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Lexical Access in Monolingual, Bilingual and Multilingual Children: A Comparative Study

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Abstract

The responsibility of deciding which of the activated lexical item needs to be prioritized for further processing is done by lexical selection mechanism. This uncomplicated mechanism is complicated for bilingual and multilingual populations as they face a cognitive challenge during speech processing and production. That is, the words in all the languages begin to get operative to certain extent and may compete for selection. Perhaps because of this complexity, the process involved in case of bilingual and multilingual group has not gained much attention. Hence the present study was conducted aiming to extend research in this area by examining and comparing the lexical access between monolingual, bilingual and multilingual children using picture naming reaction time experiment. 180 subjects participated in this study within the age range 8.6-9 years i.e., 60 monolinguals, 60 bilinguals and 60 multilinguals. The findings indicated faster availability of L1 in monolinguals suggesting that there is experiential difference seen between the monolingual, bilingual and multilingual children in the process of acquisition and language use and also the role of interference from the competing language in bilinguals and multilingual children.

Key words: lexical access of children, monolingual, bilingual, bilingual

Introduction

When people acquire new words, they store the newly learnt words in their lexicon for later retrieval. During the language production, the words are retrieved from the speaker's lexicon that matches to their communication intent. So, while desiring to communicate a specific conception, it is first crucial to retrieve the lexical item that matches the target idea. The mechanism through which this is accomplished is commonly called as lexical selection

(Caramazza, 1997; Dell, 1986; Levelt, 1989, 2001; Levelt, Roelofs, & Meyer, 1999). There are many lexical representations that start operating because of the spreading activation from the semantic level to the lexical level. Thus, a selection mechanism is compelled. Therefore, through the spreading activation, the corresponding lexical node is also activated along with theactivation of any representation at conceptual level. So in this context, not only the word that correlates with the intended meaning is activated but also the other semantically related words are also activated.

Amongst all the activated words, the responsibility of determining which item needs to be given more consideration for the further processing is controlled by lexical selection mechanism. For example, when picture of cow is given to name, the intended semantic representation COW becomes active, but closely related ones, such as GOAT, FUR, TAIL, MILK etc also become active (Dell, 1986; Caramazza, 1997; Levelt, Roelofs and Meyer, 1999).

So, in almost many regard, it is thought that the along with the target activated semantic representation the corresponding lexical representation is also activated by the spreading action at the lexical level. Thus, the word which has the greater level of activation that in normal is error-free and also equates to the desired meaning is chosen by the lexical selection mechanism.

Applying the lexical selection mechanism in the bilingual speech production situation, the Current models of Bilingual for lexical access particularly presume that the two languages in the bilingual are shared by a same semantic system (De Bot, 1992; Costa, Miozzo & Caramazza, 1999; Green, 1986; 1998; Kroll and Stewart, 1994; Potter, So, von Eckhardt, & Feldman, 1984; Poulisse & Bongaerts, 1994).That is, every semantic/conceptual representation is linked to its correspondent lexical nodes in the other two languages. Even though, few researchers have stated that conceptual representation are language dependent (e.g., Lucy, 1992; Paivio & Desrochers, 1980; Van Hell & De Groot, 1998), the latest hypothesis extensively accepts the notion that, the bilingual group have a distinctive conceptual storage system which is shared by both the languages (Mitchel, 2005).

If the above hypothesis states that the semantic system is shared by both languages in

bilinguals, then the question emerges whether the spreading activation theory in the middle of lexical system and the semantic system also executes regardless of the language programmed for the response. It is acclaimed that the corresponding lexical nodes receives proportionate activation along with the activated semantic representation. If in bilinguals, only the desired language received the spreading activation from the semantic system, then the lexical access in bilinguals would have prosecuted the process similar to the monolingual group. Nevertheless, the most latest postulation states that the semantic system spreads the activation to both the languages in bilingual speaker despite of the language programmed for the response (De Bot, 1992; Green, 1986; Poulisse & Bongaerts, 1994; Poulisse, 1997, Colome, 2001; Costa, Caramazza, & Sebastian-Galles, 2000; Costa, Colome, Gomez, & Sebastian-Galles (2001), De Bot, 1992; Gollan& Kroll, 2001; Hermans, Bongaerts, de Bot, &Schreuder, 1998; Poulisse, 1999). As stated by these theories, parallel activation takes place for both the languages in bilingual irrespective of the language desired for the response. That is to say that the present models believe that there is generalized parallel spreading activation of the both the lexicons in the bilingual speaker. In the same manner, few earlier researchers have proposed (McNamara & Kushnir, 1972; McNamara, Krauthammer, Bolgar, 1968; Penfield and Roberts, 1959) for the existent of a switching device that turns the semantic system on and off intercepting the spreading activation of lexical nodes which do not belong to the desired language in use.

