

COMPARISON OF RULE-BASED LEARNING IN
MONOLINGUALS AND MULTILINGUALS

By

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COMPARISON OF RULE-BASED LEARNING IN
MONOLINGUALS AND MULTILINGUALS

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Abstract: The majority of multilingual research has studied monolinguals and bilinguals; however, with the increasing number of multilinguals, it is imperative to focus on multilingual language acquisition and retention. The current study compared the ability of monolinguals, bilinguals, and trilinguals to acquire and retain a morphosyntactic rule in a foreign language. Twelve monolingual, twelve bilinguals, and twelve trilingual participants completed a rule-based learning task. The participants were trained to use the preterite verb tense in Spanish, and their ability to retain this morphosyntactic rule was evaluated over three phases: baseline, immediate retention, and delayed retention. The accuracy of participants' responses and reaction time following the presentation of the stimuli was measured using E-prime software. The accuracy data found a significant main effect in the phases of learning across the participant groups. Similar results were noted for reaction time as well. There was a significant main effect of the phases of learning across the three groups for reaction time. All participants performed better during the delayed retention phase compared to immediate retention and baseline. Bilingual participants demonstrated better accuracy, while trilingual participants were the least accurate. On the contrary, trilingual participants had the shortest reaction time, while bilinguals had a longer reaction time. The current study found evidence for both facilitation and cross-linguistic interference during the process of language acquisition in multilinguals. Research in multilingual language acquisition suggests that previous language exposure may have both positive and negative impacts on novel language learning based on a range of factors.

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CHAPTER I

INTRODUCTION

Language acquisition has been a topic of interest for researchers for an extended period, due to the complexity and relevance of how language, a vital aspect of daily life, is developed. Much of the current research has studied monolinguals and bilinguals; however with the increasing number of multilinguals, it is imperative to focus on multilingual language acquisition and retention. There are many different perspectives on how to define multilingualism. The simplest of these definitions consider multilingual to demonstrate active understanding and use of two or more languages (Aronin & Singleton, 2012). Furthermore, multilinguals can be defined by the quantity of language they readily use, such as trilinguals utilizing three languages. One in three individuals speaks two or more languages throughout typical activities of life, such as work, school, and home (Wei, 2000). Due to the rising prevalence of multilingualism, researchers have begun to question if the acquisition of multiple languages has an impact on future language acquisition. Furthermore, does the language acquisition pattern look similar in monolinguals and multilinguals? Multilingual language acquisition is a web of intertwined characteristics that impact each other. While the process of learning an

additional language was previously described as a structured and uniform event, new research is redefining this process as variable and multidimensional (Canagarajah, 2007). The complexity of learning a language is compounded in multilinguals leading to a positive or negative effect on the process of language acquisition. A review of previous literature in multilingual language acquisition is necessary in order to provide a foundation of understanding, give an explanation for the hypotheses postulated in this study and identify how the results of this study will benefit current literature. Research within this domain has focused on facilitation of language, cross-linguistic interaction, and factors that influence language acquisition. The literature review for this study has been organized based on these domains.

CHAPTER II

REVIEW OF LITERATURE

Facilitation in Language Learning in Bilinguals and Trilinguals

In the scope of language, facilitation refers to factors that enhance language learning. Facilitation in multilinguals has increased complexity due to multiple languages involved. Past studies have examined the impact of bilingualism on the acquisition of other languages and found positive effects. Bilinguals tend to possess improved metalinguistic awareness, increased linguistic repertoire, and increased language-learning skills and strategies when compared to monolinguals (Cenoz, 2013).

Metalinguistic awareness is the intentional reflection and analysis of different aspects of language (Karmiloff-Smith et al., 1996; Hofer, 2015). Metalinguistic abilities are skills that allow individuals to distinguish the difference in the form and meaning of language to manipulate it (Jessner, 2008; Hofer, 2015). Metalinguistic awareness allows bilingual learners to view language in a more holistic and abstract manner (Moore 2006; Ransdell, Barbier & Niit 2006; Jessner 2008). Studies have shown that multilinguals demonstrate increased metalinguistic awareness. (Bialystok, 1986; Bialystok, 1988; Cromdal, 1999; Bialystok, 2006; Alsheikh, 2017).

Jessner (1999) mentioned that metalinguistic skills play a significant role in the cognitive process of language learning. Comparing and contrasting the native language while learning an additional language facilitates the development of metalinguistic awareness and skills. It also facilitates the acquisition of future languages in multilinguals by utilizing their understanding of language and language learning from experience and taking advantage of the linguistic skills, they have acquired through previous language learning. Jessner also states that trilinguals have enhanced ability to manipulate an additional language in comparison to bilinguals, and therefore trilinguals exhibit better metalinguistic awareness. It is proposed that cross-linguistic awareness, a part of metalinguistic awareness, is also advantageous in language acquisition as it helps multilinguals to compare multiple languages simultaneously, thus broadening their linguistic resources (Roehr-Brackin, 2018). Overall, proficiency in two or more languages has been reported to result in more advanced metalinguistic awareness, which in return facilitates the acquisition of language (Ringbom, 1987; Cenoz & Valencia, 1994; Lasagabaster, 1997; Jessner, 1999; Alsheikh, 2017).

Researchers have also investigated the involvement of linguistic repertoire and vocabulary development in the facilitation of an additional language in bilinguals and trilinguals. Bialystock et al. (2009) and Bilson et al. (2014) examined the similarities and differences in word development in bilingual and monolingual first-language learners. Bialystock et al. (2009) summarized findings on the linguistic performance of monolinguals and bilinguals. Research has consistently reported that bilinguals tend to possess a smaller vocabulary in each language than monolinguals. The authors elaborated that vocabulary often serves as a foundation for future language development and can

result in increased lexical links between languages. The authors' suggest that bilingualism may result in the facilitation or impedance of language acquisition. Bilson et al. (2014) evaluated the vocabularies of monolingual and bilingual children and concluded that monolinguals had a quicker rate of acquiring new words and linguistic concepts than bilinguals. While both monolinguals and bilinguals followed a similar structure in language acquisition, differences in the order of word learning and preference of the cueing between the groups were noted.

Studies have indicated a similar rate in learning words for concepts in bilinguals and monolinguals (De Houwer, Bornstein, & Putnick, 2013; Hoff et al., 2012; Cattani et al., 2014; Bilson, 2014) and similar abilities in relating words to objects in the environment (Byers-Heinlein & Werker, 2013; Werker, Byers-Heinlein, & Fennell, 2009; Bilson, 2014). Besides, studies have shown that monolinguals and bilinguals tend to acquire their first words around the same time (Vihman, Thierry, Lum, Keren-Portnoy, & Martin, 2007; Bilson, 2014). On the other hand, some research suggests that vocabulary development in monolinguals and multilinguals is different (MacLeod et al., 2018).

Researchers have determined that school aged multilingual children tend to score lower than monolingual children on vocabulary tests (Allman 2005; Bialystok et al. 2010; Uchikoshi 2006). MacLeod et al. (2017) compared vocabulary learning in monolingual and multilingual children to determine differences in the rate of vocabulary growth, size of vocabulary, and factors that influence vocabulary growth in monolinguals and bilinguals. After studying over 300 monolingual, bilingual and trilingual children before and after school entry, it was determined that all children experienced a steep increase in vocabulary size prior to school entry as a result of four main factors: the language of

assessment, age of onset of second-language acquisition, current language exposure pattern, and sociolinguistic context (MacLeod et al., 2017). However, multilinguals speaking a minority language showed a significant difference in both vocabulary size and growth at the start of school, but this difference diminished following the entry in school. The authors concluded that the status of the language spoken (minority language or not) had a significant impact on vocabulary development (MacLeod et al., 2017).

Another study examined the receptive vocabulary and linguistic understanding in Spanish-English bilingual preschoolers and found that the timing of English exposure with school entry had an impact on their Spanish and English development (Hammer et al., 2018). The study followed preschool bilinguals, who spoke Spanish and English for over two years. The children were placed in a school setting where all teaching and communication was English. Data was collected for two years, and growth rates indicated that the children exposed only to Spanish before school exhibited improved throughout the study. However, children with bilingual exposure before entering school did not demonstrate a change in their scores over the course of the study. The findings of this study indicate that the order and timing in which additional language is exposed to children, does have an impact on their ability to learn the language.

Bilson et al. (2015) examined 435 children between 6 months of age to 7 years of age who were bilingual and learning English. Results of vocabulary learning indicated that monolinguals had a quicker rate of learning words and linguistic concepts than bilinguals. It was noted that the monolingual and bilingual participants learned the vocabulary in a different order. The authors concluded that second language learning is an entirely different process than first language acquisition, as one language influences

the new language acquisition, learning words in one language will facilitate learning synonyms of the new language (Bilson et al., 2015). Overall, the influence that an individual's linguistic repertoire has on facilitating language acquisition has been associated with the closeness in languages, indicating that languages which are closely related are more useful for a bilingual learning a third language (Cenoz, Hufeisen & Jessner 2001, 2003; De Angelis 2007; Ringbom 2007; Jarvis & Pavlenko 2008).

