

## Capturing Urban Student Voices in the Creation of a Science Mini-Documentary

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**Abstract:** It has been widely proposed that student voices should play a crucial role in designing and implementing curriculum and instruction that promote students' engagement in science learning. In this study we examined the voices of two seventh grade boys from a low-income urban community as they worked together in an after-school program to create a student-directed video documentary about science. Our analysis showed that these students used their voices to construct identities that they cared about in school, by reconstructing some aspects of their school identity that did not match who they aspired to be, as well as by gaining new resources to enact their desired identities. The examples provided demonstrate that integrating student voice in a science project can make participation in science a valuable tool in students' identity formation. © 2006 Wiley Periodicals, Inc. *J Res Sci Teach* 43: 667–694, 2006

Instead of searching for and listening appreciatively for voices that differ, voices that jar, voices that might even offend, we are perhaps too ready to hear those voices that broadly echo our own. (Hargreaves, 1996, p. 13)

The call for the integration of student voices in curriculum design and instruction is not new to education. Progressive visions of education have generally argued for a central role of student voices in educational practices as a means to engage students in active learning. These have been present as far back as Dewey's (1899) "transformed recitation," in which he envisioned students providing their experiences and ideas and having a dialogue with teachers in order to set up new lines of thought and inquiry. Critical visions of education have further claimed that their voices allow learners to create their own meanings and become authors of their worlds, demanding that students assume a proactive role in planning, implementing, and evaluating their own learning (Freire, 1971; Giroux, 1988; Simon, 1987). Evidence from a variety of research studies has consistently shown that including student voices in science education can enhance motivation,

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contribute to the development of a wider range of teaching strategies, and help raise overall levels of student achievement in science (see Jenkins [2006] for a review of studies on student voice in science education).

Despite these calls, student voices still do not fare well in many American schools:

Whether spoken or written, they have too often been reduced to lifeless, guarded responses—responses to the questions and assignments of powerful others, responses formed in the shadow of teacher scrutiny and evaluation. Given the fate of student voices, it is difficult to believe that traditional schooling contributes to the flourishing of individuality and democratic decision-making. (Lensmire, 1998, p. 261)

There are many reasons why student voices have been quieted in schools. One of the primary reasons was asserted by Moll, Amanti, Neff, and Gonzalez (1992): students are usually regarded by teachers and administrators as consumers rather than producers of knowledge. When students are viewed only as consumers, their voices are often reduced to responses to the questions of others who know the “right” answers in advance and what is expected of them, silencing student critical thinking and creativity.

This traditional conception of students as knowledge consumers is particularly detrimental for science education, as it directly opposes the latest science education reform movements (AAAS, 1990; National Research Council, 1996), which seek to engage students in authentic science inquiry by fostering children’s role as active investigators of the world and generators of knowledge. Inquiry-based science pedagogy accords student voices a central place in the learning process, as students learn to pose questions, gather and analyze evidence and construct arguments based on it, and communicate their findings to others (AAAS, 1990; Singer, Marx, Krajcik, & Chambers, 2000).

In addition, we argue that the absence of student voices in science curriculum and instruction constitutes an important reason (although not the only one) why research has shown that the majority of students from low-income urban communities in the United States develop negative attitudes toward science and their future in the field by the time they complete middle school (Atwater, Wiggins, & Gardner, 1995). This becomes particularly serious given the large and long-standing achievement and opportunity gap in science between urban minority students and more affluent student populations (NCES, 2003). We agree with Reiss (2000) in his claim that school science education will only succeed when students believe that the science they learn is of value to themselves. In our view, the absence of student voices in science curriculum and instruction causes school science to be disconnected from students’ out-of-school lives, interests, and cares, and therefore is meaningless outside the need for success at school.

With the aim of understanding the roles urban student voices can play in science learning we investigated the following research questions: In what ways do two seventh grade boys living in a low-income urban community express and use their voices when they work in an after-school program to create a student-directed video documentary about science? What are students’ purposes behind the use of their voices? In what ways does an investigation into student voice inform our understanding of students’ science learning within the context of a science video project?

### Learning, Identity, and Voice

Our understanding of student voices is grounded in sociocultural perspectives of learning and cognition, which describe learning as a situated process shaped by the characteristics of the

environment in which it takes place. As people learn, they move from a peripheral participation in the subject matter community toward a more central position where they become a fundamental part of the decision- and rule-making processes (Lave & Wenger, 1991). These perspectives suggest that learning should be thought of as an ongoing process of identity formation, in which learners acquire what is needed for participation in relevant communities of practice, while they construct the kinds of individuals they are and whom they aspire to be (Wenger, 1998). In this process, people negotiate their identities within the rules and expectations of the world they participate in, even as they engage in their daily practices (Luttrell & Parker, 2001).

Science learning is viewed, within this framework, not only in relation to the science knowledge, skills, or ways of thinking students acquire and learn to use, but also against the identities that they are able to generate or accept for themselves within scientific or science-related communities of practice (Calabrese Barton & Brickhouse, in press). As Witz (2000) states, learning science is part of a larger process of identity formation, which includes students finding their place in society, direction in life, and establishing a deep relationship with the subject matter of science in such a way that it turns into a source of inspiration and occupies a formative position in their lives.

But how does one begin to capture the process of identity formation within a learning context? In other words, how is it possible to understand the ways students generate or express science-related identities within a community of practice such as an after-school science program? We believe that one useful way of doing this is by analyzing how students choose to express themselves over time, or how they use their *voices* as tools for enacting present identities or building desired ones as they learn.

We, therefore, understand *voice* as a dynamic construct, closely related to how one learns or constructs new identities within a context. In other words, learning is reflected in a change in voice when voices allow people to participate in specific communities of practice with more central roles. For instance, we see science learning when students express themselves in ways that show how science has become part of their present identities or evidence that they have acquired new concepts and skills that allow them to participate more fully in science-related communities of practice. We also see science learning when students use their voices effectively to gain more scientific expertise, which will in turn allow them to increase their participation in science-related contexts.

In the next section, we explain our choice of digital video technology as a means to capture the voices of urban youth within the context of an after-school science program.

### Capturing Student Voices Through Digital Video Technology

In attempting to answer the call to incorporate student voices as a central part of science curriculum and instruction, we have worked with urban youth from low-income communities to explore new modes of participation in science learning that would be responsive and open to their voices. For this, we have worked with middle school students for 3 years (2001–2004) in creating student-directed mini video documentaries about science during voluntary after-school science and technology programs.

These programs purposefully sought to provide a space for students to express their voices by asking students to make choices at every stage of the creation of the science movie. Students were asked to create a movie about science and were given the freedom to decide on any movie topic that related to science, as long as they were able to support their selection by explaining why their topic was “scientific.” Students also had the space to make decisions regarding the movie content,

negotiate the length and frequency of the after-school meetings with the teachers, and choose their roles in the video production.

Given the nature of the project, we expected the analysis of student participation in these programs to offer us, as researchers, new lenses for understanding student voices in science learning. These included the means by which and contexts in which their voices were expressed, the motives behind them, and how their voices reflected the construction of science-related identities.

Our choice of using a digital video documentary as a way to capture student voices was grounded in two assumptions. First, was the idea that technology can serve as a powerful tool to engage students in science learning. As Blumenfeld et al. (1991) pointed out, using technology contributes to students' learning process by enhancing their interest and motivation. Along these lines, O'Neill and Calabrese Barton (2005) showed that the possibility of telling stories related to science through digital videos allowed students to cultivate a sense of ownership and engagement in the project. Through the use of technology, therefore, we intended to generate a space in which students would be able to express their voices while they learned about science.

Second, we believe that using digital video technology allows students to communicate on their own terms as they are able to employ multiple forms of expression, such as selecting what footage to collect, acting, singing, dancing, showing pictures they think are meaningful, or interviewing people they think are important. The versatility of this kind of technology, together with its simplicity (in our experience, middle school students quickly learn how to use it with the guidance of an experienced teacher), offers many possibilities for the expression of student voices. For example, students are able to cut and edit scenes, add special effects to them, or attach songs to different parts of the video. This versatility is shown in Elmesky's (2005) work with African American teenagers attending an inner-city neighborhood school in Philadelphia in the creation of "Sound in the City," a 40-minute digital movie about the physics of sound. In her study, Elmesky showed how using digital video technology allowed students to portray and build their connections to science in personal ways. She demonstrated that her students were able to make the traditionally distant culture of science become their own by including in the science video a variety of rap songs, dance, and posters that featured symbols and practices from their experiences in their lives outside of school.

