

Language Brokering in a Middle School Science Class¹

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1. Introduction

The following interaction was recorded in a seventh grade science class in October, 2001:

- Ms. J: One, one milliliter weighs one gram, how much would seventy-five milliliters weigh?
- All: Uh, seventy-five grams.
- Ms. J: Seventy-five grams, very good, so that's the answer to number nine.
- Ms. J: Write it down, seventy-five.
- Ms. J: Now, to get milligrams, you multiply by a thousand, so seventy-five times a thousand is ...
- Pedro: One seventy-five.
- Ms. J: Seventy-five times one thousand, how much, very good, seventy-five thousand, okay, you done now, you done?
- Big Manuel: ¿*Qué?* [what?], oh.
- Pedro: A thousand, *cómo se escribe* [how do you write] a thousand?
- Little Manuel: *No me entiendo nada.* [I don't understand anything.]

This excerpt illustrates the situation that many immigrant children in the United States face every day in school. The teacher, Ms. Jackson, is leading a class discussion and giving directions to complete a measurement task. Of the three students who comment individually, two, Pedro and Big Manuel, are immigrants from Mexico who have been in the United States for several years and have acquired enough English to follow along. The third, Little Manuel, arrived in the U.S. over the summer and has been placed in all-English classes. And, as he notes in the excerpt above, he has not acquired sufficient English to understand the ordinary interactions in the science class or indeed in any of his other classes. In many classrooms, like the one we focus on here, teachers possess minimal or no command of the language(s) spoken by their recent immigrant students. Thus, they rely on other students to act as language brokers to make the curriculum at least minimally accessible to new arrivals.

In recent years, language brokering, or informal translation, by linguistic minority children and adolescents, has received considerable attention. Scholars have focused on the relationships among translation ability, cognitive development and metalinguistic awareness (Malakoff and Hakuta, 1991), the effect of children's language brokering on family relationships and parental authority (Pease-Alvarez and Vasquez, 1994; Vasquez, Pease-Alvarez, and Shannon, 1994), acculturation (Weisskirch and Alatorre Alva, 2002), the extent of brokering among language minority adolescents and its relationship to school performance and language development (Buriel et al., 1998; McQuillan and Tse, 1995; Tse, 1995, 1996), and translation ability as a dimension of giftedness (Valdés, 2003). However, classroom language brokering as seen from the point of view of the intended beneficiary, the child who does not have a sufficient command of the language of instruction to obtain full access to the curriculum without the aid of a translator, remains an unexplored area. This paper, part of a larger study of English language acquisition and content learning in a predominantly Latino middle school science classroom in a major southwestern U.S. city, represents an attempt to fill that lacuna in the

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literature. On the basis of analysis of approximately 45 hours of audio- and videotaped data collected over a full school year, we examine the first step in the process: what types of information are made available to the beneficiary through translation that would not be available through other means such as reading from books or the board, or following the actions of others? Specifically, we address two related questions. First, what are the differences in frequency across types of teacher talk, e.g. classroom management, discipline, and content information? Second, what types of teacher talk are translated and what types are not translated by student language brokers? Finally, we consider the reasons why some types of talk are translated and some are not.

2. Setting

Garner School District² is one of several school districts in the greater San Ramón metropolitan area. The district, one of the poorest and smallest urban districts in Texas, is located in the city's oldest *barrio*. The student enrollment is overwhelmingly Latino and includes many students from long-established Texas families as well as a smaller number of recent immigrants. Approximately 25 percent of the students in the district are designated as LEP³ and receive bilingual or ESL instruction. In the elementary schools, about 30 percent of the students are enrolled in bilingual classrooms. By middle school, all students, including new immigrants, are enrolled in all-English classes.

