

LANGUAGE AND COGNITION IN BILINGUAL CHILDREN
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There are many myths about bilingualism in children, many of them negative ones. Some educators have cautioned against the use of two languages in children, claiming that bilingualism causes cognitive, social, and emotional damage to children. Although few scholars today would claim that bilingualism could cognitively harm children, this view has been advocated in the past, and can still be occasionally witnessed in the popular press and heard expressed even by some educators. It is also the personal experience of this writer that this belief lingers in the American soul, if casual dinner party conversations are any indication.

This topic should be of great concern to those interested in foreign language education and to practitioners of bilingual education as well. Any decision about the soundness of pedagogical approaches involving two languages should be informed by the research base on the issues of bilingualism and cognitive development.

Theoretical Issues

Of fundamental importance in conceptualizing this area of research are the theoretical tensions concerning the development of language and thought (Hakuta 1986). The claim that bilingualism would have any effect on cognitive ability, be it positive or negative, is based on the assumption that language is a central part of cognitive activity. However, the influential developmental theory of Jean Piaget, for example, places a minimal role on language in cognitive development, and therefore Piaget's theoretical approach would maintain that bilingualism should have no effect on cognition. On the other hand, theorists such as Lev S. Vygotsky emphasize the importance of language in guiding thought processes, viewing it as a process of social shaping through linguistic mediation, so according to this theory, bilingualism can have profound effects on cognitive processes--they could be negative or positive, depending on society's attitudes and actions towards the phenomenon.

Another related tension is the question of whether or not the mind should be thought of as a "limited capacity container." The claim that bilingualism can cause a cognitive slowdown is based on the assumption that there is only so much information that can be processed by the child at any given time, and therefore attempting to learn two languages would, so to speak, blow some cognitive fuses. Theoretical issues such as these continue to be debated in the behavioral sciences, and their outcomes have influenced, and

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will continue to influence, the research on bilingualism and cognitive ability.

Historical Background

In addition to theoretical concerns, there have been societal concerns influencing research on bilingualism that need to be considered. Indeed, the literature on the negative consequences of bilingualism on mental development can be traced back to social concerns at the turn of this century about the quality of immigrants who happened to be bilingual. The debate in those days concerned not so much issues of mental development and psychology, but rather social issues concerning the new wave of immigrants from Southern and Eastern Europe that had begun in the late 19th century. Social scientists and educators reflected the concern of the public that these new immigrants were not adapting well into mainstream American society. As evidence, they pointed to the fact that the new immigrants were performing poorly on IQ tests, and that their children were doing poorly in the schools, again as reflected in standardized testing.

Two opposing camps of psychologists attempted explanations of the cause of this adjustment failure. They are essentially the same two camps who are still debating the determinants of IQ, even though the tests themselves have changed considerably since those early days. The hereditarians believed that IQ is determined primarily through heredity, and therefore could not be modified by experience. The environmentalists, on the other hand, believed that IQ could be developed through experience. A factor that came to play a central role in this debate was bilingualism, where a bilingual individual is not necessarily one proficient in two languages, but rather one who comes from a language background other than English and is proficient in English to varying degrees.

The hereditarians argued that bilingualism was not a factor in the low IQ scores. The environmentalists, in contrast, argued for the position that the bilingual experience delayed the mental development of children. This was consistent with the then-prevalent views of development that stressed the role of experience in learning in children. Ironically, neither camp was willing to admit that perhaps IQ tests administered in English simply were not a good measure of intelligence for people who were not comfortable in English. A legacy of this early research is the view that bilingualism causes cognitive retardation.

Research with "True" Bilingual

More recent studies of bilingual, a tradition begun by Elizabeth Peal and Wallace Lambert (Peal & Lambert 1962) at McGill University in Montreal, have tended to look at what would be

considered "real" bilingualism in children. These studies select for study only children who are roughly equal in their abilities in two languages. In these studies, a variety of mental performances are measured, often of the same types of abilities as those measured in IQ tests. The results of these studies indicate that when these children are compared with a group of monolingual children (with equivalent socioeconomic backgrounds), the bilingual children perform better. These results have been replicated in over 30 studies in different cultural settings.