To look at the ways individual student voices played out in our after-school science video project, we developed the following conceptual framework.

### Analyzing Student Voice: A Conceptual Framework

#### *From a Generic Voice to Individual Voices*

Research in student voice has been oriented toward an understanding of students' collective voice toward schooling and instruction with the purpose of enhancing students' experiences in school. According to Lensmire (1998), the analysis of voice often does not penetrate deeply to the level of "face-to-face" interactions in the classroom, in which different voices collaborate or conflict.

In discussing the voice of the teacher, Hargreaves (1996) reasoned in a similar way when he claimed that speaking of *the* teacher's voice assumes a representative voice, generic to all teachers, which misrepresents individual voices and identity formation. Our study aims, therefore, to analyze individual student voices without presuming the existence of one generic voice. We believe that by recognizing students' individualities, we can understand the richness of their

purposes and motivations to engage in science learning and the development of their science identities.

### *Voice as Perspective*

The concept of student voice has been described in educational research as students' collective perspectives toward matters usually related to schooling. As Mitra (2004) points out, student voice has traditionally been defined in a broad manner as "the most basic level of youth sharing their opinions of problems and potential solutions" (p. 651). Using this definition, recent educational research has shown the positive outcomes of school programs aimed at fostering youth voice, both for school improvement and for the participants themselves.

Regarding school improvement, Fielding (2001) demonstrated that the project "Students as Researchers," in which high school students researched school issues that they identified as important with the goal of providing recommendations for school change, resulted in transformative school practices such as the incorporation of students when evaluating a new curriculum.

Along the same lines, SooHoo (1995) worked with students as co-researchers in a project that allowed middle school students to identify their barriers to learning, including oppressive school practices, lack of respect for students, and discrimination of Hispanic students. Their participation in this research later allowed students to negotiate with their teachers regarding several issues of school governance, instruction, and curriculum. This resulted in school improvement from the students' perspective.

Another set of studies has shown that school programs that seek to foster student voices can also benefit the young people who participate in them. For example, Mitra (2004) showed that "Pupil-School Collaborative," a project in which high school Latino youth tutored and translated for their immigrant peers, and "Student Forum," in which high school Latino students researched ways of making school a better place for students, promoted "a consistent growth of agency, belonging and competence" in the participants (p. 651). Mitra's study showed that students' agency grew because they were able to articulate their opinions and feel that their views were heard, as they played leadership roles. The students' sense of belonging increased as well as they developed new caring relationships with adults in school. Finally, there was a growth in their sense of competence, as they gained skills to critique their environment, solve problems, and speak publicly.

In addition, Rudduck and Demetriou's (2003) data from the initiative "Consulting Students about Teaching and Learning," in which a group of teachers interviewed students from six different schools in the UK, suggested that being able to talk about their experiences of learning in school and having their accounts taken seriously offered students a stronger sense of school membership, respect, and self-worth; a firmer sense of self-as-learner; and a heightened sense of agency.

### *Voice as Participation*

Although students' perspectives constitute an essential component of student voices, we believe that the definition of voice as perspective fails to capture another fundamental part of the construct of voice. This we have labeled *participation* (or "voice in action") and it is related to what students actually *do* when they take part in learning practices.

This second component of voice is grounded in the sociocultural views of learning that we bring to this study, which characterize voice as "an active role in the social construction of

meaning” (Lensmire, 1998, p. 268). Sociocultural perspectives understand voice as both embedded in a social and physical context and affecting it, shaping the person’s life and the lives of others (Mitra, 2004). Through their actions, students “attempt to make themselves present and to define themselves as active authors of their own world” (Simon, 1987, p. 377). When looking at participation, therefore, we seek to analyze all students’ observable actions, which also include what students decide *not to do* (e.g., when a student chooses not to engage in a particular activity proposed by the group).

Finally, we believe that student voices are fundamentally influenced by the purposes linked to them. This refers to the reasons, both conscious and unconscious, that students have for using or expressing their voices in the ways they do. For that reason, our analysis of student voices is integrated with the students’ *goals* behind their perspectives and participation.

### *Operationalizing Voice in the Video Project*

With the aim of analyzing the ways different voices played out in the science video project, we sought to operationalize the construct of voice in a way that allowed us to capture students’ perspectives and participation in the after-school program.

The first challenge we faced was to find a concrete manner to document students’ perspectives during their work in the science video project that authentically reflected the ways those perspectives were enacted. We opted to document students’ perspectives by analyzing their *talk* during their collective work, informal conversations, or interviews. We define students’ *talk* in a broad sense, meaning not only what students say, but also how they say it and to whom. We also include in students’ *talk* other nonverbal forms of communications, such as body language or written forms of communication.

Although we do not claim that students’ talk fully captures every perspective (e.g., it fails to record those ideas of beliefs that students choose not to express and therefore cannot be assessed by the researchers), we chose to look at student talk because we believe that our broad definition of *talk* includes the main ways that students communicate with others and express their views. In this way, student talk allows us to gain enough insight to understand students’ perspectives with respect to their participation in the science video project, school, and science itself.

Second, we propose that students’ participation can be operationalized by looking at students’ *choices* during their work. We base this idea on work by Edwards (1994), who proposed a focus on student voice in education by providing students with opportunities to choose during all phases of curriculum design and implementation. With *choices* we refer to students’ selection of what to do and how to do something. As we explained before, we also refer to what students choose not to do, such as when they decide not to participate in a specific activity. Finally, we not only look for conscious or intentional choices but also try to interpret those choices directly revealed in students’ actions, for these may reflect dispositions that the actors are not necessarily aware of.

We believe that the use of this broad definition of choices allows us to capture the most salient features of student participation. However, the limitations of this operationalization of participation mostly reside in the researcher’s capacity to interpret students’ actions in terms of the conscious and unconscious choices they are making and situating them in the broader context of their participation in general. To overcome this limitation, we sought to ask students about the meanings of the choices we observed whenever possible in order to complement and contrast our own interpretations with theirs.

Our conceptual framework and operationalization of student voice is summarized in Figure 1.

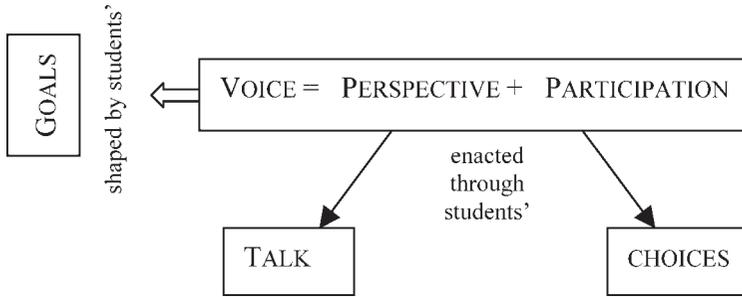


Figure 1. A conceptual framework and operationalization of the construct of voice.

### Research Questions

Our study of student voices was guided by three research questions:

1. In what ways do two seventh grade boys living in a low-income urban community express and use their voices when they work in an after-school program to create a student-directed science video documentary?
2. What are students' purposes behind the use of their voices?
3. In what ways does an investigation into student voice inform our understanding of students' learning within the science video project context?

### Research Methods

#### *Methodology*

We employed a critical ethnographic approach. Critical ethnography is intrinsically political, an openly value-based approach to research which assumes knowledge generation to be an active and context-based process (Lather, 1992). By using this methodology we attempt to respond to the call for new ways to examine and transform social inequalities by co-creating spaces that are more open to the voices of youth (Pizarro, 1998). Research grounded in critical methodologies seeks to document the process of empowerment by valuing “the right to a voice in one’s own language” (Trueba, 1999, p. 594) and embracing human agency. Consequently, this orientation to research seeks to incorporate multiple voices and embraces the histories, cultures, and epistemologies of the participants (Calabrese Barton, 2001).

This methodological framework has guided us in the design of a research project in which students were able to create their own way of talking about science. Giving students the space to express their views and negotiate the steps involved in the creation of their movie aligns with the goal of fostering students’ active participation in the construction of meanings, and therefore provides a unique context to explore student voices.

Finally, the advantage of doing critical ethnography via media studies, such as a video production, is that it does not limit students to any one form of expression, as we explained earlier. In this way, a more complete story can be told from the students’ views than what might be allowed by observations or interviews alone. Therefore, by having primary control in the creation of the science video the students were able to express the ideas that they found relevant in ways they found more suitable for their purposes.