In 2001-02, the period during which we collected the data, 628 sixth through eighth grade students were enrolled at Madera Middle School, the site of our research. Of these, 191 were designated as LEP, 52 of whom were new immigrants from Mexico. The classroom selected for our research is a 7th grade science classroom, called group 7B, whose teacher is the science coordinator in the school. Ms. Jackson, an English monolingual, has been teaching for nine years, and is generally considered one of the best science teachers in the district. At the beginning of the school year, group 7B consisted of 22 students, four of whom were moved to a different class two weeks into the term. All but one of the students, an African American boy, were of Mexican descent. Over the course of the first two nine-week periods, two students, both recent immigrants, transferred out of the school and one new arrival from Mexico entered. By the end of the school year, two additional students had transferred out and three new non-immigrant students had entered. Fifteen students remained throughout the full period of data collection, from August 2001 to May 2002. This group consisted of six recent immigrants whose level of English proficiency ranged from absolute beginner in the case of four to intermediate in the case of the two, both of whom had been in the United States for more than two years. The basic demographic characteristics of the district and the school are summarized in table 1.

	Garner I.S.D.	Madera Middle School
Students	13,439	628
Hispanic	97%	97%
Economically disadvantaged	96%	96%
Identified as LEP	2,924	191
New immigrants	97	52

Table 1. Garner Independent School District and Madera Middle School: Demographic Characteristics

Group 7B's classroom was a science lab, with high tables where groups could work collaboratively to complete the various lab activities that occupied the greater part of each class period. Madera Middle School employs block scheduling so the class met every other day for an hour and forty minutes.

² This and all other names of people and places are pseudonyms.

³ The term LEP (Limited English Proficient) has come under criticism because it classifies students by what they lack rather than by what they can do. However, school districts continue to use the term as an official designation. We use LEP to refer to official classifications.

3. Methods

During the fall semester, all classes were recorded on both video and audiotape, with the exception of days on which students were taking examinations. On most days, students worked in no more than five groups, of which we recorded three, one on video and two on audio, using wireless microphones. Two members of the research team were present at all class sessions and took elaborate field notes as well. All recordings were transcribed orthographically and entered into CHILDES for analysis (MacWhinney, 1991).

Our original intention was to identify three focal students: a recent immigrant, a student who had attended a bilingual program, and a student who had attended all-English classes since entering school. However, it soon became apparent that such a procedure would prevent us from examining the variety of educational experiences that students brought to the classroom. Moreover, a concentration on only three focal children would single out those individuals in a way that might prove detrimental to the overall inclusive goals of the class. We therefore developed a rotation for having different students wear the wireless microphones on different days. Given the very large amount of data collected during the first semester and in several follow-up sessions during the second semester, we were able to obtain ample documentation of the progress (or lack thereof) of the recent immigrant students in English language acquisition and to gauge the extent to which they had access to the curriculum.

Given the nature of science class 7B at Madera Middle School, with an English-speaking teacher, approximately equal numbers of bilingual and monolingual English and Spanish speakers, and a high degree of cooperativeness among the students as a whole, informal translation by untutored translators had a potentially crucial role. We examine language brokering from the perspective of the intended beneficiary, the non-English speaking student. In this article, we focus on two class periods, one at the beginning of the term and one approximately halfway through the first term, although we also draw examples from other days as appropriate.

To determine the types of information presented and to gain an overall view of material that might require translation, we coded all of the teacher's utterances on both days according to the categories illustrated in table 2. An utterance was defined as a meaningful unit marked by an intonational boundary.

Type of talk	Examples
Class management	Uh, we can't waste any time, because somehow, somehow, A day got ahead of y'all, A day's class is a whole day ahead of y'all. (8/30) If I can have your attention for a second, on number nine. (8/30)
Behavior management	Okay, group talking stop please. (10/11) You don't listen, you don't get chips. (10/11)
Announcement	Don't forget that tomorrow's an early release day. (10/11)
Procedural knowledge (including task set-up)	Okay, now you're gonna weigh the beaker with two hundred and twenty-five.... (8/30) The groups that you ignored, that you didn't break down into size, you need to eat them and get them out of the way so you can have room on your paper towels. (10/11)
Declarative knowledge	This looks more like a trapezoid to me. (10/11) It says kingdom, phylum, class, order, family, genus, species, that's how we organize things in science. (10/11)

Table 2. Types of Teacher Talk

The focal child in the data examined here is Manuel Jiménez (Little Manuel), who had moved to San Ramón from a border city in Mexico, where he attended six years of primary school. Mexican school records showed that Manuel had been quite a successful student before moving to the United

States. However, he had never studied English before being placed in all-English classes at Madera Middle School. Neither Manuel’s lack of English nor his small stature, however, interfered with his social success. At a school dance held in the middle of the semester, it quickly became apparent that he was the star of the evening and had his pick of young girls to dance with. In fact, one of the teachers, a 15 year veteran of the school, observed that no one had ever danced like Manuel and that “they are all copying him!”

