



Lexico-semantic production and cognitive processing in Indian bilinguals

Received : 05.04.2020
Accepted : 10.06.2020
Published : 30.06.2020
DOI: <https://doi.org/10.5281/zenodo.11436359>

Ramandeep Kaur¹
Father Muller Medical College

Abstract

Children who learn two languages differ in their language learning experience in comparison to the monolinguals. In order to investigate lexical semantic knowledge, picture naming method is primarily used. Kohnert, 2002 reported increasing name agreement for pictures as proficiency in each language increased. Age and language factors seem to have a positive effect on the naming task in both mixed and single language conditions, although the processing of single language is faster than mixed language (Kohnert, Bates, Hernandez, 1999; Naranowicz et al, 2022). In Indian context, Cherian (2008) investigated verb processing of Malayalam-English bilinguals, in high and low competition conditions. She implied a different verb processing in L1 and L2 languages which varies according to years of exposure with L2. The present study focuses on identifying the patterns of lexical development within heterogeneous groups of school going Kannada-English bilingual children using noun processing and thus determines the effect of dual-language control in these bilinguals. The results indicated improved accuracy improved with increased age and language experience for processing of nouns. In 5 to 7 age group, the performance in blocked condition is better than that in the mixed condition. Overall results signify superior Noun processing in low competition when compared to the high competition condition for Kannada-English bilingual children. Apart from this, the study also implies that age and language experiences play an important role in processing of nouns. Thereby, bilingual children respond better for L1 (Kannada) in younger age groups, though the language dominance becomes parallel for both the languages, with language experience and age. The noun processing in bilingual children is different in L1 and L2 languages and varies according to years of exposure with L2 language. This is an important aspect which needs to be considered while assessing the lexical processing of a bilingual child.

Keywords: lexico-semantic production, bilingual children, Kannada-English, language acquisition, language processing

1. Introduction

Language is a complex symbolic system used in various modes of communication. Language learning and use is determined by biological, cognitive, psychological and environmental factors. The term “bilingualism” is defined as an individual’s native-like control of two languages. It has been seen that children who learn two languages differ in their language learning experience, compared to the monolinguals. The bilinguals and monolinguals experience different cognitive environments and thus use different resources

¹ Father Muller Medical College, Department of Audiology and Speech Therapy
Contact: minikr17@gmail.com

to communicate. Most of the research in the same area support beneficial effects of independent representation for the languages (Durgongulu, Roediger, 1987; Brauer, 1998). Krashen, Scarcella & Long (1982) stated that development of both the lexicons is superior for bilingual children who are second language acquirers

Grammont, 2002 proposed enhancement of acquisition if two languages are presented in separate contexts, whereas when mixed they hinder acquisition and induce confusion and interference. In order to investigate lexical semantic knowledge, picture naming method is primarily used. The early sequential bilingualism is known to be a complex process that involves the interaction between first language (L1) and second language (L2). To understand this process, the control of the dual language system as a function of the language experience and developing cognitive skills has to be considered. Language skills in bilinguals are most often understood in terms of relative cross-linguistic proficiency. Early sequential bilinguals are defined here as children who learn a single minority language from birth (L1) and begin to learn a second, majority language (L2) sometime during early childhood. When skill level is comparable across the two languages, it is called “balanced bilingualism.” In contrast, when one language is stronger than the other (as is most often the case) this language is considered “dominant.” The term ‘proficiency’ in the present study refers to a complex, multifaceted, global construct that is measured relative to age and linguistic experience.

Kohnert (2002); Kohnert & Bates (2002); Kohnert Bates & Hernandez (1999) aimed at identification of potential patterns in lexical processing across age and experience, within the highly variable landscape considered to be a hallmark of developing bilingualism. They concluded that there were positive developmental effects on noun processing for both L1 and L2. To be more specific, in both Spanish and English, older participants outperformed younger participants for both picture naming (Kohnert et al., 1999) and picture identification (Kohnert & Bates, 2002). The positive impact across age was most evident in the mixed language condition that required the greatest control of processing skills at the cognitive–linguistic interface (Kohnert, 2002). In addition, they reported greater overall gains in English (L2) than Spanish (L1), despite increased lexical processing efficiency in both L1 and L2. This shift to L2 dominance (i.e., relative language skill) was observed earlier in picture identification (evident after an average of 6.8 years of systematic English exposure) relative to picture naming (evident only after approximately 10 years of systematic English exposure). These findings for the first time provided evidence for the continued growth of L1 and L2 skills, as well as a dominant language shift among school-age Spanish–English bilinguals in the aspect of basic lexical processing. Kohnert et al. (1999) documented the continued development of the inhibitory control mechanism in noun processing among early sequential Spanish–English bilinguals.

