Partnering To Develop Academic Language for English Language Learners Through Mathematics and Science

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While the call for partnerships between public schools and universities is now several decades old, good exemplars continue to be needed. Research indicates that such partnerships can take many forms and can function in different ways. For example, at the most comprehensive level, partnerships involve the creation of professional development schools (PDSs). At the core of PDSs, which historically began in response to *Tomorrow's Teachers: A Report of the Holmes Group* (Holmes Group, 1986) and Goodlad's *Teachers for Our Nation's Schools* (1990), was the preparation and induction of new teachers into the profession. As PDS models proliferated across educational settings, the National Council for Accreditation of Teacher Education (NCATE) responded by developing a series of guidelines—the National Standards for Professional Development Schools (2001)—to support institutions in their efforts to orchestrate the high levels of commitment required by these comprehensive partnerships.

On a smaller scale, partnerships can involve public schools and universities coming together to increase learning outcomes for particular groups of students. This type of partnership has been increasingly noted as the number of English language learners (ELLs) enrolled in public schools continues to grow. Researchers have been focusing on the partnerships that arise as content teachers and English as a second language (ESL) specialists work together to best meet the needs of this growing population (Arkoudis, 2006; Davison, 2006; Kaufman & Crandall, 2005).

The partnership we discuss falls within the latter category. It brought together an urban school district and a university to develop a curriculum emphasizing academic language for its ELL students. The partnership began when the district's elementary ESL coordinator approached three university faculty for support in developing a three-year summer school curriculum emphasizing mathematics and science for the ELL students enrolled in the Language Center Program (LCP).

The LCP was developed in response to research documenting the achievement gap between ELLs and their native English-speaking counterparts, and is aimed at developing language as well as academic content (Echevarria, Vogt, & Short, 2008). Geared for recently arrived immigrants at the upper elementary grades, the LCP is structured as a "school-within a school" and aims at gradually transitioning 3rd- through 5th-grade ELL students into mainstream classrooms over a two- to three-year period. Currently,

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the district has an LCP at 11 elementary campuses. In addition to providing academic classes during the regular school year, the LCP offers a 3-week optional summer program. These summer programs engage ELLs in curriculum units according to their level of English language proficiency. LCP students entering the district without literacy skills may participate in a specialized summer curriculum (known as the Preliterate Program). ELLs at the beginning, intermediate, and advanced levels of language proficiency engage in grade-level content curriculum units (social studies, mathematics, and science). Depending on their level of language proficiency, these students enroll in Year 1 or Year 2 summer classes. The district, however, did not have a Year 3 curriculum for students attending the summer camp.

In this article, we report on the outcomes that resulted from the planned objectives and on the unanticipated outcomes that spontaneously resulted as the partnership evolved. We begin with a discussion of the primary and the secondary objectives the partnership sought to achieve. The primary objectives included support for ELLs in acquiring academic language and the development of a science and mathematics content-based curriculum. In addition, we expected to collect research data and, through the implementation phase of the project, to provide ELLs with opportunities to experience authentic integrated instruction (see Figure 1).

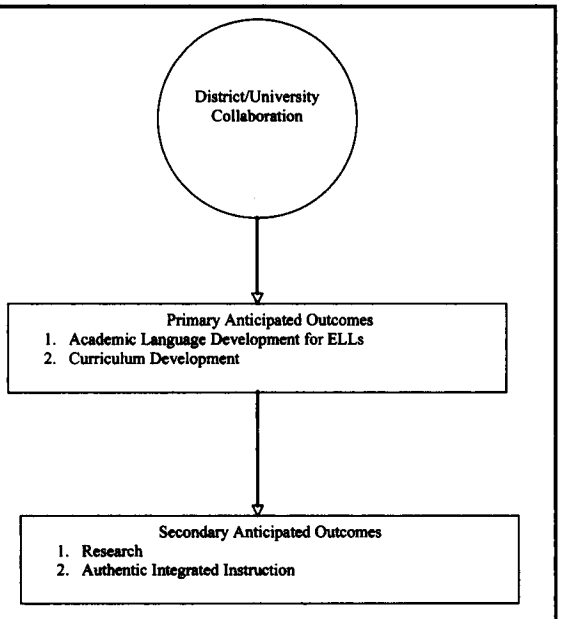

Figure 1
Anticipated Outcomes

Anticipated Outcomes of Partnering To Develop Curriculum for ELLs

Academic Language Development. Although it is expected that most ELLs will develop conversational fluency within two to four years, development of the advanced language competencies associated with academic language proficiency might require five to nine years (Hakuta, Goto Butler, & Witt, 2000). Conversational language involves the use of interpersonal language in everyday situations. Academic language, on the other hand, requires that students have the background knowledge necessary to understand and use content-specific technical vocabulary, processes, and specialized discourse patterns. For example, while ELLs may have knowledge of words used in everyday language (such as "rain" or "finding out"), they may not have the specialized knowledge of academic words used in academic contexts (such as "precipitation" or "investigating"). In terms of genre and discourse patterns, ELLs might be more familiar with the use of temporal order in story narratives and be less accustomed to the discourse organization structures (e.g., cause/effect, compare/contrast) that they will most likely encounter in academic textbooks for mathematics, social studies, or science (Scarcella, 2003).