4. Findings

The first period examined occurred early in the term, on August 30. In fact, it was the first period that we were able to record. The focal student, Little Manuel, was grouped with three other Spanish-speaking boys, Juan, a recent immigrant who spoke no English, Manuel Gonzales (Big Manuel) who had been in the United States for approximately three years, and Pedro, who had immigrated approximately two years earlier. The class period was divided into three main parts: 1) a warm-up activity referred to as the DUST (Daily Understanding of Science Terms), on this day designed to introduce the idea of different ways of sorting objects; 2) the completion of a measurement assignment; 3) a “button lab” that required students to sort buttons in a variety of ways. For the measurement assignment, various lab stations with scales, rulers and other apparatus were set up. Students moved in groups from station to station, measuring and recording their findings, until they had completed all tasks. The teaching of the scientific concepts that underlay the lab activity was intended to be primarily inductive. That is, after a brief explanation from Ms. Jackson, students would complete experiments or other tasks. Once the tasks were completed, the teacher would explain the relevant scientific concepts in some detail, often by leading a whole class discussion. On August 30, however, this part of the lesson was cut short by a fire drill.

The second class period from which we draw many of our examples took place on October 11, after the routines for the semester had been well established and class members had come to assume clearly defined roles. This class was divided into two main activities. First, students had to complete a math activity, part of the “math initiative” designed to improve overall math abilities, that required them to use toothpicks to construct geometric figures. Next, students carried out a lab activity, the “potato chip lab”, designed to familiarize them with the biological classification system. The teacher began this section by leading a discussion about the ways potato chips could be sorted into groups. For the greater part of the class period, students worked on the lab in groups. Finally, the teacher led a whole class discussion of biological classification, designed to reinforce the purpose of the lab. By mid-October, Little Manuel had been moved to a different table to work with two bilingual girls, Nellie and Marilyn, as well as a third girl, Tamara, who understood a good deal of Spanish, although she generally spoke very little in either English or Spanish.

4.1 Types of teacher talk

The overall results for the types of teacher talk on the two days are shown in table 3.

Type of talk	8/30/01	10/11/01
Class management	30.7%	11.3%
Behavior management	16.7%	12.8%
Announcement	--	1%
Procedural knowledge (including task set-up)	34.8%	38.3%
Declarative knowledge	16.7%	36.5%

Table 3. Types of Teacher Talk

Note that although the proportion of procedural knowledge utterances is similar on the two days, other types of talk differ a great deal. The number of statements devoted to classroom management decreased from 30.7 percent on August 30 to only 11.3 percent on October 11, and the amount of talk devoted to behavior management decreased from slightly from 16.7 percent to 12.8 percent. In

contrast, the number of declarative statements and requests for declarative statements increased from only 16.7 percent on August 30 to 38.3 percent on October 11.

One possible explanation for the differences in types of talk on the two days concerns the dates of the classes analyzed here. The August 30 class occurred at the beginning of the school year. At this point early in the term, class routine was still being established and students were testing the limits of tolerated behavior. Hence, we find a greater proportion of Ms. Jackson's talk devoted to classroom and behavior management. Table 3 shows a considerably greater proportion of declarative knowledge statements on October 11 than on August 30. Ordinarily, Ms. Jackson planned a block of time to discuss the meaning of the lab activity that students had engaged in earlier in the period. The greater part of the teacher talk coded as declarative knowledge on October 11 came during the final 20 minutes of the period. This was exactly the time that was missing on August 30 due to a fire drill, as noted earlier. When students returned to the classroom, rather than returning to the topic of the lab, Ms. Jackson emphasized the importance of obeying fire safety instructions and offered a long narrative about her own narrow escape during an actual fire when she was a middle school student.

