How Talented Students in a Rural School District Experience School Mathematics

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This study examined the mathematics experiences of talented children in an impoverished rural school district located in a coal-mining area of Appalachia. Using interview methods, the researchers explored the children's ideas about the nature of mathematics, their perceptions of the mathematics instruction they received at school, and their engagement with mathematical ideas at home and in the community. Findings centering around 3 themes suggested that the children's experience was constrained by the presentation of mathematics as a discipline focused on calculation and bound by rules. Students' view of mathematics was further limited by a narrow conception of its usefulness. The study found, however, that the children received support for mathematics learning from their families and from the teacher of the gifted. Notably, instruction provided in the gifted program was reported as being more advanced, more challenging, and more engaging than what was offered in regular classrooms.

Although there are many studies relating to the mathematics achievement of gifted students (e.g., Heid, 1983; Malpass, O'Neil, & Hocevar, 1999; Montague & Applegate, 1993; Sriraman, 2003; Stanley, Keating, & Fox, 1974; Strauss, 1988) and a few studies exploring how gifted students learn mathematics (e.g., Freudenthal, 1977; Hope, 1987; Presmeg, 1986), there is very little research that examines the way gifted students experience mathematics and mathematics instruction. In fact, besides the research on students' beliefs about mathematics (e.g., Mtetwa & Garofalo, 1989), there is very little other empirical work that considers how children—gifted or not—experience mathematics (cf. Walkerdine, 1988).

Building on the small body of extant literature, the present study sought to examine how mathematically talented children in a disadvantaged rural community experienced mathematics, both as a discipline and as a school subject. Our aims were to find answers to

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questions such as: "What do these children think mathematics is?," "What value do they attach to the study of mathematics?," and "In what ways do classroom and home experiences shape their thinking about what mathematics is and what it's for?"

Related Literature

How Students Experience Mathematics

Beyond the realm of ethnomathematics (e.g., Eglash, 1997), few studies use an emic perspective to examine individuals' experiences of formal and informal learning of mathematics (cf. Walkerdine, 1988). A somewhat larger body of research explores related questions: "What do learners and teachers believe about mathematics?," and "How are their beliefs shaped and reinforced?" Within this line of inquiry, some studies (e.g., Stump & Bishop, 2002; Thompson, 1984) focus attention on what practicing teachers and teachers in training believe about mathematics and mathematics instruction, and a smaller body of empirical literature explores such beliefs (and belief formation) among children.

Beliefs About Mathematics. Because education (appropriately) promotes transmission of cultural knowledge, change in what is taught happens slowly. Not surprisingly, beliefs about mathematics and mathematics learning held widely among the adults in a culture are likely to be conveyed more or less intact by teachers, as well as by parents, when they provide explicit help to their children (Masingila & Doerr, 2002; Walkerdine, 1988). Therefore, the few studies of beliefs about mathematics held by adults who are not teachers provide insight into the conventional view of the discipline (e.g., Crawford, Gordon, Nicholas, & Prosser, 1993; Furinghetti, 1993; Galbraith & Chant, 1993; Lipsey, 1973). These studies suggest that, in general, adults reach conclusions about mathematics in response to the formal instruction they themselves received. According to Furinghetti, moreover, " . . . the adult's image of mathematics is conditioned (unfortunately, usually in a negative direction) by the school experience of the individual in a more radical way than happens with other subjects" (p. 37). And, that conditioning, she argues, causes the majority of adults to "harbour feelings of refusal and repulsion towards the discipline" (p. 37).

Studies of adolescents' and young adults' views of mathematics also reveal that their beliefs are shaped by long exposure to a rule-based version of instruction (Rector, 1993; Schoenfeld, 1985). In general, this regimen leaves students with the sense that the discipline is rigid, impenetrable, and boring (White & Frid, 1995). A survey conducted by Schoenfeld, for example, showed that high school geometry students, while parroting rhetoric about the importance of mathematical reasoning, nevertheless relied on rote memorization in order to succeed in math classes. There is, however, variability in the perspectives held by students (Carpenter, Lindquist, Matthews, & Silver, 1983; Coe & Ruthven, 1994). Moreover, as Coe and Ruthven note, this variability seems to be associated with the type of instruction that students receive:

> The evidence presented here, when compared with typifications of student beliefs in more traditional settings, suggests that students who have followed reformed curricula are more diverse in their beliefs, and that some—at least at the level of espoused belief—adopt a more critical perspective towards mathematical knowledge and show a greater appreciation of the role of enquiry in mathematical thinking and learning. (p. 108)

Despite the predominant view that mathematics holds little intrinsic appeal, students do tend to believe it is useful. Nevertheless, beyond the obvious practical uses of arithmetic, they are rather unsophisticated in their characterizations of its applicability, as suggested by the following quotes from students who participated in Schoenfeld's (1985, p. 30) study:

- "It is helpful in chemistry and physics."
- "All of the math courses taken in high school are useful for certain professions."
- "Math is useful by getting us into good colleges, and having better reasoning."

- "I really don't find geometry useful at all. Algebra can help you with science sometimes."
- "If you were to become an engineer or technician you need the basic rules to follow for measuring things and estimating things."

These quotes reveal that many students see the value of mathematics principally in terms of the access it provides to educational and career opportunities (Schoenfeld, 1985; White & Frid, 1995). As White and Frid conclude about the students whom they studied, ". . . career aspirations and the relationship of mathematics study requirements to career aspirations was an integral component of their conceptions of mathematics" (p. 8).

Interestingly, research on students' beliefs about the basis for success in mathematics reveals two distinct sets of views. Whereas some students appear to attribute success to attentiveness, hard work, and practice, other students seem to view innate mathematics ability as the primary basis for success (Buerk, 1982; McSheffrey, 1992; Mtetwa & Garofalo, 1989; Schoenfeld, 1985). Furthermore, students tend to maintain quite constrained beliefs about what success in mathematics means (Coe & Ruthven, 1994; Spangler, 1992; White & Frid, 1995). For the gifted elementary-aged children in Spangler's study, for example, success manifested itself in rapid completion of assigned problems. For the older students investigated by White and Frid, success was construed in terms of the social importance of the careers to which mathematics provides access:

> In general . . . few students enjoyed mathematics for its own sake. A strong interest in mathematics was sometimes expressed in relation to career aspirations and social importance of mathematics, with enjoyment achieved through being successful in relation to these other key components. (p. 9)