### *Description of the Project*

This research study is part of a larger project conducted at a public middle school in a low-income community in New York City that is predominantly Latino and African American in composition. Our research center has partnered with the school since 2001 in the process of reforming science curriculum and instruction.

Part of our collaboration with the school consisted of creating and teaching after-school science programs for sixth and seventh grade students. These voluntary programs aimed to support students in the design and production of video mini-documentaries that expressed their ideas about science in their lives. One of us (M. Furman) joined the program in 2004 as a teacher and researcher and worked with the third group of students, which consisted of four seventh grade boys. These four students were part of a larger group who had created their first movie that they called "Survival" in 2003. At the beginning of the spring semester 2004, we met the students for a discussion session regarding the 2003 video and four of them expressed their wish to create a new movie. From then on, we met students after school once or twice a week for 2 hours in the school science laboratory for one semester. Over the semester, two of the original four students quit the project, and four new boys joined it.

Our role included providing the equipment to make the digital movie (a camera, a laptop computer, and movie-editing software), teaching students how to use it, taking them on field trips if the project required us to do so, and overall guidance in movie production. Students had the responsibility to conceive of the ideas for the movie, write the storyboards, collect and direct all footage, work in the editing process, and select the soundtrack. Students also had the opportunity to show their movie to the rest of the school if they wanted, which they did at the end of June 2004. Their final 20-minute video production was based on the life-cycle of different animals, including humans, and they entitled it "The Cycle of Life."

### *Participants*

We conducted case studies of two students of the group, Anthony and William. Both 12-year-old boys were second-generation Latino immigrants from the Dominican Republic and were eligible for the school's free lunch program. We purposefully selected these students for two reasons: first, they demonstrated an intense participation throughout the project (they were part of the initial group of four students and attended the majority of the meetings from the start of the semester); and second, they had contrasting profiles with respect to school science, which we believed would enrich our analysis of student voices in science learning.

Anthony was judged by his teachers and some of his peers a "trouble-maker" and a "low-performing" student. He was part of the lower-level-tracked class and he maintained a C average in his academic records. As his science teacher explained to us, he considered school and science "boring" and rarely responded to class assignments or turned in his homework. We observed that, during science classes, he was either silent or off task, talking with his friends instead. His teacher explained that she often seated him apart to prevent him from disturbing other students. Anthony was a very outgoing child and usually engaged in playing with other students both in and out of the class. He also had many friends in his neighborhood, and on two occasions he brought some of them to the video project meetings.

In 2003 Anthony applied to participate in the after-school program and asked to be the director of photography of the production. During the course of the project, other members of the group proposed to expel him from the group because they felt that he rarely shared the camera and other equipment with other members and that he often disturbed their work. The teacher mediated

this tension by setting a whole-group meeting in which students exposed their opinions and the group as a whole attempted to find a solution. Anthony was asked to write a letter of apology and promise to change his behavior in order to be readmitted, which he did. In the 2004 discussion session, Anthony was enthusiastic about producing a new movie and offered his lunch and after-school time to work on it, becoming one of the biggest supporters of the project. Despite this, tensions similar to the previous year's frequently emerged, usually when teachers or other students felt that he was not contributing to the production process.

On the other hand, William was regarded by his teachers and peers as a very good student, especially in science, and belonged to the honors-level-tracked class. On average, his science grades were in the A and B range. His teacher reported that he claimed to like science and enjoy school and always turned his homework and school assignments on time. He identified himself as a prospective veterinarian whenever he was asked about his future career goals. Despite his good grades, his parents closely followed his school progress and wanted him to further enhance his school performance. For instance, he attended a daily after-school math and literacy program to improve his grades.

According to our classroom observations and our talks with his teacher, William was respected by his peers for his knowledge but was not a very popular student in class. He always raised his hand to answer the teacher's questions and volunteered to help teachers in class. However, he usually worked by himself on school assignments and rarely engaged in games or discussions with his classmates during instructional time. His science teacher told us that she and other teachers usually called him "the oldie" because he always looked very serious in class and rarely played or joked with other children. Yet, we were able to observe that after class he would sometimes engage in games with other students and change his "solemn" attitude for a more playful one.

### *Data Collection*

Seven types of qualitative data were collected over the course of the project:

- Participant observation field notes recorded after every after-school meeting.
- Videotaped individual semistructured interviews with students, regarding their views on their participation in the video project, their decision to join it, and what they had learned from it.
- Field notes recorded during and after observing students in their school science classes.
- Informal interviews with the students' science teacher regarding each student's academic performance and her general impression of them as members of her class.
- Students' artifacts created during the video-making process, such as storyboards and questionnaires for teachers and zookeepers.
- Four hours of video footage the students collected for their movie.
- "The Cycle of Life," the final 20-minute video.

By collecting these different sources of data we attempted to get a contextualized and detailed picture of the ways in which Anthony and William expressed and used their voices during their work on the project. Conducting observations of the students in their school science class and interviewing their science teacher, for example, gave us information regarding their school identities and performance that was useful in helping us to better understand their personalities and relation with school, their peers, and science as a subject. Analyzing artifacts such as the footage that students collected for the movie, including the final movie itself, allowed us to gain insight into their ideas about what counted for them as science, what scientific topics they were interested

in, and how they wanted to express their ideas around them. In addition, participant observations of our after-school meetings helped us analyze the evolution of students' identities as science learners and members of the project. Interviewing students individually allowed us to inquire about their own meanings and purposes in relation to the different aspects of their participation in the program and their ideas around science and learning experiences in general, and enabled us to check our interpretations of their talks and choices during the project.

Finally, the collection of data from multiple sources permitted us to address what Lincoln and Guba (1985) referred to as the trustworthiness of data and findings, as it allowed us to triangulate different forms of data during our analysis to confirm or disconfirm the themes that we identified during our analysis. Our inferences and general analysis were also periodically shared with our urban science education research group, who helped us refine or confirm our interpretations.

### *Data Analysis*

We conducted an ongoing data collection and analysis process, beginning with our first interactions with students and ending with the final piece of writing, in a dialectical theory- and practice-building process in which practice and research shape each other in a cyclical manner. Specifically, data were analyzed using a grounded theory approach, systematically researching for themes and patterns (Glaser & Strauss, 1967). We initially coded our data for each student and constantly revisited it to support the progress of our work as well as to confirm or modify any conjecture developed from it.

Over this evolving and iterative process, we developed different categories of analysis regarding student voices that evolved into the conceptual framework and operationalization previously offered. In this process we developed three layers of coding, which led to the findings presented herein. Our first coding scheme looked closely at what students *said* through their expressed interests (i.e., who I want to work with, what topic I want to study) to capture their perspectives, as suggested by previous studies centered on voice (Fielding, 2001; Mitra, 2004; SooHoo, 1995). Once we completed this initial coding, however, we determined that we needed to return to the data to better understand the role that the students' *actions* played in helping us to interpret their voices. As we worked with them during the project, we understood that students' actions were also an essential part of student voices and that their actions were the result of choices and negotiations within the science video program learning community. Thus, we identified a second component of student voice related to their participation, and proposed that it could be operationalized by looking at students' choices.

After the development of our conceptual framework for student voice we reexamined our data under the lens of students' perspectives and participation. More specifically, we coded our data in terms of students' talk and choices and looked for patterns across them to develop new coding schemes. In one of our initial iterations, for instance, we coded students' talk in relation to their audience (i.e., other students, their peers in the video group, teachers, etc.) and their styles (i.e., formal or informal talks). The choices we coded for each student were related to the different stages of the project at which we believed they had the space to negotiate the ways in which they wanted to participate (i.e., the topic of the movie, their roles in the movie production, whom to work with, etc.).

Although these codes were helpful in allowing us to organize the different types of students' talk and choices, we found that these coding schemes were insufficient for grasping the meanings behind the students' use of their voices throughout the project. Therefore, we added a third layer of coding to students' talk and choices in terms of the *purposes* behind them, as interpreted by us and by the students themselves. Looking at the data we identified two main themes regarding students'

voice-related purposes: purposes related to *showing who they are and want to be* and purposes related to *gaining new tools to become who they aspire to be*. As we show, both themes were intimately related to the students' identity-formation process.