In comparison with the single-language condition, the mixed-language condition elicited slower RTs (Reaction Time) for all age groups and lower accuracy for younger children but not for adolescence. However, the RT difference was reduced with increasing age. Magiste (1979, 1992) observed processing of speed and accuracy in school-aged children during basic



comprehension tasks and production tasks. It was reported that, even on these very basic-level encoding and decoding tasks, 4–6 years of experience was needed for equal performance in L2 and L1. Also, processing efficiency in L1 actually regressed as L2 skills improved. Mägiste (1979, 1992) designed these studies particularly to look at potential critical period effects. She concluded that both the age of the child at beginning of L2 learning, as well as, the communicative context of L2 learning, implicated as important variables in relative L1-L2 proficiency for sequential bilinguals (Bialystok, 1991; Grosjean, 1998; Langdon, 1992). However, these factors were not controlled across groups. Thus, the generalization of these studies to other groups of bilingual children becomes unclear.

1.1. *The Dual Processing Model*

This model hypothesizes that words are stored in two different ways: Verbal and Non-verbal representation. The verbal one responds to words in each language. The two verbal systems are organized in separate but interconnected associative structures, derived from experience of two languages. Thus the storage of words is a direct functioning of two codes. Pavio (1986) suggested that the dual coding system provides a common store for the verbal information. But, at the same time, keeps the two verbal processes as separate entities, although linked together through associated channels.

Verb processing in early sequential bilinguals was investigated by Jia, Konhert, Callado & Acquino-Garcia (2006). They confirmed improvement in action-naming proficiency for both L1 and L2 with age, along with a shift from L1 to L2 dominance in accuracy. In comparison with the single-language condition, the mixed-language condition engendered slower reaction time for all age groups and lower accuracy for the younger age groups relative to older group. Also, verb processing was considerably slower and less accurate than noun processing.

In Indian context, Sreedevi (1976) reported that children first develop noun verb distinction followed by concrete noun. Cherian (2008) investigated verb processing of Malayalam-English bilinguals, in high and low competition conditions. She implied a different verb processing in L1 and L2 languages which varies according to years of exposure with L2.

1.2. *The need for this study*

As evident from the literature, bilinguals/multilinguals show differences in processing of various languages. Thereby, bilingualism is an important aspect that must be taken into consideration while assessing the lexical processing of a bilingual child.

However, Indian context encloses not many studies that considers the lexical development in a heterogeneous group of early sequential bilinguals as a function of interactive exposure to the language. Cherian (2008) used action verbs to determine lexical processing in Malayalam-English bilinguals. As a part of further investigation, the present study focuses on identifying the patterns of lexical development within heterogeneous groups of school going Kannada-English bilingual children using noun processing and thus determines the effect of dual-language control in these bilinguals.

1.3. *The aim of the study*

The objectives of present study aim:

1. To investigate the processing of nouns in low competition (One language) and high competition (both the languages) conditions in Kannada-English bilinguals.
2. To study the effect of age and language experiences on noun processing.
3. To study the effect of dual language control system in bilinguals.

2. Methodology

2.1. *Participants*

Forty Kannada-English bilingual children age ranging from 5 to 16 years participated in the present study. The participants were divided into four groups (ten in each group) depending upon their age; 5 - 7 years, 8 - 10 years, 11 - 13 years, 14 - 16 years. All the participants were reported to be typically developing, by parents and school reports, with no history of audiological or neurological/psychiatric impairments. These participants were recruited from two schools, both of which enroll a large number of bilingual students.