It has been determined that efficient language-learning strategies also play a significant role in facilitating language acquisition (Nayak, Hansen, Krueger & McLaughlin, 1990; Wilson & Sperber, 2005; Kostić-Bobanović, 2011). There are varying perspectives on what language strategies are and how they aid the process of language acquisition. O'Malley (1985) explained learning strategies as procedures, while Rubin (1975) considered them to be devices or techniques. Overall, the consensus is that learning strategies are valuable resources that can be used to assist in the pursuit of knowledge (Griffiths & Oxford, 2014). Kostić-Bobanović (2011) compared the use of language learning strategies in monolinguals and bilinguals learning English as a foreign language. The study found that bilinguals utilized more strategies when learning a new language than monolinguals. More specifically, usage of memory and metacognitive strategies by bilinguals were reported to be statistically significant when compared to monolinguals. Memory strategies are techniques to help sending information into long-term memory and retrieving it when needed, in this instance for communication purposes. Examples of memory strategies include using imagery and sounds to remember new words. Metacognitive strategies pertain to the organization, direction, and coordination of

learning, self-evaluation, and goal setting involved in the management of learning (Kostić-Bobanović, 2011).

Psaltou-Joycey & Kantaridou (2009) studied 1555 Greek students classified as bilinguals or trilinguals of a variety of foreign languages to determine if differing levels of language competence in multilinguals correlated with the use of language strategies and learning styles. The results of the study indicated that trilinguals used more language strategies than bilinguals. More specifically, trilinguals demonstrated a greater use of strategies in the cognitive and metacognitive domains. Overall, it is not simply the strategies that facilitate language acquisition, but the ability of the multilingual learner to demonstrate greater flexibility than monolinguals in the application of these strategies (Nation & McLaughlin 1986; McLaughlin & Nayak 1989; Nayak et al. 1990).

Overall, the studies that pertain to language facilitation suggest that the knowledge of an additional language enhances metalinguistic skills and language learning strategies in bilinguals and trilinguals thereby positively influencing foreign language learning. However, there exists a controversy surrounding the nature of vocabulary development in bilinguals and trilinguals.

Cross-linguistic interference in bilinguals and trilinguals

Paradis & Navarro (2003) examined bilingual Spanish-English children to determine the presence of cross-linguistic interference and the impact of external factors on additional language acquisition. Researchers had reported that bilingual learners tend to experience interference of the languages during bilingual development. This interference can occur in the domains of phonology (Paradis, 2001), syntax (Döpke,

1998, 2000; Hulk & van der Linden, 1998; Yip, V., & Matthews, S. (2000.; Müller & Hulk, 2001), or morphology (Nicoladis, 2002).

Müller & Hulk (2001) sought to define the conditions that would allow cross-linguistic interference to occur in bilingual language learning. Their research determined that interference of language is most likely to be present in the pragmatic and syntax segment of the linguistic system. More specifically, this is the moment in the production of language at which the pragmatic context has an influence on the syntax structure that is selected.

Ahkukana et al. (1981) studied interference and second-language acquisition. Their research aimed to determine whether errors in second-language learning were a result of interference or external factors, such as the structural complexity of a language. To evaluate this theory, they recruited forty participants who were in their second year in the Department of French at a Nigerian university. Twenty of those participants had no French history, and the other twenty had a minimum of five years of exposure learning the French language. The results of the studies explained that the lack of error patterns was indicative of influence from external factors as opposed to cross-linguistic interference.

Bartolotti and Marian (2012) claimed that the acquisition and activation of multiple languages would result in competition between the languages. To test this claim, twelve Spanish-English bilinguals and twelve English monolinguals were taught an artificial language designed to elicit language competition and tested on the language by measuring eye-tracking and mouse-tracking. The results indicated that bilinguals reduced

cross-linguistic interference more effectively than monolinguals, likely due to experience in managing multiple languages.

Chan et al. (2017) compared monolinguals and trilinguals, speaking Cantonese, English, and Mandarin, explicitly targeting the influence of cross-linguistic interference during language acquisition. Both facilitation and competition were reported. Facilitation occurred with Mandarin due to overlap in the form and function from other language structures. Competing structures in English and Cantonese resulted in increased errors indicating cross-linguistic interference. Overall, Chan et al. (2017) demonstrated how the presence of multiple linguistic structures and backgrounds could have both a positive and negative effect on the further language acquisition explained by the processes of facilitation and interference.

There have been limited studies that examined cross-linguistic interference in bilinguals and trilinguals, and therefore there is limited information on the positive or negative effect of cross-linguistic interference on foreign language learning. More studies need to corroborate the impact of cross-linguistic interference across various tasks.

Factors that affect bilingual and trilingual language learning

There are numerous extraneous factors that impact the acquisition of a second and third language (Herdina & Jessner, 2000; Kaipa, 2018). Researchers have divided these factors into two categories: internal and external factors. Internal factors involve the state of the individual, such as language aptitude, cognitive styles, motivation, and personality. The internal factors include language aptitude, cognitive styles, motivation, and personality (Kaipa, 2018). These factors place some individuals at an advantage when acquiring language. On the other hand, external factors consist of variables that are apart

from the individual, such as the language setting, age of acquisition, educational context, ethnolinguistic significance, and socioeconomic factors. The external factors consist of the educational context, language setting, ethnolinguistic significance, and socioeconomic status (MacLeod et al., 2017; Kaipa, 2018).

An additional external factor in the success of acquiring a second or third language is the type of training that is administered. Research shows that there is a significant difference in the ability to retain a new language depending on the method that was used in learning the language. Bloom and Shuell (1981) compared massed and distributed practice on the learning and retention of second-language vocabulary in French. They found that distributed practice, consisting of three 10-minute units on three consecutive days, and massed practice, all units being completed on the same day during 30 minutes, resulted in nearly identical scores when tested immediately after. However, the authors found that four days later, the participants in the distributed practice performed better than those in the massed practice.

Nation (2003) discussed several techniques to incorporate the first language in creating a positive and effective environment for learning a foreign language in the classroom. Language focused learning, or teaching with language as the target, was discussed, and it was determined that through much research translation from language, one is the most effective method of learning.

As discussed in the previous section, language-learning strategies and the use of these strategies has been classified as a significant factor influencing language learning (Kostić-Bobanović, 2011). The importance of language learning extends beyond the initial acquisition of language. These strategies provide valuable insight into the structure

that makes up the language. Overall, utilizing language-learning strategies allows an individual to apply what they have learned about one language to another language that is being acquired.

Models of Bilingual and Trilingual Language Acquisition

A variety of linguistic models have been proposed in an effort to better understanding the process of language acquisition in monolinguals, bilinguals, and trilinguals. The most commonly utilized models that examine the acquisition of L3 include: the L1 transfer hypothesis, the L2 status factor model, the cumulative enhancement model, the typological primacy model, and the scalpel model of L3 acquisition (Kaipa, 2018). The L1 transfer hypothesis claims that L1 has a direct influence on L2 and L3 acquisition (Ranong & Leung, 2009; Jin, 2009; Hermas, 2010). The L2 status factor model opposed the L1 transfer hypothesis by stating that L2 plays a critical role in the process of trilinguals acquiring morphosyntactic elements (Bardel & Falk, 2007). The cumulative enhancement model highlights the grammatical development of a language, stating that all languages previously acquired may influence L3 acquisition (Flynn, Foley, & Vinnitskaya, 2004). The typological primacy model suggests that L3 acquisition is affected by the similarity of L1 and L2 grammar (Rothman, 2011, 2015). Finally, the scalpel model proposes that trilinguals have the ability to acquire precise grammar in L1 and L2 (Slabakova, 2017). Overall, knowledge of the current models of language acquisition provides valuable insight into the factors involved in the process of novel language learning.

Bilingual and Trilingual Morphosyntactic Acquisition

Morphosyntactic acquisition refers to the acquisition of morphologic and syntactic aspects of language (Hedge & Pomaville, 2013). Morphologic rules help to modify the meanings of words, phrases, and sentences, whereas syntactic rules help in the formulation of acceptable phrases and sentences. Morphosyntactic acquisition is one of the most frequently researched domains in bilingual research (Kroll & De Groot, 2009). Tense refers to the location of an event on time by giving a reference point at the time of speech (i.e., past or present), while aspect describes the temporal makeup of a verb or predicate (Comrie, 1985; Comrie, 1976).