Models of instruction aimed at developing language and content—commonly known as "sheltered instruction"—make content comprehensible to the students through a wide range of strategies recognized as effective for this particular population. Teachers using sheltered instruction adapt grade-level content in mathematics, science, and social studies to the language proficiency level of the students, emphasize key vocabulary, and develop activities that contextualize instruction so that new concepts are comprehensible to the students and promote student interaction (Echevarria, Vogt, & Short, 2008).

In creating our partnership, we were aware of the value of having content and language specialists collaborate in the development of curriculum. Bringing these two specialists together served to avoid the difficulties often experienced in settings involved in curriculum integration (Bunch, Lotan, Valdés, & Cohen, 2005). ESL classroom teachers, while understanding the challenges of acquiring academic discourse, are often asked to develop curriculum in content areas where they do not feel expertise. Content specialists, on the other hand, while able to bring academic rigor into the planning process, are not always knowledgeable or able to adapt the curriculum to best serve ELLs in the classroom.

Curriculum Development. The partnership developed over two phases: *planning* and *implementation*. The *planning phase* began the fall semester preceding the summer implementation of the program. Four individuals participated in the planning phase: the

district elementary English as a second language (ESL) coordinator, an ESL professor, a mathematics education professor, and a science education professor. During the planning phase of the partnership, the team met on a weekly basis. These sessions allowed the university faculty to examine the students' backgrounds and language proficiency. It was determined that concepts related to earth science (erosion) and numerical fluency (fractions) would drive the LCP summer camp's curriculum. (See the Appendix for a summary of key components of the curriculum.) Materials, assessments, and daily lessons also were developed at this time.

The *implementation* phase took place during the summer of 2007. During this phase, an LCP classroom teacher joined the team, and the district coordinator, while remaining involved in the project, phased out of the day-to-day activities of the partnership. Nineteen LCP students participated in the summer camp and attended school for three weeks, from 8 a.m. to 12 noon every morning. The classroom teacher and the three professors jointly delivered the curriculum. At the end of each morning, daily activities were evaluated and plans for the following day were revised, thereby modifying the curriculum to be implemented the following summer at other district LCPs.

Research. This partnership offered an unusual opportunity to engage in research focusing on the acquisition of academic language in mathematics and science as well as authentic integration of mathematics, science, and literacy. Data were collected from various sources, including student journals, student models, attitude inventories, photographs, videotapes of lessons, and audiotapes of small-group discussions, as well as audiotapes of faculty debriefings, faculty journals, and edits to the proposed curriculum. A research community consisting of the three professors, the ESL coordinator, the classroom teacher, two science education doctoral students, and one curriculum studies master's student analyzed the data and read and discussed articles about language acquisition.

Authentic Integrated Instruction. As materials were reviewed and activities implemented, the university and public school personnel truly became partners in creating an authentic, integrated curriculum. Even though each had a particular area of expertise, both sides felt comfortable stepping over those boundaries to create a unique and authentic learning experience. Cameras were always at hand to photograph evidence of erosion (as part of the science component). By chance, the area was experiencing excessive rains, causing a great deal of erosion. Local news covered stories of the floods and "the carrying away of earth and other materials" on a daily basis. All members of the teaching staff brought in various types of media, from newspapers, online documents, and television. Because of the desire to keep

learning authentic, it was possible to incorporate these materials into the lessons on a daily basis. Assessments collected included child-created, three-dimensional artifacts and written work contained within the student journals. Thus, pre-made worksheets were not used.

Even though the integration of the curriculum was an expected outcome, the ability to cross content boundaries among the classroom teachers was somewhat unexpected. It wasn't unusual for the mathematics specialist to take photographs, or for the language specialists to "step into" the mathematics lesson. It was this particular aspect of the collaboration that allowed for the creation of a seamless curriculum that integrated extensive background knowledge in each of the content areas. As each of the teachers taught or watched others teach, they felt comfortable asking clarifying questions or adding content connections. We are aware that once the curriculum is replicated in other classrooms, only one classroom teacher—not four content specialists—will be available for implementation. It is our belief that because this curriculum was field-tested in this manner, the flow of the material, the time expectations, and the knowledge background needed were refined to the point that one classroom teacher will be able to replicate this curriculum.