4.2 *Types of translation and interpretation*

In class 7B, translation was initiated in a variety of ways. On occasion, Ms. Jackson explicitly requested a bilingual student to translate, as in (1), when she wanted students to copy notes dealing with the periodic table.

(1) Directing translation

- Ms. J: Pedro, do you want to write all of this out, or do you want to keep this one?
Ms. J: Big Manuel tell 'im what I said, tell Pedro.
Big Manuel: He say yes.
Ms. J: Okay, and that's Juan, right, tell Juan.
Big Manuel: [inaudible]
Ms. J: Okay, if Juan talks I stop.
Big Manuel: He say, um, he said he's gonna write it down.
Ms. J: And everybody starts copying. He's gonna copy it, word for word?
Big Manuel: Yeah.⁴

Such explicit teacher requests for translation, however, were infrequent and generally focused on making sure that students understood the procedures that they were to carry out. The data on which the present paper is based contain no examples of Ms. Jackson requesting a student to translate science content.

On other occasions, Spanish monolinguals would request translation, as in the following excerpt, recorded on October 11 toward the end of the class period. Ms. Jackson had finished leading a whole class discussion of the biological classification system, which the potato chip sorting task had been designed to illustrate. She concluded the discussion of biological classification by using an example from the class. In (2), Little Manuel, our focal student, was selected as the illustration.

(2) Request for translation

- Ms. J: It's sort of like, when you look at your ... it says kingdom, phylum, class, order, family, genus, species, that's how we organize things in science. I'll give you another example, and I'm going to use the names and I'm gonna see if you can figure out what I'm talking about. In the kingdom of Madera Middle School, there is a phylum called seventh graders, within that phylum of seventh graders,

⁴ All oral language was transcribed using the CHILDES system (MacWhinney, 1991). Here a modified transcript is provided. The following symbols are used: <xxx> [>], overlapping speech follows; <xxx> [<], overlapping speech proceeds; +/, interruption; +, self-completion; #, a pause of about a second; xx, unintelligible syllable; [/], retracing.

- there is a class, another type of group, called seven point two, team seven point two. In that class, that team of seven point two, there is an order called group B.
- Armando: What?
- Ms. J: Very good, see how it's narrowing down, within that order of group B, there is a family of separations, of boys, within that family of boys, there is a genus, there is a group of boys called Manuel.
- Little Manuel: Huh?
- Ms. J: And within that group, that genus of Manuel, there is a species called Jiménez.
- Freddy: ¡A la!
- Little Manuel: Huh?
- Ms. J: Did you see how I started out big, the whole school, coming down to seventh and eighth graders, coming down to our team, coming down to this group, within this group boy and girl, within <boys> [>] within the group of boys, the ones called Manuel, and within that, going down to the last name.
- Victor: <boys> [>].
- Student: Jiménez.
- Ms. J: I got all the way down to one specific person in Madera Middle School. And that's the way science lets us sort things.
- ...
- Little Manuel: ¿Yo qué, yo qué, qué dijo la Miss? [I what, I what, what did Miss say?]
- ...
- Tamara: When?
- ...
- Little Manuel: ¿Qué, eh, eh, eh, qué dijo la miss? [What did Miss say?]
- ...
- Little Manuel: Eh, Annette, ¿qué dijo la miss de mí? [Annette, what did Miss say about me?]
- Ms. J: Was your hypothesis right or wrong?
- Little Manuel: ¿Qué dijo? [What did she say?]

On most occasions, in contrast to (2) above, one or another member of the class responded to Little Manuel's requests for assistance. Such assistance, however, did not usually involve direct translation of what Ms. Jackson was saying. Rather, as shown in (3), it usually consisted of directions for completing a task. Here, Nellie, a bilingual student who has attended U.S. schools since kindergarten, explains the math task on October 11. Recall the students had been instructed to use toothpicks to form geometric figures.

(3) Student translation

- Ms. J: This time you're going to remove four toothpicks to form two squares that are equal in size, they gotta be the same size.
-
- Little Manuel: Ay ¿Aquí qué tenemos que hacer? ¿Copiar aquello? [What do we have to do here? Copy that?]
- Nellie: No en éste pero en otro. [Not in this (book) but in the other (book).⁵]
- Little Manuel: Ah. Bueno, ¿en ésta qué tenemos que hacer? [Ok, in this (book) what do we have to do?]
- Nellie: No más dibujalo así y luego lo dibujas así. [Just draw it like this and then you draw like this.]
- Little Manuel: ¿Cuál? [Which?]
- Nellie: Dibujalo así y luego lo dibujas así. [Draw it like this and then you draw like this.]

