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Vocabulary acquisition in bilingual children: Are they more delayed in English than their monolingual peers? Does this depend on input of language?

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Abstract
The current study investigated the effect of exposure to English on bilingual language acquisition. 18 monolingual and 6 bilingual children, aged between 29 -32 months, took part in standardised language tests measuring productive and comprehensive vocabulary. Although previous research has investigated this, not all variables known to affect vocabulary development have been controlled for. This study controlled for socio-economic status, birth order and different levels of exposure to English and compared these to test scores. Results suggest exposure is a significant predictor of productive ($p = .01$) and comprehensive ($p < .01$) language development. A greater difference was found between groups for production ($p < .01$) supporting previous research suggesting production may be more problematic than comprehension for bilingual children.

Ethical Statement

The data collected for this study was done so in an ethically sound manner. The participants were children with a mean age of 30.35 months and therefore the parents were asked for informed consent before their child could participate in the study. The consent form was emailed to the parents beforehand along with the information sheet which explained the purpose of the research, how long it would take and that each session would be recorded by video. The parents were also asked if they would want to know if their child had a speech and language delay beforehand and any queries from the experimenters were checked by speech and language therapist Frederique Arreckx, who watched the videos back and also made sure the experimenters were strictly adhering to the standardised rules of each test.

Confidentiality was maintained as the tape recordings were only seen by the other collaborating researchers and the supervisors of the project. The tapes were kept in a locked room and some recordings were kept on a computer in a locked room. These were later transferred onto disc and kept together with the other files in a locked room. This data will be destroyed after five years and the children were only referred to as numbers in the data. The parents' were reminded of their right to withdraw the data at any point and have it destroyed. They were informed of this three times during the testing: once in the email confirming the appointment to the parent, once during the debriefing and once at the end of both sessions when the parents were emailed thanking them for their participation. The children were praised throughout the sessions even if their answers were incorrect and the experiment was discontinued if the child stopped responding to the experimenters' questions or appeared to lose interest, so not to cause any distress to the child. Due to the length of the tests performed each participant was asked to come in on two separate occasions so the length of each session did not exceed 30 minutes. If these over ran or the child became tired, they were asked to come in for a third session to complete the study or breaks were given in between tests if this was not possible. At the end of each session the children were thanked for their participation and given a balloon and young scientist's certificate. The parents were offered the choice of either three pound travel money or a young scientist t-shirt for their child which costs the same to produce. They were given a written de-brief at the end of the second session which explained what the researchers were investigating. It also included contact numbers in case the parents had any further questions or wanted their data removed.

This research did not involve any psychological/physical harm or deception to the child. The data used in this report was collected, coded and transcribed by myself and the two collaborating researchers; Katherine Kraft and Zelah Hunt.

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Introduction

Standardised Tests

Britain is becoming a largely populated multi-cultural and multilingual society with 59% of Speech and Language (SL) therapists having at least one bilingual child on their caseload (Winter, 1999) and there is evidence of these rates continuing to rise (Enderby & Petheram, 2000). The SL profession is dominated by white monolingual females (RCSLT, 1999) with very few bilingual therapists (Law et al. 2000), or specialists within the area (Winter, 1999). Although most people in the world grow up in multilingual environments (Gosjean, 1982; Romaine, 2001), only two percent of basic language development research includes children learning more than one language (Bhatia & Ritchie, 1999) and only 6.8% of children with English as an additional language are being tested in their home language (Lindsey et al. 2002). Crutchley, Conti-Ramsdon and Botting (1997) demonstrated that this can be detrimental for bilingual children. They used language tests standardised to monolingual English children, to compare bilingual and monolingual children already being treated in a language impairment unit. Their results suggested that the bilingual children's language impairment appeared to be more complex than their monolingual peers and their test performance differed in a way that could not be explained by the severity of their SL difficulty. These differences suggest that treating bilinguals and monolinguals as a homogenous group may be detrimental to bilingual children and obscure the differences between the groups. Using monolingual norms in the past has led to much over-diagnosis of language impairment in bilingual children (Gutierrez-Clellen, 1996; Restrepo, 1998) but greater awareness has also contributed to under-diagnosis due to SL therapists taking extra care not to over-diagnose (Crutchley, 2000). More recent tests however have tried to include bilingual norms e.g. the British Picture Vocabulary Scale II (BPVS II; Dunn, Dunn, Whetton & Burley, 1997), where supplementary data has been provided for children with English as an additional language (Whetton, 1997). However, this sample has only been normed for the BPVS II and other variables such as socio-economic status (SES), exposure to language and birth order have not been controlled for. It has been suggested that the most efficient way to measure a bilingual child's language would be to test them in both languages to establish which language is most dominant (RCSLT, 1998). However, in the current society, there are not enough skilled professionals and a lack of unbiased assessments (Law et al. 2000; Winter, 1999). Therefore, another way of measuring a child's dominant language is needed to help understand any differences between monolingual and bilingual children.

Reasons for Delays in Bilingual Children

Preschool bilingual children often score below monolingual children of the same age on receptive (Doyle, Champagne & Segalowitz, 1978; Rosenblum & Pinker, 1983; Pearson, Fernandez & Oller, 1993; Nicoladis, 2003, 2006) and productive vocabulary (Junker & Stockman, 2002; Gathercole, Thomas & Hughes, 2008; Vagh, Pan & Martinez-Sussman, 2009), when tested in one language. The extent to which bilingual children hear a particular language differs dramatically and on average they are exposed to each language less than monolingual children

(Pearson, Fernández, Lewedeg & Oller, 1997). This may be dependent on the community the child is growing up in; whether it is a one language community or a bilingual community can affect not only the child's exposure to the second language (L2), but also whether they develop L2 sequentially or simultaneously to L1. Children from these two different community types will also vary greatly (DeHower, 1990; Frederickson & Cline, 1996). This variation in exposure may explain why it is so difficult to tell if a bilingual child is delayed or in fact has a lower vocabulary (Westman, Korkman, Mickoss & Byring, 2008) in the language they are tested in.

The differences between receptive and productive language are also worth considering when testing bilingual children. Research has generally shown that language learners tend to understand words before they start to produce them (Clark & Hecht, 1983; Harris, Yeeles, Chassin & Oakley, 1995), and producing words appears to be harder and requires more practice than understanding them. Although it is assumed that productive and receptive vocabulary share a common semantic store, they may differ as it is suggested that productive vocabulary may also require motoric representations of words (Fromklin, 1987). Therefore, as bilinguals hear fewer words in one language than monolinguals and also spend less time speaking in one language (Gathercole & Hoff, 2007; Gollan, Montoya, Cera & Sandoval, 2008), they may have difficulty with lexical access in production. This has been found in bilingual adults (Gollan & Acenas, 2004) and more recently in bilingual children (Yan & Nicoladis, 2009). Thus, although bilingual children's comprehension has been found to be smaller than monolingual children's (e.g. Nicoladis, 2003; 2006), production appears to be more affected, with a larger gap found between comprehension and production (Oller, Pearson & Cobo-Lewis, 2007).

Further risk factors commonly associated with low vocabulary knowledge in all children are: low socioeconomic status (SES), gender differences and birth order. Children from lower income groups have been shown to have a lower vocabulary (Hart & Risley, 1995; Raviv, Kessenich & Morrison, 2004); consequently, measures of language development may be reflecting non-linguistic factors based on pre-existing SES differences (Morton & Harper, 2007). However, ethnic status and SES are often confounded (Skiba, Poloni-Staudinger, Simmons, Feggins-Azziz, & Chung, 2005), making it difficult to examine the effects of either variable. Recent research has shown however, that both affect language growth independent of the other (Pungello, Iruka, Dotterer, Mills-Koonce, & Reznick, 2009). The geographical area may also affect SES which may directly affect how children score on their vocabulary development and their test results. For example, the Oxford CDI (Hamilton, Plunkett, & Schafer, 2000) norms are not representative of the population as all participants were from Oxford; therefore biased to have a higher SES. This could make their ceiling scores higher at a lower age.

Gender has also been shown to be an important factor in lexical development. Significant differences have been found between male and female language acquisition, with females' generally reaching language milestones earlier than males (Tamis-Lemonda, Bornstein, Kahana-Kalman, Baumwell & Cyphers, 1998), and having higher vocabulary competence than males the same age (Bornstein, Haynes & Painter, 1998; Fenson et al. 1993; Maital, Dromi, Sagi & Bornstein, 2000).

Research also suggests that birth order has an affect on language development, with later born children having a smaller vocabulary than first born children (Fenson et al. 1994). Similar findings have been shown in Hebrew children (Maital et al. 2000) and more recently in bilingual children (Shin, 2005). Research has suggested that this may be due to the differences in interactions with the later born child; e.g. less dyadic conversations between mother and child (Bates 1975; Hoff-Ginsberg & Kruger, 199l; Nelson, 1973; 198l; Pine, 1995). However, there has been contradicting evidence about the effect of birth order on language development. It has been found that having an older sibling does not affect language development except in personal pronouns; which the second child develops more quickly due to being exposed to more varied and rich language models (Oshima-Takane, Goodz & Derevensky,1996; Oshima-Takane & Robbins, 2003). There has been limited research on birth order but it is closely linked with input and suggestive of the causal role exposure plays in language development, in both monolingual and bilingual children.