There are two contradicting theories that explain morphosyntactic acquisition in bilinguals; Separate Development Hypothesis (SDH) and Interdependent Development Hypothesis (IDH). SDH claims that in bilingual children the morphosyntactic development of one language does not have a notable effect on the morphosyntactic development of the other language (Meisel, 2001; De Houwer, 2009), while IDH suggests that morphosyntactic acquisition of the second language in bilinguals is dependent on their first language (Cummins 1978, MacWhinney, 2009). The proponents of SDH suggest that multilinguals who have better morphosyntactic skills would find it easy to acquire additional languages due to more developed morphological and syntactic skills (De Houwer, 2009). Daana (2018) examined the Separate Development Hypothesis through the analysis of the phonological development of bilingual children speaking English and Jordanian Arabic. Data on the presence of phonological processes in both languages was also collected to simplify the production into segments in order for analysis between the languages. Results for the study indicated that the development of

segments was consistent with trends and phonological processes (e.g., assimilation, substitution, metathesis) being found in both languages. Overall, this research provides supportive evidence of the Separate Development Hypothesis or the notion that morphosyntactic skills of one language do not impact the development of morphosyntactic skills in another language.

Hanna et al. (2016) suggested demonstrating proficiency in the grammar of the second language poses additional problems than mastering the lexical elements of the language. This motivated researchers to attempt to answer the question of why and how this difference in grammar learning and lexical learning is present. For this study, they decided to use the neurophysiological index of mismatch negativity (MMN), which has the ability to change acoustic items (i.e. amplitude, latency) and linguistic features (i.e. semantics, morphology, syntax). After measuring the syntactic proficiency of native and non-native English speakers, it was determined that second-language English learners demonstrated native-like grammar processing reflected in MMN when presented with incorrect subject-verb agreements. The implications of this study include the ability of second-language learners to develop grammar sensitivity physiologically similar to native speakers when asked to discern a grammatical rule.

Several studies have been conducted to analyze aspects of acquiring Spanish as an additional language. Barreña & Almgren (2013) evaluated the acquisition of verb-object and object-verb order in Spanish and Basque by studying simultaneous bilinguals and successive bilinguals in comparison to monolingual speakers. Spanish and Basque were chosen to study as they differ in terms of word order, Spanish following the subject-verb-object structure, and Basque adhering to the subject-object-verb format. They concluded

that bilingual children utilize the same syntactic patterns as their monolingual counterparts. Moreover, the presence of multiple languages did not appear to interfere when differentiating the word order. It was also concluded that Spanish children utilized the verb-object word order more frequently.

Fafulas (2010) investigates the acquisition of different structures in Spanish, specifically targeting the present progressive aspect. The study examined second-language learners acquiring Spanish. Results indicated that the lexical aspect, semantics of the adverb, and participant group are significant factors involved in predicting verb forms for second-language Spanish learners.

Dolgunsöz (2013) attempted to uncover any differences in developing grammar strategies with monolinguals learning a second language or bilinguals learning a third language. It was hypothesized that trilinguals would have superior grammar strategies when compared to monolinguals due to the increase in linguistic knowledge and experience. To test this, three groups of bilinguals were compared with a group of trilinguals through the use of a qualitative questionnaire. The author concluded that the number of languages known is strongly correlated with the frequency of grammar strategy use (Dolgunsöz, 2013).

Fabiano-Smith & Goldstein (2010) determined that when bilinguals are compared to monolinguals, there is higher production accuracy with sounds that are shared between languages. In addition, greater transference to phonetic inventories has been seen with bilinguals (Gildersleeve-Neumann et al., 2008; Fabiano-Smith & Barlow, 2010; Fabiano-Smith & Goldstein, 2010; Keffala, 2016).

The aforementioned studies suggest that learning of an additional language might follow a different trajectory in trilinguals and bilinguals when compared to monolinguals. However, there has been very limited research that examined the morphosyntactic acquisition in trilinguals.

Statement of the problem

While the above studies further our understanding on bilingual and trilingual foreign language learning, they also present with considerable limitations. There have been equivocal results regarding language facilitation and cross-linguistic interference in multilingual (bilingual and trilingual) morphosyntactic acquisition. It is not clear whether trilinguals will exhibit cross-linguistic interference or facilitation when acquiring the morphosyntax of a foreign language. Studies related to language facilitation suggest that trilinguals might be at an advantage when learning a foreign language, while studies on cross-linguistic inference suggest that monolinguals might find it easy to learn an additional language when compared to bilinguals and trilinguals (Cenoz, 2013; Cromdal, 1999; Bialystok, 2006; Alsheikh, 2017; Cenoz & Valencia, 1994; Lasagabaster, 1997; Jessner, 1999; Alsheikh, 2017; Cenoz, 2013; Paradis, 2001; Hulk & van der Linden, 1998; Yip & Matthews 2000; Müller & Hulk, 2001; Nicoladis, 2002).

Past studies have mostly focused on various strategies that helped in learning a foreign language in multilinguals and not on the morphosyntactic acquisition of foreign language in this population (Nayak, Hansen, Krueger & McLaughlin, 1990; Wilson & Sperber, 2005; Cenoz, 2013). However, none of these studies manipulated the process of language learning in trilinguals and bilinguals by exposing them to a foreign language and examining their ability to acquire the morphosyntax of the foreign language. This

line of research will inform us whether trilinguals learn the morphosyntax of a foreign language in a similar manner to that of bilinguals and monolinguals.

Current study

In contrast to the observational methodology of previous studies in trilinguals, the current study employed a quasi-experimental design to compare the ability of monolinguals, bilinguals, and trilinguals to acquire and retain a morphosyntactic rule in a foreign language. The participants were trained to use the preterite verb tense in Spanish, and their ability to maintain this morphosyntactic rule was evaluated. The study comprised three phases; baseline, immediate retention, and delayed retention. The baseline session assessed the background knowledge of the participant's preterite form. The retention sessions (immediate and delayed) evaluated the participant's ability to learn the morphosyntactic rule in the new language. Participants were trained on present tense as well as preterite form. The training lasted for two days, and a PowerPoint presentation was used for training. All participants completed an immediate retention session on Day 2 after training and delayed retention on Day 3. The reaction time and accuracy were measured across all participants during the three phases of learning. Based on past studies, the following hypotheses were postulated.

Hypothesis 1: Trilingual participants will exhibit better accuracy and reaction time during the acquisition and retention of morphosyntactic rule when compared to bilingual and monolingual participants.

Rationale: Facilitation of language and more advanced language manipulation skills will result in trilinguals demonstrating the highest accuracy and quickest reaction time. Proficiency in two or more languages has been reported to result in more advanced

metalinguistic awareness, which in return facilitates the acquisition of language (Ringbom, 1987; Cenoz & Valencia, 1994; Lasagabaster, 1997; Jessner, 1999; Alsheikh, 2017; Bialystok, 1986; Bialystok, 1988; Cromdal, 1999; Bialystok, 2006). It has been determined that efficient language-learning strategies and the ability of the multilingual learner to demonstrate greater flexibility than monolinguals in the application of these strategies also play a significant role in facilitating language acquisition (Nation & McLaughlin 1986; McLaughlin & Nayak 1989; Nayak et al. 1990; Wilson & Sperber, 2005; Kostić-Bobanović, 2011).

Hypothesis 2: The participants will exhibit better accuracy and reaction time during the delayed retention phase when compared to other phases of learning.

Rationale: With greater exposure to the morphosyntactic rule, participants will perform better during the delayed retention phase of learning than the baseline and immediate retention phases. Motor learning literature on language acquisition supports greater gains in learning with distributed practice as opposed to massed practice when acquiring novel utterances and vocabulary in a language (Bloom and Shuell, 1981; Kaipa, Howard, Kaipa, Turcat & Prema, 2020).

CHAPTER III

METHODOLOGY

This study followed a quasi-experimental research design. The study was approved by the Institutional Review Board approval at Oklahoma State University. All the participants provided written consent before their participation in the study. The following section details participants, stimuli, procedure, and analysis.

Participants

Twelve monolinguals, twelve bilinguals, and twelve trilinguals between the ages of 18-55 years without background knowledge of Spanish participated in this study (23 females, 12 males) ($M=31.39$; $SD= 12.59$). The demographic details of the participants are provided in Tables 1, 2, and 3. The participants were recruited using a non-probability convenience sampling and were not matched according to age or sex. The monolingual group consisted of native speakers of Standard American English ($M= 29.75$; $SD= 14.60$). The bilingual group included individuals who spoke English in addition to one other language, excluding Spanish ($M=29$; $SD= 11.23$). The trilingual group included individuals who spoke English in addition to two other languages, excluding Spanish ($M= 35.42$; $SD=11.76$). A heterogeneous group of bilinguals and trilinguals were recruited for the study considering the geographical location where the current study was conducted. The monolingual participants were all born and raised in the United States

(U.S.A.). The majority of the bilingual and trilingual participants were raised in another country and immigrated to U.S.A at various ages in adulthood. The bilingual and trilingual participants successively learned L2 and L3. All participants reported no history of sensory, motor, or cognitive abnormalities, and completion of a high school diploma.

