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Not Just Numbers: Creating a Partnership Climate to Improve Math Proficiency in Schools

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Abstract

Although we know that family involvement is associated with stronger math performance, little is known about what educators are doing to effectively involve families and community members, and whether this measurably improves math achievement at their schools. This study used data from 39 schools to assess the effects of family and community involvement activities on school levels of math achievement. The study found that better implementation of math-related practices of family and community involvement predicted stronger support from parents for schools' partnership programs, which, in turn, helped estimate the percentage of students scoring proficient on math achievement tests.

Mathematics has always been a core subject in U.S. schools. It is for this reason that international comparisons showing that U.S. students score below the international average on mathematics literacy and problem solving are alarming (Lemke, Sen, Pahlke, Partelow, Miller, Williams, Kastberg, & Jocelyn, 2004). In addition to concerns about low overall achievement in math, persistent findings of inequalities in math education and gaps in math achievement among groups of students also are troubling. Research continues to show that in the U.S., on average, males tend to perform better than females on math achievement tests, White and Asian American students outperform African American and Hispanic American students, and children from upper income families perform significantly better on math achievement tests than do their peers from families with lower incomes (Byrnes, 2003; U.S. Department of Education, 2001, 2003; Wirt, Choy, Rooney, Provasnki, Sen, & Tobin, 2004).

Efforts to improve math achievement in the U.S. are needed at the federal, state, district, and school levels. Pong, Dronkers, and Hampden-Thompson (2003) showed that the achievement gap in mathematics between children from single- and two-parent families was narrower in countries where national policies helped equalize economic resources across households. Macro-level influences of federal policy, while important, do not fully explain trends in students' math achievement (Lee, 2002). Schools need to be central actors in improving students' math skills and achievement test scores.

A long list of school strategies have been developed and implemented to improve student achievement in mathematics. In general, most of these efforts aim to improve mathematics

curricula, standards, and teaching (Ball, 1993; Knapp, 1997; National Council of Teachers of Mathematics [NCTM], 1991). In their review of research on the effects of math interventions, Baker, Gersten, and Lee (2002) found that students having difficulties in mathematics benefited most when teachers had data on student performance, used peers as tutors, provided clear and specific feedback to students about their errors, and provided explicit instruction in teaching math concepts and procedures. Their review noted that few programs sought to connect or communicate with students' families, and that when they did, the practices were an "add on" to the program. Compared to studies of classroom practices, little is known about whether or not schools' efforts to increase family involvement affect students' math achievement.

Mathematics and Family Involvement

Children's home environments and family involvement are associated with their mathematics performance in school. Studies have shown that students from single-parent households and homes in which parents have little formal education tended to do less well on math achievement tests and took fewer math courses than their peers from two-parent and more affluent households (Parcel & Dufur, 2001; Pong, et al., 2003; Schiller, Khmelkov, & Wang, 2002; Valadez, 2002). Family demographic characteristics, however, cannot explain how or why the family context affects student achievement or other outcomes related to mathematics.

Parents' socialize their children in ways that significantly affect their children's self-perceptions of ability and achievement in math. Studies found, for example, that children's self-concepts of math ability were more closely related to their parents' perceptions of the child's ability than to the actual grades the students earned (Frome & Eccles, 1998; Parsons, Adler, & Kaczala, 1982). The effects are important given evidence that children's self-perceptions also helped shape later career decisions (Bleeker & Jacobs, 2004). In addition to helping teachers improve students' self-perceptions of their math abilities, schools may need to help parents increase their understanding of and expectations for students' math achievement and progress.

Children performed better and continued further in mathematics if they participated in parent-child discussions about school and if their parents were active volunteers at the school or members of the PTA or PTO (Catsambis, 2002; Desimone, 1999; Ho & Wilms, 1996; Ma, 1999; Valadez, 2002). Although research has shown that math interventions rarely connect with students' families or the community, studies also suggest that doing so might be useful for improving student math achievement.

Challenges to Family Involvement in Math

There are at least two important reasons why family involvement is less common in math than in other subjects such as reading or language arts. First, math has been shown to be used differently at home and at school (Gonzales, Andrade, Civil, & Moll, 2001), but teachers have not been guided to take students' social contexts into account when planning math lessons or math homework. Second, most teachers have little or no pre-service or in-service education on how to involve parents with students to practice or extend math skills (Pressini, 1998) or to establish positive relationships and a climate of partnerships with parents or others in the community (Epstein, 2001; Chavkin, 1993; Gal & Stout, 1995; Hoover-Dempsey, Walker, Jones, & Reed, 2002; Shumow & Harris, 2000).