Despite their limited exposure to school mathematics instruction, even young children tend to exhibit a preoccupation with rules and memorization, as well as showing little conversance with the idea that mathematics might involve problem solving, reasoning, or modeling of the empirical world (Frank, 1998; Kouba & McDonald, 1991; Mtetwa & Garofalo, 1989). Moreover, young children seem to think of mathematics almost entirely in terms of calculation, despite the fact that even the most conventional curricula and teaching methods also attend to other topics, such as measurement, estimation, classification, and probability (Frank, 1998; Mtetwa & Garofalo, 1989). Typically researchers explain these beliefs as the obvious product of the rule-based version of mathematics instruction to which students are exposed. According to Mtetwa and Garofalo, for example,

> [children's] rather artificial separation of mathematical activity into the formal and algorithmic on one hand, and the informal and common-sensible on the other, is also a by-product of our instructional practices . . . the usual overemphasis of computational manipulations over quantitative reasoning. (p. 613)

One study in particular supports an extremely pointed interpretation of the dynamics that lead to a diminished and, at the same time, aggrandized view of mathematics. Walkerdine's (1988) post-structural analysis of the ways young children discuss mathematics with mothers and teachers presents evidence of disjunctions in the character of the discourse. Whereas mothers often use quantitative concepts in a regulatory and situated manner (e.g., telling a child during a particular meal that she cannot have *more* mashed potatoes), teachers tend to use such concepts to cultivate the production of abstract signs (e.g., asking children to identify "which is *more*, 40 or 400?"). Using examples such as these, Walkerdine posits that school mathematics engages abstract reasoning through the production of signs in a deliberate effort to decontextualize quantitative concepts and thereby to demonstrate their universal applicability. As a result, mathematics contributes to a false sense of control, to "a fantasy of an omnipotent power over a calculable universe" (Walkerdine, p. 190). From Walkerdine's perspective, then, mathematics must remain decontextualized if it is to sustain views of power that reinforce dominant cultural assumptions and accompanying relations of power.

Mathematics for Gifted Students

What we know about how gifted students experience mathematics primarily comes from studies of the mathematics instruction they receive. And, in general, these studies confirm that, in elementary schools, gifted children typically participate in the mathematics lessons provided to their same-age peers. Indeed, relatively little differentiation is made during the time gifted students are in the regular classroom, and most gifted students spend most of their time in the regular classroom (Westberg, Archambault, Dobyns, & Salvin, 1993). Elementary school mathematics emphasizes basic concepts and skills, as well as focusing to some degree on mathematical reasoning, but it appears to offer students little opportunity for investigation or extended projects that would help them understand the nature of mathematics and its applications (Whittington, 2000a).

Even in the intermediate grades (i.e., fourth through sixth), mathematics instruction in most schools emphasizes computational skills, such as those used in division and multiplication with whole numbers, and computation with fractions, decimals, and percents. Problem solving also forms a part of mathematics education in these grades, but it is still rather rare to find regular classroom programs that make the potential applications of mathematics an integral part of daily classroom work (Whittington, 2000b). What instruction in problem solving typically includes are practical real-world applications, such as computing the prices of items or the time to travel between towns. Schools, however, actually provide instruction that prepares few students for advanced high school mathematics. Consequently, few intermediate-level students are afforded experiences that position them to pursue mathematics and science majors in college and careers in mathematics or science (Assouline & Lupkowski-Shoplik, 2003).

Programs for elementary-level gifted students typically serve students who are gifted in mathematics (though many students who are talented only in mathematics are not included in programs for the gifted). For elementary students identified as gifted, one of the most common delivery models is the pull-out, resource room program, which offers services on a relatively infrequent basis. Pull-out programs sometimes offer opportunities for students to explore the applications of mathematics to fields such as physics and biology, as well as opportunities for learning about the career possibilities that the study of advance mathematics enables. In general, enrichment programs of this type, however, offer nonsequential problem-solving activities that are unlikely to promote the continuing development of the high-level skills that mathematically gifted students need (Assouline & Lupkowski-Shoplik, 2003).

Gifted Students' Attitudes Toward School and Mathematics Instruction. Despite the fact that the instruction most elementary gifted students receive does not differ in consequential ways from that received by other elementary students, gifted students' attitudes toward school tend, in general, to be more positive than those of other students (e.g., Feldhusen & Dai, 1997; Feldhusen & Kroll, 1991). According to a recent study, however, gifted students sometimes express disappointment with the slow pace of instruction (Kanevsky & Keighley, 2003). Like other children, they are bored by activities that fail to challenge them (Gentry, Gable, & Springer, 2000), and much of the instruction provided in regular classrooms is too easy to present a challenge to gifted children. One study found that, across both grade levels and academic subjects, gifted students reported being bored by many classroom routines—copying, memorizing, repetition, and waiting (Gallagher, Harradine, & Coleman, 1997). Because these routines dominate elementary-level instruction in mathematics, it seems quite possible that many gifted students will draw the conclusion that mathematics is boring.

Perhaps this circumstance explains to some extent why many gifted students prefer and do so well with accelerated instruction in mathematics. A study by Durden and Tangherlini (1993), for example, found improvements in attitudes toward mathematics among students who were accelerated. And, accelerated mathematics instruction certainly seems to result in improved achievement among gifted students (e.g., Ream & Zollman, 1994; Stanley et al., 1974).

Nevertheless, in general, as students move through the secondary grades, their attitudes toward mathematics tend to become less positive. A study conducted by Terwilliger and Titus (1995), for example, found significant declines in attitudes toward mathematics among both accelerated and nonaccelerated students as they progressed through high school. Nevertheless, these researchers also found that accelerated students maintained more positive attitudes than nonaccelerated students, that is, their attitudes declined less rapidly. Ma's (2003) more recent study showed that gifted students who experienced early acceleration tended to decline less rapidly in positive feelings toward mathematics than gifted students who experienced later acceleration.

Gaps in the Related Literature

The extant literature, though descriptive of gifted children's attitudes toward mathematics, does not reveal much about the wider context that shapes the practices of mathematics learning and teaching for mathematically talented students. Clearly, however, there is reason to believe that context—represented in any number of ways, for example, as culture, ethnicity, or locale—might influence how mathematics knowledge is defined and how mathematics learning is negotiated (e.g., Guberman, 1999). Moreover, the cognitive characteristics of mathematically talented students are quite likely to manifest themselves differently in different contexts, depending on the ways particular communities of adults regard competence in mathematics and the role of mathematics in daily life.