Among the abilities in which bilingual children seem to be superior, of particular interest to the educator is a skill that has been called metalinguistic ability. This mouthful of a term refers to the ability to think flexibly and abstractly about language (in adults, this can be seen, for example, in poetry where language must be carefully controlled and chosen to fit the governing "rules"). In children, this can be seen in the ability to make judgments about the grammar of sentences and to appreciate plays on words in jokes. The theory is that while all children, both monolingual and bilingual, develop metalinguistic ability, the bilingual experience attunes the child to better control their mental processes. In the research literature with monolingual children, metalinguistic ability has been linked with the development of early reading skills. By extension, it follows that bilingual children should, all other things being equal, have an edge in learning the basics of reading.

Research with Students in Bilingual Education Programs

There is now data to suggest that even language minority students in bilingual education programs who are in the process of learning English can benefit from some of the cognitive advantages of bilingualism. In one study we conducted with Puerto Rican elementary school students in New Haven (Diaz 1985; Hakuta & Diaz 1985; Hakuta 1987), the students who became more bilingual also showed superior metalinguistic ability in their native language as well as in nonverbal intelligence. This relationship was found even though the students were in the bilingual education program, and therefore had not yet attained a very high degree of bilingualism.

Educational Implications

These studies should allay the common fear that bilingualism per se might cause cognitive confusion on the part of the child. If anything, bilingualism can lead to higher levels of metalinguistic awareness and cognitive ability. Having established that bilingualism is a desirable goal on cognitive and linguistic grounds, the question then becomes one of understand the specific nature of bilingual cognition. We have recently conducted studies in New Haven in two areas that should be of

direct interest to practitioners.

The Nature of the Cross-language Transfer of Skills

Bilingual education is founded on the principle that knowledge and skills developed in one language will transfer to the other. The important question for research to address is not the obvious one of whether transfer occurs from one language to another. Rather, research needs to generate a better understanding of how this process occurs, and under what circumstances it occurs most efficiently. Although considerable research exists to show that transfer between L1 and L2 are commonplace, we do not have a detailed picture of the process. The purpose of the research was to provide such a detailed picture.

In the course of our discussions with teachers during the spring of 1986, a number of teachers expressed concern about kindergarten children's mastery of spatial terms not just in English, but in Spanish as well. Expression of spatial concepts is an important aspect of language development. In fact, many speech specialists believe that early control of spatial concepts is good predictor of later language development. Thus, for example, the Boehm Test of Basic Concepts (1986) looks primarily at these concepts in assessing the verbal and conceptual ability of children. In response to observations about this important issue, we conducted a small pilot study in order to assess the children's knowledge of these spatial terms.

The Pilot Study

For our pilot study, we drew up a list of forty crucial spatial concepts, both the Spanish terms and their (rough) English equivalents, drawing on the IDEA curriculum. We then developed a set of simple pictures representing each of the terms. Children were given pairs of pictures, and asked to choose the one which showed the spatial concept in question. The pictures were constructed to ensure that the children's answers would reflect their understanding of the concepts, and to minimize confusion from the pictures themselves.

We gave this test to 16 kindergartners in New Haven. The results reflect the children's knowledge at the end of a year of kindergarten in the bilingual program. In general, contrary to the claims of some of the teachers about the deprived state of the language of the students, they did quite well with the Spanish terms; only a few items posed serious difficulties. Their performance on the English tasks, too, was quite good. The students with a stronger grasp of the concepts in Spanish tended to do better in English. Another interesting finding was that contrary to common belief, there were no differences between boys

and girls. We also found that the mother's level of education did not seem to matter in how well the children performed on this test. These results indicated to us that by the end of a year of kindergarten most children can use many Spanish spatial terms in simple tests with pictures, and that they have begun to develop knowledge of their English equivalents. Armed with this information, we decided to conduct a rigorous experiment to look at the transfer of specific concepts from Spanish to English.

An Experiment on Transfer

The purpose of the experiment was to be as specific as possible about the area of conceptual space over which transfer occurred. As we developed and refined this experiment, indeed, we thought about it more and more as a study testing the limits of detailed specificity in terms of what we mean when we say that there is transfer between L1 and L2. What we decided to ask was at the level of specificity of the following sort: if children are made highly aware and conscious about a particular concept, such as that expressed by "alrededor" ("around") in Spanish, would s/he be better at learning and using "around" in English? Notice that this is quite a different way of thinking about transfer than asking if stronger Spanish skills lead to stronger acquisition of English. The former is a specific way of looking at transfer, the latter is more global and general.