Effect of Exposure

Research over the last few decades has provided substantial evidence that children learn a language through listening to the people around them (Brown, 1973; Huttenlocher, Haight, Bryk, Seltzer & Lyons, 1991). Therefore, input must play a vital role in language development and one of the oldest paradigms relies on the detailed observation of children's speech productions, as well as the parental speech that delivers the early language input to the child (Tomasello, 2003). Even in children speaking one language, it has been shown that the amount of exposure may affect the timing of language acquisition but not the end result (Hart & Risley, 1995; Gathercole, 2007; Gathercole & Hoff, 2007). The fact that exposure has been found to play a crucial role in lexical development for monolingual children (Huttenlocher et al. 1991), suggests that this is also likely for bilingual children. Many studies have shown differences between monolingual and bilingual populations, suggesting that bilingual children develop their vocabulary in either language more slowly and have a smaller vocabulary in that language (Hoff & Elledge, 2005; Hoff & McKay, 2005; Ortiz et al, 1985; Ortiz, Garciá, Wheeler & Maldonado-Colón, 1986; Pearson & Fernándaz, 1994). However, evidence has shown that bilingual children will have a vocabulary across both languages which is equivalent to or exceeds their monolingual counterparts (Pearson et al. 1993; 1995; Umbel, Pearson, Fernández, & Oller, 1992; Junker & Stockman, 2002).

Pearson et al. (1997) examined the role of input and lexical learning in a longitudinal study of Spanish and English children and found that having a higher exposure to a language had a strong influence on the child's acquisition of the vocabulary in that language. However, these researchers measured vocabulary based only on parental measures, which alone has been shown to underestimate vocabulary knowledge (De Houwer, Bornstein, & Leach, 2005). Additionally, they did not control for SES; another variable known to affect language development.

Thordardottir, Rothenberg, Rivard and Naves (2006) investigated bilingual children with similar SES's, from an English and French speaking country with equal variance in both languages (neither language dominating). They compared these children to monolingual children from both languages. Vocabulary was measured in both languages using the MacArthur CDI and the French CDI as parental measures of production and the Peabody Picture Vocabulary Test (PPVT), to measure comprehension, again in both languages. An effect of exposure was found for production between the English monolinguals and the bilinguals with monolinguals outperforming bilinguals, but not for the French monolinguals and bilinguals. Thordardottir et al. (2006) suggested that children, regardless of age or other factors, may have a smaller vocabulary due to the language they speak (Truaeau, Frank & Poulin-Dubois, 1999; Thordardoditter, 2005). This could explain why no difference was found between the French monolingual and bilingual children. However, their results did show bilingual children scored within the normal range for receptive but not productive vocabulary, supporting previous findings that bilingual children may have more difficulty in production than in comprehension (Yan & Nicoladis, 2009).

A similar study investigating parent and teacher reports suggested that low-income parents appear to be better at reporting their children's productive vocabulary, even in their non-native language, but underestimate their children's comprehension ability (Vagh et al. 2009). Houston-Price, Mather and Sakkalou (2007) also found that parents underestimated their children's vocabulary when using the Oxford CDI. Fenson et al. (1994) found that parents from all SES's could report productive vocabulary but found contradicting results for comprehension, with parents from lower SES overestimating receptive vocabulary, a result also found by Reznick (1990). This research suggests that although the CDI appears to be a reliable measure of productive vocabulary (e.g. Fenson et al. 1994; Sachse & Suchodoletz, 2008), it may not be such a reliable measure of receptive vocabulary, as parents may over-estimate or under-estimate, their child's comprehension and this may depend on SES. These findings imply that the CDI is best carried out alongside other standardised tests in order to get a full measure of a child's vocabulary. Vagh's et al. (2009) results also indicated that bilingual children from English speaking homes have higher total vocabularies in English when compared to their monolingual peers, and this is irrespective of home language status. This supports other research that the English of bilingual children lags compared to their monolingual peers (Baker, Simmons, & Kaméenui, 1998; August & Shanahan, 2006). The amount of exposure to each language was also shown to affect the bilingual children's vocabulary scores, with the more Spanish spoken at home, the higher their vocabulary scores in Spanish. However, although Vagh et al. (2009) and Thordardottir et al. (2006) both used multiple measures of vocabulary and controlled for SES, they did not control for birth order, which has also been shown to effect vocabulary development (e.g. Hoff-Ginsberg & Kruger, 199l; Oshima-Takane et al. 1996). Both studies used participants speaking the same two languages and although this reduces the linguistic differences associated with having more languages, it is not representative of the population. Thordardottir et al. (2006) used equal exposure rates, not accounting for the variance in language exposure that bilingual children receive, as most bilingual children do not speak equal amounts of both languages.

A further study that examined the effect of exposure on language acquisition for Welsh/English bilingual children was conducted by Gathercole and Thomas (2005). They found a direct effect of exposure, showing the children with higher exposure to Welsh outperformed the children who hear both Welsh and English at home (WEH), and the children who hear only English at home (OEH). WEH children also outperformed OEH children showing a mirror effect of exposure on the test scores. They also found a greater effect of exposure at home to exposure at school. Further supporting evidence comes from Gathercole, Thomas and Hughes (2008), who in a similar study found children with only Welsh at home, outperformed their peers from the OEH group when tested in Welsh. This is consistent with other findings that suggest vocabulary is related to exposure to language (Pearson et al. 1993; Gathercole, 2002a; 2002b; 2002c; Ollers & Ellers, 2002b; Hoff & Elledge, 2005). However, a vast majority of the research in this area is again only looking at participants with the same two languages for all participants; this lacks ecological validity as it does not relate to what SL therapists' are seeing in clinical practice. This makes their recommendations only applicable to the languages being examined. Therefore, research must also be carried out to include a variety of different languages which is more reflective of the British population. Another flaw found across this research, are studies not controlling for SES or/and birth order effect. Therefore, although low exposure appears to be directly causal of lower language vocabulary, it is not conclusive without controlling for the other variables.

Most published studies vary in the extent they explore the amount of exposure a child hears and although evidence is clearly suggestive of the contributing role that siblings have on language development, many studies have not taken this into account (e.g. Vagh et al. 2009), including research investigating exposure directly (e.g. Pearson et al. 1997; Gathercole et al. 2008). Having a clear understanding of all the variables which affect language development, would provide a greater understanding of how the amount exposure affects vocabulary development.

The Royal College of Speech and Language Therapists (RCSLT, 1998) recommends that bilingual children be tested in both languages where possible, to determine the dominant language and receive therapy in this language if needed. However, in practice this is rarely possible, therefore a practical method needs to be found to determine the dominant language of the bilingual child. Junker and Stockman (2002) suggested that using a total conceptual vocabulary (TCV) would allow for the child's additional language, therefore allowing monolingual norms to be used. In this case bilingual children would not need additional norms, only a scoring mechanism that combines the child's knowledge for both languages. They found that bilingual children's scores were even more comparable to monolinguals when they were given credit for only their stronger language. However, there is still a great amount of variability within each language that each bilingual child hears; one source of that variability is thought to be that of exposure (Pearson et al. 1997). Until it becomes possible to test each child in both languages, measuring exposure may help to provide a clearer picture of bilingual children's language development.

Our study

We conducted a study using 18 monolingual children and 6 bilingual children with a variety of additional languages and looked at the affect exposure had on bilingual children's language development when controlling for SES, birth order effect and where possible additional language development. We used three different measures to test the children in the laboratory; the Preschool Language Scale IIII (PLS IIII; Zimmerman, Steiner & Pond, 2002); the British Picture Vocabulary Scale III (BPVS III; Dunn, Dunn & NFER, 2009) and the SETK (Grimm, 2000). We also used two parental reports, the Oxford CDI (Hamilton et al. 2000) and the Input

Scale (Floccia, Abbot-Smith, Arreckx, & Cattani, 2009), which measured exposure to English, SES, and Sibling Status. These were compared to their scores on the other measures. The primary aim of this study was to examine the effect exposure to English had on the test outcomes when controlling for SES and sibling status. The secondary aim was to find out if there was any effect of SES and sibling status on the measures of vocabulary. Finally; if there was any difference between the receptive and productive language of bilingual children.

We hypothesised, in light of previous findings (e.g. Pearson et al. 1993), that exposure to English would be a significant predictor of vocabulary. We also expected to find a difference between the monolingual and bilingual children on all test measures, with the monolinguals' scoring higher than the bilinguals'. It was predicted that the bilingual children would score closer to their monolingual peers in receptive language, but further apart for production. This is in light of research suggesting producing words is harder than understanding words for bilingual children (Yan & Nicoladis, 2009). SES was also expected to affect test performance, replicating research by Fenson et al. (1994), who found the higher the SES, the higher the children's scores. The final prediction was that birth order will have a negative effect on tests, such as that found in research from bilingual populations (Fenson et al. 1994; Shin, 2005).

Method

Design

A two factor mixed design was used. The between subjects independent variable was the language of the child and the within subjects variable was the standardised tests carried out on all children in both conditions. There were two between subjects' language conditions; monolingual and bilingual. The dependent variables were the scores on the following standardised language tests: Oxford Communicative Developmental Inventory (CDI; Hamilton et al. 2000), as well as the second language CDI's used for the bilingual children where possible, the Preschool Language Scale IIII (PLS IIII; Zimmerman et al. 2002), British Picture Vocabulary Scale III (BPVS III; Dunn et al. 2009) and the Sprachentwicklungstest für zweijährige Kinder (SETK; Grimm, 2000). The primary independent variable is the exposure to English recorded on the Input scale (Floccia et al. 2009). Further independent variables included the SES and sibling status of the children, which were also recorded on the Input scale.