Stimuli

One hundred and eighty Spanish sentences served as stimuli for the study. One-hundred-ten of the 180 sentences selected were in the preterite form or past tense. The remaining 70 sentences were in the present tense. Variations of sentences were created in Spanish by using English equivalents of the pronoun he, she, and they. These sentences had an equal amount of regular and irregular Spanish verbs. The verbs considered for the study were selected based on the frequency of use in Spanish. Each of these sentences was produced by a native Spanish speaker and recorded using PRAAT software. A picture was provided with each sentence as a visual cue to identify the associated verb. E-prime software was used for stimulus presentation and data collection (E-studio, Psychology SoftwareTools, Inc) (Schneider, Eschman, & Zuccolotto, 2002). The stimulus used for the current study is provided in appendix 1.

Procedure

Before the start of the experiment, each participant was required to complete a consent form and the Language Experience and Proficiency Questionnaire (LEAP-Q) (Marian, Blumenfeld, & Kaushanskaya, 2007). The LEAP-Q was utilized to determine the linguistic background of the participants, including their proficiency in each language and a timeline of language acquisition. Following this, participants completed the baseline phase, training phase, and retention phase, which lasted for three consecutive

days. The training phase comprised of the first two days lasting 25-35 minutes each day. The retention phase lasted 15 minutes long on Day 2 and Day 3. Each of these phases is explained in detail below. Participants received ten dollars as compensation for participating in this study.

E-prime software was used for stimulus presentation during baseline, immediate retention, and delayed retention tasks (E-studio, Psychology SoftwareTools, Inc). The participants were instructed to look at the computer screen and follow the instructions that appeared on the screen. A 1500 ms blank screen appeared on the screen, followed by the instructions. Each trial was comprised of a fixation cross at the center of the computer for 500 ms, followed by the appearance of the stimulus for 5000 ms. The inter-stimulus interval (ISI) was 500 ms. Each trial during the baseline, immediate retention, and delayed retention tasks presented an audio recording of a native Spanish speaker with a picture of the verb on the screen. The participant was required to identify if the verb in the audio recording is a preterite form or not. The reaction time and accuracy of the participants were computed for all the three days across the baseline, immediate retention, and delayed retention tasks. The reaction time was measured as the duration between the presentation of the stimulus and initiation of response from the participant. Ten verbs in three variations using English equivalents of the pronoun he, she, and they were presented across the tasks. In order to receive 1 point, the participant had to correctly identify the verb tense in two out of the three presentations, resulting in 10 possible points.

Baseline Phase (Day 1): This phase collected the baseline knowledge of participants on Spanish preterite forms and determined their initial accuracy and reaction

time. Forty sentences were used to assess baseline performance. The baseline session lasted for about 15 minutes.

Training Phase (Days 1 & 2): All the participants were trained to use the preterite form in Spanish. Participants were trained using 25 sentences on Day 1 and an additional 25 sentences on Day 2. Training stimuli consisted of 50 total sentences presented in Spanish and English. Twenty-five sentences were presented in the present form, and 25 sentences were presented in the past form. The Spanish and English forms of both present and past tense sentences were presented on the same slide with a picture depicting the meaning of the sentence. Participants were played an audio recording of the sentence and asked to repeat them. The present tense and past tense audio recordings were each played five times, and the participant repeated it five times. One day of training consisted of a total of 250 repetitions. Microsoft PowerPoint was used for training the participants.

Retention Phase (Day 2 & 3): Following training, on Day 2, immediate retention was carried out to measure the immediate performance of the participants. The third day served as the delayed retention phase, during which the participants were tested on their ability to identify preterite tense forms in Spanish using 40 additional sentences similar to the ones used in the training phase. A schematic representation of the three phases is shown in Figure 1.

Statistical analysis

E-data aid of the E-prime software was used to analyze the accuracy and reaction time of the participants. The total number of correct preterite forms identified by the participant provides the accuracy score. The accuracy scores were converted to a percentage. The time taken by the participant to respond to the stimulus after its onset

determined the reaction time. The reaction time was measured in milliseconds (ms). The data was entered into SPSS 23.0 (IBM Corp., Armonk, NY) for statistical analysis. The accuracy and reaction time of the participants were compared using a mixed-model analysis of variance (ANOVA). Separate ANOVAs were carried out for accuracy and reaction time. The data were analyzed as a function of phases of learning (baseline, immediate, and delayed retention). The between-group factor was the three groups (monolingual, bilingual, and trilingual) and within-group, factors were the phases of learning points. The alpha value was set at .05.

CHAPTER IV

RESULTS

The results of the mixed-model analysis of variance for accuracy data revealed that there was a significant main effect of the phases of learning, $F(2, 66) = 54.93, p < .001$ and the participants performed better on delayed retention ($M = 85.91, SD = 8.62$) in comparison to immediate retention ($M = 80.75, SD = 13.32$) and baseline ($M = 63.49, SD = 13.64$). In addition, there was also significant difference in learning across the three groups, $F(2, 33) = 4.94, p = .013$. The bilingual participants ($M = 81.55, SD = 13.55$) had higher accuracy over monolingual ($M = 77.58, SD = 8.18$) and trilingual participants ($M = 71.03, SD = 10.82$). Figure 2 displays the estimated marginal means of the accuracy data in percentage.

The second analysis compared the reaction time of the participants across three groups and the three learning phases. The results suggest that there was a significant main effect of the phases of learning, $F(1.47, 48.44) = 57.95, p < .001$ and the participants had shorter reaction time for delayed retention ($M = 2941.16, SD = 1191.79$) in comparison to immediate retention ($M = 3428.93, SD = 1069.69$) and baseline ($M = 4528.99, SD = 1405.35$). In addition, there was also significant difference in learning across the three groups, $F(2, 33) = 3.84, p = .03$. The trilingual participants ($M = 2969.38, SD = 1163.67$) had shorter reaction time over monolingual ($M = 3735.35, SD = 1226.68$) and bilingual

participants ($M = 4069.62$, $SD = 936.66$). Figure 3 displays the estimated marginal means of the reaction time data in millisecond.

CHAPTER V

DISCUSSION & CONCLUSION

Discussion

There have been no experimental studies in the past that compared the accuracy and reaction time of monolinguals, bilinguals, and trilinguals when learning the morphosyntactic rule of a foreign language. The aim of this study is to evaluate whether multilinguals are at an advantage when acquiring a grammatical rule in a novel language. The results of the current study revealed bilingual participants had higher accuracy scores than monolinguals and trilinguals during the acquisition and retention of morphosyntactic rules. In regards to reaction time, trilingual participants were faster than monolinguals and bilinguals. The participants significantly differed from one another on accuracy and reaction time across the three phases of learning. The participants demonstrated higher accuracy and shorter reaction time during the delayed retention phase in comparison to other phases of learning. The results have been explained based on the hypotheses stated earlier.

Accuracy and Reaction Time during the Acquisition and Retention of Morphosyntactic Rule

Trilingual participants exhibited the least accuracy when compared to other groups during the acquisition and retention of the morphosyntactic rule. The accuracy data did not find evidence for the initial hypothesis stated. Cross-linguistic interference, the

cognitive burden, and amalgamated grammatical system in trilinguals account for their low accuracy rate (Döpke, 1998, 2000; Hulk & van der Linden, 1998; Yip, V., & Matthews, 2000; Müller & Hulk, 2001; Nicoladis, 2002; Amaral & Roeper, 2014; Rothman 2015; Slabakova, 2016).

Researchers have evaluated the possibility of competition across the various language systems in trilinguals and suggested cross-linguistic influence as one of the reasons for the slow acquisition of grammar in the foreign language (Slabakova, 2016; Chan et al., 2017). Chan et al. (2017) compared cross-linguistic interference in monolinguals and trilinguals during language acquisition. Trilingual children proficient in Cantonese, English, and Mandarin were compared with the control groups of monolingual children fluent in Mandarin and a group of monolingual children fluent in Cantonese. Subject and relative object clauses were presented, and participants were required to indicate their understanding of complex relative clauses. The results of the study found that trilinguals experienced facilitation when processing relative clauses in Mandarin due to the overlapping form and function of Cantonese. In addition to language facilitation, the authors found evidence for cross-linguistic interference from the error rate of the participant. Thus, the study demonstrated how the presence of multiple competing linguistic structures could have a negative effect on language acquisition. In the present study, during the identification of morphosyntactic rule in the immediate and delayed retention phases, the presence of three languages would have negatively affected the performance of trilinguals resulting in lower accuracy rate (Döpke, 1998, 2000; Hulk & van der Linden, 1998; Yip, V., & Matthews, 2000; Müller & Hulk, 2001; Nicoladis, 2002). The grammatical system in trilinguals is amalgamated, making it dynamic when

compared to monolinguals, and this would have contributed to the low accuracy rate in trilinguals (Amaral & Roeper, 2014).