2.2. *Data collection and processing*

The stimuli included 90 common noun pictures collected from various sources ranging from school text books for kindergarten students, educational books and pictures from teaching aids for teaching verbs for kindergarten children. The pictures were then given to 15 bilingual speakers of Kannada-English and were to grade the pictured words in terms of their occurrence in daily living conditions, in both Kannada and English separately (Grading Scale: 1 to 5, from least occurring words to most occurring). They were also asked to name the pictures both in Kannada and in English separately. The pictures were selected based on two criteria:

1. Commonly used words on daily basis in both Kannada and English
2. There should be at least 80% agreement in the names given by the speakers in both Kannada and English
3. Lastly, a total of 50 pictures were selected and remaining were excluded as they did not match the criteria (Examples provided in Appendix).

2.3. *Procedure*

The pictures were presented through a 15 inch hp dv6000 laptop computer placed at a distance of approximately 12 inches away from the subject.

Thus, there were four conditions in the experiment: Blocked Kannada, Blocked English, Mixed Kannada and English. The pictures were equally divided into different tasks (10 each) and 10 pictures were given before the actual experiment, as practice trials. These pictures were randomly presented across the tasks and the participants were given 5 sec to see the pictures. A 2-sec blank interval was given before presentation of each picture. During this blank interval, the subjects were cued (kannadadalli



heli-say in Kannada) to name the picture in the blocked Kannada condition and “say in English” to name a picture in the blocked English condition. In the mixed condition subjects were cued as “say in English then Kannada” for Mixed English condition and “say in Kannada then English” for Mixed Kannada condition. The instructions were recorded by a female speaker in a quiet room using a digital sound stereo headphone (SSD-HP-202).

The mixed task was present in every third trial, after one blocked Kannada and one blocked English condition. The order of the mixed Kannada and mixed English condition was counterbalanced among participants.

The participants are required to name the pictures in the target language. The responses are recorded using a digital sound stereo headphone (SSD-HP-202) and further analyzed by the experimenter.

2.4. Scoring

The responses are coded as correct or incorrect based on the coding system used by Kohnert and Windsor (2004) to qualify children’s responses to the noun pictures. A fluent bilingual Kannada-English speaker did the coding of the responses. The correct responses fall under the following category:

1. Names that are equal to the dominant name used by adult bilingual speakers.
2. Morphological variation of the dominant name e.g.; “eating” instead of “eat”
3. Synonym of the dominant name

2.4.1. Incorrect responses would be

1. Within language and within category errors including subordinate names
2. Within language and across category errors in which the non nouns are used
3. Cross language and cross category errors including direct translation
4. Cross language and cross category errors in which incorrect words were present in non target language.
5. Within language invented words
6. Across language invented words
7. No response errors (within 4 sec time window)

The errors are further grouped together for ease of analysis. Errors 1 and 2 are grouped under within language errors. Error 3 and 4 are grouped under between language errors and errors 5 and 6 belong to the invented words category. The accuracy was indicated by the percentage of correct responses by the total number of pictures for that condition for each of the blocked and mixed condition.

After the analyses, ANOVA was conducted to evaluate the significant differences between the low competition and high competition conditions.

3. Findings

The present study focuses on noun processing in Kannada- English bilinguals in four experimental conditions. The results obtained by various group of individuals are indicated in the following figures.

3.1. Accuracy scores

3.1.1. Within group comparison

In 5-7 years age group, the results showed that the noun processing in blocked conditions (Mean accuracy 7.6) is better than the mixed conditions (Mean accuracy 3.6) in both the languages (See Figure 1). In blocked condition, naming in Kannada (Mean accuracy 8.9) is better than that in English (Mean accuracy 6.3). However, in mixed condition, naming in both English and Kannada show almost similar scores. Moreover, ANOVA results show a significant difference between blocked and mixed conditions.

Children within 8 to 10 years, also show better naming in blocked conditions (Mean accuracy 7.9) relative to the mixed condition (Mean accuracy 4). Similar to the previous group, processing in blocked English (Mean accuracy 9.9) shows lower responses than blocked Kannada (Mean accuracy 5.9). ANOVA results also show significant differences between the two conditions, mixed and blocked.

