* | - Necklace |
| 17 | *kʰuṭṭtā* | - Leg |
| 18 | *kʰām* | - Envelop |
| 19 | *siɹak* | - Blanket |
| 20 | *kopilā* | -Bud |

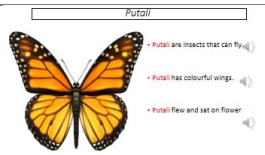
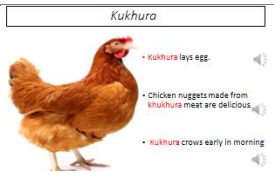
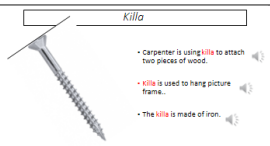
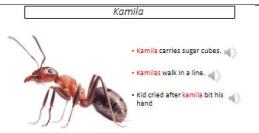
# Appendix B

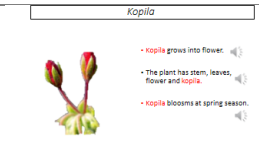
## Stimulus for Cohort Two

# Appendix C

## Stimulus For Cohort Three

| SN | Words (IPA) | Sentences | Presentation |
|---|---|---|---|
| **1** | *kapāl* | She will comb *kapāl*.<br>Her *kapāl* is lengthy and curly.<br>She applies shampoo on *kapāl.* |  |
| **2** | *ʧarā* | *ʧarā* flies in sky.<br>Many *ʧarā* are eating grains.<br>*ʧarā* has feathers and wings |  |
| **3** | *keṭā* | *keṭā* means boy.<br>*A keṭā* played ball.<br>*keṭā* wore shirt and trouser. |  |
| **4** | *bʰakundo* | *bʰakundo* is round.<br>Kids are playing *bʰakundo* .<br>Kick *bʰakundo.* |  |
| **5** | *faɹsi* | *faɹsi* are huge and round vegetable.<br>Halloween and *faɹsi* comes together.<br>I like a soup made from ripe *faɹsi*. |  |
| **6** | *maha* | *maha* is sweet.<br>Honeybee gives *maha*.<br>Drinking *maha* syrup and lemon is healthy |  |

| | | | |
|---|---|---|---|
| **7** | *giʈʈi* | People are throwing *giʈʈi* in pond to see ripples.<br>There are *giʈʈi* in riverbank.<br>This pavement is made from *giʈʈi*. |  |
| **8** | *putali* | *putali* are insects that can fly.<br>*putali* has colourful wings.<br>*putali* flew and sat on flower |  |
| **9** | *gudʰ* | She used *gudʰ* to stick papers on wall.<br>She purchased *gudʰ* from a stationary store.<br>*gudʰ* is extremely sticky |  |
| **10** | *kukʰuɹā* | *kukʰuɹā* lays egg.<br>Chicken nuggets made from *kukʰuɹā* meat are delicious.<br>*kukʰuɹā* crows early in morning |  |
| **11** | *killā* | Carpenter is using *killā* to attach two pieces of wood.<br>*killā* is used to hang picture frame..<br>The *killā* is made of iron. |  |
| **12** | *koʈʰi* | The thief has a black *koʈʰi* near his nose.<br>A *koʈʰi* is a type of birthmark.<br>*koʈʰi* are harmless black dots on skin. |  |
| **13** | *kamilā* | *kamilā* carries sugar cubes.<br>*kamilā* walk in a line.<br>Kid cried after *kamilā* bit his hand |  |

| | | | |
|---|---|---|---|
| **14** | *paniyo* | *paniyo* is the largest spoon.<br>Serve rice with *paniyo*.<br>Grab *paniyo* from utensils |  |
| **15** | *bʰādā* | There are *bʰādā* in kitchen.<br>Foods are served in *bʰādā.*<br>Put the dirty *bʰādā* in sink |  |
| **16** | *sikɹi* | *sikɹi* is expensive.<br>*sikɹi* is made up of gold.<br>She is wearing *sikɹi* around neck. |  |
| **17** | *kʰuṭṭtā* | *kʰuṭṭtā* is part of body.<br>Dogs have four *kʰuṭṭtā*.<br>Wear shoes in *kʰuṭṭtā*. |  |
| **18** | *kʰām* | I bought *kʰām*<br>I kept letter inside *kʰām* before posting.<br>*kʰām* is made from paper |  |
| **19** | *siɹak* | *siɹak* is heavy.<br>She wrapped the baby in a *siɹak.*<br>She put the *siɹak* over the child while sleeping. |  |
| **20** | *kopilā* | *kopilā* grows into flower.<br>A plant has stem, leaves, flower and *kopilā*.<br>*Kopilā* bloosms at spring season. |  |