Bilingual Practices in a Science Classroom: Bilingual Hispanic Students’ Ways of Constructing School Science

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1. Introduction

The purpose of this paper is to examine how bilingual Hispanic middle school students interact with the hands-on and inquiry-based curriculum unit in the setting of a science classroom. The research reported in this paper is part of a larger ethnographic study of science classroom discourse collected at a middle school in Montgomery County, Maryland. In describing code switching, we focus mostly on the ways that bilingual Hispanic students talk while getting involved in classroom activity, showing that both Spanish and English are used in conveying the meanings related to lessons.

Background

In the 1980s a large wave of Hispanic immigrants came into Maryland. Between 1990 and 1994 the Hispanic population in Maryland grew another 29%. By 1995, the Hispanic population in Maryland numbered 172,000. According to the U.S. Census Bureau, the primary Hispanic immigrant groups in these areas are Salvadorans, Puerto Ricans, and Mexicans, although there are also significant numbers of Guatemalans and Hondurans. As the Hispanic population grows, the environment in which teachers work is becoming increasingly diverse in Montgomery County Public School (MCPS). More specifically, some classrooms have more Hispanic students than other ethnic minority students. MCPS is a large Maryland school district (136,000 students), with a student population that is rapidly growing and becoming both ethnically and socio-economically diverse (Lynch, Kuipers, Pyke, and Szesze 2003). According to MCPS records, Hispanic students’ enrollment has grown up to 64.3% from 1998-99 to 2002-03. About 17% of the total MCPS students in 2002-03 were Hispanics (Lynch, 2003). The school of this study has 21.4% Hispanic students and 25% of students in the classroom were Hispanic.

Given the number of Hispanic students in the school district, it is not surprising that there are both ESOL and bilingual Hispanic students in almost every classroom in MCPS. However, little attention has been paid to the role of bilingualism in the classroom in this increasingly Hispanic school district. Studies of diversity and science education in other areas in the US have examined the relationship between cultural differences and achievement (Lee, Fradd, and Sutman, 1995; Warren, B., Rosebery, A.S., 1

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With focus on instructional practice (Lee and Fradd, 1998), and the relationship between science education and linguistic minority students’ identity (Hazelwood 1996; Brown 2002). These studies on ethnic minority students in science classrooms have documented differences in students’ responses to and participation in science. However, researchers have not yet shown the importance of bilingual speakers’ responses to the science curriculum, and how verbal interaction among students enables them to discursively organize knowledge during the learning process.

2. Conceptual Framework

Sociolinguistic approaches can provide a portrayal of patterns of language choice in a bilingual society. The determiners for choice of language are location, formality, intimacy, seriousness of situation, and sex of speakers. For example, in the US, bilingual Hispanics tend to use Spanish at home and among friends or family members, while they use English at school or at work. However, language behavior is sometimes beyond speakers’ consciousness about their choice in code-switching behavior. Gumperz (1982:61) points out that a speaker tends to choose language fairly quickly and automatically without being aware of the determiners of language choice. Urciuoli (1996) demonstrates how Puerto Rican immigrants and their language are classified as “low class” and “ethnic” in the US. Zentella (1997) examined how the children of Puerto Rican immigrants learn how to code switch in order to “defend themselves” to be ready for schooling. By showing systematic code switching or mixing among Hispanic children, Zentella (1997) argues that code switching should not be considered as “broken” English, but rather a language that indicates the increasing cultural and linguistic diversity in the US.

Code switching can be defined as the use of more than one code or language in the course of a single speech event (Gumperz 1982). There is substantial body of literature on code switching, in particular, code switching in classroom. For example, research on bilingualism and code switching in classroom has focused on linguistic minority students’ academic performance (Zazkis 2000; Kearsey and Turner 1999) or teacher-student interaction (or teacher-led classroom discourse) in a bilingual classroom or code switching as a marker of identity (Cleghorn, 2000; Arthur 2001; Heller 2000; Zentella 1997). Thus, few studies have paid attention to code switching as a tool to construct knowledge through interaction among bilingual students. The data analysis in this paper focuses on student-student interaction which is enabled by the hands-on and students’ autonomous inquiry curriculum.