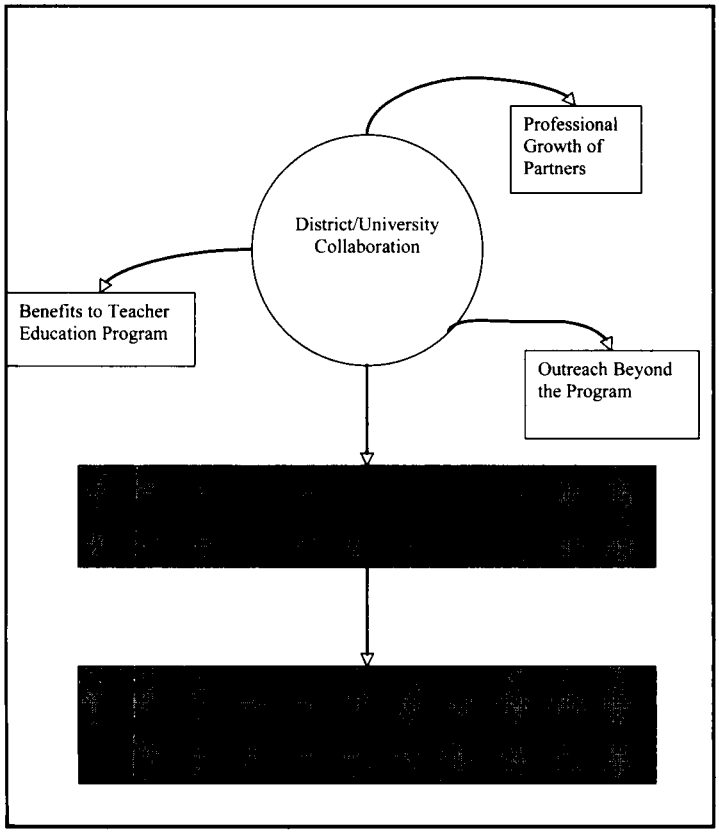

Figure 2
Unanticipated Outcomes

Unanticipated Outcomes of the Partnership

The implementation phase of the project was pivotal in going beyond the initial objectives. Unanticipated benefits included professional growth, benefits to students enrolled in the university's teacher preparation program, and community outreach (see Figure 2). It is the unanticipated outcomes that we find to be most interesting and that cause us to reflect more deeply about the value of partnerships.

Professional Growth. The implementation phase of the partnership provided a unique opportunity for professional growth. Each of the teaching partners learned from observing others interacting with the students, from reading articles outside her immediate area of expertise, and from reflecting on the teaching events of the day. These reflective sessions were critical in terms of developing new understandings about teaching and learning. While all of the teachers were experienced, they never had worked side-by-side with specialists in fields different from their own. The mathematics and science educators understood grade-appropriate content, classroom management concerning laboratory equipment, and ways to authentically integrate mathematics and science instruction; their understanding of working with ELL students, integrating language, and the development of academic language, however, was limited. The ESL educators understood language acquisition, the need to maintain a focus on language, and the role of monitoring and assessing language development, but felt inadequate in establishing deep understandings of science and mathematical concepts.

A distinctive feature of this professional growth opportunity involved the unusual role of the university partners. Typically, when a university is involved in professional development, university personnel assume leadership roles. In this particular partnership, the district teacher and university professors taught side-by-side. The district teacher initially expected to be scrutinized and evaluated by the university professors and soon found this not to be the case. Her expertise in highlighting academic language using text, in particular, was highly valued and became a learning tool not only for the children but also for the university faculty. The university faculty members, on the other hand, were afraid that the classroom teacher would find their interaction with children to be a bit "rusty" and inadequate, since they had not directly worked with elementary students since initiating their university teaching careers. However, the classroom teacher came to value

the way in which the university faculty members approached and supported the children by heeding her recommendations and suggestions for classroom management. Consequently, the partnership provided the university faculty with an authentic experience with children. A common criticism of university faculty is their lack of current, ongoing experiences in the very classrooms in which those they prepare will teach. The fact that the three-week implementation phase of the partnership took place during the summer was an important scheduling factor, in that it allowed university faculty to participate in ways that would not have been possible during the regular academic term.

Benefits to the Teacher Education Program. The partnership provided the three university professors with a common experience from which to draw when working with preservice teachers. The university's EC-4 teacher preparation program admits students once a year. Each cohort follows the same course sequence, which creates a form of spiral curriculum that builds around key ESL understandings. One of the benefits of having an established sequence is that it allows professors to build on what has been previously introduced and allude to concepts that will be presented later on. As a result, ESL concepts are reinforced multiple times and in multiple settings. The partnership was invaluable in that it allowed the professors to use the common experience to cross-reference each other while teaching within their content areas in math, science, and ESL.