These gaps in teachers' knowledge and skills pose significant obstacles for educators in implementing effective school, family, and community partnerships for improving students' learning in mathematics. Two studies provide information that may help close these gaps. The first, a quasi-experimental study of interactive homework in the elementary grades, shows that teachers who assign activities that enable students to share math work with a parent help more

parents and students talk about math at home and help students earn higher math achievement test scores (Van Voorhis, 2007). The second, a study of parent-child interactions with mathematics, found significant variation in the ability of mothers to help their children, and concluded that school-family partnerships may be one way these inequities in children's experiences can be addressed (Hyde, Else-Quest, Alibali, Knuth, & Romberg, 2006). For this to happen, however, research is needed to identify a range of partnership activities that educators can implement and that are likely to help students meet math learning goals.

Theoretical Basis of Partnership

This study draws upon Epstein's (2001) framework of six types of involvement to characterize math involvement activities: (1) Parenting – Helping all families establish supportive home environments for children; (2) Communicating – Establishing two-way exchanges about school programs and children's progress, (3) Volunteering – Recruiting and organizing parent help at school, home, and other locations, (4) Learning at Home – Providing information and ideas to families about how to help students with homework and other curriculum-related materials, (5) Decision Making – Having parents from all backgrounds serve as representatives on school committees, and (6) Collaborating with the Community – Integrating resources and services from the community into students' experiences to strengthen school programs.

Theoretically, schools that organize and coordinate goal-oriented partnership practices and implement activities across the six types of involvement are more likely to engage families in productive ways and share the same goals at school and at home for students' success and achievement (Epstein, Sanders, Simon, Salinas, Jansorn, & Van Voorhis, 2002). Studies have shown that schools with stronger programs of school, family, and community partnerships have higher levels of parent involvement at school as volunteers and representatives on school governance committees (Sheldon, 2005; Sheldon & Van Voorhis, 2004). Strong partnership programs with activities for the six types of involvement focused on specific academic and non-academic goals have helped schools reduce student behavior problems, improve student attendance, and increase students' report card grades and standardized achievement test scores (Epstein, 2005; Epstein & Sheldon, 2002; Sheldon, 2003; Sheldon & Epstein, 2002; Sheldon & Epstein, 2004; Sheldon & Epstein, 2005a; Sheldon & Epstein, 2005b).

A Partnership Component of School Climate

The way school personnel interact and collaborate with families and the surrounding community may also affect school climate, which, in turn, influences student outcomes. School climate – the organizational characteristics that capture the tone or atmosphere of a school (Sweetland & Hoy, 2000) – has been associated with all aspects of school life including leadership style, sense of community, expectations for students, an ethos of caring, and a variety of student outcomes (Goddard, Sweetland, & Hoy, 2000; Gottfredson, Gottfredson, Payne, & Gottfredson, 2005; National Research Council, 2003; Sweetland & Hoy, 2000). Discussions of school climate often focus on students' perceptions of academic press, teachers' feelings of empowerment, levels of discipline and order, and organizational health.

These discussions about school climate tend to ignore whether or how the nature and extent of family and community involvement affects the school atmosphere. Yet, schools that are more welcoming to and inclusive of parents elicit reports from parents and teachers of more positive and academically-focused school climates (Desimone, Finn-Stevenson, & Henrich, 2000; Epstein, 2001). Further, at the school level, positive school-home relationships predict higher student achievement over time (Goddard, 2003). In addition to using family and community involvement activities to increase support at home for students' math learning, implementing effective partnership practices also may affect the school atmosphere and climate.

The importance for schools to investments in the development of stronger relationships with family and community partners has also been argued in relation to school improvement efforts. Schneider and Bryk (2002), for example, argued that schools and school reforms are most likely to be successful when there are strong and positive relationships between teachers, students, parents, and the community in which the school and families are embedded. Few studies, however, have explored the consequences for schools of having a strong and positive partnership climate

One study, by Giles (2006), looked at how three principals in urban schools improved school-family relationships as part of their leadership approach. In that study Giles (2006) described how each principal was instrumental in improving the school, and how school, family, and community partnerships were part of each one's comprehensive turnaround strategy. She also detailed some of the ways the principals, acting as transformational leaders, made professional practices available to parents, "as equal partners" (p.278) in order to improve the school culture. Giles argued that without leadership to involve families and the community in students' education, struggling urban schools are not likely to experience success.

Based on these studies, we argue that the partnership aspect of school climate reflects the extent to which schools and families perceive each other to be part of a shared community, the degree to which they share a value of and support for education, and the degree to which schools, families, and community partners work together and cooperate to help students learn and improve their schoolwork. Furthermore, we argue, this aspect of the school atmosphere may be associated with school outcomes. Unfortunately, little information exists about how family and community involvement activities contribute to a positive partnership climate or how this component of the overall school climate relates to school outcomes.

Research Questions

This study extends an earlier study of family involvement in math, which was seriously limited in the types of analyses that could be conducted because of the small number of schools involved (Sheldon and Epstein, 2005a). The present study, with a larger sample of schools, investigates how math-related family and community involvement activities contribute to schools' climate of partnerships, and how partnership climate affects students' proficiency on math achievement tests. Three research questions framed this study:

1. Which math-focused partnership activities are most commonly implemented in schools as they develop their programs of family and community involvement?
2. What is the relationship between the schools' implementation of partnership activities and climate of partnerships to school levels of student performance on math achievement tests?
3. How do math-related partnership activities connect to schools' partnership climates?

Method

Procedure

Schools in the National Network of Partnership Schools (NNPS) were sent a survey and asked to participate in a project exploring connections between school, family, and community partnerships and student performance in mathematics. As members of NNPS, the schools were interested in developing school-wide programs of school, family, and community partnerships through the creation of Action Teams, development of goal-oriented partnership plans, and implementation of involvement activities that use Epstein's six types of involvement (See Epstein, et al., 2002). At the time of the study, membership in NNPS was free and open to any

school interested in developing stronger partnerships with their students' family and community.

Schools were informed that participation in this study about math achievement was voluntary and required the chairperson of the Action Team to complete a short survey in the fall of 2001 and another in the fall of 2002. In exchange for full participation, schools chose a gift of the NNPS handbook (Epstein, et al., 2002) or a \$25 gift certificate for NNPS publications, products, or conference registration.

The baseline survey asked schools to report the math-focused family and community involvement practices they planned to implement to help improve students' math achievement, and the follow-up survey asked schools to report on the implementation of the practices they listed the previous year. In addition to the information collected about schools' partnership practices, respondents were asked to report their overall perceptions of the quality of the schools' partnership programs and on parents' support of that program. Also, schools reported the percentage of students who scored at passing or proficient levels on the state's standardized math tests during the 2000–2001 and 2001–2002 school years.

Sample

Baseline and follow-up surveys were obtained from 41 schools. Over three-quarters were elementary or K-8 schools (n=32) and the remaining nine were middle or high schools. Twenty-two schools (53.7%) were located in large urban or central city areas, whereas the others were in suburban (n=9), rural (n=3), or other urban (n=6) areas. Most schools (80%) received targeted or school-wide Title I funding. On average, schools reported that 28% of their students came from families where English is spoken as a second language at home, ranging from 0% to 91%. Also, on average, 62% of the students received free- or reduced-price meals (FARMs), ranging from 0 to 100 percent across schools.

Dependant Variable

School Math Achievement—The dependant variable for this study was school level student performance on states' standardized math achievement tests. Because the schools were located in different states and administered different achievement tests to students, all schools reported the *percentage of students who scored at or above satisfactory or "proficient"* on their math achievement test for a single grade level for the 2001 and 2002 school years. The most frequent grade levels for which math achievement was reported were third grade (n=8), fourth (n=13), and fifth grades (n=7). A few schools (n=7) omitted test scores on the follow-up survey. In these cases, the missing information about school levels of student proficiency on math achievement tests was obtained from the Internet, typically from the school districts' websites where these data are made public. The baseline and other scores provided by schools were also confirmed and checked for accuracy using publicly available data from the Internet and proved satisfactory. Achievement test scores could not be obtained or confirmed for 2 schools, making a final total of 39 schools in the analyses.