Considering the next age group from 11 to 13 yrs, Similar blocked condition (Mean accuracy 9.5) advantage was observed over the mixed condition (Mean accuracy 4.2), although scores for blocked conditions improve when compared to the younger children. ANOVA results again show significant differences between the two age groups. Moreover, in both blocked and mixed conditions a shift in trend of accuracy scores are seen in English than in Kannada suggesting that in this age group noun processing was better in English than in Kannada.

As years of experience increase i.e in 14 to 16 years, the accuracy scores are also better for mixed condition and almost equivalent to the blocked condition accuracy, thereby showing an increased trend of naming in Kannada. In this group of individuals, the processing in complex (mixed) conditions improved with the increase in the age and also exposure to the language. Also, as seen there is a shift in language processing from Kannada to English not only in blocked but also in mixed conditions.

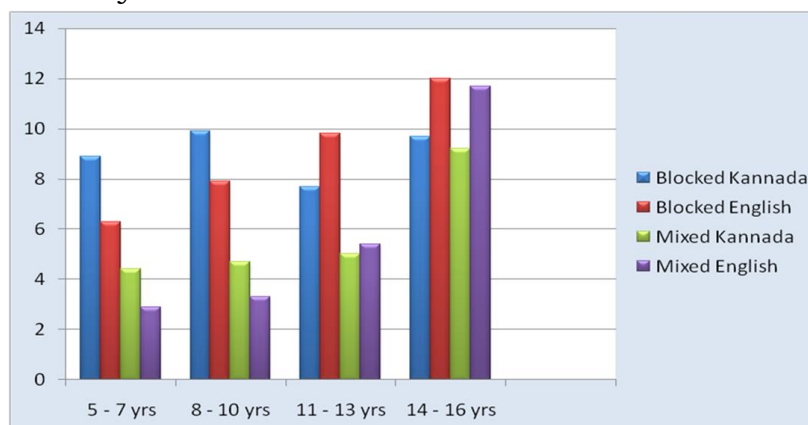


Figure 1. The mean accuracy scores of the age groups across different conditions

3.1.2. Across group comparison

As clear from the figure 1, the results of the present study reveal that as the age increases, the overall scores become better. However, ANOVA did not show a significant difference for the same. Besides these differences, it is prominent that across all the groups there is a consistency of better processing in Blocked English condition, relative to the blocked Kannada condition. In Mixed condition as well, Mixed Kannada accuracy scores are worse than Mixed English scores.

ANOVA analysis across all the age groups showed significant differences between blocked and mixed conditions. However, in the oldest group of children (14 to 16 years), the proficiency on two languages increases due to more language experience and thus no significant differences are observed for the same.

3.2. Error Analysis

The errors are clearly indicated in Figure 2 (2.1, 2.2, 2.3, 2.4) for different age groups. The errors in responses of children are classified into different types as described above.

3.2.1. Within group comparison

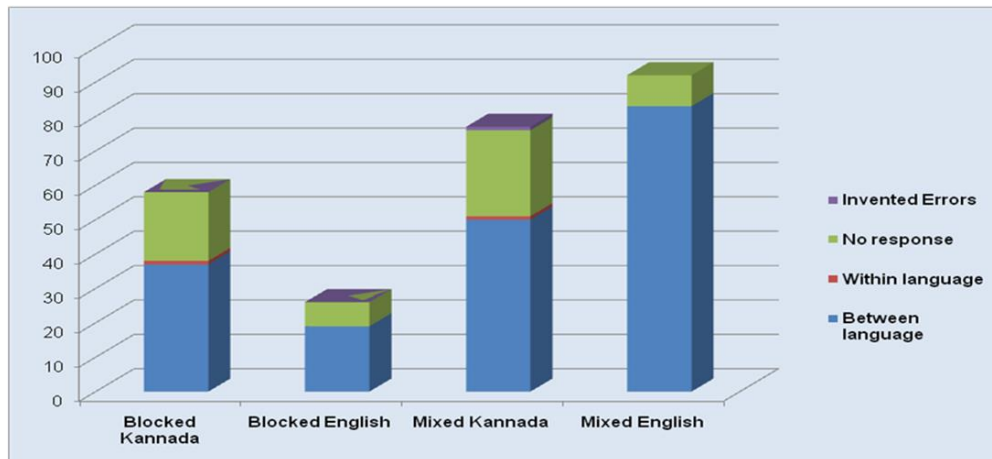


Figure 2.1 Errors in 5-7 years age range

As seen in Figure 2.1, in age group of 5 to 7 years, ‘between language’ errors are the most prominent errors in both blocked and mixed conditions. These are further followed by ‘no response’ errors for all the conditions. On the other hand, the ‘within language’ and ‘invented errors’ are seen to be the minimal.