The work reported here represents one of the few systematic studies of the role context plays—in this case, context defined by rural locale—in talented students' experiences of mathematics. With little related literature to draw on, our research is best viewed as preliminary and descriptive, rather than as theoretical or conclusive.

Methods

Our first concern in organizing a study of talented rural students' experiences of mathematics was to gain access to children who could serve as informants. Therefore, we contacted a school district in a state with a number of rural Appalachian districts in order to obtain consent to conduct the study.[1] In addition, we contacted the teacher of the gifted in that district, who agreed to allow her students to be interviewed during their scheduled time in the resource center.

The teacher helped us identify participants based on predetermined selection criteria, as well obtain permission from students and their parents. Sixteen mathematically gifted students were selected for the study. Criteria for selection were (1) a minimum score at the 95th percentile on the mathematics portion of the Stanford-9 Achievement Test *or* (2) a minimum score at the 95th percentile on the mathematics subtest, a combination of scores on the Applied Problems and Calculation subtests of the Woodcock-Johnson.

The District

We conducted the study in Mountain County, a rural community in the Appalachian region of the United States.[2] We selected the district because of its extreme rurality. In addition, because one of us had worked with the county administration and the gifted education teacher in the past, we felt a special interest in this county and knew that the school personnel would be willing to cooperate in a study of this kind.

The county is among the most remote of the rural locales in the state in which it is located. Although its mountainous landscape is beautiful, the rugged terrain continues to isolate the region from more urban and suburban parts of the state. The county (which is coextensive with the school district) covers 535 square miles and is populated by approximately 27,000 people.

With an average of about 51 people per square mile, far below the state average of 75 people per square mile, the county is less populous than it once was. During the mid-20th century, Mountain County was one of the busiest coal mining regions in the United States. Although its current population is only 27,000 (U.S. Census Bureau, 2000), the population reached a high of nearly 100,000 in the 1950s (Carter, 1995). Primarily because of the earlier mining boom, the county is one of the few in this Appalachian state with a heritage of significant, though still limited, racial diversity. In the 1950s, the African American population was about 24% of the county population. Of the current population, approximately 3,000 inhabitants, or about 11%, of the county population identify themselves as Black or African American.

Since the advent of automation in the mines, this county has had more than its share of poverty. The scarcity of level land restricts opportunities for commercial agriculture. Perhaps because of the terrain, few industries and even relatively few service jobs have become available to replace lost mining jobs. The county's economic history of decreasing jobs has resulted in higher unemployment, as well as lower population. In 2002, the unemployment rate was about 10%. Statistics computed from the 2000 census reveal that approximately one third of the county's residents have incomes below the official U.S. poverty level.

According to the Bureau of Business and Economic Research (Condon, Childs, & Bogdan, 2000), in 1998 the largest employers in Mountain County were the state and local governments, which accounted for 31% of personal earnings. The report identified mining as still an important employer; it is the second largest employer, representing about 23% of earnings. In 1999, the county's median household income was $16,931, compared to the state average of $29,696. Because of low earnings and a low population, the tax base to support the local schools is one of the lowest in the state.

The school system, which serves the entire county, includes seven small elementary schools, three middle schools, and three high schools. The achievement in these schools is remarkable considering the economic hardship facing the county. According to the state's accountability "report card," the district's 4,800 or so students score, on average, somewhat above the 50th percentile on the nationally normed achievement test administered statewide to assess school and district performance.

The Informants

The informants were 16 gifted children[3], included in the study because of high standardized test scores in mathematics. The children ranged in age from 7 to 14, with half in the 7–9 age range and half in the 10–14 age range. Grade levels represented among the group were second, third, fourth, fifth, seventh, and eighth, with children coming to the gifted program from seven elementary schools in the district and two middle schools. Table 1 provides information about each of the children.

With the exception of one African American girl and three students of unknown race, all of the other children were White. Eight of the chil-

Table 1
Case-by-Case Demographics

Name	Age	Grade	Residence (county seat or rural)	Race	Number of siblings	Family structure	Number of districts attended
Melanie Allen	9	3	Rural	W	1	Two parent	1
Janet Barth	7	2	Rural	W	1	Two parent	1
Susan Doddridge	7	2	Rural	W	1	Two parent	1
John Eastman	7	2	Rural	W	0	Two parent	1
James Freeman	7	2	Rural	W	1	Single parent	1
Brittany Keller	8	3	Rural	W	1	Single parent	2
Samantha McIntyre	9	4	County seat	W	1	Two parent	1
Nicole Patterson	8	3	Rural	B	0	Single parent	1
Brent Pauley	13	8	Rural	W	1	Single parent	1
Jeremy Rittenhouse	13	8	Rural	W	1	Single parent	2
Molly Roth	10	5	Rural	W	2	Two parent	1
Rob Somerset	13	8	Rural	W	3	Two parent	1
Gene Taylor	13	7	County seat	O	3	Two parent	1
Brendan Trilling	10	5	Rural	W	3	Two parent	1
Christopher Walton	13	8	Rural	O	1	Single parent	1
Evan Young	14	8	Rural	O	1	Two parent	1

Note. All names are pseudonyms.

dren were girls, and eight were boys. Most of the children (62.5%) lived in two-parent homes, and 13 (81.3%) of them lived in relatively small families with two or fewer siblings. Although the district is quite poor, many of the students came from middle-class homes, with one or both parents working. Several had parents who worked as teachers or teachers' aides in the school district, and a few reported that their fathers were employed in jobs in technical fields or in sales—jobs that required them to spend a considerable amount of time away from home.

Fourteen of the students lived in rural parts of the district, and two lived in the county seat, which has a population of 2,500. The others lived in or near what might be called rural villages, rather than towns. The largest of these has a population of 330. None of these families made a living by farming; the land in Mountain County is too poor and hilly. Many of the families, however, supplemented their resources with gardens, growing corn, onions, tomatoes, and beans in their yards or on larger plots of land belonging to them or to relatives. The children in these families helped, to a limited extent, with chores related to gardening and canning. Recreation for the children typically included—in addition to the video games, television, and reading that most gifted students enjoy—lots of outdoor play, mostly unstructured, including riding on four-wheelers or dirt bikes and horseback riding.

Most of the children reported that they had spent their entire school careers within the district, with only two of the children reporting that they had ever attended school anywhere else. Although none of them had attended (or even visited) an urban school, most believed that schools in cities were likely to be larger and more impersonal than the rural schools they attended. Some thought that these larger schools might provide a more varied curriculum, with greater opportunities for field trips and other special events. All reported enjoying the experience of attending school in a rural locale, citing the intimate, family-like atmosphere of their schools as the primary reason for this attitude.