The logic of the experiment was as follows. We decided to train different groups of children in different concepts in Spanish. Following this differential training, all children would be taught a common set of words in English. Some of these English words would cover the same conceptual space as that trained in Spanish for one group of children; other English words would cover the conceptual space trained in Spanish in the other group of children. The question, then, could be asked whether children are better in learning and using the English words for which they had been "primed" in the Spanish training. If this could be shown, then we would have solid evidence for the specificity of transfer from L1 to L2.

In particular, we decided to train one group of students on spatial concepts in Spanish, and another group on temporal concepts. We concentrated on terms that our pilot study suggested would cause difficulty. The spatial terms selected were: alrededor/sobre, centro/esquina, cerca/lejos, hacia adelante/para atras, derecha/izquierda, primero/segundo/tercero, and invertido. The temporal terms were: primero/ultimo, antes/ahora/despues, ayer/hoy/manana, pasado/presente/futuro, nunca/algunas veces/siempre, and durante. Besides these two groups who received training on specific Spanish concepts, a third group was selected as a control group, and received no linguistic training. Rather, this group received a self-concept development program.

In terms of specific transfer, then, we predicted that those students who received training on Spanish temporal concepts would learn and use English temporal terms better than those who received training on spatial concepts. Also, we predicted that students receiving training on Spanish spatial concepts would do better on English spatial terms than the temporal group. Finally, both groups were expected to do better than the control, who received no linguistic training.

A total of 68 first graders participated in our study. The children were selected from two pairs of classrooms in two different schools. Within each class, students were divided randomly into the three experimental groups: one which received spatial training, another which received temporal training, and a third which received the self-concept, non-linguistic training (control).

Prior to the actual training, we also administered a pretest to determine the children's levels in Spanish and English vocabulary, and their use of spatial and temporal concepts in Spanish in a variety of tasks. One purpose of the pretest was to see if the three groups, though randomly selected, might differ in their basic abilities in the two languages. They did not. Another purpose was to determine the extent to which English and Spanish abilities influenced the post-treatment scores in English.

The spatial and temporal training component in Spanish had three major goals: first, to review the concepts themselves, that is, to focus on those particular conceptual categories of time and space relations; second, to review the L1 terms which express those concepts; and third, to teach the children to recognize these terms in written form. The second two goals, vocabulary development and word recognition, were aimed at developing aspects of the children's "metalinguistic awareness", i.e., utilizing the distinction between linguistic form and meaning, highlighting the word as a linguistic unit, and demonstrating that written language conveys the same kind of meaning as spoken language. Training was conducted in 30-45 minute sessions in small groups by Margarita Rodriguez Lansberg, a research assistant to the CLEAR project. Each session covered one set of contrasting concepts. Thus, one session, for example, covered primero/ultimo, another covered antes/ahora/despues, and so forth. At the end of each session, an informal assessment was conducted to ensure that the students were in control of the concepts and their written form. The entire training phase covered a period of approximately three weeks.

After the training phase came the English training phase. Here, all children were exposed to the same materials. They were taught the full set of English words corresponding to the Spanish spatial and temporal concepts. The classes were taught, more or

less, in a traditional ESL-type context by Laurie Gould and Marcus Rivera, both research assistants to CLEAR. Assessment of learning and use of the English terms was conducted in a group-administered paper-and-pencil test.

From the viewpoint of the advocate of a specificity-oriented view of transfer, the results were disappointing. That is to say, there was very little evidence of the specific transfer of training from Spanish to English. There was one exception having to do with the cognates (presente-present/pasado-past/futuro-future) used in this study. There was good evidence that students transferred training in these cases from Spanish to English. This was particularly true for students whose English level was low. However, in terms of overall results, it is safe to conclude that transfer on the specific level did not occur. We feel confident in making the claim that it did not, because we used a relatively sophisticated experimental design in which we excluded a lot of contaminants that could have muddied our results.

The results, however, were quite encouraging for the advocate of a global view of transfer. Regardless of the training condition, the level of control of Spanish was an excellent predictor of how well the students did on the post-training test. This fact held true even after the students' initial level of English was taken into account. Thus, the study once again turned up evidence for transfer occurring at a global level, but not at the specific level.