Independent Variables

Partnership Program Components—School representatives were asked to report on the implementation and effectiveness of 15 family and community involvement practices. The activities are:

1. Conducted workshops for parents that described and explained the achievement tests their children must take;
2. Offered workshops that helped parents understand how to work with their children at home to prepare for achievement tests;

3. Included math activities in school or classroom newsletters for parents to use at home with their children;
4. Sent home information about each child's progress in math between report cards;
5. Conducted conferences with parents to discuss how to help their children improve in math;
6. Hosted Math Nights to have family members and children work together on math problems and concepts;
7. Provided students opportunities to work on special math-science projects with a parent or other experts;
8. Connected business and community leaders with students as math mentors;
9. Provided family members information about how to contact their children's math teacher;
10. Held open house or Back-to-School nights where family members can meet teachers and see how math is taught at the school;
11. Used volunteers as math-aides in the classroom;
12. Assigned homework that requires students to show family members their work and talk about math concepts and problems;
13. Provided a lending library for students to take home math activities and resources;
14. Had parents meet with school and/or district leaders to discuss math education and school performance; and
15. Hosted a career day or event where community members talk to students about how they use math in their work or hobbies.

Respondents indicated whether or not each practice was enacted during the 2001–02 school year (0 = “no”, 1 = “yes”). From these reports, a variable was created for the *sum of partnership practices implemented*. Second, respondents rated the effectiveness of each practice implemented for promoting family and community involvement in students' math education. Respondents were provided a 4-point scale to rate each practice as “Not Effective” (1), “Somewhat Effective” (2), “Effective” (3), or “Very Effective” (4). Based on these reports, each practices had a *perceived effectiveness* score.

Average Effectiveness of Partnership Practices: A scale was constructed to estimate the perceived overall effectiveness of schools' partnership program. Schools ratings of practice implementation and effectiveness were combined to create a 5-point scale, ranging from 0 (not implemented) to 4 (very effective). The measure is the average score across the 15 items described above ($\alpha = .76$).

School Partnership Climate: Using a 4-point scale on the follow-up survey, school respondents indicated the extent to which they agreed or disagreed with the statement: “At this school, parents support the school's partnership program.” Respondents indicated whether they “Strongly Agree” (4), “Agree” (3), “Disagree” (2), or “Strongly Disagree” (1).

Data Analyses

Descriptive analyses were conducted to characterize the sample, levels of math proficiency, and relationships of the key variables of the study. Next, regression analyses examined which variables predicted school levels of math achievement in 2002. Because two years of data were collected, each school served as its own control in the analyses. Regression models controlled

for the school's poverty level (i.e., percentage of students receiving free- and reduced-priced meals) and the prior year's (2001) percentage of students scoring at or above proficient¹.

Finally, analyses explored whether schools' uses of math-related family and community involvement activities predicted ratings of schools' partnership climate, controlling for prior levels of math achievement and the percentage of students receiving free- or reduced-price meals. We also explored the relationships between practice implementation and effectiveness with partnership climate to better understand if and how schools' partnership program activities predicted climate ratings.

Results

Table 1 presents means, standard deviations, and zero-order correlation coefficients for the main variables in this study. Across schools, about 54% of students passed or scored at or above proficient on their state's math achievement test in 2001. This varied by school level, with elementary and K-8 schools reporting that 56.2% of students were at or above proficient in 2001, compared to 46.7% of students in secondary schools. These percentages increased in 2002 to 59.6% for elementary schools and 54% in secondary schools.

On average, the schools in this sample reported that they "agreed" with the statement that parents are supportive of their partnership efforts ($M = 3.21$, $sd = 0.62$). Also, schools reported implementing an average of 10 math-related partnership activities during the school year. This indicates that the schools were, in fact, trying to strengthen home-school-community connections in the interest of improving students' levels of math achievement.

The correlation coefficients in Table 1 show that school levels of student performance on math achievement tests are consistent from one year to the next. The percentage of students scoring at or above proficient in 2001 was strongly related to student performance in 2002 ($r = .767$, $p \leq .000$). According to the correlation analyses (not shown), elementary and secondary schools did not differ in their levels of math achievement in either 2001 or 2002, or on the other measured variables. However, schools with greater percentages of students receiving free- or reduced-price lunches reported lower percentages of students scoring at or above proficient on their math achievement tests in 2001 and 2002 ($r = -.584$, $p \leq .000$ and $r = -.607$, $p \leq .000$, respectively), and implemented a greater number of partnership practices ($r = .453$, $p \leq .005$).