Interviews

Students were interviewed by one member of the research team who had grown up and then later worked as a teacher in a school district close to the district in which the informants were attending school.

Interviews were conducted in a room adjoining the classroom in the resource center where the teacher of the gifted provided instruction.

In order to structure conversations with the children, the interviewer made use of an interview schedule focusing on relevant issues. The interview schedule included open-ended questions to elicit information about the children's experiences with mathematics, as well as more structured questions to elicit demographic data (see Appendix). The interviewer used these questions primarily to start and advance the conversation with each child. When a child provided a limited response, the interviewer asked additional probing questions. Furthermore, the interviewer allowed students to speak without interruption, even when their answers seemed to stray from the main topic of discussion. In this way, the interviewer was able to elicit rich, detailed responses from all of the students. The children, however, varied somewhat in their willingness to talk with the interviewer. One fifth-grade girl was considerably less talkative and one second-grade girl was considerably more talkative than the other children.

Each interview lasted approximately 60 minutes and was recorded on audiotape. Tapes were later transcribed; then they were reviewed carefully for accuracy by the interviewer.

Data Coding and Analysis

Each of the three researchers analyzed data from the transcripts separately, first by establishing coding categories and then by sorting and classifying the codes in order to establish broader categories and eventually to identify themes describing relationships across categories. Because we used interview data almost exclusively, we relied on Weiss' (1994) approach to issue-focused analysis. As Weiss explains, both predetermined and emergent codes are used for initial categorization of data. These are then sorted and integrated into more comprehensive units of meaning and finally integrated into statements about the issues most salient to the informants. Although Weiss calls these integrated statements "issues," we have used the more widely used term, "themes."

Following our separate work with the data, the researchers met to discuss the themes each had identified. Although everyone agreed about the salience of the themes discussed in this paper, each saw the relevance of one or two other themes. Notably, however, the themes identified by all three researchers (and reported in this paper) were represented in the comments offered by all of the 16 children, whereas those identified by one or two of the researchers (and eventually dropped) were represented in the comments of only some of the children. Furthermore, the themes we eventually selected tended to be somewhat broader than those identified by individual researchers, and in some cases they subsumed the themes identified by one or another of the researchers. For example, one researcher called a theme "the purpose of math." This theme fell within the scope of the somewhat broader theme, "the substance and value of mathematics." We dropped two themes that offered interesting insights because they were represented in the comments of only some of the children. These related to the way computers are used in elementary-school mathematics instruction and the way gifted children explain differences in the mathematics ability exhibited by their peers.

The researcher triangulation accomplished through our approach to data analysis provided some assurance that the themes reported in the paper are reliable representations of the ideas contributed by the gifted students who were interviewed. Moreover, following the determination of themes, we reviewed all of the transcripts to make sure that significant sections of each interview were devoted to each of the themes.

Findings

In order to provide a context for the discussion of salient themes, we first present a brief description of the educational arrangements for elementary and middle school children in Mountain County. Information about the district's gifted program was summarized from information provided in conversations with the teacher of the gifted, as well as from one of the researchers' recollections about what she observed in the gifted classroom[4].

The Gifted Program in Mountain County

Like most districts in the state, the Mountain County schools provide limited services to gifted students. Although required by the state to serve gifted children in grades one through eight, many teachers choose not to refer children for testing. Some teachers and parents are reluctant to send children on the long bus ride required in order to attend the program, which is housed at a resource center in a school located in the county seat. Students who attend the program, therefore, are more likely to live close to the town than to come from more remote sections of the county. Nevertheless, the students' average travel time between their homes and the resource center is 40 minutes each way.

Currently, 40 elementary and middle school students in Mountain County attend the gifted program at the resource center. Of these, seven are African American students. The proportion of African American students in the gifted program is a little larger than the proportion of African Americans in the county population as a whole. Among students in the program are many whose family incomes are lower than the average family income in the state.

The schools these students attend are small. The largest elementary school has 314 students, and the smallest, which is a K–8 school, has 140 students. The average class size for these schools is about 14. Mathematics class sizes are slightly larger, and, for the grade levels represented in this study, average 16 students. The mathematics teachers use a county-adopted textbook that emphasizes calculation, but also features problem solving and applications, as well as suggestions for individualizing instruction. Elementary students in Mountain County spend approximately 90 minutes per day on mathematics, and middle school students spend approximately 50 minutes. Like students in other counties in the state, students in Mountain County are provided instruction related to a scope and sequence curriculum adopted by the state board of education.

The gifted resource room has, for students in these grade levels, an average class size of seven. The students arrive about 9 in the morning and stay until 1:30 for one day of enrichment in language arts, science, social studies, and mathematics per week. Many lessons are interdisciplinary and thematic. As with most pull-out programs, there is little chance to accelerate systematically because the time in the gifted program is so limited and the opportunities to work with the teacher are spaced a week apart. A variety of enrichment materials are used in the resource room, most of which emphasize problem solving and applications of mathematics in science.

Themes

Our data revealed three themes, which, taken together, accounted for about half of the education-related comments offered by the 16 children interviewed. One theme concerned the substance and value of mathematics, a second theme focused on the nature and quality of mathematics instruction, and a final theme concerned the support for mathematics learning provided in children's homes, especially by mothers.

The Substance and Value of Mathematics. When the children talked about mathematics, they typically demonstrated a naïve understanding of the discipline. Far from seeing mathematics as a way of expressing ideas or as a method for characterizing relationships and patterns, these gifted children instead saw mathematics principally as a set of procedures with numbers—as calculations and algorithms. Asked, for example, if math lessons ever involved problem solving, one eighth grader commented, "No. It's just math" (Rob Somerset).

Even the older students, who were encountering algebra, saw this approach to expressing relationships mostly in terms of calculation. According to one eighth grader, for example, algebra involved "solving for variables and stuff," and he described lessons in his algebra class as "writ[ing] rules to the math until we could remember them in our head" (Brent Pauley).