Despite its significance as a universal occurrence, multilingual Lexical representation has not obtained a great importance as a part of research in the field of applied linguistics, psycholinguistics and linguistics. For a long period linguist have tried to explain and describe the manner of how languages work in humans by concentrating on the monolingual group and refused to take notice of bilingual and multilingual speakers. However, Bilinguals recently have been getting a lot of attention by the linguistic, psycholinguistic and applied linguistic researchers since few decades, but, many researchers have failed to go further bilingual group and have restricted their proposals and experimental work to only two languages.

Multilingual Interactive Activation Model (MIA) was developed by Dijkstra, (2003), Dijkstra & van Hell, (2003), by implementing the similar mechanism and architecture that are presumed in the bilingual model to explain the lexical representation in multilinguals.

Still, comparatively less is known regarding the lexical connections between the three or more languages that are learnt by the multilingual group.

The multilingual populations also face a cognitive challenge during speech processing and production. That is, the words in all the languages begin to get operative to certain extent and may compete for selection (e.g., Bajo et al., 2010, Kroll, Bobb, Misra & Guo, 2008). For example when a picture is viewed by a monolingual speaker, the conceptual representation is set into motion followed by the associated lexical and phonological representations prior verbalization. This uncomplicated mechanism becomes more complicated for a bilingual and multilingual, considering that for a given concept greater than one lexical representation is mapped. That is when a bilingual and multilingual speaker names a picture of a `cat' in one of the language; there is activation of the words in all the languages to some extent, by that making a person to choose the appropriate word for verbalization (Bialystok, 2009; Green 1986, 2003). For example, Presuming that the parallel activation is true, when a Dakhni-Kannada-English multilingual is asked to name the picture of a cat in English, the activation of the Dakhni and Kannada translation word (e.g. /billi/ –cat in Dakhni and /bekku/ –cat in Kannada) corresponding to the target lexical item and is also activated.

Mayhap, considering the complicatedness of understanding the lexical access in speech production, the bilingual and multilingual group has not received much attention regarding how the lexical processes function in these cases.

Comprehending the organization of the lexicon is an enduring psychological and philosophical question. The lexicon, like all psychological representations, cannot be examined directly. Rather, psycholinguists normally investigate the evidence concerning the lexicon by examining the lexical access. There are several methods used in the past to evaluate the lexical access such as priming study, speech errors, verbal fluency and picture naming tasks.

Priming studies shed light on the organization of the lexicon. One word primes another if hearing the first word leads to faster recognition of the second word. Researchers have found that associated words--those that frequently appear together (Meyer & Schvanevelt, 1971). Another important way to assess the lexical access is by assessing

speech production and analyzing the experimental elicited and spontaneous speech errors (e.g Dell, Juliano, & Govindjee, 1993; Fay & Cutler, 1977; Fromkin, 1971, 1973, 1980; GarcíaAlbea, del Viso, Igoa, 1989; Garrett, 1976, 1980; Martin, Weisberg, & Saffran, 1989; Martin, Gagnon, Schwartz, Dell & Saffran, 1996; Stemberger, 1990). There is a large body of work investigating speech errors (Fromkin, 1973) and the "tip of the tongue" phenomenon (Brown and McNeill, 1966). Analyses of speech errors have revealed that people tend to mix up phonologically similar items (saying bomb square instead of bomb scare) and occasionally semantically related items (oven and fridge, apple and orange), suggesting that the lexicon may be organized either phonologically or semantically, or both. Verbal fluency tasks like Rapid Naming of Animals(RNA) is another way used clinically (Troyer, 2000) with the assumption that the better the person's ability to access lexical items, the more items the person would be able to name.