The zero-order correlations in Table 1 indicate that some partnership variables were significantly associated with students' math performance at the school level. School ratings of the partnership climate was positively associated with levels of student performance on math achievement tests in 2002 ($r = .370$, $p \leq .022$). By contrast, the total number of partnership practices implemented and the average effectiveness of all partnership practices were not significantly related to school levels of student proficiency in either year. The average effectiveness of all partnership practices was positively associated with schools' ratings of their partnership climate ($r = .413$, $p \leq .010$).

Table 2 lists the 15 math-related partnership practices that schools may have implemented, organized by type of involvement. Some partnership activities were common across schools, whereas other practices were implemented by only a few schools. Six practices, mainly Type

¹Sometimes with count or rate data, Poisson or Negative Binomial regressions may be recommended because the distribution of the dependant variable is assumed to be skewed and predicted values will fall outside of the observed range of scores (Gardner, Mulvey, & Shaw, 1997; Long, 1995). In this study, however, school math achievement scores did not follow a Poisson distribution and the predicted values did not fall out of the observed range of values. Here, the error terms were normally distributed using a univariate kernel density estimation, with a constant variance (heteroskedasticity test, $p\text{-value} = 0.70$). Because the distribution of the dependant variable did not meet the assumptions for Poisson or Poisson-like methods and did meet important assumptions for linear regression analyses, we concluded that OLS regression analyses were appropriate for this study.

2-Communicating activities, were implemented by 30 or more schools. By contrast, only a few schools implemented Type 6-Collaborating with the Community activities to help students develop math skills, such as connecting business and community leaders to students as mentors and inviting community members to school to talk about how they use math in their work or hobbies. The patterns suggest that most schools were working to communicate with students' families, but were struggling to establish feasible and meaningful school-community partnerships in math.

Table 2 also reports the means and standard deviations for the effectiveness of each math-related involvement activity. Schools rated their family and community involvement activities between "somewhat effective" and "effective," with some noting the activities were well implemented and others reporting their efforts were "not effective" in promoting family and community involvement in students' math education. Among activities conducted by 20 schools or more, educators reported that family math nights, volunteer math-aides, and math projects that involve family or community partners were most effective in promoting involvement.

Table 3 uses OLS regression analyses to explore how schools' poverty levels, prior math proficiency, partnership program implementation, and perceptions of partnership climate predict school-level math performance. The first panel shows that schools' prior level of math proficiency in 2001 had a powerful effect on levels of math achievement in 2002 ($\beta = .639$, $p \leq .000$) and, when this variable is in the model the effect of poverty on school level math proficiency is marginal ($\beta = -.234$, $p \leq .073$). The next panel indicates that the addition of schools' ratings of the average effectiveness of their partnership practices did little to explain levels of math achievement. The final model shows that, even with the effects of poverty, prior math performance, and average partnership practice effectiveness accounted for, schools that reported more positive partnership climates had higher levels of math achievement in 2002 ($\beta = .274$, $p \leq .019$). The final model explained over 66% of the variance in schools' percentages of students proficient in math on state achievement tests, an increase of 5% of the explained variance in the prior models.

Given the finding that partnership climate was associated with school levels of math achievement, but the average rating of effectiveness of partnership practices was not, analyses explored the degree to which the implementation and effectiveness of math-related family involvement activities contributed to schools' ratings of partnership climate. Table 4 reports OLS regression analyses using prior levels of math achievement, levels of poverty, and the average effectiveness of partnership practices to predict ratings of partnership climate. The models in this table suggest that the percentage of students receiving free- and reduced-price meals and prior levels of math achievement do not explain schools' partnership climate in terms of parents' support for partnerships. The average rating of the effectiveness of math-related partnership practices, however, was significantly associated with ratings of partnership climate ($\beta = .404$, $p \leq .023$).

Further descriptive analyses in Table 5 reveal differences for schools between simply conducting math-related involvement activities and implementing the activities well. In all cases, the implementation of an activity was unrelated to perceptions of parents' support for schools' partnership programs. By contrast, for nearly all 15 activities, ratings of practice effectiveness were significantly or marginally correlated with the climate for partnerships measure of parents' support for their schools' partnership programs.

Table 5 shows that more effective implementation of several Type 2- Communicating activities were significantly associated with parents' support for schools' partnership programs, including parent-teacher conferences focused on math, back-to-school nights that inform

parents about how math is taught, math activities in school newsletters, workshops that explain state achievement tests, and information on students' progress in addition to report cards.

Discussion

With a larger sample of schools than in prior research and an enhanced set of math-involvement activities, this study revealed new connections of family and community involvement in math with school-level math performance. The study identified several math involvement activities associated with stronger perceived parental support for schools' partnership programs, which, in turn, helped explain school percentages of students who attained math proficiency. By linking specific math-related involvement activities to a general measure of partnership climate, we gain new information about how schools might improve their partnership climate and how positive relationships with parents may relate to levels of math achievement.

Investigation into the three research questions revealed that many schools may be focusing their partnership activities on communicating with families, although these were not perceived to be the most effective form of involvement activity for mathematics. Second, the perceived quality of a school's partnership climate is based upon the degree to which partnership activities were implemented well, more so than on how many practices were implemented. Finally, the analyses suggest that school-level math achievement from one year to the next is related to the partnership climate at a school. These findings are expanded upon in the following three conclusions.

1. Schools do not utilize all types of involvement to improve levels of student proficiency in math

In this study, data were collected from elementary and secondary schools about the range of family and community involvement practices they implemented to help students improve math skills. Consistent with reports using national datasets (U.S. Department of Education, 2001b) the schools in this sample reported near-universal implementation of school-to-home communications. The two least common types of involvement activities implemented in these schools were those using school-community collaborations to improve students' math achievement. These findings suggest that schools' connections with the community are rarely focused on improving student math achievement.

The low occurrence of math-focused community involvement practices is noteworthy because other studies report that school-community partnerships can help students experience academic success (Sanders & Campbell, 2007; Scales, Foster, Mannes, Horst, Pinto, & Rutherford, 2005). Sheldon and Epstein (2004), for example, found that schools connecting students to business and community partners reported a reduction from one year to the next in the percentage of students chronically absent from schools. Also, research has shown that use of community tutors can help improve student reading and levels of achievement (Wasik, 1998; Allen & Chavkin, 2004). In this study, interestingly, the practices that connect students to business mentors received the highest rating of effectiveness by the few schools that implemented. These ratings, along with the extant research, suggest the need for further investigation into the implementation and effects of math-focused school-community partnership activities.

2. In addition to implementing a range of partnership practices, educators also need to focus on the quality of the practices they implement

The bivariate correlations of the study's main variables indicated that the raw or total number of involvement activities conducted was unrelated to the percentage of math-proficient students in a given school. Other analyses showed that the quality of implementation was important in

whether math-related involvement activities were associated with perceived parent support for partnerships, which, in turn, was associated with higher math proficiency levels from one year to the next. Therefore, the quality not quantity of activities was central for understanding the complex connections of involvement and schools' percentages of math-proficient students.

This study suggests that specific, well-implemented activities that involve parents with children and teachers in math may be "building blocks" of a general measure of parents' support for partnerships. We expect that if this study had focused on students' reading or science test scores, the targeted actions to involve families with students in those subjects would also contribute to schools' climate of partnerships. Knowledge of these underlying dynamics may help researchers interpret findings when they are forced to use limited indicators of school climate or partnerships programs.

3. Having a strong partnership climate with families may help schools improve the percentage of students successful on math achievement tests

This study provides evidence that supports school leaders' efforts to develop a welcoming and supportive climate for students and their families. Although others have argued for greater attention to school-home relationships and climate as an avenue for improving schools (Bryk & Schneider, 2002; Giles, 2006), this study was able to demonstrate a connection between the measure of schools' partnership climate and school levels of achievement. After accounting for the effects of schools' prior levels of math achievement and the percentages of students receiving free- and reduced-price lunches, schools that perceived greater support from families for partnerships experienced higher rates of student math proficiency.

The findings from this study suggest a need for researchers to expand our definitions of school climate beyond traditional ideas of school and classroom norms of academic rigor or leadership style, to include a dimension related to school-home relationships. Several studies have shown that the nature of school-home and parent-teacher relationships is related to student and school achievement (Goddard, 2003; Hughes & Kwok, 2007). For the purposes of this study, we used educators' perceptions of parental support as an indicator of partnership climate in order draw attention to the fact that the degree to which schools supports families and families support school can have important implications for student outcomes. Further research into this topic is needed in order to more fully understand how school-home relationship function as an aspect of school climate and how this might translate into more positive student outcomes.

Limitations—Despite having a larger and more diverse sample than the previous study of family involvement and math proficiency (Sheldon & Epstein, 2005a), this study is still exploratory in its scope and nature. Future studies need even larger samples of randomly-selected schools to confirm or clarify the connections of schools' implementation of math-focused partnership practices, partnership climate, and levels and changes of students' math achievement. Although this study more than doubled the sample size of the earlier exploration, the analyses still were limited by sample size and the findings were, potentially, affected by the fact that schools voluntarily participated in the study.

Given the significant finding that the perceived partnership climate at a school predicted levels of math achievement from one year to the next, future studies should pursue the definition and measurement of this construct. This study used a single item to estimate the quality of relationships between home and school, providing a very general measure of partnership climate. Also, the climate measure was reported by school professionals, making this a measure of the schools' perspective. Future investigations into the role and relationship of partnership climate to school outcomes should develop a multi-item scale and collect data from multiple reporters (e.g., school administrators, teachers, parents, and students) on the school climate.

These studies should also collect longitudinal data in order to investigate the extent to which practice implementation affects school climate or vice versa.

Finally, this study is limited by its reliance on school level data. The results suggest that schools with stronger partnership climates have higher aggregate levels of student achievement, controlling for prior levels of aggregate achievement and student poverty. Future studies are needed that collect longitudinal data on partnerships and achievement at both the student and school levels. This would enable the use of Hierarchical Linear Modeling, which could help determine the extent to which school climate affects student learning and achievement in mathematics over and above prior achievement and other student-level covariates.

Despite its limitations, this study provides new insights into the importance of goal-oriented partnership practices. It suggests that schools that have a welcoming climate and strong parental support for the schools' partnership programs are significantly more likely than other schools to have higher percentages of students meeting state proficiency levels in math. Moreover, this study shows an explicit connection between partnership climate and the effective implementation of math-focused partnership practices. Unquestionably, schools and students need high quality instruction to improve math learning. However, if schools also create greater support for math among students, teachers, parents and others in the community, they are more likely to see higher levels of student achievement on math achievement tests.

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Zero-Order Correlations of School Background, Math Proficiency, Math Program, and Parental Involvement Measures

Table 1

	% FARM	2001 % Proficient	2002 % Proficient	Partnership Climate	Sum of Partnership Practices	Avg. Effectiveness of Partnership Practices
% Free- and Reduced-price Meals (FARM) ^a	---					
2001 % Proficient	-.584***	---				
2002 % Proficient	-.607***	.767***	---			
Partnership Climate	-.180	.179	.370*	---		
Sum of Partnership Practices Implemented	.453**	-.113	-.165	.118	---	
Avg. Effectiveness of Partnership Practices	.275+	.022	0.019	.413**	.847***	---
Mean	62.41	54.02	58.46	3.21	10.00	1.95
Std. Deviation	(33.01)	(20.09)	(21.73)	(0.62)	(2.34)	(0.65)

N = 39
^a n=37;
+ p ≤ .10,
* p ≤ .05
** p ≤ .01,
*** p ≤ .001

Table 2**Implementation and Effectiveness of Math-Focused Partnership Activities**

	Was the Practice Implemented?		How Effectively Implemented? Low (1) to High (4)	
	Yes	No	Mean	s.d.
<i>Type 1 – Parenting</i>				
Conducted workshops to help parents understand how to work at home with their children to prepare for achievement tests	24	15	2.87	0.74
<i>Type 2 - Communicating</i>				
Conducted conferences with parents to discuss how to help their children improve in math	38	1	3.08	0.66
Held open house or Back-to-School nights where family members can meet teachers and see how math is taught at the school	38	1	3.08	0.71
Provided family members information about how to contact their children's math teacher ^a	37	1	2.82	0.67
Sent home information about each child's progress in math between report cards	31	8	2.84	0.77
Conducted workshops for parents to explain achievement tests	24	15	2.84	0.85
<i>Type 3 - Volunteering</i>				
Used volunteers as math-aides in the classroom	23	16	3.22	0.73
<i>Type 4 – Learning at Home</i>				
Assigned homework that requires students to show family members their work and talk about math concepts and problems	37	2	2.70	0.77
Included math activities in school or classroom newsletters for parents to use at home with their children ^a	33	5	2.67	0.69
Hosted Math Nights to have family members and children work together on math problems and concepts	27	12	3.28	0.84
Provided students opportunities to work on special math-science projects with a parent or other experts ^a	20	18	3.22	0.65
Provided a lending library for students to take home math activities and resources	16	23	2.88	0.62
<i>Type 5 – Decision Making</i>				
Had parents meet with school and/or district leaders to discuss math education and school performance	22	17	2.91	0.75
<i>Type 6 – Collaborating with the Community</i>				
Hosted a career day or event where community members talk to students about how they use math in their work or hobbies	14	25	2.86	0.86
Connected business and community leaders with students as math mentors	6	33	3.50	0.55

N = 39 Schools;

^a = 38 schools

OLS Regressions of School Poverty, Prior Math Proficiency, Effectiveness of Partnership Practice, and Partnership Climate on % of Students Math Proficiency in 2002

TABLE 3

2-YEAR LONGITUDINAL MODEL					
	β	(t)	β	(t)	(t)
% free or reduced-price lunch	-.235	(-1.85) ⁺	-.280	(-2.01) ⁺	(-1.69)
2001 % math proficient	.639	(5.02) ^{***}	.604	(4.48) ^{***}	(4.40) ^{***}
Avg. Effectiveness of Partnership Practices			.092	(0.81)	(-0.25)
School Partnership Climate			.274	(2.47) [*]	
Adjusted R ²	.616		0.613		0.665

N= 39 schools

Standardized regression coefficients shown

⁺ p<.10,

^{*} p<.05,

^{**} p<.01, and

^{***} p<.001 levels of significance.

Table 4

OLS Regressions of School Poverty, Prior Math Proficiency, and Effectiveness of Partnership Practice on Partnership Climate

	β	(t)	β	(t)
% free or reduced-price lunch	-.008	(-0.04)	-.202	(-0.97)
2001 % math proficient	.293	(1.42)	.145	(0.72)
Avg. Effectiveness of Partnership Practices			.404	(2.39)*
Adjusted R²	0.033		0.154	

N= 39 schools

Standardized regression coefficients shown

*
p<.05

Table 5

Correlation of Math-Related Partnership Practice Implementation and Effectiveness of Activities with School Climate of Partnerships

Math-related Partnership Activities	Correlation with Climate of Partnerships	
	Practice Implementation (r)	Practice Effectiveness (r)
Connected business and community leaders with students as math mentors	.087 ns	.707 ^b ns
Conducted conferences with parents to discuss how to help their children improve in math	-.211 ns	.623* (p≤.000)
Conducted workshops to help parents understand how to work at home with their children to prepare for achievement tests	-.005 ns	.561* (p≤.004)
Hosted Math Nights to have family members and children work together on math problems and concepts	.030 ns	.546* (p≤.005)
Had parents meet with school and/or district leaders to discuss math education and school performance	.119 ns	.524* (p≤.012)
Conducted workshops for parents to explain achievement tests	.014 ns	.511* (p≤.011)
Assigned homework that requires students to show family members their work and talk about math concepts and problems	-.111 ns	.474** (p≤.004)
Sent home information about each child's progress in math between report cards	-.244 ns	.462* (p≤.010)
Held open house or Back-to-School nights where family members can meet teachers and see how math is taught at the school	NA ^a	.411* (p≤.012)
Used volunteers as math-aides in the classroom	.102 ns	.369+ (p≤.083)
Included math activities in school or classroom newsletters for parents to use at home with their children	.010 ns	.308+ (p≤.080)
Provided students opportunities to work on special math-science projects with a parent or other experts	.197 ns	.312 ns
Provided family members information about how to contact their children's math teacher	NA ^a	.292 (p ≤ .094)
Provided a lending library for students to take home math activities and resources	.229 ns	.162 ns
Hosted a career day or event where community members talk to students about how they use math in their work or hobbies	.024 ns	.431 ns

^aNo variation in implementation because all schools implemented this activity.

^bOnly 6 schools implemented this practice (n=6)