Other children characterized mathematics as "subtracting, pluses, and times" (Susan Doddridge) and "finding out what a variable is in a problem" (Jeremy Rittenhouse). And, as the following comment illustrates, they tended to see practical benefits, particularly in dealing with money, from having the skills that mathematics conferred:

> And, if you're not too good at math but [you have] to pay for gas and stuff . . . if you had to like figure it out yourself: If a gallon was a dollar, if you had three gallons, if you didn't know your math you may think that would be $300. And, you'd actually pay that. (Nicole Patterson)

Not only did the children believe that math skills would keep them out of trouble with money, they also subscribed to the view that the acquisition of mathematics knowledge would give them access to good jobs. Their understanding of how math knowledge provided such access was, however, rather sketchy; moreover, given the materialism of so much of U.S. society, their characterization of the need for money and for "good jobs" was down-to-earth and modest, as the following dialog indicates:

> Interviewer: What do you think you're going to do in the future with your math knowledge?
>
> Student: Probably do what my dad does.
>
> Interviewer: So what do you want to be when you grow up? You have any ideas?
>
> Student: I don't know what he calls what he does . . . I think he makes a lot of money.
>
> Interviewer: So why do you want money? Tell me what you're going to do.
>
> Student: Cause if you lived in a house you need to pay rent and the light bill and electricity bill and car bill and everything else.
>
> Interviewer: So if you get a good job you'll be able to do that.
>
> Student: Yes. (Brittany Keller)

Despite their rather innocent understandings about how good jobs differ from other jobs, most of the children saw mathematics knowledge as necessary for their pursuit of career success. Typically, however, their explanations of the relationship between mathematics knowledge and career preparation seemed, on the one hand, to be vague and, on the other, to be overly optimistic.

Some students, for example, held the view that mathematics is a part of the skill set required for all jobs. According to 14-year-old Evan Young, math is "very important because no matter what you're going to go into in a field . . . something's going to have to do with math." A 13-year-old classmate reiterated the point: "Most of the jobs today require some sort of math skills, whether it be just addition, integers, yada, yada, you get the idea, everything" (Jeremy Rittenhouse). Other students saw uses for mathematics in jobs as varied as store manager and rocket scientist.

When pressed, however, about the specific ways mathematics knowledge might fit into the careers they wished to pursue, most students revealed extremely limited understanding. Some talked about the fact that math was necessary for success in college, which was, in turn, necessary for career success. Others spoke in rather vague terms about the linkages between particular career options and mathematics knowledge. One eighth grader, for example, explained, "I know I'd like to become an optometrist. I'm not sure if I'd have to do very much math there, but I know I'd have a lot of science and I like science, too" (Brent Pauley). Another of the older students commented, "Well, when I go to college, I want to be a lawyer or a sports medicine doctor. And, I know sports medicine has a lot to do with science and math and stuff. I'm not sure if a lawyer has a lot to do with math or anything. But, I'm sure it does in a way" (Evan Young).

The younger children, not surprisingly, had even fewer well-formed ideas about how mathematics knowledge might actually be used by various professionals. They seemed to sense, though, that the interviewer, as well as other adults, might want them to see mathematics as useful. The story below, offered by a 9-year-old girl, provided the most farfetched illustration of a type of response given, typically in less fanciful ways, by several of our younger respondents.

> I want to be a veterinarian . . . And, if this woman comes in with a puppy, and she says, "I need some help. I need some help." And, she takes [the dog] in my office, and she says, "I need to know how many puppies my dog's going to have in the next 24 hours." And . . . you'd have to know how many she's going to have. She'll be expecting it. And, say I didn't know how to count—say she's going to have like 20, and say I didn't know how to count to 20 'cause I never learned, 'cause . . . I always got F's, and I barely passed . . . and I wouldn't know how to do it. . . . I'd just be like, "She's going to have 5. Bring her back to me in 24 hours." She comes back the next day.

> And, she's like, "Okay, [the dog's] here; she's ready." And, so she comes down and has 20. And, she says, "Well, you told me she was going to have 5, and now she has 20. What am I going to do with all these dogs?" Well, she would've made arrangements for . . . five puppies . . . but what's she going to do with the rest of them? I mean, I would say, "Oh, I'm sorry. I must've read the diagram wrong." "Yeah, you read the diagram wrong, alright." She would start fussin', and I would get fired. (Samantha McIntyre)

Taken together, the comments comprising this theme suggest that, even though they had limited awareness of what mathematics involves, the children nevertheless had come to believe that mathematics is important. Faith in the practical value of mathematics persisted across informants, from the youngest (7-year-olds) to the oldest (14-year-olds). Support for their judgment about the value of mathematics seems to have been based in adult authority. None of the students had sufficient understanding either of what mathematics involves or of what skills are required by different careers to enable him or her independently to reach an informed conclusion.

The Nature and Quality of Mathematics Instruction. Although they provided neither explicit criticism nor explicit praise of the types of mathematics instruction they were receiving, the children's comments offered insights into the practices that constituted mathematics instruction in regular classrooms, as well as in the gifted program. Almost without exception, the children commented approvingly about two features that differentiated their experiences of mathematics instruction in the resource room from their experience in the regular classroom. First, they noted that the math they encountered in the gifted program was more challenging than the math presented in their regular classrooms. And, second, they reported enjoying the opportunity in the gifted program to make more extensive and meaningful use of computers in learning math.

With regard to the level of the math lessons in the two settings, Melanie Allen, a third grader, commented, "we're doing division over here [in the resource room] and down there [in the regular classroom] we're still on the times tables." Another shared a similar perspective, "I like to do stuff like I get to do here . . . division and stuff. In school all you get to do is 2 + 2, 3 x 3, 0 x 0" (Nicole Patterson).

Several of the students explained that they experienced greater enjoyment in the gifted class because the work there was more challenging. According to Christopher Walton, one of the older students, "we do polynomials and stuff in here just for fun." Even second grader Susan Doddridge saw the level of challenge in the gifted program as a source of enjoyment and an incentive for working harder: "you feel like doing it 'cause it's harder, and you'd rather do that as to do those other ones fast."

These and other children's comments suggested that the gifted program offered a more challenging experience through two sorts of practices. First, and most often mentioned, were practices related to instructional pace, accomplished by modest amounts of curricular acceleration and considerable flexibility in the length of time that students were required to spend in completing assignments. Students were offered work that was approximately one year ahead of the work provided in their regular classrooms, and the teacher of the gifted allowed them to move through lessons as quickly as they could and then proceed to new lessons.

Second, though far less frequently mentioned, were pedagogical practices used to elicit problem solving. Although students' comments about these practices were limited, they pointed to the fact that there were more problem-solving activities in the gifted program than in the regular classrooms. As one child put it, "here, it is more thinking, and you've got to think about the problem" (Melanie Allen).