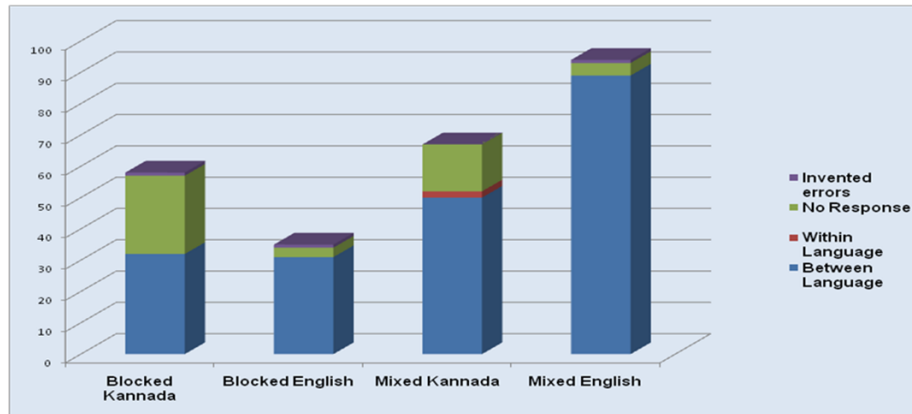


Figure 2.2. Errors in 8 to 10 years age range

As shown in Figure 2.2, similar to the younger age group, the children between 8 to 10 years also show 'between language' errors to be the maximum. These errors are more in English language (both mixed and blocked conditions) when compared to Kannada language. Thereby, indicating that the subjects mostly spoke in Kannada whenever the target language was English and vice versa. However, least number of 'within language' errors are seen which denotes that most of the times when the target language was correctly initiated then there were no errors in the naming response.

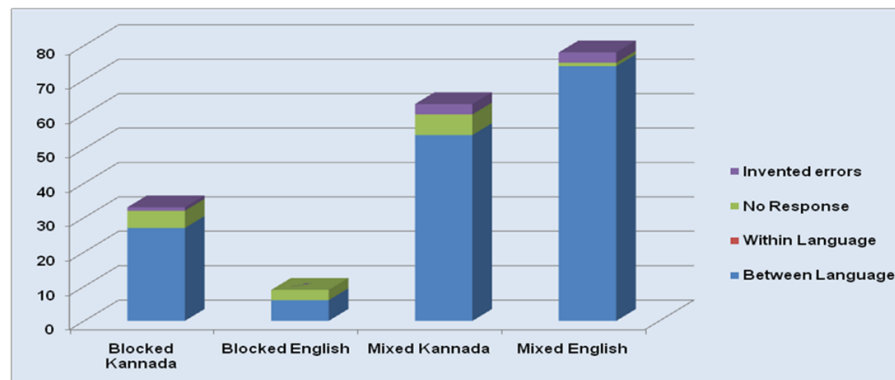


Figure 2.3. Errors in 11 to 13 years age range

Figure 2.3 again denotes that the same pattern of errors is followed where the 'within language' errors are minimal along with a maximum occurrence of 'between language errors'. Also, it is noted that the errors are more frequent in the mixed conditions when compared to the blocked condition, for all the age groups.