Participants

24 participants were used in this study; 18 monolingual and 6 bilingual children. The participants ranged in age from 29.09 to 32.12 months with a mean age of 30.39 months overall. The bilingual participants had a mean age of 29.72 months (SD = 0.53) for the first session and 29.99 months for the second session (SD = 0.66). For the monolingual participants, three children came in for a further third session. Therefore, on the first session the monolinguals' had a mean age of 30.32 months (SD = 0.88), second session; 30.39 months (SD= 0.81) and third session; 30.67 months (SD = 1.28). The planned age range was averaged at 30 months; however, the age range was made wider than originally planned to be able to include all the bilingual children available. There were 12 males and 12 females in total with five males and one female in the bilingual condition and seven males and 11 females in

the monolingual condition. Five of the six bilingual were of mixed ethnicity; one child; English and Spanish, two children; English and German, one child; English and French and one child English and Italian. The sixth child was Kurdish. The children were recruited through the Plymouth Babylab database which contains the names of all the children who had joined and were willing to take part in the different studies at the University of Plymouth. The recruitment of these children to the Babylab was carried out in Plymouth city centre, as well as local nurseries and schools. If the parent(s) chose to sign up, they were asked what language(s) their child spoke and which accent(s) they heard. Parents were also asked to report whether their child had ever had a hearing or developmental impairment which might have affected their language development, was more than six weeks premature or whether their child had ever been diagnosed as having a language delay. Four children were excluded from the data; one was more than six weeks premature, one from parental interference, and two children who had SL difficulties. The data from one child who refused to continue with the tests was included and the missing variables were entered into SPSS. One child came into the baby lab as bilingual but when scored for exposure to English, this was found to be 100 and when investigating this further, the parent confirmed that this child neither produced nor appeared to understand any of the additional language. Therefore, this particular child was classed as monolingual.

Materials/Apparatus

The Babylab database was used to recruit the participants and each participant was given a balloon and a printed colour Babylab certificate which was laminated and had stars corresponding with how many sessions the child had attended, e.g. one star for one session. The parent was also given the choice of a t-shirt or three pounds to cover expenses. If they chose the t-shirt, they had a choice between a variety of different colours, styles and sizes.

Each child was tested using standardised tests used within the speech and language disorder population. The first of these was the PLS IIII (Zimmerman, Steiner & Pond, 2002) which measures young children's auditory and expressive language. The PLS IIII has been standardised to monolingual children aged from one to six years, five months old. It contains items which target interaction, attention and vocal/gestural behaviours to examine the child's language development and has been normed to a sample of 702 children. The test was started at the age of one and a half years for all participants so that there was no problem of having to go back to reach the basal score. The test was competed when the child reached their ceiling score of five questions in a row wrong. Due to time constraints, only the auditory section of the PLS IIII was used and a second test, the SETK; a word production test standardised to the German population was used, (Grimm, 2000) which has also been used with English children (Dittmar, Abbot-Smith, Lieven & Tomasello, under revision). The final test used was the BPVS III; a standardised test of receptive vocabulary (Dunn et al. 2009). This is standardised to children from age two years six months to 16 years 11 months. It contains 168 stimulus words on 14 sets and the child points to each picture until he/she reaches the ceiling of eight wrong in one set. Although this test is normed for children aged 30 months, and the age range of the children in this study was 29 – 32 months, this was anticipated to not to cause any problems as it has been found that the BPVS III is successful with children as young as 24 months (Arreckx, Abbot-Smith, Cattani & Floccia, 2009).

However, this was a trial test and the same standardised scores and instructions were not used. These tests were conducted over two sessions both lasting approximately half an hour. The PLS IIII and the BPVS III will be referred to throughout this paper as PLS and BPVS.

There was a further condition where the parents were asked to complete two forms: the toddler version Oxford CDI (Hamilton et al. 2000). This is a UK adaption of the MacArthur CDI (Fenson et al. 1993), standardised for English children. This was a parental measure of vocabulary which consisted of 416 words organised into19 different categories such as animals, toys and transport, in which the parent had to mark if their child said a word, understood a word, or both. This would give the overall score of each child’s productive and receptive vocabulary. The Oxford CDI was normed for children up to 25 months. However, these norms are not representative of the population as the sample was only taken from Oxford and therefore are biased towards a higher SES. There sample sizes are also small for each age of the children, a problem that is also found in the PLS norms. However, as this is the only version for English and the original version of the MacArthur CDI was normed for children older than this; we anticipated that the age range we used would not reach the ceiling as the SES would also have more variety. The additional language CDI’s were all normed for up to 30 months old. However, as we were expecting the bilinguals to score lower than the norms (Pearson & Fernandaz, 1994; Hoff & Elledge, 2005), we anticipated that these children would not reach the ceiling score so therefore used this measure for all the children in the study. Also, where possible the additional language CDI’s were used, although for the Kurdish child this was not available. We did however use the French, (Kern, 2001) Spanish, (Ornat & Karousou, 2005) German (Szagun, Steinbrink, Franik & Stumper, 2006), and Italian (Caselli, Pasqualetti & Stefanini, 2007) normed CDI’s.

The second form completed by the parents was the Input scale devised to measure each child’s exposure to English, sibling status and SES. The SES was measured using the English education equivalents of the Italian CDI SES scores (Caselli et al. 2007), which scored SES as: high SES; either of the parents having a PhD, Masters or Undergraduate Degree, medium SES; any one parent having a Diploma, NVQ qualifications, A-level or equivalent and a low SES; one parent having O-Level, GCSE, or no qualifications. We scored the parental SES using the qualification level of the most educated parent. For the sibling status the children were split into two groups for analysis; ‘first born children’ or ‘only child’ and ‘later born children’. This was to investigate the effect of birth order. We used the Input scale to compare to the test results and the CDI as a further measure of each child’s vocabulary and to validate the scores on the tests. The bilingual children were also given a further measure; the CDI in their additional language, to validate their amount of exposure they receive.

All the testing was recorded on a video camera; this was changed from cassette recordings to a digital camera in order for the computer files to be transferred easier and backed up. The experimental room was set up to be as child friendly as possible with a small table and two small chairs for the child and the parent to sit on and the experimenter would either sit on the floor or on a small sofa, whichever was best to develop a good rapport with the child.

Procedure

The tests were conducted by three different researchers; with two research assistants helping at times. Each experimenter used the same materials and a standardised set of instructions. All the experimenters were trained before testing any children for the study and carried out practice trials on children which are not included in the data. The researchers were also randomly allocated to different children on the Babylab database which meant that they all tested both males and females so any effects of multiple experimenters were minimised.

Upon arranging a date to attend the sessions, the parents were sent an information sheet by email with the consent form, which they were asked to read beforehand and sign upon arrival in order to give consent for their child to participate in the study. This form also asked the parent whether they would want to know if their child had a speech and language delay. Any queries were checked by a Speech and Language Therapist who watched the video recordings back and also checked the tests were being carried out in strict adherence to the standardised rules of each test. They were also sent the CDI (in both the child's languages if the child was bilingual) by email and asked to complete before arrival. Parents were asked to indicate from the list of words on the CDI, if their child could say a word, understood it or both. The parents of the bilingual children were also given where possible, the CDI in their second language. However, the additional CDI's only measured only production. They were also sent directions to the Babylab and an information sheet with consent form which they were asked to read before coming to the session. This explained the study aims and was signed upon arrival.

When the parent(s) and child arrived for the first session, they were greeted in the waiting area by the experimenter and offered a hot drink. The Input scale was then completed by the parent with the help of the experimenter. This consisted of questions relating to their children's exposure to English, how many siblings they had and the educational level of the parents in order to measure the socio-economic status. A further form was completed either in the beginning or at the end of the study as to whether the parent would like the three pound for travel expenses or the t-shirt for their child. They were then asked to go through to the experimental room to be tested. The parent was reminded for a second time (first in the information sheet) about recording the session and with their permission, the video recorder was switched on. Before the test began, the parent(s) was asked not to interfere with the session, in order to enable the child to answer the questions independently and adhere to the standardised instructions of the measures being used. The child was first tested with the auditory part of the PLS. For example, the experimenter would ask the child to point at a picture from the manual and mark down the response of the child. There were also questions which involved using toys such as "can you give me just one block" from a pile of blocks. The child was praised throughout, but if for some reason the child stopped interacting with the experimenter the testing was discontinued. The PLS was completed when the child got five or more questions wrong consecutively. The PLS would take up the first session and in the second session the SETK and BPVS were carried out. The SEKT involved showing the child objects and pictures and asking the child to say what the object/picture is. This took approximately five to ten minutes. The BPVS consisted of a booklet of different pages each with a choice of four pictures shown to the child. The child was told the name of the object and had to point to it. The experiment continued until the child reached their ceiling for the test (eight wrong). This usually took around ten minutes. If the parents interfered at any point in their child's testing, they were reminded of the importance of not helping the child due to the strict standardised instructions for each test. If a parent continued to interfere, the child's data was removed from the study. The child was again praised throughout and at the end of each session given a balloon and a young scientist certificate and the parent was given either the t-shirt or the three pounds, whichever they chose. After the second session the parent was given a written de-brief, which explained what the researchers were investigating. It also included contact numbers in case the parents had any further questions or wanted their data removed. The parent was again emailed after the sessions to thank them and remind them that if they would like their data removed to contact the experimenter. Between the two sessions the CDI was checked by the experimenter, and if there was any queries this would be taken up with the parent in the second session. Some children attended three sessions due to not completing the tests in the second session. This may have been due to tiredness or lack of concentration; the tests were therefore continued in a further session so as not to cause any distress to the child. In this case it was marked on the test that it had been completed in a further session so the videos could be monitored closely for any problems. Each session was booked no longer than one week apart.