Computer-mediated instruction also differed between the gifted and the regular classrooms. Whereas the regular teachers seemed to use computers to reward students for completing their work and to keep them occupied while others finished their assignments, the teacher of the gifted provided students with opportunities to make use of software that encouraged new learning and strengthened problem-solving skills. All of the teachers—both in the regular and the gifted classrooms—also appeared to be using computer programs to give students practice with skills they had already learned, such as math facts and simple computation.

Although they clearly could distinguish between more and less challenging computer applications, the students seemed to prefer even the simplest computer programs to the routine of instruction in their regular classrooms. In fact, their portraits of mathematics instruction in regular classrooms revealed practices that seemed to have limited potential for engaging the minds of any students let alone those most talented in mathematics.

In responding to questions that elicited descriptions of what math lessons were like, some students focused on the repetitiveness of instructional routines, as the following quote from a second grader illustrates:

> I mean, we hardly get our work done when she gets with that overhead. And, she has to show kids . . . we've been over it a hundred times, the same ole thing, same ole thing, same ole thing. And, now she's decided for the ones who do get their math done and good grades, they're gonna be able to have free computer time. And, while she's showing them other ones who will not pay attention, she'll show them, she will show them again what to do, and then when we'll start a new thing we'll have to get off [the computer] and do our work. (Janet Barth)

Others pointed out the extent to which their teachers relied on textbooks and prepared materials in an effort to provide what they saw as sufficient drill and practice. Third grader Melanie Allen explained, "She just tells us to go to our math book, and she tells us to go to what page and what to do, and then she just like lets us do it." As the following comment from seventh grader Gene Taylor suggests, teachers' concern about state accountability tests seemed to influence their decisions about the work they required of students:

> When the bell rings, you have to practice for Stanford-9 test. He'll give us two questions out of the practice book and gives us time to answer them. Then we go over the answers, and then, like after we get done with that, we go on with our regular lesson.

Some students also characterized mathematics instruction in their regular classrooms as a time when interaction between students and teachers was limited. This point was illustrated by a comment from eighth grader Christopher Walton:

> Our teacher, she like doesn't talk to us. She like talks to the wall. And, she sits on a podium and writes it down on a projector, and it goes back on the board and you can barely read it. . . . What she would do is, we all have assigned seats, and she would turn the projector on [and] go over the homework we did. She'd go over that, and then the last part of class, like 15 or 20 minutes, she'd give us our assignment.

Although the norm for these math classrooms seemed to involve a steady diet of routine—lecture, recitation, and practice—there were a few reports from students of other approaches. One teacher, for example, encouraged enjoyment of mathematics by treating math lessons in a positive and playful way. The two students from her class both quoted her invocation: "Get out your beautiful, gorgeous blue math book" (John Eastman; James Freeman). In another classroom, the teacher often put students in groups and allowed them to provide one another with help. In one of the primary classrooms, the teacher occasionally provided the children with "counters." In several other primary rooms, teachers used competitive games to help students learn their math "facts." Some teachers permitted students to use calculators to check their work. One primary teacher allowed students to develop graphs of their shoe sizes by putting their shoes on a large piece of paper, and an eighth grader had had the opportunity in the previous year to use "algeblocks."

Most startling, however, was that, even when prompted, students could rarely recall any specific problem-solving activities or experiential learning activities involving math. Their response to questions about such activities typically was to talk about experiences in other subjects, like science and social studies.

Overall, then, these data suggest that the gifted children in this rural district were experiencing mathematics instruction that was below the level at which they might be able to perform. Moreover, this instruction represented math predominantly as calculation and rule-following and only sometimes as problem solving and sense-making. Unlike the largest portion of their other instruction in mathematics, the children were enjoying the time they spent using computers. Most of that time, however, was devoted to recreation (i.e., when the computer was used as a reward for rapid completion of assigned work) or to drill and practice.

Support From Home. The talented children who were interviewed all seemed aware that they had aptitude for mathematics. Most reported that, from the age of 5 or 6, they had enjoyed math and had known they were good at it. When asked who supported them in their mathematics learning, all of the students said that they received some support from home.

Interestingly, the support they received came primarily from their mothers. One eighth grader's comments provide an illustration: "[My mom] tries to help me when I'm having problems with math. She would help me figure out a problem if I was in trouble with it. She'd do anything to try and help me" (Jeremy Rittenhouse). According to another eighth grader, "After I do my homework at night, [my mom] checks it and goes over it with me and makes sure I do everything right. And, she gets my math book and reviews everything with me" (Evan Young).

According to several children, mothers not only helped with homework but also developed additional problems for their children to solve. For example, Janet Barth, a second-grade student, explained, "Well, usually after I come home from kindergarten, my mom would sit down with me and give me some math problems, and she still does."

In a few families both parents played a role in providing encouragement and assistance:

> They just keep encouraging me to study my math and try to like it if I get bored with doing the stuff that we're doing in school, just trying to find other stuff to do that's related to math. They always encourage me to come to gifted because I know they know I get like algebra-like high school work here. (Gene Taylor)

In one family, the father played the major role in encouraging his 10-year old daughter's interest in math and in helping her with homework:

> He uses math to help us with our homework 'cause when he went to college he can remember most of those things that he did, and he helps us. And, we're doing better at our homework if he checks it and explains to us what we're doing wrong. (Molly Roth)

In many families, support for the learning of math was coupled with the expectation that the children would perform well in school. In two cases, children reported that this expectation was explicitly related to grades. In one case, bad grades prompted a students' mother to visit her son's school: "Mom's mad when I get like below like a B. . . . They just make sure I have good grades, and, if they don't, Mom went down to the school" (Christopher Walton). In another, the parent paid his daughter when she got good grades in math and in other subjects.

Some parents seemed to be more concerned about standardized test scores than about grades. One student reported that his mother believed that, given his aptitude for mathematics, his standardized test score was too low, "On my SAT test last year, I got like a 60 in math my mom said. She looked over it and showed the teacher . . . the grades and stuff. I got a 60. She thought I did bad, but they said anything over 50 is great" (John Eastman).

Many other children, by contrast, explained their parents' expectations in less specific terms, such as, "They tell me that if I keep doing it, doing math how I do it now, I'll be real good at it when I get older" (Molly Roth), or "My parents want me to be able to do good 'cause they know I can. They know [even] if I just don't want to do it . . . I should be able to do it. But, they know I can succeed at it" (Brendan Trilling).