Educational Implications

The study clearly showed that students with high levels of development in Spanish also developed high levels of ability in English. What we failed to demonstrate was that specific development of concepts in Spanish was tied to the learning of those specific concepts in English. Thus, the findings are not consistent with a view of transfer that proceeds step by step, skill by skill, from Spanish to English. Clearly, this finding comes from limited observation of a limited arena of academic learning in these children. Nevertheless, the most obvious implication of this study is that academic programs for these children should be geared towards the holistic development of their native language skills. The general native language base then would result in transfer to English. The study argues against a myopic view of transfer, where each concept in the native language is taught aimed at its transfer to English. To take an analogy from writing instruction, much in the same way that attention to details such as spelling can lead instruction astray from the overall goal of literacy development, we believe that too much attention to specific transferable skills can detract from the overall goal of developing a strong and integrated language arts base in bilingual instruction.

Translation as a Metalinguistic Skill

The second set of studies conducted in New Haven have to do with the ability of bilingual children to translate (we use this term generically to cover both translation and interpretation abilities) between Spanish and English. This ability was first called to our attention in one of our brainstorming workshops sessions by Steve Strom, an elementary school teacher in New Haven, who pointed out that he used children who could translate as instructional assistants by pairing them up with monolingual Spanish-speaking children when using English materials. Translation interested us (my collaborators in these studies include Marguerite Malakoff, Laurie Gould, Marcus Rivera, Margarita Rodriguez Lansberg, and Jose Capuras) for two reasons. First, it is a valued skill with high snob-appeal, conjuring up images of international organizations and jumbo jets. And second, the ability to translate well implies a high degree of awareness about the interrelatedness as well as distinctiveness of the languages involved.

In our first study, we decided to explore the psycholinguistic properties of translation. As subjects, we selected 4th and 5th graders who had had some experience translating for their relatives and friends (by parental report). We constructed tasks in which they were to translate words, sentences and stories from English to Spanish and from Spanish to English (in all of these cases, we provided the source in written form on a computer screen, and the children provided the responses orally). Ability to translate was assessed by measuring the time it took to provide the translation, and by analyzing the types of errors made in translation. We also gave them a written story to translate into written form. Finally, we made assessments of their proficiency levels in English and Spanish.

Overall, the results showed that these children were very good translators. We were interested in the extent to which they made intrusion errors, i.e., where vocabulary or grammatical structures from the source language intrude into the translation. Here are some examples:

Source:La luna blanca brilla en la noche.

Translation:The moon white shines in the night.

Source:Es redonda la mesa y las cuatro sillas son azules.

Translation:It's round the table and the four seats are blue.

Such intrusion errors were infrequent, even when there were ample opportunities for them to occur.

We note that this low incidence of intrusion errors strongly supports the contention of sociolinguists who have studied code-switching (e.g., Zentella 1981) and argued against the belief that it is the result of language confusion. Our subjects amply demonstrated that they could code-switch whenever the situation so warranted, i.e., when they were with other Spanish-English bilingual, but almost categorically separated the languages in the translation tasks.

We also discovered some interesting properties about translation efficiency. For example, we were interested in finding out how well the proficiencies in the two languages could predict translation speed. It turns out that what matters in translation efficiency is the proficiency in the language into which the translation is being made. Thus, when translating from English to Spanish, Spanish proficiency is more important, and when translating from Spanish to English, English proficiency matters more. In addition to proficiency in the languages, though, we found that performance on another kind of task mattered even more. In this task, the subjects asked to make a determination as to whether words projected on the computer screen were English or Spanish (we used only words that could not be judged on superficial features such as accents and letter combinations unique to either language). The speed with which subjects could perform this task was an even better predictor of translation efficiency. We believe that this task reflects what specialists in translation have called a translation proficiency, different from the proficiency of the two languages independently. Translation proficiency, we believe, is related in important ways to various metalinguistic skills and is an ability that can be trained through practice and experience.

Having found some interesting properties, we then moved on to the question of how widespread this ability might be. In our initial experiment, we did not sample from a random population of bilingual children, but rather on the basis of what parents told us about their children's abilities. In the next study, we tested 52 fourth and fifth graders from bilingual classrooms, not being particularly selective, and choosing all students who were able, on the judgment of the teachers, to write minimally in both languages. For this study, we did not give them the full battery of tests as in the first study, but rather a simple story translation task going in both directions. Below are some examples of translations that we received:

SOURCE

Los tres niños jugaban bajo el árbol viejo en la casa de su abuela. Cerca del jardín estaba un perro enorme. El perro salió corriendo y los niños lo siguieron. Llegaron todos a

una vieja casa abandonada. Enraron silenciosamente para buscar al perro. Dentro de la casa oscura, se abrió una puerta con un ruido extraño. Uno de los niños saltó un grito porque tenía miedo. Pero otro de los niños cirrió hacia la puerta abierta. Allí descubrieron al perro y se fueron todos a su casa.

TRANSLATION 1

The three boys were playing under an old tree in they're grandmothers house. Near the back hard there was a big dog. The dog came out running and the children ran after him. Then they all got to an old house that was empty. They entered the house silenlli to find the dog. In the old dark house a door opend with a strange noise. One of the boys scried because he was scared. But one of the boy's ran to the door that was open. There they discovered the dog and went home.

SOURCE:

A lonely cat was looking for something to play with. He suddenly saw a baseball. He began to play with it. After a while he got bored, though, and went outside. In a garage he discovered a whole bunch of paper boxes and began climbing them. Inside one of the boxes was his old friend, Fido the dog! Together the two animals played all afternoon. They realized afterwards that they had lost track of time and that it was very late. When the cat got home, he washed up and ate his dinner.

TRANSLATION:

un gato solo estaba mirando a algo para jugar. El derepente vio un juego de pelota. El comenso a jugar, despues un tiempo el se amorinno, penso, y se fue afuera. en un garage el descubrio un bonche de cajas de papel y comenso a treparse por el. Adentro uno de las cajas fue el mayor amigo, Fido el perro! juntos los dos animales jugando al mediodia. Ellos se dieron cuenta despues aqueyo ellos fuero perdidos atrapado el tiempo y despues fue vastante tarde. cuando el gato se fue a casa, el vano arriba y el comio.

Undoubtedly, overlooking minor details of spelling, these are excellent translations, certainly products you would be proud of had these been produced by your foreign language students.

As in the first experiment, we conducted various analyses of errors in the written translation task. We found that errors were roughly comparable in both quantity and quality between the subjects in the two experiments. For example, in the above stories going from Spanish to English, in the first experiment,

there were an average of 1.79 errors attributable to source language intrusions per story and an average of 2.17 errors in the second experiment. Going from English to Spanish, there was an average of 3.23 errors per story for the first experiment, and 2.18 for the second experiment. In general, then, we can conclude that translation skill is widely distributed among the population of bilingual youngsters found in bilingual education programs.

Our comparison of the two populations on this translation task is noteworthy on a further point, which is that in going from English to Spanish, the second experimental group (those in the bilingual program) made fewer grammatical errors overall than did those subjects in the first group (many of whom had been mainstreamed or never been in bilingual programs). This pattern, combined with other information on language use obtained from this population (Hakuta, Ferdman & Diaz 1987), suggests a rather rapid decline of Spanish language skills within this school population.

Educational Implications

The studies suggest that by as early as fourth or fifth grade, probably even earlier, bilingual students are very capable of translation in both directions. We believe that the ability to translate is related to a variety of metalinguistic skills, the delineation of which constitutes our future agenda. We furthermore believe that translation skills can be developed, and can serve as an effective method of developing metalinguistic skills in bilingual youngsters, and that this would have a positive effect on their literacy skills. Equipped with these observations, we have made some preliminary attempts to develop programs for the training of translation skills, one such effort being reported in the chapter by Shannon and Delgado.

Conclusions

Our research on the cognitive bases of bilingualism suggests that true, additive bilingualism can be a valuable part of the educational enrichment of linguistic minority students. Bilingualism is positively associated with higher levels of cognitive functioning. Bilingual students are adept at translation -- a skill that is truly enviable from the monolingual perspective. It appears that one way to achieve this would be through the holistic development of the native language early on in the child's education, followed by an aggressive effort to maintain the native language and develop metalinguistic skills (such as translation training) once bilingualism is attained.

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