Results

Standardised scores were used for the BPVS and the PLS. However, as some scores from the BPVS were below the lowest standardised score possible, the lowest possible standardised score was used for these children. However, the raw BPVS scores were analysed to ensure both results were in the same direction which they were and they were strongly correlated with each other, $r = .978$, $n = 23$, $p < .001$, suggesting it was not problematic to use the lowest standardised score for these children.

For all the CDI measures, the raw vocabulary scores were used. Two monolingual children had missing data; the SES from input, and a BPVS score. In these cases the missing variable '9' was entered into SPSS.

A one-way ANOVA tested for any experimenter bias as there were multiple experimenters testing. This was found to have no significance on any measure; PLS and the SETK; $F(4, 13) < 1$ and the BPVS; $F(4, 12) < 1$. An independent samples *t*-test showed there were no significant differences found between the ages of the participants' on the first, $t(22) < 1$ and second test date, $t(19) < 1$ and there were no bilingual children that attended a third session. The same was found for gender differences within the monolingual group with no significant differences on any measure between males and females; for PLS, SEKT, CDI comprehension and production; $t(16) < 1$ and for the BPVS; $t(15) < 1$.

All test scores

Descriptive statistics for the percentage of English, the socio-economic status (SES), the Preschool Language Scale IIII (PLS), the British Picture Vocabulary Score III (BPVS), the SETK, and the Oxford Communicative Development Inventory (CDI); for productive and receptive vocabulary and the CDI in the second language are given in Table 1.

Table 1: Mean and standard deviation for bilingual and monolingual children for all measures (n = 18 for monolinguals, n= 6 for bilinguals except for the BPVS where n = 17 for monolinguals and for the CDI in other language where n = 5)

	Bilingual		**Monolingual**	
Measures	**Mean**	**SD**	**Mean**	**SD**
Sibling status			1.22	.43
SES	1.33	.82	1.41	.63
PLS	97.83	22.32	108.5	28
BPVS	76.67	5.75	79.71	6.8
SETK	18.33	7.15	25.67	2.58
CDI Comprehension	324.50	71.13	397.89	16.23
CDI production	251.33	112.29	374.89	28.22
CDI in other language – production	193.33	175.34	1.22	.43
Percentage of English	64.17	33.84		

SES and Sibling status were coded in order to examine the data. For the SES; low SES was scored as one, medium was scored as two and high SES was scored as three. For sibling status; one, was first born or only child and two was later born. The bilingual children in this study had no siblings.

Table one shows that the bilingual and the monolingual means are in the direction expected with monolingual scoring higher than the bilinguals on all measures. An independent samples *t*-test found a significant difference between conditions on the CDI production, t (5.21) = 2.67, p = .02, (one-tailed). The monolingual children scored higher (M = 374.89) than the bilingual children (M = 251.33). The difference between conditions was 123.56. A significant difference was also found for CDI comprehension, t (5.17) = 2.506, p = .021 (one-tailed). The monolingual children scored higher (M = 397.89) than the bilingual children (M = 324.50). The difference between conditions was 73.39.

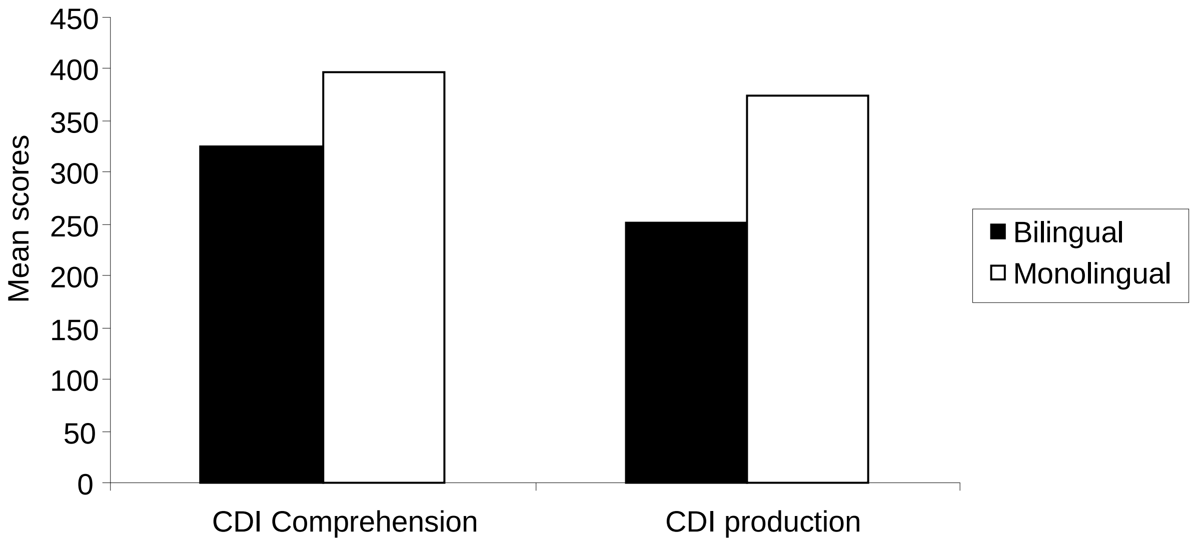

Figure 1: Bar graph to show the mean differences between monolingual and bilingual groups on the CDI (*n* = 18 for bilingual, *n* = 6 for bilingual).

The final difference found between conditions was for the SEKT, t (5.41) = 2.465, *p*= .021, (one-tailed). The mean difference between conditions was 7.3.

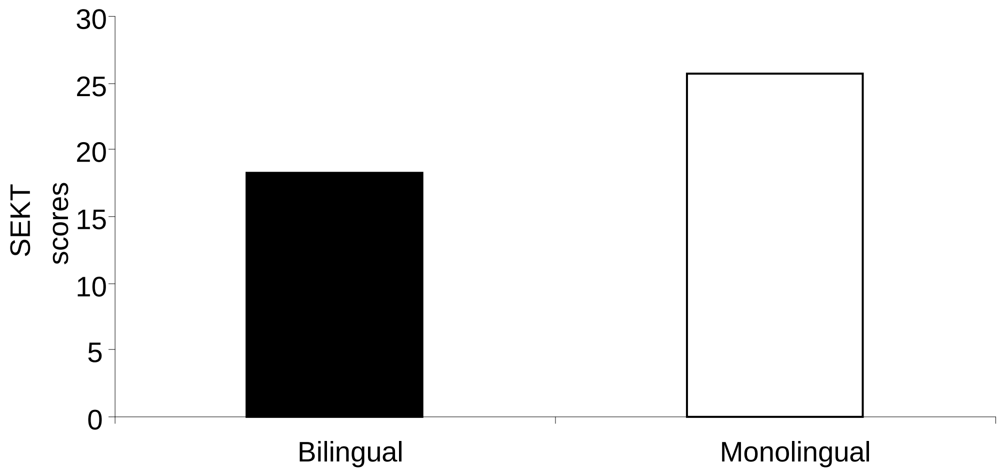

Figure 2: Bar graph to show mean difference between conditions for the SEKT (n = 18 for monolingual, n = 6 for bilingual)

However Levene's test for homogeneity showed that the assumption of equality of variance for the bilingual and monolingual group was violated on the SEKT, CDI comprehension and production. Therefore caution should be taken when interpretations are made from these results. This result is in line with the experimental hypothesis that overall monolingual children will score higher than bilingual children on the tests. However, no difference was found for the BPVS and the PLS; therefore the hypothesis cannot be accepted for all the tests. This however, supports the hypothesis that there would be a larger difference between bilingual and monolingual children in production than comprehension.

A further significant difference was found between conditions in sibling status, t (22) = 2.204, p = .042 (two-tailed). However, Levene's test for homogeneity showed that the assumption of equality of variance of the bilingual and monolingual group was violated so equal variance was again not assumed. This was expected as the bilingual condition had no children with siblings.

Overall effect of exposure to English on test outcomes

A multivariate analysis of variance (MANOVA) was carried out to look at the exposure to English as a predictor of comprehension and production vocabulary measures as an overall dependant variable.

Comprehension

In terms of the comprehension measures, a significant effect of the percentage of English heard on the combined dependant variable was found; comprehensive vocabulary, F (3, 13) = 7.59, p = .003; Wilks' Lambda = .36; partial η^2 = .64. Analysis of each individual dependant variable, using a Bonferroni adjusted alpha level of .017, showed that the PLS, F (1, 15) = 4.03, p = .063, partial η^2 = .21 and the BPVS, F (1, 15) = .68, p = .423, partial η^2 = .04 were not significant measures of receptive vocabulary but the CDI comprehension was, F (1, 15) = 20.51, $p < .001$, partial $\eta^2 = .58$.

Production
For the production measures; the SEKT and CDI production, a significant effect of percentage of English heard was found on the combined dependant variable; productive vocabulary, F (2, 16) = 6.49, $p = .009$; Wilks' Lambda = .55; partial eta squared = .45. Analysis of each individual dependant variable, using a Bonferroni adjusted alpha level of .017, showed that both the CDI production, F = (1, 17) 11.18, $p = .004$, $\eta^2 = .40$ and the SEKT, F (1, 15) = 13.35, $p = .002$, partial $\eta^2 = .44$ contributed to the combined dependant variable.

Therefore, this suggests that although the comprehension measures appear to be more reliable measures of vocabulary than production as an overall dependant measure, it is the CDI comprehension alone that is having this effect, whereas the two production measures are both working independently for the overall production. This also supports the main hypothesis that the amount of exposure to English is a strong predictor for both receptive and productive language but appears to be more so for production.

Effect of exposure to English, SES and sibling status on test outcomes
Further tests were conducted to examine the effect exposure to English had on each language measure separately. A stepwise multiple linear regression analysis was carried out on all the data; both monolingual and bilingual children, to examine the predictability of exposure to English on the test scores. This also examined the secondary hypotheses; the predictability both SES and sibling status had on the test outcomes for all the different measures.

PLS
Using the stepwise method, SES was found to be a significant predictor of PLS score, F (1, 21) = 5.23, $p = .031$. SES accounted for 16.4% of the variance (Adjusted R^2 =.164) in the PLS. The un-standardised and standardised regression coefficients for the significant variables are given in table two.

Table 2: The un-standardised and standardised regression coefficients for the significant variable

Predictor variable	B	SE B	β (Beta)
% of English	-18.61	8.1	-.45*

* $p < .01$

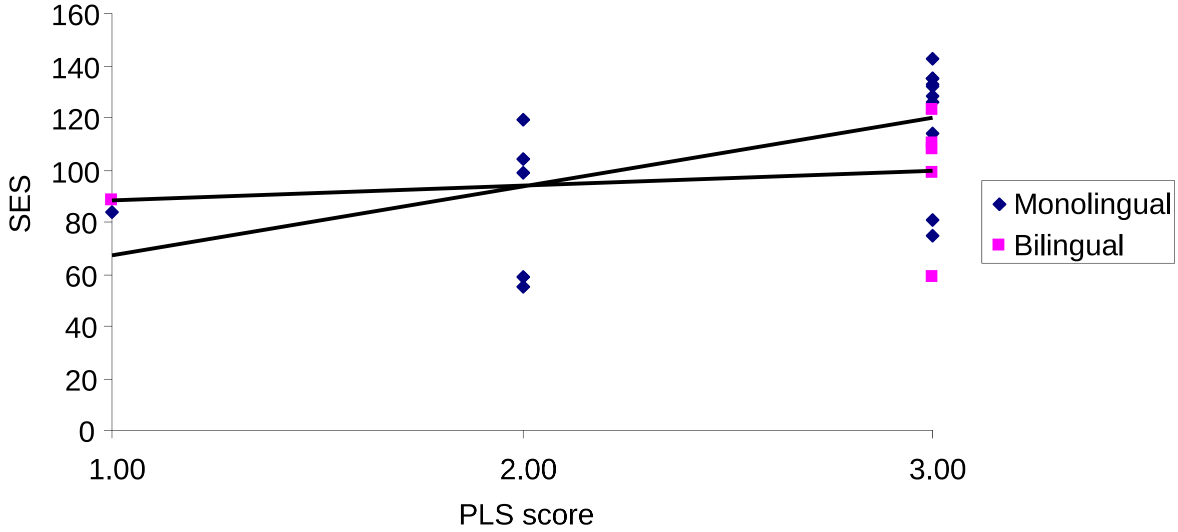

Figure 3: Scatter plot to show the linear relationship between SES and PLS scores (*n* = 17 monolingual, *n* = 6 bilingual)

This supports the hypothesis that the higher the SES, the higher the child will score on the tests. Sibling status and percentage of English were not significant predictors of the PLS, F (1, 21) < 1.

SEKT

Using the stepwise method, percentage of English was found to be a significant predictor of SETK score: F (1, 21) = 28.06, $p < .001$. Exposure to English accounted for 55.2% of the variance n the SEKT (Adjusted $R^2 = .552$). The un-standardised and standardised regression coefficients for the significant variables are given in table three.

Table 3: The un-standardised and standardised regression coefficients for the significant variable

Predictor variable	B	SE B	β (Beta)
% of English	.17	.03	.76**

**$p < .001$

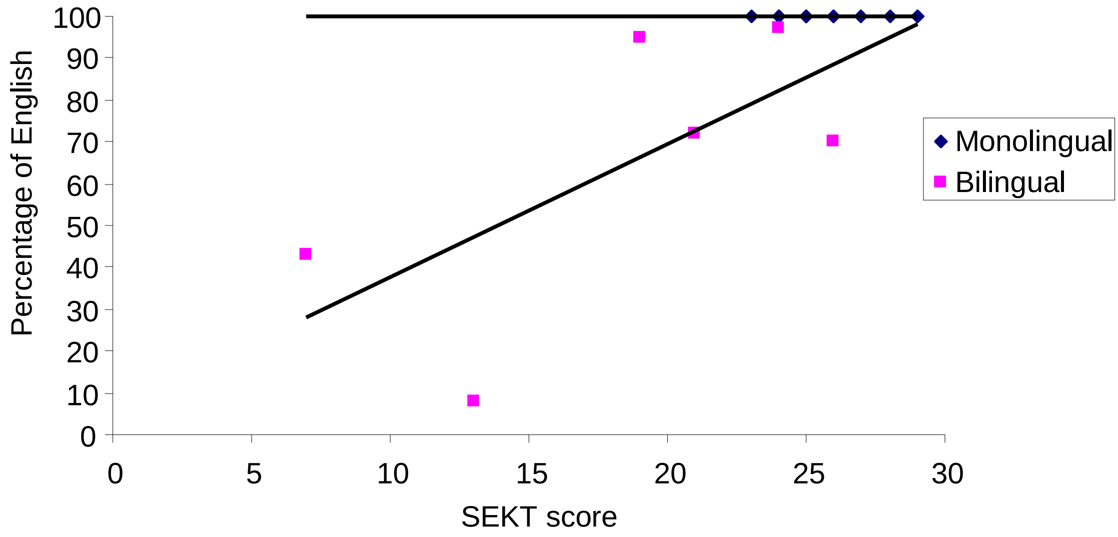

Figure 4: Scatter plot to show the linear relationship between exposure to English and SETK score (*n* = 18 for monolingual, *n* = 6 for bilingual).

This supports the experimental hypothesis that the more exposure to English a child has the better they will score on the tests. SES and sibling status were not significant predictors for the SEKT, F (1, 21) < 1.

CDI comprehensive

Using the stepwise method, percentage of English was found to be a significant predictor of CDI comprehensive score, F (1, 21) = 34.64, $p < .001$. Exposure to English accounts for 60.5% of the variance in the CDI comprehensive test (Adjusted $R^2 = .605$). The un-standardised and standardised regression coefficients for the significant variables are given in table four.

Table 4: The un-standardised and standardised regression coefficients for the significant variable

Predictor variable	B	SE B	β (Beta)
% of English	1.72	.29	.79**

** *p* = <.001

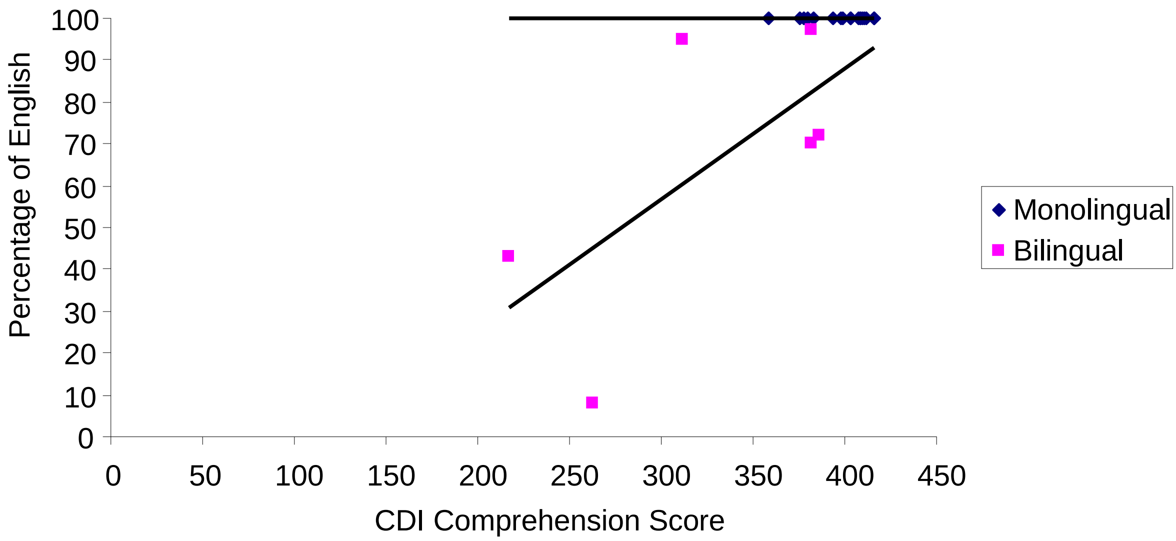

Figure 5: Scatter plot to show the linear relationship between exposure to English and CDI comprehension scores (n= 18 for monolingual, n = for bilingual)

This supports the main experimental hypothesis that the more exposure to English a child has the higher they will score on the tests.
SES and sibling status were not significant predictors for the CDI comprehension; F (1, 21) < 1.

CDI production
Using the stepwise method, percentage of English was found to be a significant predictor of CDI production score, F (1, 21) = 14.71, *p* = .001. Exposure to English accounts for 38.4% of the variance (Adjusted R square = .384). The un-standardised and standardised regression coefficients for the significant variables are given in table five.

Table 5: The unstandardised and standardised regression coefficients for the significant variable

Predictor variable	B	SE B	β (Beta)
% of English	2.29	.60	.64*

* p = .001

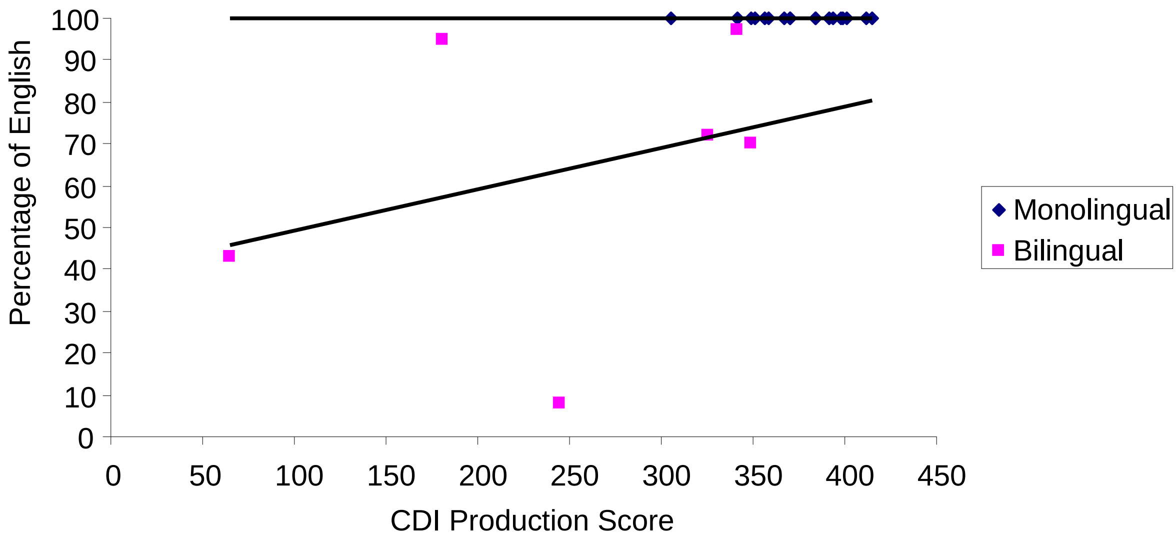

Figure 6: Scatter plot to show the linear relationship between exposure to English and CDI production (n = 18 for monolingual, n = 6 for bilingual).

This supports the experimental hypothesis that the higher the percentage of English the higher the test scores in English. SES and sibling status were not significant predictors for the CDI production; F (1, 21) < 1.

This suggests that exposure to English is a significant predictor of scores on the CDI production, CDI comprehension and the SEKT and provides further support for the primary experimental hypothesis that exposure to English affects the test scores of language development measures.

Investigation of separate groups

A bivariate correlation was carried out on the monolingual and bilingual conditions separately to further examine the primary hypothesis of an effect of exposure on all measures for the bilingual condition separately and to at test the hypotheses for sibling status and SES on the conditions separately. The bivariate correlation also compared the dependant measures (e.g. PLS, SEKT) to validate the measures of language used to test the children

Monolingual

Firstly, the monolingual children's data was analysed to look for correlations between the language measures. There was a significant positive correlation between the CDI production and the PLS, r = .674, n = 18, p = .002, (two-tailed). A significant positive correlation was also found between the CDI comprehension and the PLS (r = .602, n = 18, p = .008, two-tailed) and a significant positive correlation was found between CDI production and CDI comprehension, r = .706, n = 18, p = .001, (two-tailed). This suggested that the PLS, CDI comprehensive and CDI production worked well as measures together. No significant correlations were found for the SEKT and BPVS and any other measure.

Analysis of the data in figure seven using Peason's r indicated SES was significantly positively correlated with the CDI production, r = .539, n = 17, p = .013, (one-tailed). The variables were therefore moderately correlated, with increases in SES associated with increases in the PLS scores. This supports the experimental hypothesis that the higher the SES, the higher the language measure scores.

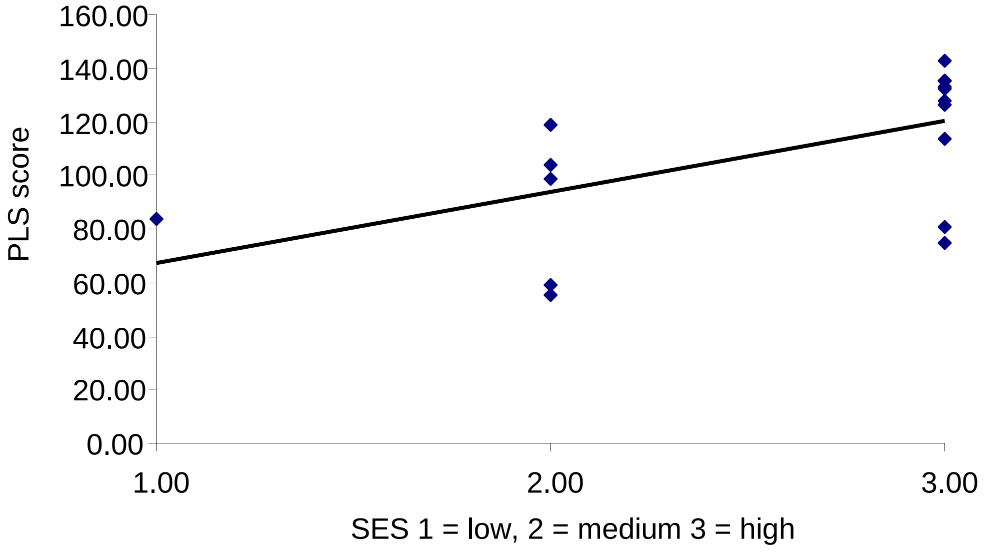

Figure 7: Scatter plot to show the positive correlation between SES and PLS for the monolingual condition (*n* = 17).

A significant positive correlation was also found between the SES and the PLS in the monolingual condition, r = .566, *n* = 17, *p* = .006, (one-tailed). As the SES increased so did the score for the PLS.

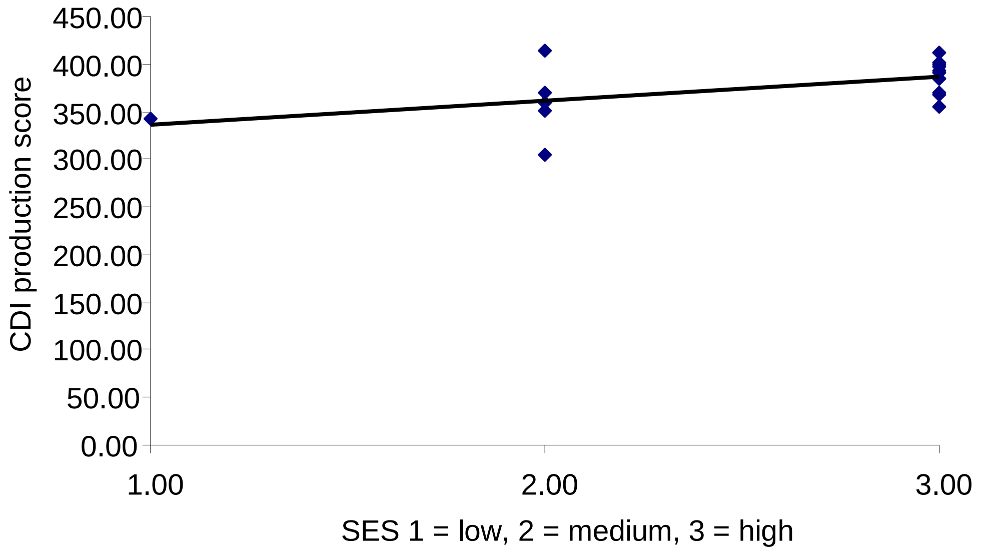

Figure 8: Scatter plot showing linear relationship between SES and CDI production score for the monolingual condition (n = 17).

This again supports the experimental hypothesis that the higher the SES, the higher the test scores. No significant correlations were found between BPVS, SETK, and any other measure.

Bilingual
For the bilingual condition, exposure to English was also controlled for when looking at the correlations. Sibling status was not included as all children in the bilingual group had siblings. The bilingual condition showed a different pattern from the monolingual children with a significant positive correlation between the CDI production and the SETK, r = .887, n = 6, p = .018, (two-tailed), a significant positive correlation between the CDI production and the CDI comprehension, r = .919, n = 6, p = .01, (two-tailed) and a significant positive correlation between the CDI comprehensive and the SEKT, r = .961, n = 6, p = .002, (two-tailed) but no correlations between the BPVS, the PLS and any other measure. This suggests that production measures appear to be better individual measures for the bilingual children in particular supporting the MANOVA findings. A surprising result found, was the correlation between the BPVS and exposure to English. Although this was not significant, it was found to be in the opposite direction to what was predicted, r = -.362, n = 6, p > .05. This suggested that as exposure to English increased, the score on the BPVS decreased.

A significant positive correlation between the SES and the percentage of English heard, r = .813, n = 6, p = .049, (two-tailed) suggests that the higher the SES, the higher the child's exposure to English.

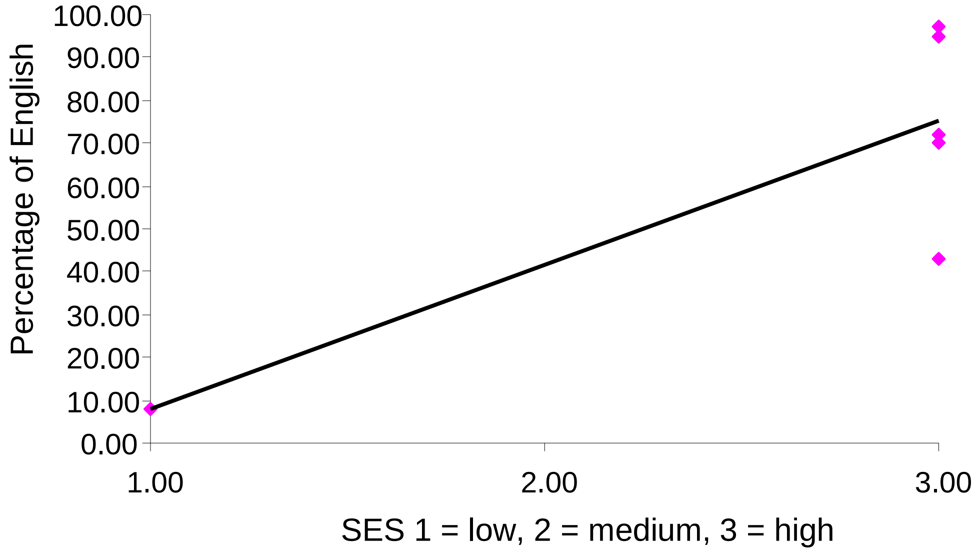

Figure 9: Linear scatter graph to show the relationship between SES and Exposure to English (n = 6).

The CDI in the additional language was found for five out of the six bilinguals; German, Spanish, Italian and French. Although no significant correlations were found, the results were in the direction expected for all measures; BPVS; r = - .433, n = 5, p > .05, PLS; r = -.103 n = 5, p >.05, SEKT; r = - .780, n = 5, p > .05, CDI production; r = - .730. n = 5, p > .05 and the CDI comprehension; r = - 862, n = 5, p

= .085. This is shown for the CDI production in English and the CDI production in the addition language below in scatter plot ten.

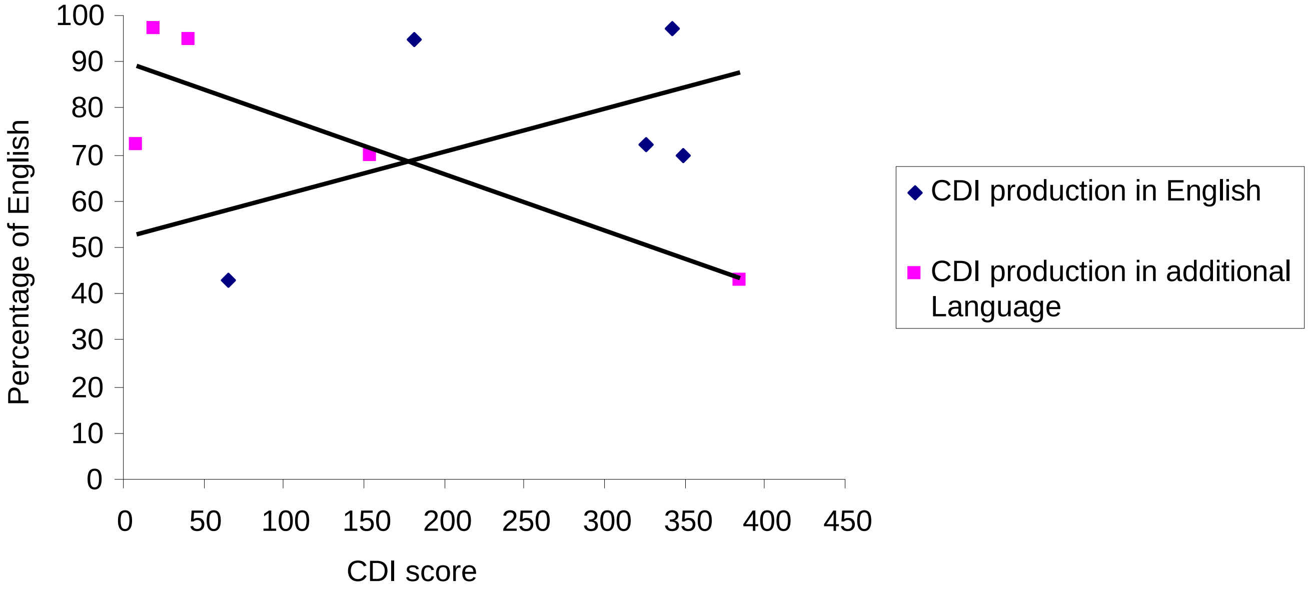

Figure10. Scatter plot showing the relationship between the CDI production in English and the additional language production CDI in the bilingual children (*n* = 5)

This is found to be in the direction expected; as percentage of English increases, the production in the second language decreases. This validates the exposure score on the Input scale for the five out of the six bilingual children.

Production vs. Comprehension; is there a bigger gap for production than comprehension in bilingual children?

The tests found to be significantly different across groups were further examined to test the hypothesis of a difference between production and comprehension overall.

CDI production vs. CDI comprehension

The bilingual children scores were significantly different from the monolingual children on both the CDI comprehension (p = .021) and the CDI production (p = .02). However, for CDI comprehension the difference (73.39) was smaller than the difference found for the CDI production (123.56). A repeated measures ANOVA found the difference between the CDI production and comprehension to be significant; F (1, 22) = 41.65, p < .001, partial η^2 = .65.

The SEKT vs. CDI comprehension

The SEKT and the CDI have different scales of scoring with the CDI ceiling score; 416 and the SEKT ceiling score; 30; thus accounting for the larger difference between groups for the CDI comprehension measure.

The bilingual children also scored significantly different from the monolingual children on both the CDI comprehension (p = .021) and the SEKT; a production measure (p = .021). The difference between the SEKT (production measure) and the CDI comprehension was also found to be significant, F (1, 22) =1813.75, p <

.001, partial $\eta^2 = .99$, showing the difference between the groups on the SEKT (7.3) was further apart than the CDI comprehension difference (73.39).

Further support that bilingual children may find language production more difficult than comprehension was that no significant difference was found between bilingual and monolingual children on the BPVS or PLS ($p > .05$); both measures of comprehension.

This indicates that the bilingual children are scoring closer to the monolingual children for comprehension measures than production on all measures. This supports the hypothesis that bilingual children would have larger differences from the monolingual group for production measures than comprehension and score closer to their monolingual peers on the comprehension measures.

Discussion

The current preliminary investigation aimed to examine the relationship between the different levels of exposure that bilingual children receive in a language and the effect this has on their language development whilst controlling for SES and sibling status. The results are consistent with the main experimental hypothesis and the previous research which suggests the higher the exposure to a language, the better developed a child is in that language (e.g. Pearson et al. 1997; Gathercole et al. 2008). However, when the bilingual children's data was analysed separately from the monolinguals, no significant effect of exposure was found. This may be due to the small number of bilingual participants in the study. However, the results were in the direction expected, with the higher the exposure, the higher the test scores. The overall difference however, suggests that an effect of exposure would have been found in the bilingual group had there been a greater number of participants, such as that found by Gathercole et al. (2008). The effect of exposure when analysing both conditions was only found on three different measures: the CDI comprehension, CDI production and the SEKT. The fact that these were also the tests shown to have significant differences between the means of the monolingual and bilingual groups indicates that the amount of exposure was the main contributing factor for this difference. This was supported further by the MANOVA.

Surprisingly, no effect of exposure was found on the other two measures; the PLS and the BPVS, although the test scores for the PLS were found to be in the direction predicted. The most surprising result was the effect of exposure to English on the BPVS, which was in the opposite direction to that predicted in the bilingual condition suggesting that as the exposure to English increased, the BPVS score decreased. An explanation for these results may be that the children in this study recognised the words said by also using their second language to help them, which may use similar sounding words, especially as most of the languages were European (more similar to English). This could be interesting to examine further in future research. However, all the children in this study appeared to be scoring below the mean standardised score for the BPVS, with both groups scoring equally low on this particular test. This may be due to the age of the children as some were below 30 months. As the test is standardised to 30 months, this indicates that the BPVS may have been slightly too old for some of the children. Although, Arreckx et al. (2009) found the BPVS a reliable measure of receptive vocabulary when testing 24 month olds, this was a trial version administered differently from the standardised instructions and standardised scores were not used. In addition, the experimenters running the study felt all children appeared to find the BPVS particularly difficult to concentrate on and became bored quicker than in the other tests. This may have been because, unlike the PLS or the SEKT which used toys as well as pictures and involved more interaction between the child and experimenter, the BPVS involved continuously looking at pictures and pointing to the correct one. It could also be argued that both groups in this study have a low comprehension which is why they were below the standardised mean. This however cannot be the case, as scores of the children on CDI and PLS (the other comprehension measures) were both within the standardised range. This may also be why the BPVS did not correlate with any other measure. Therefore, the BPVS appears not to be sensitive enough for this sample and may obscure differences between the monolingual and bilingual children. Thus, it can be assumed that the BPVS is not a valid measure of the participants' in this studies comprehensive language. If further research was conducted using the BPVS III, it would be more reliable to use with it with slightly older sample. It may also be more useful to use the BPVS II which has standardised scores for bilingual children (Whetton, 1997).

However, this cannot explain why no significant difference was found between the bilingual and monolingual children's scores on the BPVS and PLS; both comprehension measures. This finding suggests that bilingual children may find it harder to produce words than understand them (Clark & Hecht, 1983; Harris, Yeeles, Chassin & Oakley, 1995; Yan & Nicoladis, 2009) and this may be due to difficulties in lexical access (Gollan & Acenas, 2004; Yan & Nicoladis, 2009). Although a significant difference was found between the bilingual and monolingual children on the CDI comprehension, the difference between groups was shown to be significantly larger for the production measures supporting previous research (Oller et al. 2007), and is consistent with the hypothesis that bilingual children will score closer to their monolingual peers for comprehension.

The results however, still suggest that having a lower percentage of English exposure affects comprehension with bilingual children's scores lower than their monolingual peers (e.g. Pearson et al. 1993; Nicoladis, 2003; 2006), which provides further support for the main hypothesis. However, the fact that only the parental measure of comprehension showed a significant effect of exposure draws the question as to why a significant difference was not found between conditions for the PLS or the BPVS. The PLS was a lengthily test and some children did not manage to complete it within the first session. Although most children appeared to enjoy the questions using the toys which involve more interaction with the experimenter, the children appeared to become easily distracted during the picture manual questions; however this does not explain why the mean scores were within normal range for both conditions. Perhaps, the reason no difference was found between conditions for the PLS and BPVS is because bilingual children are scoring at the same level as their monolingual peers in comprehension. Therefore, it may be that parents are over-estimating/under-estimating the vocabulary that their children understand on the CDI. Previous research has shown production to be more reliable than comprehension for this measure (Vagh et al. 2009; Fenson et al. 1994; Sachse & Suchodoletz, 2008; Reznick, 1990). However, this has only been found in low income groups, which suggests that this is not likely to be the reason for our findings. Therefore, this particular finding still remains inconclusive and more

extensive research is needed to look at the differences between production and comprehension to enable conclusions to be drawn.
The current findings for the effect of SES on the test scores support the hypothesis and previous findings which suggest the higher the SES, the higher the vocabulary (e.g. Hart & Risley, 1995). This was found for the PLS and CDI production in the monolingual group, but also for the PLS, when looking at the results of the overall group analysis (linear regression). However, the fact that no significant effect of SES was found in the bilingual group suggests this result is due to the monolingual group. There was little variation in the bilingual group as five out of the six children had a high SES and one child had a low SES. Therefore, it would be expected that having more variation within the sample should show the same effect as the monolingual group. The fact that these results were not found in the bilingual group separately or for other test measures, suggests it is likely that the effect of exposure found was due to exposure alone, and not SES. SES correlated significantly with percentage of English which was expected, as both have been shown to have an affect on language development (e.g. Fenson et al. 1993; Pungello et al. 2009; Vagh et al, 2009). A possible problem however, is that most of the children had a high SES status, so the one or two with the lower SES may have pushed the results to be significant. However, as the results are consistent with the vast amount of research in the field (e.g. Hart & Risley, 1995), it is accepted that SES would have been a stronger predictor of language development had there been more variation in the sample.

For the final prediction, that sibling status would have a negative effect on the scores of the measures; no significant correlations was found. This was to be expected however, due to the sample used, as only four participants had an older sibling. In future research, it is still worth controlling for birth order effect as children with older siblings have been shown to be affected in language development (e.g. Shin, 2005; Oshima-Takane & Robbins, 2003), although this research cannot agree whether this effect is positive or negative. The difference found between groups was due to none of the bilingual participants having siblings. This may have had an affect on the monolinguals results. However, due to the fact it was only the monolingual group which had siblings, we can be sure in this study that no effects of exposure found were due to a birth order effect. Future research should try to have as equal variance as possible in both groups.

The vocabulary measure used for the second language (CDI's) were found for five out of the six additional languages and although no significant results were found for this measure, the results were in the direction expected according to the bilingual child's exposure score on the Input scale; the higher the percentage in English, the lower the score in the other language. However, as the additional language CDI's only measured production vocabulary, the relationship between comprehension and production could not be examined. In future research, it would be interesting to investigate the difference between production and comprehension in the additional language, as if the finding of a difference between comprehension and production in bilingual children becomes more robust, this should be found in both languages.

Gender differences have generally been shown to have an affect on vocabulary development, with females generally out performing males of the same age (e.g. Tamis-Lemonda et al. 1998). The current study had a greater number of female participants in the monolingual group (*n* = 11) and it could be argued that this may have been a confounding variable, causing the monolingual children to score higher than the bilingual children, where the majority were males (*n* = 5). However, there was no significant gender difference found within the monolingual group and therefore we can conclude that this is not the reason for any greater test scores found. Having stricter controls on gender numbers would make this less of a confounding variable; however, as the monolingual group had significant variability for both genders, any confounding effects of gender differences were reduced.

A possible weakness with the present study is the amount of variation in the sample with the bilingual children's languages: German, Italian, French, Spanish and Kurdish. This may have an affect on language development as it has been suggested that some languages have smaller vocabulary sizes at the same age than other languages (e.g. Truaeau et al. 1999; Thordardoditter, 2005). However, although this may affect the vocabulary of the additional language, this should not affect the children's English vocabulary, and having a sample with greater variance gives the findings greater relevance to the clinical practice and thus gives the research greater ecological validity.

A further potential weakness in the present study is that some participants were tested on all measures on the same day. This may have affected their performance on the tests as most participants had two separate sessions. As this was only the case for two out of the six bilingual children; this is difficult to measure, as this confounds with percentage of exposure to English. However, no significant differences were found across the different ages for each session, which suggests, this had no effect. Future research should try and make testing as similar as possible for all participants.

If repeating this study, gaining further evidence of the bilingual children's English vocabulary from a significant other, who only speaks to them in English, would be useful. This would be even more so if both parents do not speak English. For one of the children in the study, both parents did not speak English well and therefore, a friend of the family was asked to help fill in the parental CDI to whom English was also a second language. The results suggested, for this particular child, that the parents had underestimated the percentage of English heard, as the child scored only eight percent on the Input scale, when according to the test scores the exposure should have been higher. This may be why in the results (scatter plots) for exposure to English; one child is lower for exposure but higher on the tests scores. Although evidence suggests that non-native parents can report the vocabulary of their children well, even if this is not their first language (Vagh et al. 2009), this is presumably when the parent(s) have a fair amount of knowledge of the language; at least more than their child. Therefore it would be more reliable to use both a parental measure and a further measure of the bilingual children's language.

Something that was not examined in the current study is the cultural differences which could affect the scores. As our study included one Kurdish child it is important to consider the differences between cultures as this may have affected the outcome of the tests, especially in children who are not from typically Western cultures. For example, in some cultures children may be unfamiliar with the interactive patterns of pointing to things, as well as a lack of English vocabulary (e.g. Hispanic; Anderson, 2002; Pena, Quinn & Inglesias, 1992). This could cause errors to be taken as errors in receptive vocabulary, rather than lack of understanding especially in tests such as the PLS or BPVS which involve a large amount of interactive pointing questions. Linguistic biases may also occur in many of the tests, where the language expected is typical of white western cultures. This may cause content bias; when experimenters assume that all children have been exposed to the same concepts or vocabulary (Liang & Kamhi, 2003). Therefore, using tests which are more sensitive to different cultures would help the scores reflect the bilingual children's true ability. The environment a child has grown up in as has also been found to affect performance and using more home style interactions with bilingual children has been shown to increase their engagement, motivation and participation in classrooms (August & Shanahan, 2006). This is something that was not considered in the current study and may have been a confounding variable especially with the Kurdish child who was not born in England. However, in the sample of bilingual children used in this study this is unlikely to have affected the scores, as most children were born in England and have European parents, with a similar culture to England. In future research this should be considered especially when using children from more Eastern or Asian cultures.

The present findings suggest that when looking at bilingual language development in children, measuring the exposure to each language they receive, to give an idea of which language is dominant, may be a good start before examining their development in a specific language. Furthermore, it suggests, that SES does play an important role in language development and is consistent with previous findings that the lower the SES the lower the vocabulary (e.g. Hart & Risley, 2005). However, future research needs to address is how to disentangle these two factors in order to examine how much each factor effects language development. In the present study, as most of the bilingual participants came from a higher SES status, we can assume that exposure is the significant predictor of vocabulary development.

Although significant differences were found between the bilingual and monolingual children for comprehension and production measures, it is important to specify that this is only when measuring bilingual children in one language. If they were measured in both languages we would have expected similar or greater vocabularies to the monolingual children (e.g. Pearson et al. 1993). Measuring a child's total conceptual vocabulary (TCV) appears to be another way of finding out if a bilingual child is delayed (Junker & Stockman, 2002; Pearson et al. 1993) and this appears to work well when a child has one language more dominant than the other. However, this involves measuring the child's vocabulary in both languages which may not be practical for SL therapists especially as the additional vocabulary measures will be in a different language. Although the best way to test a bilingual child's language would be to test them in both languages, unfortunately this is not practical with current resources. Even though standardised language tests are being developed for additional languages, there is still the predicament of finding out whether a bilingual child is clinically delayed or just naturally behind its monolingual peers. This research suggests measuring input of language will give the SL therapist an idea of which language a child has more exposure to and is dominant in.

The SEKT, in this study was found to be a reliable measure; however, with more extensive research and English standardised norms, this could be used as a production test validated by parental measures. As bilingual children appear to be more delayed in terms of production rather than comprehension, the score on the SEKT could be used to compare against exposure. This would be a quick and efficient way for SL therapists to investigate any deficits that are not explained by exposure. Although this may not be a solution to the problem, with further investigation, it could be a start, and could be used on all children, no matter what linguistic or cultural background. However, the current results suggest that caution must be taken when working with parents who speak little English and it may be useful to seek additional information from a significant other who has English as their first language or have adequate fluency in it.

In conclusion, the current study found that exposure to English was a significant predictor of test scores which was in line with the primary hypothesis. However, exposure appeared to affect language production greater than comprehension. SES also affected vocabulary development in the expected direction. Sibling status was found to show no significant difference, however we assumed that this was due to the fact that not many of the participants had siblings. Therefore, when looking at the sample overall, exposure to English was found to be the most significant predictor of language ability even when controlling for SES and sibling status. The difference found between production and comprehension supports past research suggesting that production appears to be more difficult than comprehension for bilingual children and this may be due to difficulties in lexical access (e.g. Yan & Nicoladis, 2009). Further investigation into this difference, could have strong implications in clinical practice; helping SL therapists to use a more reliable and informative tests and establish whether measuring the productive language would be more beneficial than measuring the comprehension when testing children from backgrounds with more than one language.

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