In general, the data suggested that parents were highly supportive of their children's efforts to learn math. Mothers seemed to play a more active role than fathers in translating encouragement into routine practices, such as providing assistance, checking homework, and providing extra math problems for their children to solve. From the children's reports of their discussions of math at home, there was little evidence suggesting that parents saw math in ways that differed substantially from the ways teachers presented math. Like teachers, parents seemed to construe math primarily as memorized rules, calculation, and routine procedures.

Summary. The three themes represented in our data revealed that mathematically talented children in one rural district felt supported and encouraged in their study of math, with parents and the teacher of the gifted providing the greatest amount of support. These themes also suggested, however, that, even from supportive adults, the children had received neither (1) a sophisticated understanding of what mathematics considers and enables nor (2) a realistic understanding of the role mathematics plays in various professions. Moreover, although the children reported that mathematics was important in daily life, not even the older children provided examples of how mathematics beyond simple calculation was used in any practical domain. Finally, the reports of typical instructional practices in regular classrooms provided evidence that these talented children were primarily receiving slow-paced and repetitive instruction that emphasized calculation, rote memory, and rule-following. The children seemed to be encountering very little in their school experience that might cultivate their capacity for problem solving, logical reasoning, or creative thinking.

Discussion

Our analysis of data from interviews with 16 talented mathematics students provided tentative answers to the original questions guiding the study. These answers tended to confirm findings from previous research focusing on students' and teachers' beliefs about mathematics—both the earlier studies, which typically did not attend to context (e.g., Thompson, 1984), and some more recent studies (e.g., McSheffrey, 1992; White & Frid, 1995), which addressed context by situating students' and teachers' ideas about mathematics within a wider interpretation of their experiences at home, in the community, and at school.

Corresponding to results from research on students' beliefs about mathematics, our findings showed that the gifted children in our study harbor constrained views about what mathematics is. Like the children and adolescents studied by Frank (1998), Mtetwa and Garofalo (1989), Rector (1993), and Schoenfeld (1985), among others, our young informants saw mathematics primarily as consisting of computation, application of memorized rules, and use of prescribed procedures. These beliefs tended to dampen the children's curiosity about mathematics while at the same time encouraging them to construe their own competence in terms, on the one hand, of competitiveness for grades and, on the other, of rigorous compliance to teachers' and parents' expectations.

Such characterizations of competence, however, may bolster an erroneous view of mathematics, namely that it represents a body of received wisdom, whose very nature limits creativity and critique. Moreover, the association between success with mathematics and competitiveness may fuel elitist views of mathematics performance as a legitimate mechanism for sorting individuals into differentially valued career tracks (White & Frid, 1995). Gifted students certainly do not benefit, however, from school practices that function to link determinations of inherent abilities to status rankings in society at large (Howley, 1986).

Also possibly contributing to the development of elitist perspectives were the children's unrealistic opinions about the practical value of mathematics (see also Schoenfeld, 1985; White & Frid, 1995). By drawing on a valorized view of mathematics as widely useful (in ineffable ways) for success in college and careers, the children seemed to conclude that the material benefits made accessible through acquisition of mathematics knowledge were more significant than the types of reasoning enabled by the study of mathematics. Nevertheless, the children in our study, probably owing to their upbringing in an impoverished rural community, maintained humble views about what such success entailed. Relatively speaking, therefore, their acquisitiveness, mediated by the experience of life in the coalfields of Appalachia, was modest. Although their limited view of entitlement seemed to play no role in encouraging the children to value mathematics for its own sake, it did keep them from aggrandizing the stature associated with mathematics talent (cf. Walkerdine, 1988; White & Frid).

As well as confirming findings from earlier studies of beliefs about mathematics, our study revealed some original insights about how children experience mathematics learning in context. First, within schools, gifted students (just as those with special difficulties) seem to receive mathematics instruction from several different teachers. In our study, there was no evidence of effort among the educators involved to coordinate the instruction provided to the children in the regular and gifted classrooms. Nevertheless, the children appeared to have little difficulty negotiating mathematics practice across settings. Although they were less fond of the approaches used in the regular classroom, they seem to have adapted to them. When given greater latitude in the gifted classroom, they adjusted to those conditions equally well.

Second, the students' mathematics experiences at home were typically tied to school mathematics. Few children reported engagement with activities at home or in the community that made use of mathematics. Family discussion, therefore, appeared to focus almost exclusively on the math that the children were learning in the classroom or the homework they were assigned. Although the students may have participated in activities that made use of mathematics informally, the children did not see these experiences as falling within the domain they had come to call "mathematics" (Walkerdine, 1988).

Nevertheless, the children's comments revealed that their parents (and sometimes other members of their extended families) definitely provided relevant and consistent support for their learning of school mathematics. The children saw family members as capable of helping them negotiate the processes involved in acquiring formal math knowledge. These rural Appalachian families seemed to play an active role in cultivating the children's participation in the mathematics curriculum that the professional educators defined.

Considering the constrained view of mathematics embedded in the school curriculum and the fact that families tended to accept the educators' construction of what mathematics involves, the children seem to have had few opportunities to see how mathematics contributes in a broad sense to problem solving in the lifeworld. Not only did they lack experiences enabling them to see how mathematics is used in practical ways by community members, they also seemed to have few experiences providing them with insight into the connection between quantitative thinking and dilemmas arising from life in a rural locale. As Kloosterman, Raymond, and Emenaker (1996) note in their analysis of longitudinal data on children's beliefs about mathematics,

> Even if the sense of usefulness of mathematics that students are getting is enough to keep them enrolled in mathematics, it does not seem to be enough for them to appreciate many of the real-world connections of mathematics advocated by national groups (e.g., National Council of Teachers of Mathematics). (p. 53)

We suspect that the experiences of our informants resemble the circumstances that these researchers describe. Although the children seemed to recognize that the study of mathematics would play a major role in their future schooling, they could not really imagine math as an important source of meaning in their lives.

As educators concerned both with academic rigor and place-based pedagogy, we had hoped to see evidence that the experiences of these rural gifted children might include opportunities to connect mathematics to problem solving in local communities. Although our interview data did not offer such evidence, they did provide some insights into the way bright rural students think about their schooling experience. For example, the interviewer asked most of the children if they would prefer to attend school in a large city. All of those who responded to the question said they enjoyed attending small rural schools. Their comments suggested that they felt comfortable and supported in that environment. Some students—especially older ones—acknowledged that larger, urban schools might provide a wider selection of mathematics courses. But, none of the children seemed to see this advantage as being sufficiently compelling to overshadow the benefits of their small rural schools. Of course, none of these students had actually had the experience of attending a suburban or urban school, so their perspectives were shaped mostly by their imagination of what such schools might be like.