However, it has been argued that the above methods such as Priming, speech error analyses and Verbal Fluency have the shortcoming of characterizing the dynamics involved in the process of language production (e.g., Meyer, 1992). Hence the recent research focusing on the speech production has concentrated on the reaction time measure experiment which allows the researcher to test more objectively and help in deriving predictions from the theoretical models. So, the most common paradigm for testing the processes engaged in lexical access using reaction time experiment is the picture naming experiment. Although picture naming is an oversimplification of the processes involved in language production it involves many processes that are engaged in lexical access. While naming a picture, the initial step is to recognize the picture and to choose its corresponding semantic representation (e.g. cat). Throughout this process, along with the activation of the corresponding semantic representation of the picture, the related semantic representations also get activated (e.g. dog). Besides the activation of the conceptual representation, the corresponding lexical nodes within the mental lexicon also gets activated and the speaker needs to select the desired lexical node correlating to the picture amongst all the activated lexical nodes ('cat', 'dog', 'mouse', etc.). As soon as the desired lexical node is chosen, its corresponding phonological segments are retrieved (/c/, /a/, /t/). Further the articulatory routines in consonant to the phonological segments of the chosen word are accessed. The point where the lexical selection takes place is called as the grammatical encoding as it is the time where the grammatical properties of the chosen word are accessed (Bock & Levelt, 1994, Levelt, Roelofs & Meyer,

1999). And the point at which the segmental aspects are accessed is termed as the phonological encoding

There are few researches done on lexical access in bilingual and in multilinguals. The earlier studies done by Bialystok and Craik (2010) investigated the bilingualism effects on cognitive and linguistic performance across the lifespan. The results of their research indicated that speaking two languages routinely had greater implication on the cognitive ability and it also enhanced the executive control functions throughout the lifespan. But the only reported negative effect of being bilingual was on their verbal skill and knowledge especially the vocabularies were smaller and the access to the lexical items was less rapid.
Ma¨giste (1978) conducted several experiments on bilingual and trilingual group at Stockholm University. The language considered for testing were German and Swedish in Sweden and the trilingual group had migrated with different extent of L1s. The objective of the research was to study the speed of language processing in bilinguals, multilinguals and then to compare their performance with the monolingual group. Decoding (e.g. reading aloud printed words) and encoding tasks (picture naming and naming two digit numbers) were used to assess the performance. Comparing the performance of monolinguals with bilinguals and multilinguals revealed that the multilinguals had significantly longer reaction time for both the languages and especially with the encoding tasks. Even though this study did not give the actual figures, the figures given in the study gave an inference that the multilingual group had almost 200 ms slower processing speed the encoding tasks compared to the other groups. The rationale behind the slower reaction time in trilingual group can be (a) the frequency of usage of two or more languages can be less compared with one and (b) there may be competition between the language systems. The findings of the study substantiate the interdependence hypothesis reported in bilingual storage. In the following research, Ma¨giste (1986) reported that the trilingual performance was poorer in the many parts of the Raven Matrices and also they were slower in bilingual Stroop tests in both German and Swedish languages. The above findings at least hint that there may be a cost to be paid for learning another language.

In Indian language context, there are several studies concentrated on the lexical semantic relationship in bilinguals. Iyer (2006) studied the lexical access and processing in monolingual English and bilingual Hindi-English adult speakers. Online picture naming task and word reading task were used to assess the lexical access. The performances of these two

tasks were compared between the monolingual English speaking group and the bilingual Hindi-English speaking group. Results were discussed aiming the issues related to lexical processing, language development and processing. Altogether, the findings suggested that the lexical task performance improved with age. Additionally, predictor-outcome relationships were mostly homogeneous for both bilingual and monolingual groups. The age at which the language was acquired played an important predictor for both word reading and picture naming behavior in both monolinguals and bilinguals. There was effect of frequency in bilingual languages for the word reading task along with differences in orthographic interacting with the effect of frequency.

Ramakrishna and Prema (2008) study the semantic and lexical organization in bilinguals by Comparing between the monolingual Kannada and bilingual Kannada speaking children using the repeated word association task to see the organizational abilities in monolingual and bilingual children. Bilingual children showed greater number of paradigmatic responses even at the age of 6 years whereas the monolingual children shift from the syntagmatic to paradigmatic responses occurred at later stage and stabilized at 8 years.

The majority of studies till date have concentrated on lexical access in monolinguals and bilinguals. Because of limited number of research have been conducted on trilinguals or multilinguals and comparison of performance between monolingual, bilingual and multilingual groups, the consequences of speaking more than two languages on Lexical access remain poorly understood. In Indian context, there are several studies which are concentrated on bilinguals and there is scarcity of studies concerning the Lexical access related to multi-ligulas. Hence the present study was conducted aiming to extend research in this area by examining and comparing the lexical access between monolingual, bilingual and multilingual children. The objectives of the study were to compare the performance between the monolingual, bilingual and multilingual children and to compare the reaction time for picture naming task across the groups.

Method

Participants

Total of 180 subjects participated in this study within the age range 8.6-9 years. The subjects were divided into three groups in this present study. Group 'A' constituted 60 monolingual, group 'B' included 60 bilingual children and group 'C' had 60 multilingual children. All the subjects were students. All were native Dakhni (L1) speakers. The monolingual group had Dakhni as their mother tongue, having Urdu as their medium of instruction. The bilingual group, had Dakhni as their first language in the early childhood and started with the acquisition of their second language, Kannada (L2) by the age of three years i.e., in their preschool period. The medium of instruction was in Kannada (L2). The Multilingual group had Dakhni (L1) as their mother tongue and having both Kannada (L2) and English (L3) as the language spoken at school. All the multilingual speakers had Dakhni as their first language in the early childhood and started with the acquisition of their second language and third language, Kannada and English by the age of three years i.e., in their preschool period. All the participant's performance in the school was average or above average as per the school records and teachers. They all had normal hearing sensitivity, intelligence and behavior as per the screening report of qualified Speech and Language Pathologists and Audiologists. All were from Middle socio-economic status. Next, to gather information about their language use and proficiency level, second language proficiency using International Second Language Proficiency Rating Scale (Wylie &Ingram, 2006) was administered. ISLPR was used to assess the second language proficiency in both bilinguals and multilinguals. For Monolingual children group, Proficiency 0+ Formulaic Proficiency (Able to perform in every limited capacity within the most immediate, predictable areas of need, using essentially formulaic language) in second language was considered as Monolinguals for the study. For Bilingual and Multilingual children rating of 2+ indicating proficiency of language for formal and informal communication was considered for the study. In the multilingual group, for the third language proficiency assessment, A language history questionnaire (Gullberg and Indefrey (2003), was administered to assess participants' language history.

Procedure

Task

Picture naming task was conducted in the present study. Picture naming task investigates the processes involved in lexical access is by examining the mechanisms engaged in naming a picture. Although picture naming is an oversimplification of the processes involved in language production it involves many processes that are engaged in lexical access. (Costa, Colomé and Caramazza, 2000).

Stimuli

The picture naming task included 50 pictures of the nouns from ten categories. Each category had five nouns as stimulus. An additional 5 pictures was used as practice items. The pictures was presented using laptop preprogrammed using DMDX to analyze the accuracy and latency of the response time to name the pictures was calculated.

Testing

The participants were individually tested. Instructions were given by the researcher verbally in their first language. The instructions were as follows' ""You will be presented with set of pictures one by one. You are required to name the pictures as fast as possible". Each participant was seated in front of a computer screen at a distance of 2 feet and was instructed to name lists of pictures in their L1. Before the experimental lists began, each participant was given practice trails as training session. This practice trial had lists of picture similar to the experimental lists. The list of pictures were structured as follows: (i) a picture was presented at the centre of the screen on a white background for 2500 milliseconds; this was followed by blank interval of 500 milliseconds (iii) the participants were instructed to name the pictures in their L1into the microphone. The entire testing of picture naming task was carried out in a single sitting. The responses of the subjects were measured on two parameters, namely, accuracy and latency. A response was considered accurate when it is same as that of the target word. Each accurate response was assigned one point. Thus the maximum score that a subject can obtain is fifty. A total number of such accurate responses for each subject were calculated and total number of accurate responses for each group was obtained. The duration between the end of the investigator's stimulus and the end of the subject's response was considered as the latency of that response and was measured in seconds. The latencies were measured only for accurate responses. The latency measurement was done using DMDX software. Total latency (in seconds) for each subject was calculated.

Results

Table 1: Mean Correct Responses for Monolingual, Bilingual and Multilingual groups.

GROUPS	N	Mean Correct Response	SD
Monolingual	60	32.9	7.3
Bilingual	60	32.6	6.1
Multilingual	60	30.7	5.3

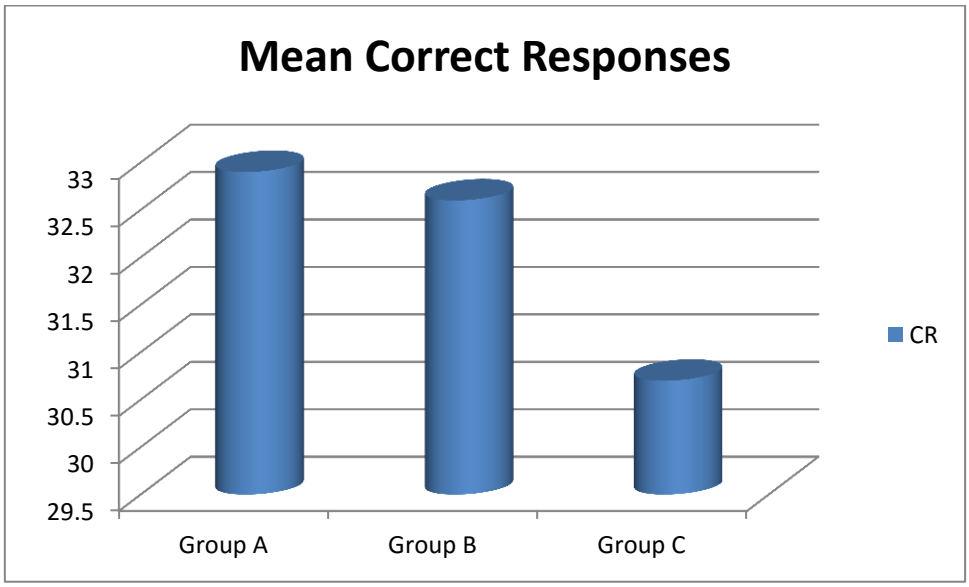

Fig 1: Performance Comparison between Monolinguals, Bilinguals and Multilinguals.

The picture naming task across the three groups was compared using the paired sample't' test. The analysis was performed on condition means for correct and validly named responses. The mean correct responses were extracted. The mean Correct Response (CR) for Picture Naming task for monolingual, bilingual and multilingual groups was 32.9, 32.6 and 30.7 respectively. The study of the scores indicates that the monolingual group performed better than bilingual group followed by multilingual group for the picture naming task, however, the MANOVA results indicated that there was no significant ($p > 0.05$) difference between group 'A', Group 'B' and Group 'C' for the mean correct responses. The mean and standard deviation scores of this task are depicted in Table 1 and Figure 1.

Table 2: Mean Reaction (msecs) Time for Monolingual, Bilingual and Multilingual groups.

GROUPS	N	Mean Reaction Time	SD
Monolingual	60	1088.7	181.6
Bilingual	60	1205.8	99.0
Multilingual	60	1293.8	219.4

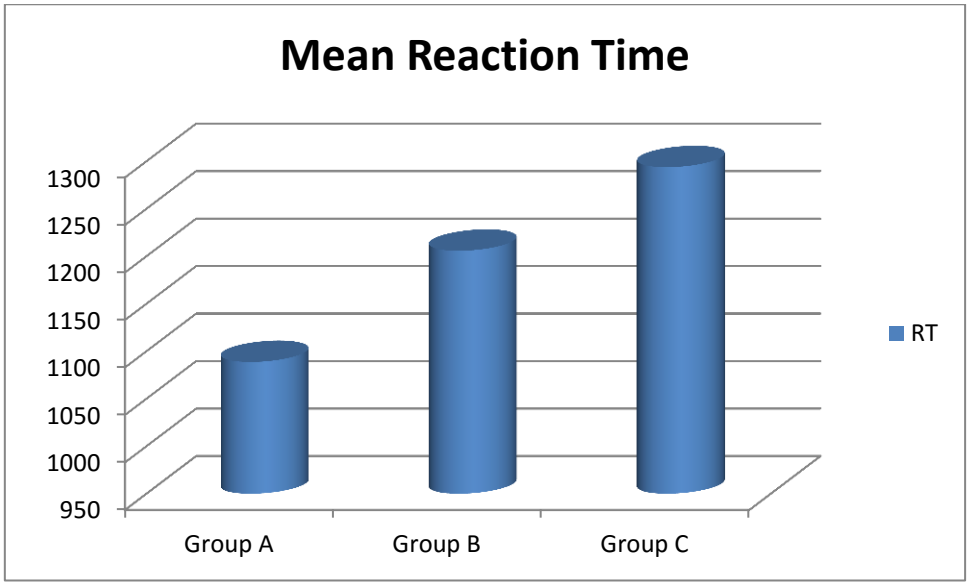

Fig 2: Mean Reaction Time (msecs) between Monolinguals, Bilinguals and Multilinguals.

The mean Reaction Time (RT) for picture naming task for monolingual, bilingual and multilingual groups was 1088.7 ms, 1205.8 ms and 1293.8 ms respectively. This indicates that the participants of Group 'A' named picture faster compared to Group 'B' compared to Group 'C'. Further, the MANOVA results indicated that there was significant ($p < 0.05$) difference between group 'A', Group 'B' and Group 'C' for the mean reaction time i.e., Group 'A' performed significantly better than the Group 'B' and followed by Group 'C'. The mean and standard deviation scores for this task are shown in Table 2 and Figure 2.

Discussion

In this present study we conducted picture naming task on monolingual, bilingual and multilingual children to study the accuracy and speed of lexical access. Picture naming task

was incorporated in this study as it allows testing more specific prediction and it is a popular paradigm to study the lexical access. The results of the study revealed that, both accuracy and the speed of lexical access was better for monolinguals compared to the bilingual and multilingual children, however, for accuracy task the difference between the groups were not significant but the speed scores between the groups were significantly different. Several explanations for these differences between monolingual, bilingual and multilingual children may be proposed. The difference in the accuracy may be attributed to the experiential difference in the language use and the process of language acquisition. For example, multilingual and bilingual children may experience certain items in particular circumstances wherein only one language may be used consistently to name that particular item, hence the number of words used in that specific language decreases.

There can be two more main hypotheses that can be proposed. One is the **weaker links hypothesis**, that states that, the poorer access observed in bilinguals and multilinguals can be attributed to the variation in the degree of the associative links between the concept and the words used, i.e., in monolinguals the exposure is more compared to the bilinguals and multilinguals in a specific language (Gollan, Montoya, Cera, & Sandoval, 2008). In contrary, the **competition hypothesis** states that, the bilinguals and multilinguals require an effortful processing to retrieve words from a specific language as they need to suppress the inhibitory interference caused by the competing languages (Dijkstra, 2005; Green, 1998).

The later hypotheses suggests that the bilingual and multilingual group need to exert more of inhibitory mechanism in order to suppress the activation of other related semantic items when asked to name a desired item. That is, the words in all the languages begins to get operative to certain extent and may compete for selection (e.g., Bajo et al., 2010, Kroll, Bobb, Misra & Guo, 2008) which implies that cognitive control mechanisms must be at work to control this cross-language activation. Some researchers have argued that inhibitory control may serve the role of suppressing the non-target words and help in accessing the target word. (e.g., Costa, Santesteban & Ivanova, 2006; Green, 1998).

The current findings are in consonant with the earlier results by comparing the reaction time and accuracy in picture naming task between monolingual, bilingual and multilingual children. Similar findings have been reported in bilingual studies by Kohnert &

Bates, (2002) and Ivanova & Costa, (2008) who reported that bilingual adult and children exhibited slower reaction time and poor accuracy for picture naming task even while naming the pictures in first language. They attributed their findings suggesting, that our processing mechanism may have built a rhythm to process in L1 and thereby the language processing in a language in which the elements are retrieved slower and hence it becomes available later (Franceschini et al., 2006). Additionally, it was propounded that in our system there is a 'different drummer' that controls the processing speed based on the availability of the elements. So, these findings suggest that as monolinguals are exposed to greater frequency to a particular language compared to the bilingual and multilingual group, therefore, the availability of the elements in L1 are faster or easily accessed in monolingual group compared to bilingual and multilingual.

Conclusion

The study aimed at comparing the lexical access between monolingual, bilingual and multilingual children. The objectives of the study were to compare the performance between the monolingual, bilingual and multilingual children and to compare the reaction time for picture naming task across the groups. Results indicated both accuracy and the speed of lexical access were better and faster for monolinguals compared to the bilingual and multilingual children. These findings indicated that faster availability of L1 in monolinguals suggesting that there is experiential difference seen between the monolingual, bilingual and multilingual children in the process of acquisition and language use and also there is role of inhibit interference from the competing language in bilinguals and multilingual children.

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