### Findings

How did Anthony and William express and use their voices during the science video project? What do their voices tell us about their purposes in engaging in a science-related activity and their learning? We found in our analysis that these two boys used their talk and choices during the project with the main goal of constructing identities they cared about in school. These desired identities entailed the possession of certain attributes, namely, being knowledgeable of science and technology, becoming capable of accomplishing things (such as a movie production), and being popular in front of their peers and teachers. We interpret these attributes to be related both to who students are and want to be, and also to how they want to be seen by others, as identity is constituted by the "ways in which one participates in the world and the ways others interpret that participation" (Brickhouse & Potter, 2001, p. 996).

Anthony's and William's voices became tools in the process of their identity formation in two different ways: by allowing them to show others who they were and wanted to be, and also by gaining them access to new resources aligned with their desired identities. These two components of the identity-formation process were described by Lutrell and Parker (2001), when they stated that, in forming their identities, students must "decide what kind of people they are" and construct "what they aspire to be" (p. 995) by acquiring new resources.

#### *Showing Who They Are and Want to Be*

In this section we focus on the ways Anthony and William used voice to help others see them in the ways that, in our interpretation, they wanted to be seen: knowledgeable about science and technology; capable of accomplishing things; and popular in school.

In looking at our data we noticed two ways in which this theme played out: First, we observed that both students used their voices to reconstruct aspects of their identities that did not match who they wanted to be. Second, the boys used their voices to sustain those aspects of their identities for which they felt most proud.

In the following episodes we provide evidence of students' choices and talk embedded in six narratives with the aim of showing an integrated picture of the ways students used their voices as tools for showing who they are and want to be. The first three narratives are focused on Anthony's voice, whereas the last three are centered on William's voice.

#### *Anthony*

*Reptile boy.* During our first meetings students were expected to agree on a movie theme in order to start working on the video production. In all these meetings, Anthony readily supported William's proposal of having "Animals" as a movie topic. As Anthony later explained, his choice of this topic was related to his interest and knowledge about animals, particularly reptiles, and his desire to bring his pet iguana to school. "I know about animals. I know a lot about reptiles. I have an iguana at home, I can bring it for the movie," he suggested.

Along these lines, Anthony proposed to be interviewed about his bearded dragon (a type of iguana) for the movie. During the interview he answered all the questions in a very confident

manner. For instance, he recommended a diet for a bearded dragon and explained his source of knowledge about reptiles:

If you need to feed a bearded dragon I recommend you to feed him with carrots, tomatoes, vegetables, and when you come back from school you should feed him on roman lettuce. . . . When I was 8 years old, I was watching Discovery Channel and I watched a bearded dragon, and ever since then I have been impressed by lizards, I study them, I go to internet, I find out and then go after my dad: “Dad, can I get this lizard?” Even if it was very expensive, a hundred dollars, he came around and bought me one, and ever since then I just kept buying more lizards and I am now known as “reptile boy”.

In this interview Anthony positioned himself as a reptile expert, as someone very knowledgeable about a particular aspect of the natural world. Including the interview as part of the movie would thus let him show the school audience, students and teachers alike, his expertise. His home-based practices of science (i.e., the care of his iguana) would thus become part of “legitimate” school knowledge by becoming part of the movie, allowing Anthony to gain epistemic authority in school. Finally, his commentary about being known as “reptile boy” demonstrates his wish to show his love and knowledge of reptiles as a fundamental part of his identity.

It is worth noting that Anthony’s knowledge about reptiles was not learned at school, where he rarely participated in his science classes, but through the internet and television documentaries. We believed that Anthony’s expertise would really surprise most of his teachers, who, according to our interviews, regard Anthony as a “low-performer” or “uninterested” child. Linking his out-of-school knowledge and science practices to school science curriculum could therefore be a way to engage him in school science activities. We examine this idea later in this study (see Discussion).

In addition to his support of the topic of “Animals,” Anthony proposed the topic, “The science of cars,” as a movie theme. In support of his idea, he suggested interviewing his father—a car mechanic—at his workplace. In our interpretation, this choice would also allow him to gain epistemic authority in school, as showing his father as an expert would validate his own out-of-school experiences in the school context. By being included in the science movie, his father’s knowledge would also become part of valid school knowledge. (Although the topic, “The science of cars,” was accepted at first by the group as a possibility, it was later replaced by the topic “Animals,” which more students supported.)

In all, this example supports how Anthony’s choice to show his knowledge and bring his out-of-school experiences to the movie, and the way he talked about them as an expert, contributed to reconstruct his present school identity of being labeled as a lower-track student, a part of his identity that, in our view, did not match who he wanted to be, into being someone knowledgeable of science whose ideas should be respected.

*The duel.* Anthony’s voice also allowed him to position himself as someone knowledgeable of science among the video project members. During one of the meetings, while he was interviewing William about snakes, he switched from his interviewer’s role to engage in a spontaneous “duel” with him. In this duel he challenged William’s knowledge about snakes in a playful (but also aggressive) way, as the following excerpt reveals:

A: Where is the King Cobra mostly to be found?

W: Hum . . .

A: India! [screaming].

W: India. I was about to say it.

A: Where is the Komodo . . . ?

- W: Komodo Dragon, Komodo Island!  
A: Yes, that is correct.  
W: Komodo Dragons are not snakes, they are lizards!  
A: Back off! [playfully threatening him with a stick].  
...  
A: Why do cobras pop out the basket when the person plays a flute? Explain that, will you?  
[pretending to play an imaginary flute].  
W: Because they have no ears . . .  
A: No, it's because they are disturbed and pop out to see what's going on [pretends to be a cobra popping out of a basket]. That is why. Ha! [screaming].  
W: I already knew that!  
...  
A: What is a snake's favorite meal?  
W: Favorite meal. . . . Well, it has many kinds of meals, depending on the type of snake.  
A: Cobra.  
W: The cobra? I don't know about cobra, but I . . .  
A: Mice [interrupting him].  
W: Yes, mice is the diet, but also insects.  
A: I am known as "reptile boy," you can't beat me in my own field.

By challenging William's knowledge (who, as we said, was part of the honors-tracked class and thus was labeled as "smart" in the school context), we believe that Anthony was able to reposition himself within the group as somebody knowledgeable and whose views should be valued. As we explained, the tenor of the duel was both playful and aggressive. Both students' body positions and tones of voice revealed, in our view, that there was more underlying this duel than a desire to play with facts about snakes. Using his voice (in this case, by choosing to challenge William's knowledge but also by doing it in a simultaneously playful and aggressive way) was a means for Anthony to reposition himself within the video project group as a knowledgeable member, and also to show himself and other members of the group that he was able to "beat" one of the "smart" guys by using his own knowledge (especially when he claimed that he could not be "beaten in his own field").

Anthony was aware of the differences in school position between himself and children like William belonging to the honors-tracked class. This was dramatically exposed by the fact that Anthony forcefully resisted the incorporation of four of William's friends to the project, after two of the original members had quit and only he and William remained in the program. He did so by persistently threatening to quit the project, loudly protesting in front of the new students and repeatedly leaving the meetings, only to come back a few minutes later. When he was asked about his reasons for this behavior, Anthony argued that his opinions did not matter anymore after the incorporation of the new students. We believe that he felt that the new students were intruders into the space he had built, a space where he could be both an expert and the center of attention, something that was not often available to him in school. He may have felt overpowered by the incorporation of new students, also part of the honors-tracked class, whom in his words he did not like "because they were geeks." In turn, this tension ended in Anthony leaving the project in the last month, after many of our attempts to negotiate for him to stay in the production.

*Science is boring.* As described, Anthony was an outgoing child, regarded by his peers as a popular student. For example, at the video project meetings he would often engage other members of the project in playing with him, sometimes interfering with the video production work itself. The same was true for every science class that we observed at school.

During the video creation, Anthony's voice allowed him to sustain his popularity among the student audience in school (who would watch the video at the end of the semester) by proposing to include events in their movie that he believed other children would find attractive or fun. For instance, we believe that his demand to show his iguana in the movie was aimed to sustain his popularity in the student community, as an iguana is an exotic animal that other students would be interested in. Although Anthony knew that he was not allowed to bring his iguana to school, he attempted to negotiate for bringing it by providing a valid reason (in school terms) for an exception to be made: to use it for a science movie centered on the topic of animals.

Consequently, with the goal of sustaining his school popularity in mind, whenever Anthony was in charge of the camera he included funny comments or captured things that he thought would make other students enjoy their movie. For example, at the zoo he chose to videotape several animals that were mating and narrated his footage in an informal way, with comments such as: "Wow! They are having a blast!" His style was always very casual and enthusiastic (as opposed to William's, who was usually more formal) whenever he narrated the scenes that he was filming. He later acknowledged that he had filmed the mating animals because it was fun and other students would be interested in seeing it.