Another explanation for the low accuracy rate in trilinguals is the cognitive burden due to the presence of an additional grammatical system. Trilinguals who acquire their L3 early in their life tend to find the acquisition of grammar easy when compared to those who acquire L3 in their later life (Rothman, 2015; Slabakova, 2016). Considering this, it is possible that the trilinguals would have found it challenging to learn the morphosyntactic rule in a foreign language and thereby resulting in low accuracy across the three phases of learning.

Concerning reaction time, trilingual participants demonstrated the shortest reaction time when compared to monolinguals and bilinguals. A potential explanation for the difference in reaction time is the speed-accuracy tradeoff (SAT). Within the framework SAT, the decisions made slowly tend to be accurate in comparison to the faster responses, which results in a high error rate (Chittka, Skorupski & Raine, 2009; Kaipa, 2016; Donkin, Little, & Houpt, 2014). Donkin et al. (2014) explained how individuals could decide to focus on producing quicker responses while disregarding their accuracy. Researchers found that when participants emphasized speed, they failed to attend to all the information presented, resulting in lower accuracy scores. They further explained the phenomena by claiming that participants trade accuracy for speed by not only processing less of the information but also utilizing strategies to maximize the efficiency and reduce the load on their processing system. Another study determined that the number of languages known is strongly correlated with the frequency of grammar strategy use (Dolgunsöz, 2013). While this phenomenon would explain the quicker

reaction time, its application is limited by the decreased accuracy found in trilingual participants.

The short reaction time in trilinguals can be explained using the parasitic model within the domain of multilingual lexical processing (Hall & Ecker, 2003; González Alonso, 2012). This model suggests that foreign language entries in multilinguals (trilinguals) are parasitic on the well-established L1, L2, and L3 hosts. Thus, trilinguals would have employed the cues across these languages to encode and decode the new entries.

Bilinguals exhibited superior performance on accuracy when compared to other groups. This finding may be explained by bilinguals demonstrating more developed metalinguistic awareness. Research suggests that bilinguals have better metalinguistic knowledge and tend to display better ability to reflect on the language and to manipulate it (Ben-Zeev, 1977a, 1977b; Bialystok, 1991, 2001; Cenoz, 2003; Cummins, 1978; Ianco Worrall, 1972; Ricciardelli, 1992). Thus, bilinguals would have been able to learn Spanish better than monolinguals. In the case of trilinguals, the cognitive burden because of the three languages and cross-linguistic influence would have been detrimental in the acquisition of morphosyntactic rule in Spanish. It would have resulted in reduced accuracy in comparison to bilinguals. There are limited studies that explored the metalinguistic skills of trilinguals.

Although bilingual participants demonstrated the highest accuracy, they were also found to have the slowest reaction time. Bilinguals' decreased reaction time may be as a result of the speed-accuracy tradeoff previously discussed. Another possible explanation is a difference in the manner of learning for monolingual versus multilingual participants.

While the training was presented in the same manner for all participant groups, differences in the processing of information may contribute to the discrepancy. A study conducted by Bilson et al. (2015) determined that vocabulary learning indicated that monolinguals had a quicker rate of linguistic concepts than bilinguals. It was noted that the monolingual and bilingual participants learned the vocabulary in a different order.

While some research has evaluated factors that may influence second and third language acquisition, there is limited information specific to the acquisition of the Spanish language, or, more specifically, the preterite form of Spanish. One study conducted by Paradis, Nicoladis, Crago, & Genesee (2011) evaluated bilingual children's acquisition of the past tense by implementing a usage-based approach. Results from their study suggest that input factors can have an impact on children's acquisition rates. Their study found that both bilingual and monolingual children were less accurate with irregular past tense forms, and bilingual children were as accurate as monolinguals in their language with the greatest exposure. Statistical analysis was not performed on participants' accuracy with different verb types. However, participants appeared to retain preterite patterns with the regular verbs quicker than irregular forms

Accuracy and Reaction Time across the Phases of Learning

The accuracy and reaction time of the participants during the baseline phase, the immediate retention phase, and the delayed retention phase were measured and compared across the three groups. The participants exhibited higher accuracy and faster reaction during the delayed retention phase when compared to other phases. The performance of participants on immediate retention was better than the baseline. These results are in support of the initial hypothesis postulated.

Although there are no studies that trained participants on the morphosyntactic rule and compared their ability to identify rule after two days of practice, similar training studies are commonly seen in motor learning literature on language learning. Bloom and Shuell (1981) compared massed and distributed practice on the learning and retention of second-language vocabulary and found significant learning after three days of training in participants who were assigned to the distributed practice group. Another recent study by Kaipa and colleagues (Kaipa et al., 2020) found similar results. Researchers compared the effects of massed versus distributed practice when learning novel foreign language utterances. The participants' phonetic accuracy and naturalness of productions were assessed, and results indicated that individuals in the distributed practice group demonstrated better learning than those being taught through massed practice.

The current study also found that participants across all the three groups acquired the morphosyntactic rule and retained it even after two days of learning and thereby demonstrating significant learning. The training session that was distributed across two days was effective. It brought about significant change in the participants' knowledge of preterite forms as well as the ability to identify preterite forms from non-preterite forms.

Limitations

The current study is not without limitations, and these limitations need to be taken into account while generalizing the results. The geographical location limited the number of participants recruited for the study. Few of the monolingual participants had passive exposure to Spanish and would have impacted participants' accuracy during the experimental portion. The current study did not follow stringent selection criteria, and therefore the bilingual and trilingual participants spoke a variety of languages.

Similarities between these languages and Spanish may have placed some participants at an advantage when learning the morphosyntactic rule. These limitations have impacted the generalizability of the results.

Conclusion

As the prevalence of multilingualism is on the rise, it is essential that the complex process of language acquisition in individuals who are proficient in multiple languages be examined. This study sought to evaluate whether being proficient in two or more languages has an impact on an individual's ability to acquire a morphosyntactic rule in a foreign language. Our findings suggest that multilinguals experience both cross-linguistic interference and facilitation during the process of novel language acquisition. Additional research is warranted to understand further all the factors that influence the process of multilingual language acquisition.

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APPENDICES

Appendix 1: Stimulus list (Experimental Sentences and Training Sentences)

Experimental Sentences	
English Sentences	Spanish Sentences
We carried a backpack.	<i>Nosotros llevamos una mochila.</i>
He carried a backpack.	<i>Él llevó una mochila.</i>
We helped the restaurant.	<i>Nosotros ayudamos al restaurante.</i>
They won the game.	<i>Ellos ganaron el juego.</i>
She ate the food.	<i>Ella comió la comida.</i>
They worked at the restaurant.	<i>Ellos trabajaron en el restaurante.</i>
We worked at the restaurant.	<i>Nosotros trabajamos en el restaurante.</i>
They helped John.	<i>Ellos ayudaron a John.</i>
We helped the restaurant.	<i>Nosotros ayudamos al restaurante.</i>
She worked in the restaurant.	<i>Ella trabajó en el restaurante.</i>
He ate the food.	<i>Él comió la comida.</i>
John ate at the restaurant.	<i>John comió en el restaurante.</i>
John won a backpack.	<i>John ganó una mochila.</i>
She helped John.	<i>Ella ayudó a John.</i>
She carried the cat.	<i>Ella llevó el gato.</i>
He drank water.	<i>Él tomó agua.</i>
He studied the game.	<i>Él estudió el juego.</i>
He lifted the water.	<i>Él levantó el agua.</i>
She lived in Oklahoma.	<i>Ella vivió en Oklahoma.</i>
They drank water.	<i>Ellos tomaron agua.</i>
He asked about the food.	<i>Él preguntó por la comida.</i>
They studied the menu.	<i>Ellos estudiaron el menú.</i>
She drank water.	<i>Ella bebió agua.</i>
We studied the menu.	<i>Nosotros estudiamos el menú.</i>
He lived in Oklahoma.	<i>Él vivió en Oklahoma.</i>
They study the menu.	<i>Ellos estudian el menú.</i>
They lived in Oklahoma.	<i>Ellos vivieron en Oklahoma.</i>