⁵ Students have both a lab book and a reflective journal. Here Nellie tells Little Manuel which book to write his response in.

- Nellie: *Arriba de éste le pones original y luego ya despues éste.* [You put the original above this and then afterwards this.]
- Little Manuel: Uhhuh. uhhuh, uhhuh, uhhuh. *Epale (e)sta va pa(ra) acá.* [Come on, this goes over there.]

At times, Ms. Jackson used her very limited Spanish to translate key terms. In (4), which follows (2) above after some intervening talk, the teacher attempts to explain her analogy between the animal kingdom and Little Manuel's relationship to Madera Middle School, i.e., as a "species". Using a few Spanish words, Ms. Jackson attempted to help Little Manuel. He, however, remained mystified by what the teacher was saying about him.

(4) Teacher self-translation

Your name is Manuel, for your first name, Jiménez, for your last name, so I, I could pick you out from all the students by going from a big group, *grupa grande*, to *solamente* [only] you.

In addition to attempts by the teacher to translate, a number of immigrant students who were still acquiring English at times translated aloud various words that Ms. Jackson was using, as in (5).

(5) Student self-translation

- Ms. J: We've got that, flavor, taste.
 Pedro: *¡Sabor!* [taste]

On such occasions, Spanish monolinguals who happened to be in earshot may have benefited from the translation, assuming of course, that they were able to connect it with the terms the teacher was using. However, we have no evidence to indicate that overhearing resulted in a Spanish monolingual's increased understanding of the teacher's talk.

In addition to translation, bilingual interactions frequently took place in student groups, although nothing said by the teacher was translated directly (see Langman, Hansen-Thomas, and Bayley, this volume). Usually such negotiations focused on the minute by minute details of the task to be accomplished rather than on any scientific goals, as illustrated in (6), again from the potato chip sorting lab on October 11.

(6) Bilingual negotiation

- Nellie: Shape not the taste!
 Little Manuel: *¡Estos tienen cosas verdes!* [These have green things.]
 Nellie: The half ones, the half ones.
 Marilyn: That's the onions.
 Tamara: That's the +/.
 Little Manuel: *(Es)tan podridas.* [They're moldy.]
 Nellie: These are the circles, these are the half ones.
 Little Manuel: Circles, circles.
 Nellie: Circles.
 Little Manuel: Circles.
 Tamara: This is half.
 Little Manuel: *Son triángulos.* [They're triangles.]
 Nellie: Half over here, circle over there.
 Little Manuel: *¡Epale, no lo saque!* [Hey, don't take it!]

Importantly, although Ms. Jackson made sure to group non-English-speaking or low proficiency students with others whom she had reason to believe could explain the tasks and material in Spanish, she did not specifically designate any particular student as a translator. Little Manuel and other recent immigrants, therefore, were dependent on the voluntary cooperation of their classmates.

4.3 What did not get translated?

The answer to the question, “what did not get translated?” is distressingly simple: science. On August 30 and October 11, as well as on the other days that we have examined closely, the directions given at the beginning of lab activities, the statements of declarative knowledge, and explanations explicitly linking the labs and other class activities to the scientific concepts they were intended to teach were never translated. On October 11, for example, Ms. Jackson explained what students were to do in the “potato chip lab.” As indicated by his question at the end of (7) below, Little Manuel had no idea of the purpose or goal of the task.

(7) Translation failure

- Ms. J: Today what I want you to do, I want you to really, really, really look at your chips.
- Big Manuel: Okay.
- Ms. J: Naturally your first instinct is that you’re going to sort your chips by their size and shape, right? That’s usually the first thing that people do, but we’re gonna sort them into as many categories as we can, this is kind of sort of similar to the button lab we did, kinda sorta, but instead of thinking about uh, the periodic table, we’re going to learn about how scientists classify all living things, okay? Besides it’s fun and gives us an excuse to eat, and we always look for labs that give us an excuse to eat.
-
- Ms. J: Put your name on this lab report ### today’s date is the eleventh. How many groups of chips do you think you and your team will end up with?
-
- Little Manuel: *¿Vamos a hacer brujería? ¿Vamos a hacer brujería?* [Are we going to do witchcraft?]