In addition, our interview data suggested that family life was extremely important to the children. Often in the literature on rural education, researchers speak of the tension between career aspirations and family expectations (Burnell, 2003). The conventional wisdom suggests that rural children frequently are forced to choose between maintaining close family relationships in their rural communities and pursuing professional careers elsewhere. Nevertheless, as many, including Burnell, have found, the actual situation seems to be more complicated (see also Chenoweth & Galliher, 2004). Like the findings of these researchers, our data also offered evidence that rural students encounter a more complicated set of choices. Several students reported that one of their parents had made choices enabling him or her both to remain close to home and to pursue a satisfying career. One father, for example, worked in the city during the week and came home on weekends. Another parent had become a teacher in order to have a good job close to home. As a consequence of their parents' choices, these children were able to imagine futures in which aspirations for higher education did not seem inconsistent with the desire to stay close to their families.

Limitations and the Basis for Future Research

Considering the small size of the sample and the reliance on interview data alone, our conclusions need to be viewed as speculative. Furthermore, we are not sure that our findings regarding students' experience of mathematics disclose anything that might be said to relate specifically to the rural context. We have no basis to determine if the experiences of mathematics reported by our informants are characteristic of rural schooling in particular or dominate schooling more generally, regardless of locale. Previous research about the beliefs of teachers and students suggests that a diminished version of mathematics may be purveyed widely in U.S. schools.

Moreover, despite questions intended to elicit connections between children's experiences in rural communities and their experiences with mathematics, our data provided little evidence of such a connection. As we suggest above, one conclusion may be that these children had limited exposure to uses of mathematics by adults in their families and communities. Another possible explanation relates to the way we designed the research. Perhaps by conducting interviews in a school building, we predisposed children to think about mathematics primarily in terms of school practice rather than in terms of practice in the lifeworld.

Our difficulties in capturing the rural experience of mathematics and mathematics learning may be instructive to researchers who wish to build on this line of inquiry. The discussion below elaborates some ideas for future research relating to rural gifted students' mathematical experiences.

First, there is certainly room for larger-scale studies of gifted children's experiences of mathematics, permitting analysis across demographic categories such as locale, community socioeconomic status (SES), and culture. Research questions illustrating this domain include:

- How does the experience of school mathematics differ among gifted students in urban, suburban, and rural schools?
- Are there systematic differences in gifted children's experience of school mathematics in rural communities with different socioeconomic profiles?
- Among rural students, does mathematics ability influence the experience of school mathematics (e.g., the nature and quality of mathematics instruction, home support for learning school mathematics, access to learning opportunities, and so on)?

Another fertile line of inquiry might take up anthropological questions of the sort addressed by researchers of ethnomathematics. So far, this research has focused on situated mathematics practice among economically enterprising children in countries such as Brazil (e.g., Nunes & Bryant, 1996; Saxe, 1988) and Nigeria (e.g., Oloko, 1993), and it has explored the mathematical bases for cultural production among indigenous peoples in various countries. But, the approach has not yet been applied to studies of the mathematics practice of U.S. children in rural communities (Eglash, 2003). Questions such as the following illustrate the way anthropological methods might augment understanding of the mathematics experiences of rural gifted students:

- How do sex-role expectations in rural communities circumscribe the domains of mathematics practice typically available to children and adolescents?
- How do measurement activities that children experience on farms resonate with and differ from measurement activities included in their school mathematics curricula?

Recent sociological theory relating to identity formation might also provide a foundation for studying the mathematics experiences of rural gifted students. For example, researchers might examine the ways that mathematics practice and the practice of mathematics education help to shape gifted students' identities—those resonating with cultural and community expectations and those frustrating or challenging them. Research questions along these lines include:

- How does mathematics education assist in the production of the "college-going student" in rural communities, and what meanings are attached to this identity?
- How do advanced mathematics students in rural communities formulate aspirations in face of the conflicting expectations of parents and educators?

In conclusion, we see much room for additional research focusing on the separate issues embedded in the research questions we addressed and the findings we disclosed. At the same time, we believe our findings support the claim that gifted children in rural schools may be experiencing mathematics instruction that is neither sufficiently challenging nor sufficiently relevant to their experience in rural communities. Nevertheless, our findings also suggest that both families and programs for gifted students are supportive of children's mathematics learning. Perhaps these sites, rather than the regular classroom, are flexible enough to incorporate both more sophisticated and more practically grounded perspectives on mathematics. Such perspectives seem to us to be important to the academic development of all students, including, of course, those with evident talents for mathematical thinking.

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End Notes

1. We used a narrow definition of *rurality*—Johnson code "7" as reported in the Common Core of Data for the 2002–2003 school year (National Center for Education Statistics, 2004). In the state where we conducted the study, 42% of the districts were classified as rural on the basis of this definition.
2. Mountain County is a fictitious name for the research site.
3. According to state regulations, children identified as gifted are those children who score two standard deviations or more above the mean on a comprehensive, individualized test of intelligence, such as the Wechsler Intelligence Scale for Children–III or the Stanford-Binet Intelligence Scale IV. To qualify for gifted education services, students must also exhibit achievement or classroom performance that demonstrates a need for special services. Children who are historically underrepresented in gifted programs must meet comparable standards but may be provided alternative assessment methods.
4. One of the researchers visited this gifted program in the course of professional work that was not associated with our research project.

Appendix
Interview Schedule Matrix of Topics (i.e., illustrative questions and prompts)

General Topic	Perceptions	Stories	Judgments
Mathematics	What's the value of studying math? Why do you like to study it?	Tell about the kind of math you like to do and why.	Why do you think math is an important subject to study?
Mathematics education	How is math taught in your school? In other schools you've attended in this or other district?	What was the best math class you've had? Why was that person the best teacher?	How would you rate the quality of the math education you've received in the schools in this district?
Rural schools	What's it like to study math in a rural school? Do you think it is different to study math in a rural school than in some other school? In what ways?	Tell me what a typical math class is like here.	What things in your school help you learn math? What things get in the way of your learning math?
Families	What do the members of your family think about your study of math?	Tell about the ways you talk about math with your mom, dad, siblings, other relatives.	Do you think your family is supportive of your study of math?
The future	What do you think you'll do in the future with your knowledge of math?	What can you tell me about an adult you know who uses math in his or her work or home life?	Do you like the idea of working in a job in which you use a lot of math?