The analytic framework that I utilize for micro analysis of code switching in interaction is drawn from conversational analysis that focuses on discourse organization, particularly the ways that code switching is employed to convey meanings to participants. Discursive or pragmatic functions of code switching (McClure 1981; Gumperz 1982; Auer 1995) have been examined, resulting various types of discursive functions such as quotations; addressee specifications; interjections; message qualification; personalization and objectivization (Gumperz 1982). The above list is by no means exhaustive, but provides an array of concepts useful for analyzing the data.
3. Methods

Data was collected through video ethnography, focusing on a table with two bilingual Hispanic students and two other English monolingual students. For a selected class period, a lab table of four middle school children was filmed every day while learning the curriculum unit on chemistry (Chemistry That Applies, referred to as ‘CTA’). Our study uses video ethnography in the classroom to understand how CTA functions in a culturally diverse classroom (Kuipers, Lynch, and Pyke, 2003). Ethnographic method aims to characterize the viewpoints, internal logic, and motivating ideas of those being studied. Ethnographers rely on detailed description and analyses, and try to account for the complexity of action, knowledge, and meaning in specific contexts. The data collected through video ethnography were analyzed to illuminate discursive functions of choice of English or Spanish.

4. Findings: Code switching and science learning

Code switching is a way to use two linguistic resources to organize discourses. In this paper, we focus on largely five discursive functions of code switching: Calling attention, revoicing; clarification; objectivization and personalization. The following excerpt illustrates a few discursive functions:

Example: Clarification, Personalization and Objectivization
N(atalie) and G(loria)² are conversing during the time when they were filling out a worksheet.

01 N: So, number two is blank?
02 N: [GLORIA]?
03 G: Huh?
04 N: Number two is blank, then?
05 G: Number two? ¿Qué?
   (What?)
06 N: What's number two?
07 G: This one. Lo que hicimos el otro día. El jueves.
   (The one we did the other day. On Thursday)
08 N: Yo est... yo estaba preguntando if number two is blank then.
   (I wa... I was asking)
09 N: Thank you. What page?
10 G: I don't know. No lo ha dicho.
   (She hasn't said)

Note that how code selection contrasts varying degrees of speakers’ involvement in the message that is conveyed. For example, “yo estaba...” is personalized while “if number two…” reflects more distance from the information. In line 05 Gloria switches to Spanish in order to clarify what Natalie is asking to her. In line 07, “what we did” is personalized in Spanish. In line 08, “I was asking” in Spanish and the fact is in English. In line 10,

² All names are pseudonyms.
Gloria says “I don’t know” is in English, whereas what the teacher did is encoded in Spanish. Natalie’s question, “Is number two blank?” refers to her perception of the curriculum and their attempt to navigate the curriculum, although it does not refer to a scientific phenomenon per se.

This and other examples in this paper show that speakers draw on their linguistic resources to organize discourse. In classroom interaction, students reconstruct the discourse found in the curriculum. Specifically, this paper shows the ways in which two Hispanic female students, Gloria and Natalie, utilize English and Spanish as linguistic resources to contextualize information relevant to the curriculum. Using a language other than the “official” language of the classroom is “off-task” from the teacher’s perspective. However, I argue that code switching is a way through which bilingual students make sense of schooling when they are interacting with peers, curriculum and the teacher. Analyses like this can begin to give teachers a window into their students learning process, as well as a way of assessing and assisting them. A cooperative learning situation also requires students to negotiate roles using linguistic and social strategies. Students’ bilingual practices in interaction involve the development of an ability to use thinking that is specific to scientific endeavors, using discourse that is conducive to describing their experience of the curriculum, and their strategies for dealing with the curriculum. However, we are not sure at this point to what extent their bilingual practices in interaction may enhance the development of scientific concepts described in this specific curriculum unit.

5. Interpretation and significance of the study

Studying linguistic minority students’ learning is not a new attempt, but few studies carefully looked at students’ verbal practices as part of important everyday experience of science. Bilingual students in this study use both Spanish and English in co-construction of knowledge. The reason that we see frequent use of Spanish in classroom is that the inquiry and hands-on science curriculum allows more interaction among students. Although Spanish is primarily used in clarifying procedures rather than concepts, it still defines what ‘school science’ is, furthermore, what the curriculum is asking students to do.

In addition, ‘diversity’ is usually considered simply as a variable to understand the gap between underachieved students and achieved students. In this paper, I try to look at bilingual Hispanic students’ learning strategies rather than seeing them as social categories that are used in statistic analysis of student achievement.

Bilingual education researchers and practitioners may benefit from this sort of research because this study shows how bilingual students talk in classroom when they interact with each other. For example, the fact that students do not necessarily engage in conceptual inquiry among them suggests bilingual students’ limited use of their vernacular language. Further research may include examining science discourse in Spanish by interviewing several Hispanic students if they have more proficiency in science language in their mother tongue or not.

6. Selected References