As we have noted, on October 11 Ms. Jackson led a whole-class discussion and provided extended commentary designed to reinforce the idea of the biological classification system and link the classification of animals to the potato chip sorting task that the class had just carried out. None of this, however, was translated. Hence, the non-English speaking students in the class had no opportunity to see the connection between the very simple sorting task of the potato chip lab and any scientific concept.

5. Discussion

We suggest that the relatively frequent translation of procedural directives compared to teacher talk about scientific concepts is a consequence of the fact that such directives generally employ relatively familiar language. In contrast, teacher explanations of new academic content involve complex concepts that are unfamiliar both to the translator and to the beneficiary of the translation. Indeed, because the content is both unfamiliar and complex, student language brokers often lack the necessary domain-specific vocabulary in the language into which they are translating. Such domain specific scientific vocabulary provides a basis for developing scientific concepts and relationships and forms part of what students are learning for the first time in Ms. Jackson’s class. None of the students who undertook the task of translating for their peers had ever studied science in Spanish beyond the elementary school level.

The difficulty of the dual task of mastering scientific content and translating is revealed in (8) recorded on October 31. On this day, students were to prepare a one minute scientific explanation in English and in Spanish of a concept they had already studied. Here Marilyn is translating the instructions for Little Manuel and asking Hansen-Thomas (Holly), who is acting as teacher, for support.

(8) Translation is hard

- Marilyn: *El propósito de esa actividad es para crear cri- crear* [The purpose of this activity is to create] how do you say expert, miss?
- Holly: ¿*Experto?* [Expert?]
- Marilyn: Yeah, thank you. *Un experto científico de voz* [an expert science voice] # I'm trying my best, sorry.
- ...
- Marilyn: And uh, expert science voice. *Una voz de un* [a voice of a] +/-.
- ...
- Marilyn: +, *científico* [scientific], whatever, okay # *y en [//] en español y inglés. Cada explicación va a ser por un minuto. Tu grupo, el grupo de experto científico de voz va, va a record +/-.* [in Spanish and English. Each explanation is going to be a minute. Your group, the group of expert science voice is going to record]
- Holly: Uh, *grabar* [record].
- Marilyn: +, *a grabar y lo van a poner en video.* [to record and they are going to put it on video]. Okay. This is hard.

Note that Marilyn has interpreted this task as a word for word translation of the English text she has been provided, rather than an explanation of the intention of the text into Spanish. This is in contrast to the summarizing that takes place when oral instructions are being translated as outlined in earlier examples. In those instances, the lack of scientific domain knowledge and associated vocabulary is not noticeable as students are simply summarizing actions to carry out in every day language. Once a task, as that in (8), demands such vocabulary, the lack of knowledge becomes more apparent. It is not at all surprising that students are not able to translate given that they have no domain knowledge in the language into which they are translating, in this case Spanish.

6. Conclusion

Our analysis indicates that the types of language brokering that go on in this classroom, and presumably others as well, do not provide a sufficient basis for non-English-speaking children to gain full access to the curriculum, nor do they seem useful for English acquisition. In addition, what gets translated depends not only on the translation ability of the language broker but also, more importantly, on the initiative and willingness of the language broker and the beneficiary to engage in interaction. (See Langman, Hansen-Thomas, and Bayley this volume for a discussion of dispositions of bilinguals to the task of translation.) While the type of language brokering described here may be beneficial to non-English speaking students in terms of allowing them to participate and “do things” in the science classroom, that is, to minimally follow along, it cannot substitute for other resources and development activities such as sheltered English and bilingual teachers or teachers’ aides. (See Langman, 2003 for a discussion of the effects of mainstreaming recent immigrants.) Clearly such resources are necessary if the concepts and language of academic subjects such as science are to be presented in a manner that is fully accessible to English language learners.

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