We studied the menu.	<i>Nosotros estudiamos el menú.</i>
We asked about the menu.	<i>Nosotros preguntamos por el menú.</i>
She lifted the cat.	<i>Ella levantó el gato.</i>
He heard the dog.	<i>Él oyó al perro.</i>
She had a backpack.	<i>Ella tuvo una mochila.</i>
She went to the restaurant.	<i>Ella fue al restaurante.</i>
He went to Oklahoma.	<i>Él fue a Oklahoma.</i>
They had a dog.	<i>Ellos tuvieron un perro.</i>
She saw a cat.	<i>Ella vio un gato.</i>
They saw a dog.	<i>Ellos vieron un perro.</i>
We heard the game.	<i>Nosotros oímos el juego.</i>
She heard the dog.	<i>Ella oyó al perro.</i>
We went to the restaurant.	<i>Nosotros fuimos al restaurante.</i>
He had a dog.	<i>Él tuvo un perro.</i>
They were at the restaurant.	<i>Ellos estuvieron en el restaurante.</i>
He was in the restaurant.	<i>Él estuvo en el restaurante.</i>
We saw a dog.	<i>Nosotros vimos un perro.</i>
She was at the restaurant	<i>Ella estuvo en el restaurante.</i>
He returned the menu.	<i>Él devolvió el menú.</i>
We fell at the game.	<i>Nosotros nos caímos en el juego.</i>
She knew John.	<i>Ella conoció a John.</i>
She returned the book.	<i>Ella devolvió el libro.</i>
She fell in the restaurant.	<i>Ella se cayó en el restaurante.</i>
She played with the dog.	<i>Ella jugó con el perro.</i>
They said hi.	<i>Ellos dijeron hola.</i>
They played the game.	<i>Ellos jugaron el juego.</i>
They knew the restaurant.	<i>Ellos conocieron el restaurante.</i>
They fell on the water.	<i>Ellos se cayeron en el agua.</i>
He played the game.	<i>Él jugó el juego.</i>
They returned the dog.	<i>Ellos le devolvieron el perro.</i>
He said hi to John.	<i>Él le dijo hola a John.</i>
We knew about the game.	<i>Nosotros supimos del juego.</i>
We said hi.	<i>Nosotros dijimos hola.</i>
He eats the food.	<i>Él come la comida.</i>
She helps John.	<i>Ella ayuda a John.</i>
They help John.	<i>Ellos ayudan a John.</i>
We lift the menu.	<i>Nosotros levantamos el menú.</i>
We win the game.	<i>Nosotros ganamos el juego.</i>
She eats the food.	<i>Ella come la comida.</i>
He studies the game.	<i>Él estudia el juego.</i>
He lifts the water.	<i>Él levanta el agua.</i>
She asks about the restaurant.	<i>Ella pregunta por el restaurante.</i>
We lift the menu.	<i>Nosotros levantamos el menú.</i>
He is at the restaurant.	<i>Él está en el restaurante.</i>
We are at the game	<i>Nosotros estamos en el juego.</i>

She is at the restaurant	<i>Ella está en el restaurante.</i>
He is in the room	<i>Él está en la habitación.</i>
They are at the restaurant.	<i>Ellos están en el restaurante.</i>
We say hi.	<i>Nosotros decimos hola.</i>
He says hi to John.	<i>Él dice hola a John.</i>
They say hi.	<i>Ellos dicen hola.</i>
We know about the game.	<i>Nosotros sabemos sobre el juego.</i>
They know the restaurant.	<i>Ellos conocen el restaurante.</i>

Training Sentences

English Sentences	Spanish Sentences
He spoke to John.	<i>Él habló con John.</i>
He called John.	<i>Él llamó a John.</i>
We watched the game.	<i>Nosotros miramos el juego.</i>
She entered the room.	<i>Ella entró a la habitación.</i>
They needed water.	<i>Ellos necesitaron agua.</i>
They made food.	<i>Ellos prepararon la comida.</i>
They considered the menu.	<i>Ellos consideraron el menú.</i>
They understood the game.	<i>Ellos entendieron el juego.</i>
He ran to the restaurant.	<i>Él corrió al restaurante.</i>
We learned the game.	<i>Nosotros aprendimos el juego.</i>
He drank water.	<i>Él tomó agua.</i>
He carried a backpack.	<i>Él llevó una mochila.</i>
She lifted the cat.	<i>Ella levantó el gato.</i>
They spoke about the game.	<i>Ellos hablaron del juego.</i>
She called John.	<i>Ella llamó a John.</i>
He watched the game.	<i>Él miró el juego.</i>
He entered the room.	<i>Él entró a la habitación.</i>
We needed John.	<i>Nosotros necesitamos a John.</i>
We made food.	<i>Nosotros preparamos la comida.</i>
They drank water.	<i>Ellos tomaron agua.</i>
She considered the menu.	<i>Ella consideró el menú.</i>
We carried a backpack.	<i>Nosotros llevamos una mochila.</i>
She ran in the game.	<i>Ella corrió en el juego.</i>
She understood.	<i>Ella entendió.</i>
She learned the game.	<i>Ella aprendió el juego.</i>
We lifted the menu.	<i>Nosotros levantamos el menú.</i>
We read a book.	<i>Nosotros leímos un libro.</i>
She was in the restaurant.	<i>Ella estuvo en el restaurante.</i>
They were at the restaurant.	<i>Ellos estuvieron en el restaurante.</i>
He did his homework.	<i>Él hizo su tarea.</i>
We gave a backpack to John.	<i>Nosotros le dimos una mochila a John.</i>
She wanted a menu.	<i>Ella quiso un menú.</i>
He came to the restaurant.	<i>Él vino al restaurante.</i>
They fell on the water.	<i>Ellos se cayeron en el agua.</i>

She thought about the dog.	<i>Ella pensó en el perro.</i>
We wrote a book.	<i>Nosotros escribimos un libro.</i>
They brought a dog.	<i>Ellos trajeron un perro.</i>
They played the game.	<i>Ellos jugaron el juego.</i>
He read a book.	<i>Él leyó un libro.</i>
They did the homework.	<i>Ellos hicieron la tarea.</i>
He gave a dog to John.	<i>Él le dio un perro a John.</i>
She was in Oklahoma.	<i>Ella estuvo en Oklahoma.</i>
We wanted a dog.	<i>Nosotros quisimos un perro.</i>
She came to the game.	<i>Ella vino al juego.</i>
We fell at the game.	<i>Nosotros nos caímos en el juego.</i>
We thought about the book.	<i>Nosotros pensamos en el libro.</i>
She wrote a book.	<i>Ella escribió un libro.</i>
He was at the restaurant.	<i>Él estuvo en el restaurante.</i>
He brought a backpack.	<i>Él trajo una mochila.</i>
He played the game.	<i>Él jugó el juego.</i>
He speaks to John.	<i>Él habla con John.</i>
He calls John.	<i>Él llama a John.</i>
We watch the game.	<i>Nosotros miramos el juego.</i>
She enters the room.	<i>Ella entra a la habitación.</i>
They need water.	<i>Ellos necesitan agua.</i>
They make food.	<i>Ellos preparan comida.</i>
They consider the menu.	<i>Ellos consideran el menú.</i>
They understand the game.	<i>Ellos entienden el juego.</i>
He runs to the restaurant.	<i>Él corre al restaurante.</i>
We learn the game.	<i>Nosotros aprendemos el juego.</i>
He drinks water.	<i>Él toma agua.</i>
He carries a backpack.	<i>Él lleva una mochila.</i>
She lifts the cat.	<i>Ella levanta el gato.</i>
They speak about the game.	<i>Ellos hablan del juego.</i>
She calls John.	<i>Ella llama a John.</i>
He watches the game.	<i>Él mira el juego.</i>
He enters the room.	<i>Él entra a la habitación.</i>
We need John.	<i>Nosotros necesitamos a John.</i>
We make food.	<i>Nosotros preparamos la comida.</i>
They drink water.	<i>Ellos toman agua.</i>
She considers the menu.	<i>Ella considera el menú.</i>
We carry backpacks.	<i>Nosotros llevamos mochilas.</i>
She runs in the game.	<i>Ella corre en el juego.</i>
She understands.	<i>Ella entiende.</i>
She learns the game.	<i>Ella aprende el juego.</i>
We lift the menu.	<i>Nosotros levantamos el menú.</i>
We read a book.	<i>Nosotros leemos un libro.</i>
She is in the restaurant.	<i>Ella está en el restaurante.</i>
They are at the restaurant.	<i>Ellos están en el restaurante.</i>

He does the homework.	<i>Él hace su tarea.</i>
We give a backpack to John.	<i>Nosotros le damos una mochila a John.</i>
She wants a menu.	<i>Ella quiere un menú.</i>
He comes to the restaurant.	<i>Él viene al restaurante.</i>
They fall on the water.	<i>Ellos se caen en el agua.</i>
She thinks about the dog.	<i>Ella piensa en el perro.</i>
We write a book.	<i>Nosotros escribimos un libro.</i>
They bring the dog.	<i>Ellos traen un perro.</i>
They play the game.	<i>Ellos juegan el juego.</i>
He reads a book.	<i>Él lee un libro.</i>
They do the homework.	<i>Ellos hacen la tarea.</i>
He gives a dog to John.	<i>Él le da un perro a John.</i>
She is in Oklahoma.	<i>Ella está en Oklahoma.</i>
We want a dog.	<i>Nosotros queremos un perro.</i>
She comes to the game.	<i>Ella viene al juego.</i>
We fall at the game.	<i>Nosotros nos caemos en el juego.</i>
We think about the book.	<i>Nosotros pensamos en el libro.</i>
She writes a book.	<i>Ella escribe un libro.</i>
He is at the restaurant.	<i>Él está en el restaurante.</i>
He brings the backpack.	<i>Él trae una mochila.</i>
He plays the game.	<i>Él juega el juego.</i>