In addition, Anthony's voice was persistent during the whole video production in terms of not including footage that he regarded as "boring." For example, he was firmly opposed to interviewing teachers, arguing that "people will get bored with that." He often complained when the group conversations became focused on a science topic, usually disrupting them, such as in the following conversation about evolution:

Teacher: We people are animals.

Student 1: We are animals?

Student 2: We are mammals, 'cos we have a backbone.

Student 1: Animals, I didn't know!

William: Evolutionized animals.

Student 1: We are evolutionized monkeys. We came from Homo sapiens.

Anthony: This is boring, I quit. What are you talking about?

Student 2: We should go the museum of natural history. To the Homo sapiens section.

Teacher: We are so similar to monkeys, if you look at our bones.

Anthony: No! We are lizards, not monkeys.

It is of interest to note that whenever Anthony felt that a topic was "scientific" he complained and tried to stop the "boring" conversation (sometimes, as in this example, by warning that he would quit the project or by introducing disruptive comments such as saying that humans are lizards). He would describe science as boring whenever he was asked about it. However, it is important to note that he chose for 2 consecutive years to become part of an after-school program that was explicitly focused on science, wrote a letter of apology to the rest of the group to get readmitted to the program when he was expelled, and always got excited talking about animals' lives or watching science documentaries.

These examples show that Anthony regarded science as school-connected and did not explicitly acknowledge that his knowledge about animals could be also considered scientific, although he proposed it as a theme for a science movie. We believe that Anthony considered being interested in school science a negative attribute and that he did not want to integrate that component to his identity. In our opinion, several strategies allowed him to reconstruct his school identity into someone knowledgeable, but without being identified as a "good student," an attribute that he was not ready or willing to incorporate into his identity. These

included selecting attractive things to show in the movie and talking about animals in an informed way, being detached from traditional school science discourse, and also pointing out that he acquired his knowledge from noninstitutional sources such as television and the internet.

### *William*

*Without me I don't think the movie would be made.* In 2004, William chose to be the movie director, a role that he had also taken in the 2003 production. He took that position in a very committed way by attending the majority of the meetings, often asking to extend the sessions when he felt that “they had not enough time to finish.” He worked very hard at all the meetings, always proposing ideas and persistently asking other students, especially Anthony, to keep on track when they got distracted. (He acknowledged this in an interview, saying that his role as a director was important for the rest of the crew, especially for Anthony, because “Anthony is always moving around and I am trying to keep him in order.”) He frequently called others to work by arguing that “we have to get this done.”

As explained earlier, after 2 months of work, only two of the initial crew members (Anthony and William) remained in the project as the others quit due to different reasons that go beyond the scope of this study. Feeling that they were at risk of not finishing their movie, William convinced four of his school friends to join the project. He talked to them from an authoritative position, explaining them that he was the movie director and therefore they would be able to join the video production even if the semester had already begun. He also persuaded them by suggesting the potential benefits that they would get by joining the program, including the use of the camera and the chance to go on field trips. He also held parallel negotiations with us about the possibility of accepting the four new students in the project by making a point on the need to have more people to finish the production.

As he told us in an interview, he was aware of his pivotal role in the creation of the movie:

I brought to the movie confidence, because I'm always telling people to come and join. And also I am telling the people to not quit and I'm helping the people out. . . . I bring 'em [four new students] here to help us out because a lot of people have been quitting, two people already and now one new more and so I want the people that are already got to stay. . . .without me I don't think the movie would be made.

His choice of being the movie director (and his active support of that choice with specific actions such as calling others to work, working hard himself at all meetings, and inviting others to help them out while speaking from his director position) allowed William to sustain his present school identity of someone capable of accomplishing things, a part of his identity for which he was proud, as the excerpt shows.

*Science reporter.* Over the production, William suggested interviewing Ms. Varelas, the school district's coordinator for professional development in science, who worked at their school laboratory. He explained that “she knows everything about science,” and could therefore be helpful for their movie. During the interview, William positioned himself as an informed interviewer, by asking not only the original questions they had planned to pose her, but also creating new questions along the way and suggesting answers himself. This allowed him to engage in an authentic conversation with her about the role of different animals in human survival, as this exchange shows:

- W: What is the most important animal that you think we need? Try to name one specifically.
- Ms. V.: One specific animal: Okay. Well, certainly I think one important animal might be chickens, because they lay eggs and eggs are a very important food source for humans. . .
- W: You think yet that *that* is the most important? [smiling to her].
- Ms. V.: Ah, it's hard for me to say which is the most important.
- W: [Interrupting] Sometimes we need cows, we need. . .
- Ms. V.: [Interrupting] They make milk, so we need them. I think that. . .
- W: [Interrupting] If all the animals in the world were being extinct, except for us?
- Ms. V.: Well, we'll be dead but anyway keep going. . .
- W: Except for us, except for us [smiling].
- Ms. V.: No, but I'm saying we wouldn't live very longer without the other animals in the world.
- W: If we had the choice to save one animal, one animal, or two, from being extinct, what two or one animal would you choose?
- Ms. V.: Well, I'm trying to think. You are assuming all the plants are alive.
- W: They are probably gonna die because, monkeys, they eat mangos and their seeds pop out and make new trees.
- Ms. V.: So without the monkeys, no new mango trees.
- W: Yes, but, it is a very hard choice. We probably wouldn't live very long without animals, but what do you think?

By assuming an informed role while interviewing someone who has a powerful position in the school context, whom he regarded as an expert, William continued to position himself as someone knowledgeable of science who was able to talk to an expert at the same level. As we explained before, William was regarded as a good student (connoting someone knowledgeable and capable) by his teachers, classmates, and parents, which was an important part of his identity that he worked hard to sustain. Including this interview in the movie would therefore maintain and expand his school identity as somebody knowledgeable of science, not only in front of his peers but also with his teachers and the school district's coordinator for professional development in science.

*Fun and educational.* "What style do you want the movie to have?" we asked students during one of the first meetings. William was very emphatic in his answer: it should be "both fun and educational, so both students and teachers will like it." Accordingly, William suggested interviewing both teachers and students for their movie and convinced others to do so, even when some group members, including Anthony, were resistant to the idea of interviewing teachers.

It is worth noting that, although William was not able to elaborate much on what he meant by fun or by educational when we asked him, he saw those two characteristics as separate entities and acknowledged students and teachers as separate audiences. In our view, this example is evidence of William's desire to use the movie to show himself as a fun-loving individual with the student audience, without undermining his popularity among teachers.

Along these lines, William told us that his favorite activity in school science was "a day when we went down to the gym, and we had to measure speed, and we had to run a distance, I think it was 25 meters, and then back. And we had to time ourselves running, and there was like a little competition." When we inquired further about why he referred to that activity as his favorite, he stated: "Because I didn't know that science was about having fun too." We have seen a similar tension between the notions of "science" and "fun" in Anthony's perspectives when he deliberately disrupted group conversations focused on scientific topics like evolution arguing that they were "boring." We believe that this disconnection has profound implications for science teaching, and we address these in our discussion of the findings.

### *Showing and (Re)constructing Who They Are and Want to Be*

In summary, these episodes show us that the two students used their voices as tools to position themselves as individuals who are knowledgeable of science and technology, capable of accomplishing things, and who wanted to be popular in the school context. In other words, student voices allowed them to show who they are and wanted to be, which constitutes the first component of the identity formation process that we proposed before.

This first component of students' identity formation played out in two ways: first, some students' choices and talk allowed them to reconstruct part of their school identities that did not match who they wanted to be. Second, other choices and talk allowed them to sustain parts of their identities that they were proud of.

Specifically, we believe that Anthony's voice allowed him to reconstruct part of his school identity from being labeled a low-performing student (which carries with it connotations of not being knowledgeable or capable) to someone knowledgeable of science and technology and capable of accomplishing things such as a movie production. His choice to be interviewed for the movie and the duel he initiated with William are examples of this. At the same time, we interpret that he used his voice to preserve his peers' views of him as a popular child, a part of his identity that he wanted to sustain. His suggestions to include attractive footage, such as a live iguana or animals mating, and his opposition to what he regarded as boring footage are examples of this goal.