Students in the teacher education program can further benefit from the experience in that it provides them with a model for establishing smaller scale partnerships, such as the one we describe. Davison (2006) points out the need for such models when noting that a common misconception is to assume that all that is needed for ESL and content area teachers to develop collaborative relations is a "sympathetic and supportive school environment and cooperative partner" (p. 456). Our experience allows us to demonstrate how ESL and content teachers can come together and critically reflect on their collaborations. Our modeling would demonstrate the "integration of content-based ESL and ESL-conscious content teaching" (Davison, 2006, p. 456).

Outreach Beyond the Program. A surprising outcome of the partnership was that it provided the university faculty with the opportunity to collaborate with parents of the ELL students who participated in the summer camp. A few months after the summer camp began, ELLs who had participated in it were invited to join the university faculty and the classroom teacher for a special event on the university campus. Six of the students accepted the invitation and attended a Saturday event at which they worked with university guests to demonstrate their solutions to several of the erosion and fraction problems they had attempted to solve during the summer camp. Parents of the children also were invited to join in the celebration and accompany their children to the university. While interacting with the faculty, it became apparent to them that the teacher preparation program at the university was aimed at helping future teachers understand the role of parents in the education process. As a result, one of the mothers in the group volunteered to participate in class discussions—with the help of a translator—to present her perspectives on the parents' role in supporting ELLs in public schools.

Conclusion

The district's need to develop a content-based curriculum to support academic language development propelled this partnership. The partnership was successful in that it allowed the participants to produce and field-test an authentic, integrated curriculum that will be implemented at other LCP summer school sites. From a research perspective, the partnership provided data that we are now in the process of analyzing to better understand what is involved in developing academic language. This analysis is also producing information that we will use to modify the curriculum before it is implemented at other sites. The partnership also yielded unexpected results. Although the professional growth that resulted from the partnership was most gratifying, its potential to affect the lives of future educators, as well as the link to the community, was most significant.

This experience reinforced for us that each partnership is unique and that a one-formula-fits-all model cannot be developed from this particular setting. However, as the ELL population continues to grow, we challenge others to come together in supporting academic language development for these learners. We believe that content and ESL teachers in other settings—elementary, middle school, secondary, or university—can benefit from similar partnerships. We also believe that such partnerships will help close the achievement gap for immigrant ELLs.

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Appendix
Key Curriculum Components

Erosion

The National Science Education Standard, Content Standard D for K-4, states: *As a result of activities in grades K-4, all students should develop an understanding of how the earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides, volcanic eruptions and earthquakes* (National Research Council, 1996). Specific concepts include:

- The surface of the earth changes.
- Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.

The curriculum will use the stream table as a model so that the students can investigate how wind, water, and ice cause erosion. Field trips to locations near the school will be used to show authentic examples of erosion. The academic vocabulary will be introduced using a word wall, sentence strips, representative artifacts, and a vocabulary bowl. Students will be asked to communicate their understandings and experiences through class and group discussions, using models, drawing pictures and diagrams, and writing in a daily log. Features of academic text will be highlighted during class readings.

Numerical Fluency

The National Council of Teachers of Mathematics (NCTM): *by grade 5, children should understand the equivalence of fractions, decimals, and percents and the information each type of representation conveys. With these understandings and skills, they should be able to develop strategies for computing with familiar fractions and decimals* (NCTM, 2000, p. 149). Specifically, students should be expected to:

- Develop an understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as division of whole numbers.
- Use models, benchmarks, and equivalent forms to judge the size of fractions.
- Understand the place value structure of the base-ten number system, and represent, estimate, and compute decimals.
- Explore relationships among fractions, decimals, and percents, and be able to recognize and generate equivalent forms of commonly used fractions, decimals, and percents.
- Explore numbers less than 0 by extending the number line and through familiar applications.
- Develop and use strategies to estimate computations involving fractions and decimals in situations relevant to students' experience.
- Use visual models, benchmarks, and equivalent forms to add and subtract commonly used fractions and decimals. (Hudson & Miller, 2006; NCTM, 2000)

The curriculum will use such strategies as problem solving, hands-on instruction, and communication as the structural basis for developing these concepts. The academic vocabulary will be introduced by using a word wall, sentence strips, and representative artifacts. Students will be asked to communicate their understandings and experiences through class and group discussions, using objects, drawing pictures and diagrams, and writing in a daily log.