Appendix 2: IRB approval and Consent form



Oklahoma State University Institutional Review Board

Date: 11/18/2019
Application Number: AS-18-156
Proposal Title: Comparison of Rule-Based Learning in Monolinguals and Trilinguals

Principal Investigator: Sarah Wendelbo
Co-Investigator(s):
Faculty Adviser: Roha Kaipa
Project Coordinator:
Research Assistant(s):

Processed as: Exempt Continuation

Status Recommended by Reviewer(s): Approved

Continuation Approval Date: 11/18/2019

The continuation of the IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

Requirements under the Common Rule have changed. This study meets criteria in the Revised Common Rule, as well as, one or more of the circumstances for which continuing review is not required. Therefore this study has been converted to the Revised Common Rule. As Principal Investigator of this research, you will be required to submit a status report to the IRB triennially.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are available for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be approved by the IRB. Protocol modifications requiring approval may include changes to the title, PI, adviser, other research personnel, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a status report to the IRB when requested.
3. Promptly report to the IRB any harm experienced by a participant that is both unanticipated and related per IRB policy.
4. Maintain accurate and complete study records for evaluation by the OSU IRB and, if applicable, inspection by regulatory agencies and/or the study sponsor.
5. Notify the IRB office when your research project is complete or when you are no longer affiliated with Oklahoma State University.

If you have questions about the IRB procedures or need any assistance from the Board, please contact the IRB Office at 405-744-3377 or irb@okstate.edu.

Sincerely,

Oklahoma State University IRB

**PARTICIPANT CONSENT FORM
OKLAHOMA STATE UNIVERSITY**

TITLE: Comparison of Rule-Based Learning in Monolinguals and Multilinguals

INVESTIGATOR:

Sarah Wendelbo, Master's Student, Department of Communication Sciences and Disorders
Dr. Roha Kaipa, Department of Communication Sciences and Disorders, Oklahoma State University

PURPOSE: The purpose of current study is to compare the ability of monolingual and multilingual participants to learn a grammatical rule in a foreign language.

PROCEDURE: The assessment protocol will be carried out in the Language Learning Lab. The participants will complete a language questionnaire to understand their language background. After completing the background measures, participants will complete the training and retention phases using E-prime software.

Baseline Phase (Day 1): Baseline measurements will be collected from all participants to determine their initial accuracy and reaction time for the trials using E-prime software. The participants will be instructed to look at the computer screen and follow the instructions that appear on the screen. Each trial will present an audio recording of a native Spanish speaker with a picture of the verb on the screen. The participant will be required to identify if the verb in the audio recording is a preterite form or not. Ten sentences will be used to determine their baseline performance.

Training Phase (Days 1 & 2): Participants will be trained using 30 sentences on Day 1 following the baseline phase and an additional 30 sentences on Day 2. All the participants will be trained to use the preterite form in Spanish. Similar to the baseline phase E-prime software will be used for training the participants.

Retention Phase (Day 3): Immediate retention following training on Day 1 and Day 2, and delayed retention on Day 3 will be measured. During the retention phase, participants will be tested on their ability to identify preterite tense forms in Spanish using ten additional sentences similar to the ones used during the training phase.

RISKS: There are no risks associated with this project, which were expected to be greater than those ordinarily encountered in daily life. To minimize these risks no identifiers were associated with your data and your participation in this experiment will be kept confidential.

BENEFITS: By participating in this experiment, you have gained an appreciation and understanding of how research is conducted. Your participation may not benefit you directly. However, your participation will help researchers to understand how language is learned in people who speak more than one language. Please indicate to the researcher, if you would like to receive a copy of the results.

COMPENSATION: At the end of the study, you will receive a \$10 gift card as compensation for participating in this study.



Approved: 11/18/2019
Protocol #: AS-18-156

CONFIDENTIALITY: Participants will be given a unique ID code which will be stamped on any of their data, and therefore there will be no way to identify participants' to their data. Signed informed consent forms will be kept separate from actual data, and there will be no way to link an individual's informed consent with their data. The records of this study will be kept private. Any written results will discuss group findings and will not include information that will identify the participants. Research records will be stored securely in a filing cabinet for a period of three years in the PI's office, and only researchers and individuals responsible for research oversight will have access to the records. The E-prime recordings in computer(s) will not be accessible to individuals other than the researchers and individuals overseeing the research. The accessibility to the computer(s) will be protected using a secure password. The E-prime recordings and all other documents will be destroyed after three years.

CONTACTS:

You may contact the researcher at the following addresses and phone number, should you desire to discuss your participation in the study and/or request information about the results of the study: Sarah Wendelbo, (918) 845-1668, sarah.wendelbo@okstate.edu.

If you have questions about your rights as a research volunteer, you may contact the IRB Office at 223 Scott Hall, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu.

PARTICIPANT RIGHTS:

I understand that my participation is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time, without penalty.

CONSENT DOCUMENTATION:

I have been fully informed about the procedures listed here. I am aware of what I will be asked to do and of the benefits of my participation. I also understand the following statements:

I affirm that I am 18 years of age or older.

I have read and fully understand this consent form. I sign it freely and voluntarily. A copy of this form will be given to me. I hereby give permission for my participation in this study.

Signature of Participant

Date

I certify that I have personally explained this document before requesting that the participant sign it.

Signature of Researcher

Date



Approved: 11/18/2019
Protocol #: AS-18-156

Table 1: Table depicting the demographic details of the monolingual participants. The mean (M) and standard deviation (SD) are indicated at the bottom of the table.

	Monolinguals		
Participant No	Age	Sex	L1
1	27	F	English
2	22	F	English
3	21	F	English
4	23	F	English
5	21	F	English
6	53	F	English
7	53	M	English
8	55	F	English
9	19	F	English
10	23	F	English
11	18	F	English
12	22	F	English
M	29.75		
SD	14.60		

Table 2: Table depicting the demographic details of the bilingual participants. The mean (M) and standard deviation (SD) are indicated at the bottom of the table

Participant No	Bilinguals				
	Age	Sex	L1	L2	Age of Acquisition of L2
1	27	M	English	Latin	17
2	30	M	English	Russian	23
3	29	F	English	French	6
4	22	F	English	French	14
5	18	M	English	French	15
6	52	F	Madarin	English	12
7	20	M	Persian	English	12
8	47	F	English	German	14
9	21	M	French	English	10
10	39	F	Nepal	English	8
11	22	M	Arabic	English	17
12	21	F	English	Choctow	8
M	29				
SD	11.22				

Table 3: Table depicting the demographic details of the trilingual participants. The mean (M) and standard deviation (SD) are indicated at the bottom of the table

Participant No	Trilinguals						
	Age	Sex	L1	L2	Age of Acquisition of L2	L3	Age of Acquisition of L3
1	30	M	Marathi	Hindi	7	English	10
2	23	M	Cantonese	Mandarin	2	English	3
3	34	F	Bengali	Hindi	Birth	English	2.5
4	28	M	Tagalog	English	Birth	French	12
5	29	M	Malayalam	English	3	Hindi	8
6	28	F	Malayalam	English	5	Hindi	8
7	32	M	Kannada	Tamil	Birth	Tamil	3
8	59	M	Marathi	English	12	English	10
9	50	F	Marathi	English	10	English	10
10	51	F	Tamil	English	5	Hindi	8
11	23	F	Tamil	Hindi	3	English	2
12	38	F	Hindi	English	5	Bengali	30
M	34.42						
SD	11.76						