On the other hand, we think that William's voice allowed him to maintain and expand the part of his school identity related to being someone knowledgeable of science and technology. His choice to take the role of the movie director, his informed conversation with the school district's coordinator for professional development in science, and his choice of animals as a movie theme (a topic he was very knowledgeable about) are examples of this. At the same time, we believe that William attempted to use his voice in the video production to rebuild his popularity among other children, while preserving his popularity between teachers. His suggestion to make the movie both "fun and educational" is an example of this.

The findings pertaining to the first theme are presented in Table 1.

### *Gaining Access to New Resources to Enact Their Desired Identities*

In the previous section we described how students positioned themselves in the school context in certain ways associated with who they are and wanted to be. In this section, we focus on the second component of the identity construction process: gaining access to new resources to enact their desired identities. In speaking about resources, we refer to what Bourdieu (1977) defined as *capital*, meaning the set of tools (including human, social, and material resources) that one has available "to use in a variety of configurations to solve different kinds of problems" (Swidler, 1986, p. 273).

As we did for the first theme, in the following episodes we provide evidence of students' choices and talk embedded in narratives to show an integrated picture of the ways Anthony and William used their voices as tools for expanding their capital to become the kind of people they aspired to be, according to our analysis.

#### *Anthony*

*The cameraman.* "What role do you want to take in the production of the movie?" we asked Anthony at the beginning of the semester. "I wanna be the cameraman," he replied. In fact, using the available equipment, such as the camera or the computer, was something that all members of the group were interested in doing and, according to most of them, this was one of their main

Table 1  
*Summary of findings for the theme “Showing who they are and want to be”*

Student	Episode	Choices	Talk	Goal
Anthony	Reptile boy	<ul style="list-style-type: none"> <li>• Be interviewed</li> <li>• Talk about topics he knew about</li> <li>• Bring his out-of-school knowledge and experiences</li> <li>• Interview his father</li> </ul>	<ul style="list-style-type: none"> <li>• Speak like an expert</li> </ul>	<ul style="list-style-type: none"> <li>• Position himself as knowledgeable of science</li> <li>• Validate his out-of-school science knowledge and experiences</li> </ul>
	The duel	<ul style="list-style-type: none"> <li>• Challenge William’s knowledge</li> <li>• Resist the incorporation of new members belonging to the honors-tracked class</li> </ul>	<ul style="list-style-type: none"> <li>• Speak like an expert but aggressively and playfully</li> <li>• Protest and threaten to quit</li> </ul>	<ul style="list-style-type: none"> <li>• Position himself as knowledgeable within the video project group</li> <li>• Preserve his space in the project</li> </ul>
	Science is boring	<ul style="list-style-type: none"> <li>• Include “fun” comments and events</li> <li>• Oppose the inclusion of “boring” material</li> </ul>	<ul style="list-style-type: none"> <li>• Narrate his footage informally and confidently</li> <li>• Make a point to bring his iguana</li> <li>• Make a point for not interviewing teachers</li> <li>• Interrupt “scientific” conversations</li> </ul>	<ul style="list-style-type: none"> <li>• Sustain his school popularity</li> </ul>
William	“Without me . . .”	<ul style="list-style-type: none"> <li>• Play the director’s role</li> <li>• Attend most meetings and work hard in each of them</li> <li>• Ask to extend the sessions</li> <li>• Bring new students</li> </ul>	<ul style="list-style-type: none"> <li>• Call others to work</li> <li>• Convince his friends to come</li> </ul>	<ul style="list-style-type: none"> <li>• Sustain his school identity as a capable student</li> </ul>
	Science reporter	<ul style="list-style-type: none"> <li>• Interview the school district coordinator for science about a topic he was knowledgeable about</li> </ul>	<ul style="list-style-type: none"> <li>• Speak like an informed reporter</li> <li>• Engage in a conversation with an expert</li> </ul>	<ul style="list-style-type: none"> <li>• Sustain his school identity as a student knowledgeable of science</li> </ul>
	“Fun and educational”	<ul style="list-style-type: none"> <li>• Film a movie with both fun and educational purposes</li> </ul>	<ul style="list-style-type: none"> <li>• Make a point of including things both fun and educational</li> </ul>	<ul style="list-style-type: none"> <li>• Reposition himself as a fun student among his peers</li> <li>• Sustain his popularity among teachers</li> </ul>

motivations to engage in the video project. Thus, Anthony had to negotiate his access to technology with other students and they ended up taking turns using it.

Anthony’s participation in the project allowed him to access to equipment otherwise unavailable to him, acquire new tools (i.e., technological expertise of how to use a video camera and editing software), and become more knowledgeable about technology, consequently

expanding both his material and human capital. His choice of the cameraman's role specifically allowed him to use the camera for long periods of time.

*Reptiles' zone.* Another reason why Anthony supported William's idea of creating a movie about animals was that it would allow them to go to the Bronx Zoo on a field trip to collect footage. In fact, he decided that filming animals rather than cars would be better, because, as he told us, "with cars we can interview my father, but I'm there [at his father's workplace] all the time. I would like to do and see something different."

Although he had been to the Bronx Zoo before, Anthony said that he wanted to go there again to see the Tiger Mountain exhibit and the gorillas, which he had not yet seen. Visiting the zoo would also give him the possibility to go to the zoo's gift shop, something that he was interested in doing, which he negotiated with us before the trip, arguing that "it was worthwhile because they had incredible things on animals."

Once at the zoo, he spent almost an entire hour in the reptiles' zone, looking closely at every cage and filming almost all of them despite the rest of the group's complaints about moving on to other areas, asking them to spend "only a little more time" every time he was asked to leave. He also visited the gift shop and bought a set of replicas of shark teeth, something he described as "making his day" because "he loved sharks" and he "would be able to show his shark teeth to his friends." Anthony's choice to support the topic of animals and his negotiation of the permission to go to the zoo gift shop allowed him to access to new experiences, knowledge, and objects that he found meaningful, while also sustaining his popularity among his friends by showing them his shark teeth.

### *William*

*Land versus sea animals.* Over the production of the movie, William suggested having the theme "Animals" evolve into a comparison of "land versus sea animals," an idea also supported by Anthony. They proposed to look at the similarities and differences between aquatic and terrestrial organisms and analyze their strategies for locomotion, getting food, mating, and breathing. For that reason, they argued, they would have to collect footage of different terrestrial as well as aquatic animals performing their everyday activities.

That idea helped William and Anthony to negotiate with us a second field trip, in this case to the New York Aquarium, to collect extra footage. Students made a case that going only to the Bronx Zoo, as we had planned, would not allow them to collect enough footage of aquatic animals, and therefore another field trip became necessary.

William had never been to the New York Aquarium and he commented afterwards that he was very excited about getting to know the place, although he strategically did not bring this up during the meeting and only supported his proposal in school terms, by arguing about their need for two field trips to collect enough footage of aquatic animals. Moreover, during the negotiation, both William and Anthony offered their school spring break to take the trip to the New York Aquarium, as we would not have any other time available for a second field trip otherwise. In this way, their voices became part of an active negotiation strategy to extend their experiences and knowledge in relation to matters they cared about; in other words, they wanted to expand their material and human capital.

As William later explained, those field trips allowed him to gain knowledge about animals, which was important in his identity construction process because he was very fond of animals and wanted to become a veterinarian in the future. After the field trips, he told us that he had learned many new things about animals through his visits to the Bronx Zoo and to the New York Aquarium.

He commented, for example: “I learned that seahorses, the men, the male carries babies in his pouches, I learned how tigers play because I didn’t know they, I just thought they were always lazy. I learned about new animals with weird names.” William also proposed to interview his school teachers and zookeepers for the movie to obtain more information about them, which they did, thus making another choice that allowed him to acquire new knowledge about a topic in which he was interested.

Finally, through the field trips William was also able to expand his experiences in relation to his neighborhood, something that he recalled during an interview. As he explained: “I’m learning a lot, because we’ve been to the Bronx Zoo, the Aquarium, and I’ve never seen the whole neighborhood, but with this club I can see the whole neighborhood and experience all of it.”

“*I want them to know something about the world.*” The choice of “Animals” as a topic and the suggestion to make the movie “fun and educational” also allowed William to teach others about something he knew and cared about and while attempting to make them care about animals as well. He explained in the interview that “some people don’t know about animals, they just care about school, life, they care about their friends. I want them to know something about the world.”