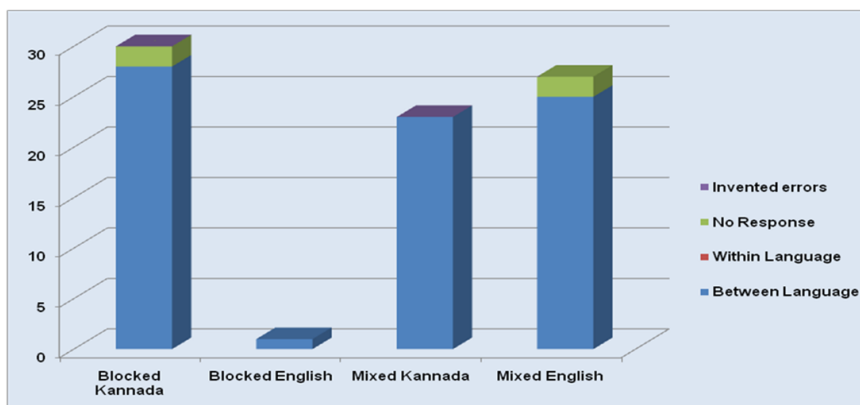


Figure 2.4. Errors in 14 to 16 years age range

A remarkable feature seen in Figure 2.4 is that the errors in blocked condition, drastically reduces when compared to the other condition. Perhaps this is due to an increase in the language proficiency with age as well as constant exposure. Apart from that, the same trend is followed where ‘between language’ errors are most prominent.

3.2.2. Across Group Comparison

It is noticeable from the above figures 2 (2.1, 2.2, 2.3, 2.4) that the total number of errors in noun processing decreases with an increase in age as well as increase of language proficiency due to exposure to language. Also, the comparison of errors across the age group shows that the ‘between language’ errors are the most frequent errors in all the age groups. Also the ‘no response’ errors are seen in all the age groups, though not very predominant. However, the other set of errors, the ‘within language’ and ‘invented errors’ depend on the language condition and age of the subject.

4. Discussion and conclusion

The literature shows that the processing of lexical items differs in monolingual and bilingual children. Thereby, the present study focused at processing of nouns across various age groups and hence aims at studying the effects of age and language experience on the same. The results give us information on the developmental patterns in levels of noun processing in L1 and L2 languages. There is a significant gain in L1 and L2 noun processing as the age increases.

When analyzing the developmental trend in English and Kannada, there is a rapid growth in the development of English as compared to Kannada as seen in significantly different accuracy scores across conditions and age groups. There is a shift that occurs in language dominance across age groups, from Kannada to English with increasing age. This could be because of two reasons, one that the older subjects have reached the adulthood, their interactive exposure with each language is equally high i.e. they have ample opportunity to interact in both the languages in both home environment (Mother tongue is Kannada) as well as in school (where Medium of instruction is English). Secondly, the time of exposure to both the languages

is the same and thus the size of the lexicon in bilinguals considering the two languages reached an equally balanced level (rather than L1 dominance over L2). These findings are supported by Fernandes and Oller (1997) and also Cherian (2008).

The findings of the study are similar to the studies done by Jia, Kohnert and Collado (2006) which reported the dominance of L2 over L1 with an increase in the age. Also, Cherian (2008) revealed similar findings with verb processing when L2 dominance was seen in the early adolescence.

Moreover, a second finding of the study was related to the developmental effects on cognitive dual language control system. Subjects performed better in blocked condition (low competition) than in the mixed condition (high competition) conditions in all the age groups as seen in the greater accuracy scores and lesser amount of errors, and also there is a significant cost in accuracy when there is a language switch task as compared to a single language task. These finding were similar to the previous studies done by Jia, Kohnert, Collado (2006) and Cherian (2008). This supports the dual language control model which suggests that the lexicon from each language is retrieved from different centers for processing. If the lexicon in both languages is derived from the same centers there would not be any difference in the blocked and mixed conditions. Thus this finding supports dual language control model.

The oldest group did not show a significant difference in mixed and blocked condition suggesting that as age increases, there is an ability to maintain accuracy in the face of competition from another language (Jia et al, 2006). Also, the increased proficiency leads to increased control over the two languages.

To summarize, the results of present study mainly showed better accuracy for L1 (Kannada) in younger age group (5 to 7 years) and almost parallel accuracy for L1 (Kannada) and L2 (English), in both blocked and mixed conditions. However the older age group (14 to 16) showed similar scores in L2 and L1 for both blocked and mixed conditions, thereby indicating equal efficiency in both languages, which is more evident in blocked than in mixed condition. This could be due to the age or their experience with the language.