Figure 1: The schematic representation of the three phases of learning

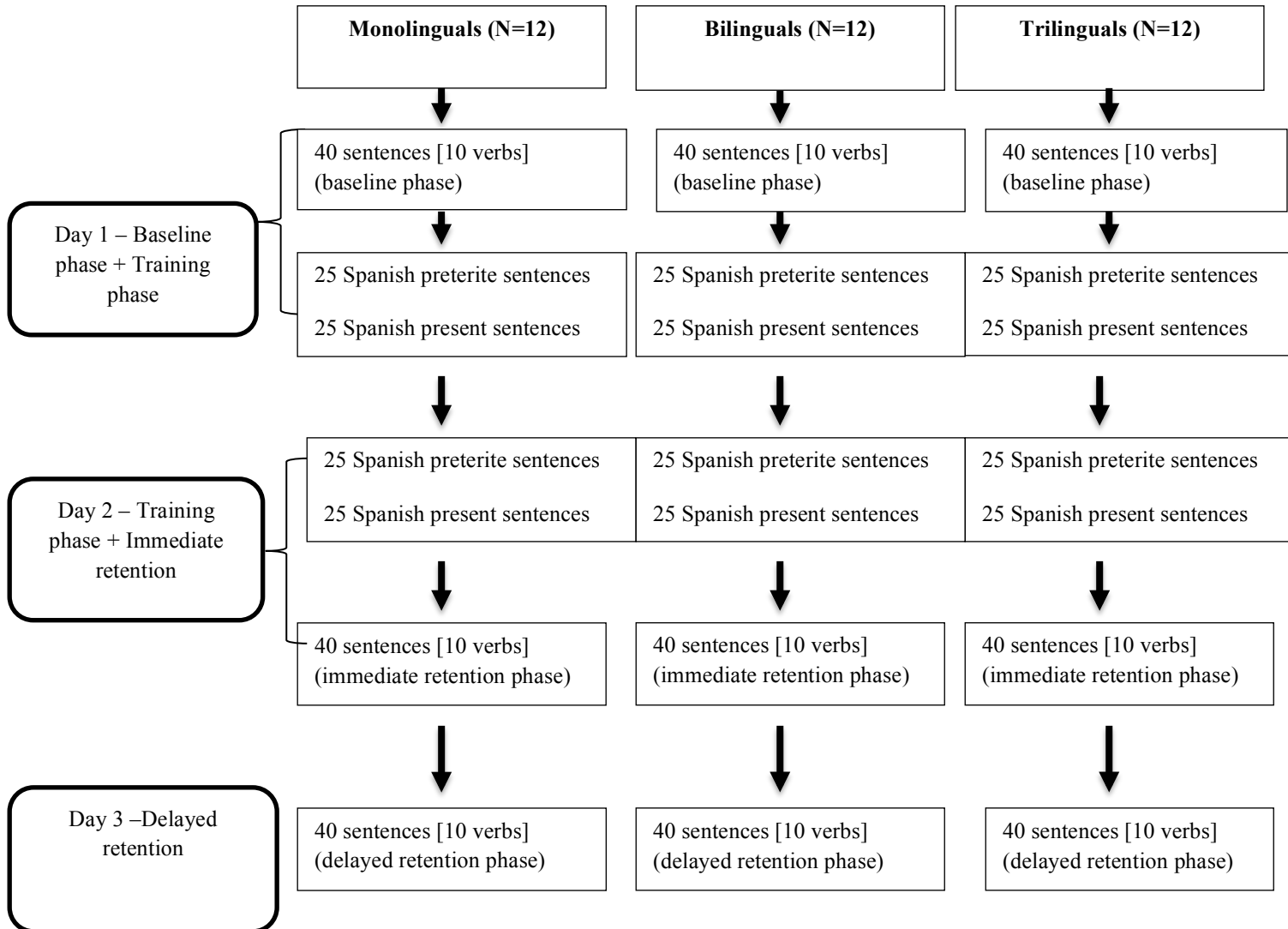


Figure 2:

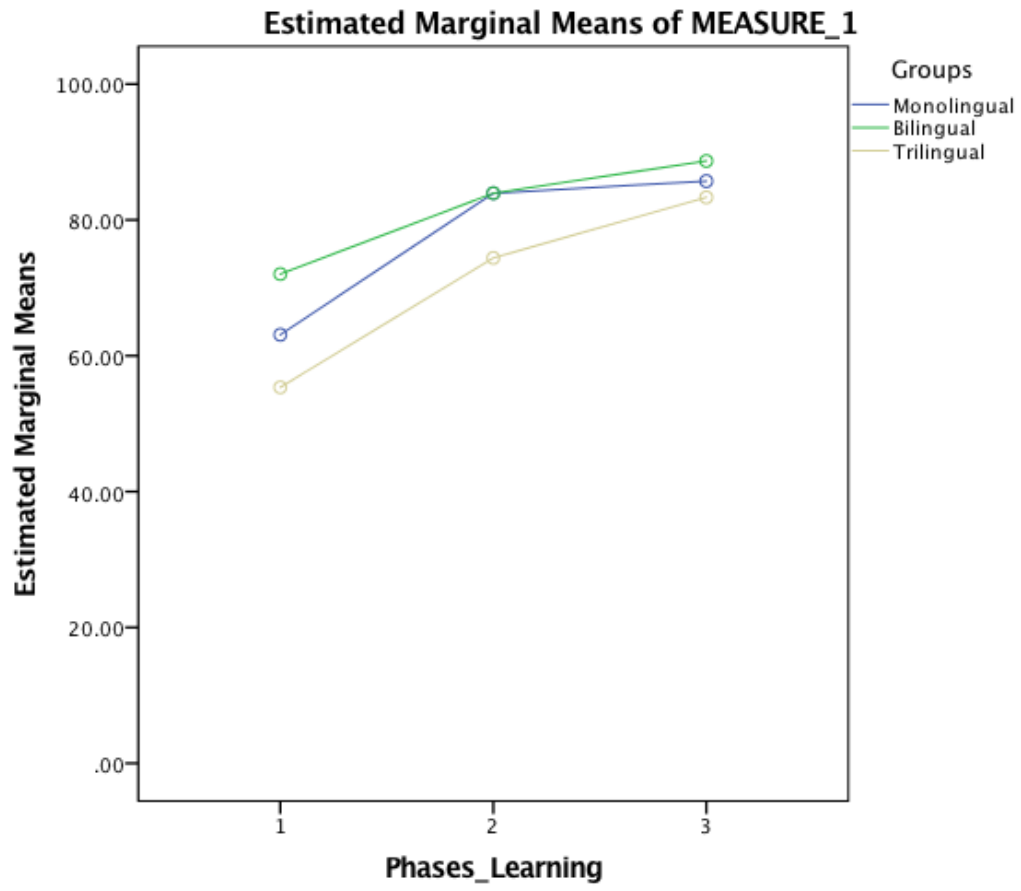
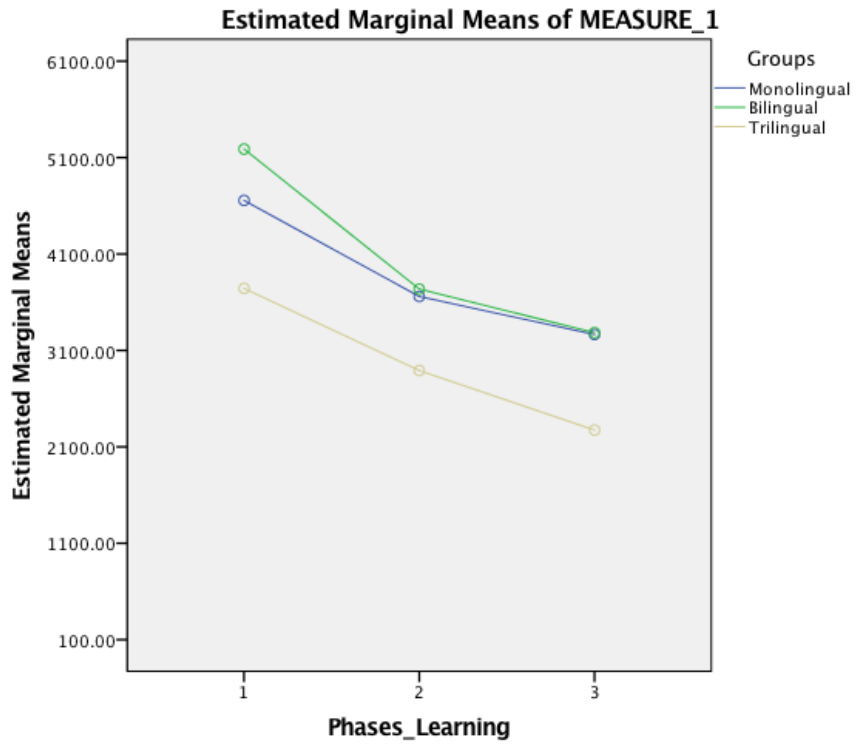


Figure 3:



VITA

Sarah Wendelbo

Candidate for the Degree of

Master of Science

Thesis: COMPARISON OF RULE-BASED LEARNING IN MONOLINGUALS AND
MULTILINGUALS

Major Field: Communication Sciences and Disorders

Biographical:

Education:

Completed the requirements for the Master of Science in Communication
Sciences and Disorders at Oklahoma State University, Stillwater, Oklahoma in
May, 2020.

Completed the requirements for the Bachelor of Science in Communication
Sciences and Disorders at Oklahoma State University, Stillwater, Oklahoma in
2018.

Experience:

Research Assistant, Language Learning Lab, Oklahoma State
University (August 2018-May 2020)

Research Assistant, Motor Speech Lab, Oklahoma State University
(August 2017-May 2018)

Graduate Teaching Assistant, Oklahoma State University (August
2018-May 2019)

Professional Memberships:

National Student Speech-Language Hearing Association
(NSSLHA)