Positioning himself as a teacher and showing others interesting aspects of animals through the movie was, in our view, part of William’s attempt of not only sustaining his present school identity of being someone knowledgeable of science but also of having others get interested in things that he cared about. This would potentially bring him recognition not only from his teachers but also from his peers, who in his opinion did not care about animals or “the world” as much as he did. Having others share interests with him could therefore expand his social capital, especially if he came to be regarded as someone knowledgeable in a topic others cared about (although, in our opinion, this would also entail the risk of losing social capital in the school, if the rest of the students found the movie too “nerdy”).

*Joining the club.* Finally, being part of the science “club,” as William usually called the science video after-school program, allowed him to invite his classmates to what he called a “fun” environment, which he had access to. In the interview, he told us that he persistently invited his friends to participate during the semester: “I’m always telling people to come and join. . . I want people to stay in the club, man. Be a part of it.”

William’s role as the movie director allowed him to have certain control of the space, as his opinions were specially taken into account by the rest of the group. This role and his commitment to the production of the movie were important tools in negotiating the incorporation of four new students to the group, as explained earlier. William convinced his friends by enticing them with the possibilities of using the camera, going on field trips, having snacks, and basically taking part of a fun movie production.

As suggested previously, bringing his friends to the movie production allowed William to sustain his identity of being someone capable of accomplishing things, as the new members helped him finish making the video. In addition, being able to invite his friends to “his” project also allowed him to expand his popularity among his school peers, because he had something to offer them that they would find enjoyable and interesting.

### *Gaining New Capital*

In summary, the narratives tell us that students used their voices as tools to gain access to human, material, and social capital that were not otherwise available, or were limited. In turn, this new capital helped them to reposition themselves within the school context as knowledgeable,

capable, and popular individuals. Both components of identity construction (showing who they are and obtaining new tools), therefore, become intimately related in a dynamic process of identity formation.

Anthony's voice allowed him to expand his human capital by acquiring technological expertise. His choice to be the cameraman and to learn how to use the available equipment is an example of this. His voice also allowed him access to new material capital, such as field trips to places he wanted to visit or to film technology. His choice of animals as the movie topic, for example, allowed him to visit places that he was interested in seeing, such as the Tiger Mountain at the Bronx Zoo, while his choice of becoming the cameraman gave him access to the camera for long periods of time.

Accordingly, William's choices and talk allowed him to expand his knowledge about a topic for which he had much interest. His persistent proposal to shoot a movie about animals allowed him to learn more about them and also to visit the zoo, extending his knowledge and experiences on this topic while also allowing him to see some parts of his neighborhood that he had not visited before. Refining the movie topic toward a comparison between terrestrial and aquatic animals allowed him to negotiate new opportunities to go on more field trips and therefore further extend his experiences.

Last, the choice of the topic of animals also enabled William to extend his social capital by teaching others about something he cared about and, in his opinion, making them care for animals as well and thus share a common interest with him. Finally, by inviting his friends to join the production William was also able to expand his social capital, as he could offer his friends an interesting activity for which he had access.

Table 2 provides a summary of findings pertaining to this second theme.

Table 2  
*Summary of findings for the theme "Gaining access to new resources to enact their desired identities"*

Student	Episode	Choices	Talk	Goal
Anthony	The cameraman Reptiles' zone	<ul style="list-style-type: none"> <li>• Play the role of the cameraman</li> <li>• Film a movie about animals</li> <li>• Spend a long time in the reptiles' area</li> <li>• Buy shark teeth at the Zoo's gift shop</li> </ul>	<ul style="list-style-type: none"> <li>• Negotiate his access to equipment</li> <li>• Support William's proposal</li> <li>• Negotiate about spending time in the reptiles' area</li> <li>• Negotiate a visit to the gift shop</li> </ul>	<ul style="list-style-type: none"> <li>• Gain technological expertise</li> <li>• Access to new experiences with reptiles</li> <li>• Access to new objects</li> <li>• Extend his popularity</li> </ul>
William	Land versus sea animals "I want them to know something . . ." Joining "the club"	<ul style="list-style-type: none"> <li>• Compare terrestrial and aquatic animals</li> <li>• Use spring break for a field trip</li> <li>• Interview teachers and zookeepers</li> <li>• Film a movie on animals</li> <li>• Screen the film in school</li> <li>• Invite his friends</li> </ul>	<ul style="list-style-type: none"> <li>• Argue about the need of conducting two field trips</li> <li>• Convince others to interview experts</li> <li>• Teach about a topic he was knowledgeable and cared about</li> <li>• Tell his friends the benefits of joining</li> </ul>	<ul style="list-style-type: none"> <li>• Access to a field trip to the Aquarium and unknown parts of his neighborhood</li> <li>• Extend his knowledge of animals</li> <li>• Extend his social capital</li> <li>• Extend his social capital</li> </ul>

## Discussion

### *Voice and Learning: Participation in Science as a Tool for Identity Formation*

How does a study on student voice help us to rethink how we might create more empowering opportunities for student learning? We have shown the multiple ways in which Anthony and William used their voices during their work in the science video production in order to construct for themselves identities that they cared about. This study supports the idea that the integration of student voices in science curriculum and instruction can have a positive effect in students' engagement in science, as participation in science becomes a tool to accomplish students' own identity-related goals. In addition, we have shown that part of William's and Anthony's identity goals included being knowledgeable about science, and therefore the integration of their voices in the after-school science program fostered their science learning. This should be understood as a process in which students get new capital to become more effective participants in science-related communities of practice.

We saw evidence of students' science learning on multiple occasions during the semester, as reflected through their voices, such as when they were able to successfully negotiate with teachers their wish to visit the New York Aquarium. On that occasion, students were able to use their science knowledge in a more efficient way than at the beginning of the semester (when they had a difficult time articulating the reasons behind their choices of movie themes), by making a case of the importance of the comparison of aquatic and terrestrial animals in terms of key biological features, such as locomotion, feeding, breathing, mating, etc., in support of their suggestion of a second field trip. William's interview with the school district's coordinator for professional development in science was further evidence of his learning, as he was able to use some ideas related to animal biology that had been discussed in our meetings to engage in an informed and authentic conversation with her.

It is of interest to note that, although being knowledgeable about science was a component of both students' present and desired identities, each boy expressed it in very different ways. Although William made explicit his interest in learning science, Anthony never acknowledged it but instead made a case of not liking science at all. However, as we suggested earlier, his choice of participating in a science after-school program for 2 consecutive years and his explicit identification of his love and knowledge for reptiles are integral parts of his identity that tell us a different story.

Anthony's perspectives give us evidence of the strong contradiction between his notions of science (which in our view means "school science") and his own out-of-school science practices, such as learning about the best diet for his iguana pet. In fact, although Anthony regarded his father's knowledge of the ways cars work and his own knowledge of reptiles as scientific (as he showed by suggesting them as themes for the science movie) and was eager to show his expertise in the movie, he did not consider being proficient in school science a desirable attribute. This was evident, for example, when he resisted incorporating what he regarded as school knowledge in the film topics, such as the discussion about evolution or when he refused to interview teachers. As we indicated earlier, Anthony made clear in his interview that he had learned about reptiles on television and through the internet; in other words, he had not obtained this knowledge in school.

Anthony's case tells us how interest in science may not be a desirable characteristic to have in many urban schools, as it can conflict with popularity among peers. We have pointed out a similar disconnect between the notions of "fun" and "educational" in William's views of what students and teachers may like for a movie, although William did not regard being interested in science as a

negative attribute. This finding is consistent with Brickhouse's (2001) study of young women's scientific identity formation in an urban school, in which she found how membership in a school science community could be undesirable for some urban girls when it conflicts with who they are in their home communities. As she pointed out, this conflict raises questions for educators about how to help students incorporate science knowledge and skills, which are usually associated with more privileged groups, in their identities, while preserving identities that are desirable for them.

Anthony's case is a good example of the ways in which many students who do not traditionally perform well in or like school science may engage in science-related activities when these activities allow them to link their out-of-school practices of science, knowledge, and experiences to science learning, and also when they help to build who they aspire to be. In fact, Anthony's expertise and interest in science-related topics, such as the life of reptiles, contradicts his school science profile of a seemingly unmotivated child. We have seen this contradiction in most of the urban schools we have worked in, where the same students who remain apathetic and do not participate actively in class usually jump out of their seats right after the bell rings to share ideas and engage in lively discussions with their friends outside the classroom. We have also frequently seen this dynamic among youth who engage in status-building science-related activities outside of school, only to be pushed away from science in school, as was the case with Miguel who was a successful black market herpetologist and school dropout (Calabrese Barton & Yang, 2000). We believe our study reveals how providing space for student voice in the science classroom may be a way to overcome contradictions and give new entry points for students' trajectories into science identities and school science identities.

### *Using Voice to Bridge Seemingly Contradictory Worlds*

Current research in cultural studies in science education indicate that students "connect" with science when they are offered instructional scaffolds that link the worlds of home with the worlds of school science (Bouillion & Gomez, 2001; Calabrese Barton, 2003; Seiler, 2001). Our findings suggest is that, although it is important to connect these differing worlds, it is also important to understand *how* students already actively and purposefully connect the worlds of science and of home outside of the structures of schooling and for purposes outside (or beyond) attaining academic success in the classroom. Clearly, Anthony honed his understanding of animals and reptiles, gained status within his peer group, and learned new technology skills. He further refined his identity as someone knowledgeable and capable in science and technology while still remaining "cool." He did not, however, use this experience to advance his standing in the classroom. William used the science video project to further cement his success as a science learner and producer, and used his knowledge and skills to further build social capital among his peers. He was already succeeding in the classroom, but, instead of using his success on the project to further advance his standing in the classroom, he used the social capital among school staff and his peers acquired from doing well in school to advance the activities of the group.

We believe that understanding how students use their voice to achieve these goals in informal science activities points toward how these might be adapted in science classroom work as well. If science classroom learning communities that value how students choose to express themselves toward multiple science goals that are both school-related and non-school-related (as traditionally understood) can be set up, then new opportunities for engaging students in the classroom can emerge. In particular, from our study we see three implications along these lines: integrating student perspectives; expanding student participation; and assessing learning through voice. Each of these points, which are taken up in what follows, shows how understanding voice

as a means of expanding participation and integrating perspectives can be helpful when incorporating student voices in curriculum construction and instruction.

### *Integrating Student Perspectives*

There are multiple ways in which teachers can provide space for students' perspectives in their classrooms. If learning communities that not only value but also require students' active expression of perspective can be designed, then we believe students will be more successful in enhancing their participation in that community. In other words, they will have opportunities to use voice as a tool to fashion their identities as individuals whose perspectives matter. On the surface, it is easy to suggest that one way to accomplish this recommendation is to link science activities with students' out-of-school science practices and science-related interests. For instance, teachers can survey students' interests and experiences in science at the beginning of the year, having thus a battery of resources that can be integrated in their lessons. However, our study shows that it is not merely the incorporation of student ideas or experiences that matters, it is how students' perspectives become the text or the practice of the community that matters. When Anthony's experiences as iguana caretaker and expert were taken up as "real science," Anthony's status began to shift from outsider to insider, from unsuccessful student to science video project leader.

We do not argue that all student perspectives be taken up as unchallengeable science experiences or events. That would be naive and inconsistent with the strength of scientific practice. We do argue that these perspectives should be treated seriously, which sometimes means having them challenged, such as when Anthony's ideas about reptiles were challenged and tested by the teachers and other students.

Incorporating students as "experts" who are capable of building lasting connections between their identities and science is at the center of this recommendation. As Moll et al. (1992) pointed out, urban families possess valuable knowledge that can be capitalized in the science classroom, even if many of these practices are not traditionally labeled as scientific. These areas of knowledge, such as health-care practices, traditional medicine, gardening, and expertise in car mechanics, can improve the quality of school experience for students. This idea of distributed expertise is consistent with the work of Brown and Campione (1994), who combined reciprocal teaching and cooperative learning strategies to encourage students to be partially responsible for teaching other students subtopics of a common curricular unit. In this way, teachers can capitalize on student expertise, as many members of the learning community become knowledgeable, thus enriching the learning environment itself.

### *Expanding Student Participation*

Integrating the second component of student voice, student participation, can be done by giving opportunities for students' choices during their work. This can be done both when developing course content and determining the rules of classroom participation. What we learned is that students express their voice in crafting empowering identities through the choices they make. Understanding choice and participation through this lens therefore becomes important as it supports students in that identity formation process.

Regarding learning content, for instance, students can be asked to select a question to investigate during an inquiry-based unit on a particular science topic. Depending on their prior expertise, students can also be asked to choose how they want to attempt to answer the question. Teachers can also encourage students to choose the format for a class presentation in front of their

peers, a book that they want to read for the class, a topic they would like to investigate as an extension activity, or choose to teach other students. In fact, these ideas are commonly implemented by many science teachers to foster students' active role in learning and are consistent with the approaches of inquiry-based science instruction (AAAS, 1990; NRC, 1996). What our study suggests, however, is the importance of being constantly alert to the need to expand student participation by creating diverse and rich opportunities for student choices in which students are allowed and expected to actively negotiate the classroom curriculum, instruction, and assessment practices. These choices can be structured more appropriately by the teacher to combine students' choices with particular classroom constraints and opportunities. It is important to note that, when we argue for the need for students' choices as a way to integrate their voices in the classroom, we are also arguing for the need to teach students how to support these choices in an informed way. Otherwise, students' choices may lose their educational value. To avoid this, teachers must scaffold the process of making informed choices by always challenging students to support their choices with reasons or evidence in a way that will make their case stronger in the negotiation process.

### *Assessing Learning Through Changes in Voice*

In this study we have stated that, as students learn, their voices change, and we provided supporting evidence from our work with William and Anthony. We have proposed that when students learn science, both their perspectives and participation enable them to become more effective participants in a science-related community of practice, and are directed toward incorporating science into their identities.

We believe “changing voices” may be an important assessment tool that can uncover dimensions of science learning not captured in standard techniques. This is because looking at changes in student voice asks that schools look at student achievement from a broader perspective, which incorporates how student voices change within their learning community and the ways science becomes integrated into their identities as learning outcomes. Looking at changes in student voice also suggests that the outcomes of learning are about more than just the acquisition of content and skills (although these are important). Rather, in this view, the outcomes of learning are focused on how youth *build and use new understandings to support new forms of participation*. This perspective extends interpretations of current policy positions, which state that scientific literacy must be measured by what students know and can do, for it intimates that “what one knows and can do” exists in a dialectic relationship with how one is able to participate—or how one is able to use their voice as a tool—within a community of practice. This stance requires us to rethink how learning might then be measured. Clearly, it is not enough to examine student scores on an external exam. The examination of student voice as evidenced by their work, their participation patterns, and their resource activation would also be critical measures. How to standardize such procedures would be challenging, as these measures are also highly context-dependent. However, we believe our data reveal that incorporating context-dependent measures is critical to understand the complexity of student learning.

In conclusion, we have argued that voice serves as a tool for identity formation, and that opportunities to express one's voice can enhance participation in a learning community in which one may have previously been excluded or chosen not to participate. We found that integrating their voices in the science video project allowed Anthony and William to express who they are and want to be while gaining new capital for building their desired identities. Anthony's case is an example of a student who, despite being unsuccessful in school science, chose to use a science after-school program to rebuild some aspects of his school identity, by gaining epistemic authority

and recognition while preserving his popularity in front of other students. William's case is an example of a student who used his participation in the science after-school program to further advance aspects of his identity for which he was proud, and to start to build social capital among his peers.

Integrating student voice into the school science classroom is a challenging proposition, for most teachers typically work with a large number of students. However, we believe that what matters most regarding student voice is understanding how student voices—their talk, their choices—can and do shape who and how one is in the classroom (or any other space for that matter). Many times, students' choices are not viewed as integral dimensions of science learning—they are simply viewed as related to social activity, management issues, or other non-science-related tasks. Although such choices do involve these other domains, they can also be entry points to science participation and learning. Anthony is an excellent case in point. As revealed in this study, Anthony struggled with a nonacademic identity, which made it easy for us, as teachers in the after-school program, to view his transgressions as problems related only to classroom management. Indeed, having Anthony in the group often made the group's management difficult, but his choices were clearly indications of his desire and effort to gain access to science and to advance his standing within a science-related community. When these goals were acknowledged, new strategies could be developed to help Anthony activate his resource in support of his learning while still valuing his goals. When this was done, he became less of a “management problem” and more of an instrumental science video producer. In other words, we know it is almost impossible for classroom teachers to “hear” the individual voices of all of their students. However, we do believe it is a worthwhile goal for teachers (and researchers) to develop a propensity or a mindset for seeing and questioning the talk and choices of students in ways that shed new light on how and why they do what they do to learn in science class.

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