Thereby, the results reveal noun processing to be better in blocked than in mixed condition in younger age groups but the oldest group did not show any difference in accuracy suggesting that the processing skills in both languages are almost similar. Thus, age and language experience are major factors that affects the noun processing accuracy scores. Also the proficiency of the bilingual children shifts from English (L2) to Kannada (L1) as the child gains more experience in English till it reaches a level of equal proficiency in both languages in the older group.

As the language experience increases with age, there is a developmental trend in inhibitory control and also in the proficiency of L1 and L2 language.

In conclusion, the noun processing in bilingual children is different in L1 and L2 languages and varies according to years of experience with the L2 language. This must be taken into an account while assessing the lexical processing of a bilingual child.



Acknowledgements

We sincerely thank our secretary Dr. M.R. Shetty, C.O.S.H. Mangalore, for permitting us to carry out this study. We express our sincere gratitude to all the lectures and our classmates in C.O.S.H. for their encouragement and support. We would also like to thank all the participants in this study. Lastly, our parents for their encouragement and unbiased suggestions.

References

- Bialystok, E. (1991). Cognitive Complexity and Attentional Control in the Bilingual Mind. *Child Development*, 70, 636-644.
- Brauer, M. (1998). *Stroop interference in Bilinguals*, In A.F Hailey and L.A Bourne. *Foreign Language Learning: Psycholinguistic studies on training and retention*, 317-337. Mahwah, NJ: Erlbaum.
- Cherian, M. E. (2008). Action naming in Malayalam-English Bilinguals. *Unpublished Master's Dissertation, University of Mangalore, Mangalore*
- DeAnda, S., Poulin-Dubois, D., Zesiger, P., & Friend, M. (2016). Lexical Processing and Organization in Bilingual First Language Acquisition: Guiding Future Research. *Psychol Bull.* 142(6), 655-667.
- Durgongulu, A., & Roeidger, H. L. (1987). Test differences in accessing bilingual memory. *Journal of Memory and Language*, 26, 377-91.
- Grammont, K. (2002). The Modeling Hypothesis and child bilingual code mixing. *International Journal of Bilingualism*, 7 (2), 113-126. DOI: 10.1177/13670069030070020101
- Grosjean, J. (1998). The bilingual's language modes. One Mind, Two Languages: Bilingual Language Processing, *Journal of Bilingualism*, 2 (4), 25-31.
- Jia, G., Konhert, K., & Callado, J. (2006). Action naming in sequential Spanish- English bilinguals. *Journal of speech, language and Hearing research*, 49, 588-602.
- Kohnert, K. (2002). Picture naming in early sequential bilinguals. *Journal of speech, language and hearing Research*, 45, 759-771.
- Kohnert, K., & Bates, E. (2002). Balancing bilinguals II: Lexical comprehension and cognitive processing in children learning Spanish and English. *Journal of speech, language and hearing Research*, 45, 347-359.
- Kohnert, K., Bates, E., & Hernandez, A. E. (1999). Balancing bilinguals: lexical-semantic production and cognitive processing in children learning Spanish and English. *Journal of Speech, Language and Hearing Research*, 42, 1400-1413.
- Krashen, S., Scarcella, R., & Long, M. (1982). *Child-Adult Differences in second language Acquisition*. Rowley M.A: Newbury House
- Magiste, E. (1986). *Selective Issue in second and third language learning*. In J. Vaid (ed), *Language processing in bilinguals: Psycholinguistic and neurolinguistical Perspectives*, Hillsdale, NJ: Erlbaum.

- Naranowicz, M.; Jankowiak, K.; Kakuba, P.; Bromberek-Dyzman, K.; Thierry, G. (2022) In a Bilingual Mood: Mood Affects Lexico-Semantic Processing Differently in Native and Non-Native Languages. *Brain Sci.* 12, 316. <https://doi.org/10.3390/brainsci12030316>
- Roseberry-McKibbin, C. (1995). Choice of Languages in Instruction One Language or Two? *Teaching Exceptional Children*, 33 (4), 10-16.
- Sreedevi, S. V. (1976). Aspects of acquisition of Kannada by 2+ year old children. *Unpublished Master's Dissertation, University of Mysore, Mysore*

Appendix

Examples of a few nominal pictures included in the study:

