Jefferson County Public Schools
Feedback/Recommendation Report
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INTRODUCTION

The following report is based on the fourth round of data collection of the Vanderbilt University study of Middle School Mathematics and the Institutional Setting of Teaching (MIST). MIST is a five-year National Science Foundation funded project designed to support four large, urban districts, including Jefferson County Public Schools (JCPS), as they work to improve the teaching and learning of mathematics in the middle grades. Similar to the first three years of the study, our first step was to document JCPS's Theory of Action, which details JCPS's goals and strategies for improving middle school mathematics teaching and, ultimately, student learning and achievement. We documented JCPS's current theory of action by conducting interviews with District Leaders in the fall of 2010. A report describing our interpretation of JCPS's Theory of Action was submitted to the district on December 14th, 2010. This report is intended to build upon that Theory of Action report by providing feedback about how JCPS's plan to improve middle school mathematics teaching and learning is actually playing out in schools and classrooms.

We have recently completed the fourth annual round of data collection to document 1) the instructional practices and mathematics content knowledge of 33 mathematics teachers in seven middle-grades schools in JCPS and 2) the extent to which structures have been established in the seven schools to support the ongoing improvement of mathematics teaching and instructional leadership. We share our findings with JCPS in May of each year of the project in order to assist the district in refining its plans for supporting and improving mathematics instruction for the following academic year. We will know that our work is successful if our findings and recommendations can help JCPS adjust its plans for supporting and improving mathematics instruction.

The fourth round of data collection included the following:

1) Interviews conducted with ten District Leaders, including representatives from the Analytical and Applied Sciences Department, Office of the Superintendent, Office of Curriculum and Assessment, Office of Exceptional Child Education, Office of Accountability, Research, and Planning, English as a Second Language Program, and the Jefferson County Teachers Association (JCTA); seven principals and two assistant principals[1] from the seven participating schools; four district mathematics resource teachers; four staff developers, three school-based ("in-house") resource teachers, one highly-skilled educator from the state; and 33 teachers from the seven participating schools. The interviews focused on issues such as the participants' knowledge of the district's plans for improving mathematics instruction, their visions of high-quality mathematics instruction and of high-quality instructional leadership, their informal professional networks, the professional development (PD) activities in which they have participated, the people to whom they are accountable, the sources of

[1] We only interviewed the assistant principal at a school if s/he was the only administrator assigned to oversee the mathematics department. Because of the small number of assistant principals interviewed, we are unable to report on assistant principals' perceptions of supports in this report. We use the term school leaders when looking across principal and assistant principal data.

assistance on which they draw, and the curriculum materials they use in the classroom.
2) Surveys of the 33 focal teachers in the study that focused on quantifying issues described in-depth in the interviews.
3) Surveys of the seven participating principals and participating resource teachers to document their instructional leadership in mathematics.
4) Video-recordings of two consecutive[2] lessons involving a problem-solving activity for each of the 33 focal teachers.
5) Video-recordings of select mathematics-focused PD sessions in which the interviewed teachers participated.
6) Audio-recordings of select school-based collaborative planning meetings in which the interview teachers participated.
7) Assessment of the 33 focal teachers' and four district resource teachers' mathematical knowledge for teaching (using instruments developed by the *Learning Mathematics for Teaching* (LMT) project at the University of Michigan).

The findings presented below are based primarily on the interview data collected during the fourth round of data collection in January 2011. Surveys of the teachers and principals, videos of teachers' instruction, and the administration of the LMT took place during February and March 2011 and have yet to be analyzed.

JCPS THEORY OF ACTION OVERVIEW

Instructional Goals

JCPS has two broad goals for middle school mathematics instruction. The district's primary goal is to support teachers' development of inquiry-based instructional practices that engage students' natural curiosity, develop deep understanding of mathematical concepts, and emphasize critical thinking and problem-solving skills. As its second goal, the district seeks to ensure that all students meet ambitious learning goals, to be measured in part by student achievement on state assessments.

Strategies

The district is implementing four key support strategies to achieve its instructional goals for middle school mathematics: 1) improve Connected Mathematics Project2 (CMP2) implementation through district- and school-based teacher professional development, 2) develop and leverage instructional leadership to support mathematics teachers' implementation of inquiry-based instructional practices, 3) use formative assessments to adjust instruction to meet students' needs, and 4) assist low-achieving students through targeted interventions. In addition, this year JCPS designated some schools as priority schools, based on a range of criteria that include achievement scores and the percent of students receiving free or reduced price lunches. JCPS provided additional support to priority schools, including the prioritization of district resource teachers' time in priority schools and the hiring of priority managers who work with and advise the principals in their school improvement efforts. All of the schools participating in our study have been

[2] The two video-recordings are consecutive, when possible.

identified as priority schools. However, we did not collect enough data specific to this strategy to be able to comment on it in this report.

SUMMARY 2008-2011

Over the past four years, JCPS has shown improvement in several areas. First, our data show that school leaders and teachers are increasingly able to articulate a vision of high quality mathematics instruction that is aligned with the district's vision (e.g., they identify "problem-solving tasks," or "whole class discussions" as key aspects of high-quality instruction). However, most teachers and school leaders are yet to develop visions of instruction that specify the role of various features of instruction in supporting students' learning (e.g., why a concluding whole-class discussion in which students compare solutions supports students' learning).

Second, the depth of teachers' mathematical knowledge for teaching (as measured by the *Learning Mathematics for Teaching* instrument) showed slight improvement between 2008 and 2010. It started below the national average in 2008 and increased to be statistically equivalent to the national average in 2010.

Third, we have seen some improvement in the quality of classroom instruction from 2008-2010 (we have yet to analyze the 2011 videos), as measured by the *Instructional Quality Assessment* (IQA). Teachers generally introduce tasks that are potentially of high-cognitive demand during the "launch" phase of CMP2 lessons, (e.g., they are using CMP2 tasks that are challenging and require students to provide evidence of their mathematical reasoning). However, teachers typically lower the level of rigor of the tasks as they implement them. For example, teachers may lower the cognitive demand of tasks by suggesting that students follow a standard procedure to solve the problem. In other cases, teachers might skip the more challenging parts of the task that require students to explain their reasoning.

Nearly all teachers in our sample are including a concluding whole-class discussion (or a "summary") as part of their lessons. Additionally, the quality of whole-class discussions has improved over time. In 2010, the majority of teachers facilitated whole-class discussions in which students were encouraged to explain how they arrived at their solutions rather than just giving answers or responding to yes or no questions. However, in many classrooms, teachers did not support students in making connections between underlying mathematical ideas.

Although we have detected improvements in teachers' visions of instruction and mathematical knowledge for teaching, and in the quality of their instructional practices, there has been minimal growth in student achievement on the state assessment. We suspect that student success on the new Kentucky assessments (aligned with the Common Core State Standards) will depend more heavily on middle-school mathematics teachers' ability to implement the CMP2 curricula as envisioned by its developers.

JCPS is implementing a number of supports to help teachers improve their knowledge and practice, including district- and school-based professional development (e.g., resource teachers/staff developers, job-embedded professional development). In what follows, we describe how the supports for teachers', resource teachers'/staff developers', and school leaders' learning are playing out on the ground and will make recommendations regarding how JCPS might adjust these supports and their implementation to make them more effective. Throughout the report, we suggest that supports should be more tightly focused and coordinated in order to support more dramatic improvement in the quality of instruction, and thus student learning and performance on the state assessment.

We focus first on district-based and school-based professional development. We then report findings and recommendations around the work of resource teachers/staff developers. We also report our findings and recommendations for the district's formative assessment initiative in the first two sections of this report. Third, we discuss supports for principals' development as instructional leaders. Finally, we focus on supports for struggling students.

SUPPORTS FOR MIDDLE GRADES MATHEMATICS TEACHERS

District-Based Professional Development for Teachers

One of JCPS's main strategies for supporting teachers' improvement of their instructional practices is content-focused teacher professional development (PD). The aim of district-based PD is to support teachers in using CMP2 in ways that strengthen students' understanding of mathematical concepts and build students' ability to use mathematics to solve real world problems.

As in previous years, teachers were given the opportunity to attend a one-week training in CMP2 at Michigan State in summer 2010. This was available for any teacher who had not yet attended. About 20 teachers participated this year, which means that a total of about 60 JCPS teachers have participated in CMP2 training at Michigan State over the last three years. Since only a couple of the teachers in our study reported attending the CMP2 training this year, we are unable to report on teachers' perceptions of this training.

In Summer 2010, JCPS offered a four-day PD conference entitled "Magic in the Middle" for all middle-grades teachers. Teachers could choose which sessions to attend. Math-specific sessions included ones that focused on the use of questioning techniques in CMP2 and the Common Core Standards. More than half of the teachers we interviewed reported attending Magic in the Middle, and many of those who did not attend were new teachers who were hired too late in the summer to attend. Teachers who attended reported that they appreciated being able to choose sessions and that the sessions were of high quality. In particular, new teachers who attended a session in which participants acted as students and were taught a CMP2 lesson found it very valuable.

Magic in the Middle also included the launch of two district-wide math-specific professional learning communities (PLCs)—one focused on using formative assessment

with CMP2 and one focused on special education and CMP2 (consisting mostly of teachers certified in special education who teach mathematics). These two district-wide PLCs included up to 30 teachers (10 teachers per grade level) and met for six hours at Magic in the Middle, and were then to meet three additional times during the 2010-2011 school year. Teachers who attended the Magic in the Middle formative assessment session reported that they found it useful because they learned strategies (e.g., bell ringers, exit slips, self-assessment tools) that they have been able to implement in their classrooms. Five of the teachers in our study participated in the formative assessment district-wide PLC, and one teacher participated in the special education district-wide PLC. They all spoke very positively of the district-wide PLCs. The teachers who participated in the formative assessment PLC reported these sessions helped them with setting learning targets and with giving effective feedback to their students.

JCPS also offered "just-in-time" PD sessions on CMP2 units throughout the school year. Just-in-time sessions took place after school at locations across the district and were each led by a teacher-facilitator. The teacher-facilitator selected investigations in upcoming CMP2 units that were likely to be challenging for students and/or teachers, and participants worked through the mathematics problems together to prepare for the upcoming unit. Almost half of the teachers interviewed report attending at least one just-in-time session, and many of those who attended were new to teaching CMP2 this year. The just-in-time sessions appear to provide an important support for teachers who are new to the curriculum. Those who attended generally reported that the sessions were very useful in planning for instruction. Participants also consistently reported that having a facilitator who was an experienced teacher of CMP2 was particularly valuable.

School-Based (Job-Embedded) Professional Development for Teachers

School-based teacher professional development is another key JCPS strategy for supporting teachers in implementing CMP2 effectively. In this report, we refer to time scheduled for teachers to collaborate on issues of instruction as *job-embedded professional development (PD)*.

We found that mathematics teachers in all the schools in our study met to work on issues central to instruction at least once per month. However, the frequency and duration of these meetings varied significantly across schools. Depending on the school, teachers met together in math department meetings, during common planning time, or in specially scheduled meetings of mathematics teachers where substitutes were provided to cover the teachers' classes. The length of time that teachers reported collaborating on issues of instruction ranged from 15 minutes in a department meeting (after administrative matters have been addressed) to several hours in schools where teachers were pulled out of their classes. For example, in some schools teachers are provided with two to three hours of job-embedded PD (led by resource teachers) about once every six weeks, and their classes are covered by substitute teachers. There are also a few schools in which teachers are provided with common planning time; in these schools, math teachers generally meet 1-2 times per week. Additionally, some schools supplement regular math department meetings with meeting in grade-level groups every 1-2 weeks; teachers at these schools

generally reported that these meetings were beneficial in planning for instruction as long as at least one teacher in the grade level had experience teaching CMP2.

The activities in which teachers engage during job-embedded PD vary somewhat by school and by grade levels (within schools). In the majority of schools, teachers reported that they spent time discussing the newly implemented Diagnostic Assessments (DAs) and Proficiency Assessments (PAs). (Teachers are expected to administer a DA mid-way through each CMP2 unit to assess students' progress and adjust their instruction. Teachers are expected to administer a PA at the end of the unit to provide a summative assessment for each CMP2 unit and to predict how well students are likely to perform on related objectives on the state assessment at the end of the year.) Resource teachers and staff developers led this work with groups of teachers. The frequency and the amount of time spent examining these data varied across schools, depending on how often teachers were provided with time to meet. Teachers indicated that work with data included the following: ensuring teachers are on pace in administering the assessments, sharing forms for data entry, analyzing data together and determining ways to adjust instruction, and planning re-teaching strategies.

In addition to examining student assessment data, the most common activities that groups of teachers reported engaging in include discussing pacing and coverage, aligning core content with CMP2, sharing instructional materials, writing learning targets in student friendly teams, and discussing questions to use for formative assessment.

Although we consider the activities described above to be important, on their own, they are not likely to support teachers' development of more sophisticated instructional practices. Research on supporting groups of mathematics teachers' learning suggests that activities that focus on a core set of instructional principles (e.g., identifying the key mathematical ideas of a lesson or sequence of lessons, planning how to launch a specific task without lowering the cognitive demand, anticipating student solutions to a specific task) are likely to support improvement in teachers' practices.

(We report on recommendations specific to professional development for teachers after the next section, Mathematics Resource Teachers and Staff Developers.)

MATHEMATICS RESOURCE TEACHERS AND STAFF DEVELOPERS

District-based mathematics resource teachers (RT) are expected to serve as a primary source of expertise in schools for mathematics instruction. RTs' main responsibility is to plan a growth trajectory for each school, based on an assessment of the quality of mathematics instruction in the school. Rather than responding to individual requests from school-site personnel, RTs are expected to develop coordinated, intentional plans to support the school's improvement. In this context, RTs are expected to facilitate school-based embedded professional development that focuses on supporting teachers in using CMP2 effectively. RTs are also expected to analyze data and support formative assessment efforts (as described above in the school-based PD section of the report). In addition, they are expected to follow up with teachers who attend district professional

development (including the Michigan State CMP2 training) by asking how well the session(s) fit their needs, whether they have implemented what they learned in their classrooms, and whether they need additional help with implementation. For the 2010-2011 school year, the number of schools for which each resource teacher is responsible has been reduced to about three schools, one of which has been designated a priority school.

This year, the position of staff developers (SD) was created in some schools, thereby reducing the number of schools served by each resource teacher. This newly created position was funded by the G.E. Initiative. Schools applied for the position by submitting a proposal that outlined how the SD would work to benefit the school's mathematics program. As a consequence, the role of SDs varies across schools. Overall, however, the expectations for their work are similar to those of RTs (with the key distinction that SDs are school-based and thus only responsible for one school while RTs are district-based and responsible for several schools).[3] In addition, some schools have funded an in-house mathematics resource teacher.

The majority of the schools in our study are served by a district RT or school-based SD. In addition, almost half of the schools in our study also have an in-house mathematics resource teacher on staff, hired at the school-level. However, in this section, we restrict our focus to district RTs and SDs for the most part.

Our findings indicate that district RTs have expertise in mathematics instruction. District RTs have higher mathematical knowledge for teaching (as measured by the LMT) than teachers and their visions of key components of high-quality mathematics instruction are much more elaborate and sophisticated than teachers' visions. For example, in contrast to most teachers in our study, district RTs describe how particular elements of instruction (e.g., the use of cognitively demanding tasks, concluding whole-class discussions) can be organized to support students' learning of key mathematical ideas. However, there is much greater variation in school-based SDs' and in-house resource teachers' expertise (mathematical knowledge for teaching, vision of high-quality math instruction). SDs' and in-house resource teachers' mathematical knowledge for teaching and visions of high-quality mathematics instruction are generally somewhat more developed than that of the teachers participating in our study.

District RTs described their role in ways that are compatible with district expectations (e.g., providing job-embedded PD, helping teachers analyze data, and documenting what they do in schools). However, only a minority of district RTs mentioned that their role included developing growth plans for their schools. SDs' descriptions of their role varied across schools (e.g., providing teachers with materials, providing job-embedded PD, observing teachers, following up on district PD). However, this variation makes sense given that SDs are hired at the school level.

[3] In the case that a school is not assigned a resource teacher or staff developer, a district-based resource teacher is "on call" to assist, should the school request help.

Our findings indicate that District RTs did not encounter challenges gaining legitimacy with teachers or school leaders this year. None of the RTs we interviewed were new to the role and most had already developed positive relationships with many of the teachers in their schools they serve. On the other hand, some SDs have experienced challenges in gaining legitimacy with teachers and in balancing the expectations of district leaders with those of their principal. However, SDs who previously held in-house resource teacher positions reported less of a challenge in gaining legitimacy and negotiating their responsibilities with principals.

Based on teachers and RTs'/SDs' reports, it appears that RTs and SDs generally spend more time working individually with teachers than with groups of teachers. Overall, our findings suggest that the extent to which RTs and SDs work with groups of teachers varies, depending on how time for teachers to collaborate on instruction is organized in the school. For example, about half of the RTs/SDs were only able to meet with groups of teachers about once every six weeks (i.e., either in after-school meetings or during a full-day pull-out session). In those cases, RTs and SDs tend to work more frequently with individual teachers than with groups of teachers. In the other half of schools, in which there was common planning time, RTs and SDs generally had more frequent access to grade-level groups of teachers. In many cases, RTs and SDs worked individually with teachers during common planning time. (We described the activities in which RTs and SDs engage groups of teachers above in the job-embedded PD section.)

When RTs and SDs work individually with teachers, the most common activities include 1) co-planning for instruction, 2) observing instruction and providing feedback, and 3) co-teaching. Co-planning takes different forms. In some cases, the RT/SD and a teacher co-plan what to include in a second mathematics class (there is no district curriculum for such classes). In other cases, the RT/SD and a teacher co-plan a particular lesson that the RT/SD then observes and discusses with the teacher afterwards. We view this use of co-planning (in the context of preparing for observation and feedback) as likely to support teacher learning because the work focuses on a particular lesson and grounds a discussion of how the teacher might improve instruction in subsequent lessons.

Many RTs/SDs and teachers also report engaging in co-teaching. We view co-teaching as a potentially useful support for teacher learning. Co-teaching provides an opportunity for a teacher to work directly with a more experienced and knowledgeable teacher on developing specific instructional practices (e.g., launching a cognitively demanding task without lowering the rigor, orchestrating a concluding whole-class discussion). Unfortunately, our findings indicate that when RTs/SDs co-teach, the intent is often to provide an extra pair of hands in the classroom, allowing the teacher to work with smaller groups of students, or to provide students with practice on test-taking strategies (e.g., "Live Scoring" of open response questions) rather than to support teacher learning.

District RTs and SDs participate in the same weekly district-based professional development activities on Fridays. Friday PD activities rotate on a six-week cycle and are varied. The Friday PD activities most frequently reported include analyzing teacher questioning and strategies in video cases, formative assessment (e.g., how to analyze DA

results and how to use data analysis forms), the vertical alignment of content, core content standards, how to meet needs of students identified as low achieving, and intervention strategies. The RTs and SDs varied in how useful they found this PD to be; while most describe the PD as helpful, criticisms include lack of cohesiveness and lack of differentiation based on years of work experience.

In addition to Friday PD, district RTs attended CMP2 PD in Michigan, and they received PD on Cognitive Coaching the previous summer. In general, they found the CMP2 PD helpful in developing a deeper understanding of the curriculum. RTs also reported that they found the Cognitive Coaching PD to be useful when working with teachers. Several SDs mentioned that they felt the Friday PD lacked a focus on how to coach teachers and said they would like to participate in Cognitive Coaching PD.

Recommendations (Supports for Teachers and Resource Teachers/Staff Developers)
The supports provided over the past four years to support the implementation of CMP2 have led to wide spread acceptance of this challenging curriculum by teachers. As we reported above, district-based PD is received favorably by teachers. However, school-based PD is highly variable in its frequency, duration, and focus. The emphasis on adjusting instruction based on assessments of student understanding is crucial and appears promising. However, much of the work does not appear to focus directly on supporting teachers to develop increasingly accomplished forms of practice.

Based on the findings reported above and on current research in mathematics teacher professional development, our *first recommendation* is that the district- and school-based PD should be organized in a coordinated manner around a focal set of high-leverage instructional practices. We conjecture that the tight coordination of district-based and school-based supports around a small set of key practices is likely to support teachers' development of both a deeper understanding of the core principles of the curriculum and more effective instructional practices.

Based on our analysis of teachers' instructional practices, we would suggest that PD focus on helping teachers identify the cognitively demanding aspects of tasks in CMP2 and on how to maintain the rigor of tasks through the three phases of the lesson: launch, explore, and summarize. For example, teacher PD in the 2011-2012 school year might focus on launching CMP2 tasks to support all students' productive engagement while simultaneously maintaining the cognitive demand of the tasks. PD in subsequent years might focus on whole class discussions in the summarize section of the lesson, with an emphasis on identifying the key mathematical ideas that should come to the forefront in discussions, questioning to press for conceptual explanations from students, and helping students make mathematical connections.

More generally, we suggest that the district continue to provide district-based PD for teachers to support the development of high quality mathematics instruction that aligns with CMP2, including district-wide conferences, PLCs, and just-in-time PD. However, we suggest the district-based PD focus on the focal set of practices. For example, just-in-time PD might explicitly focus on identifying the mathematical goals of particular lessons

in order to plan a launch that provides students with access to the task without lowering the cognitive demand.

Job-embedded professional development, or time for teachers to collaborate on issues central to instruction, is a potentially important support for instructional improvement. However, the extent to which job-embedded professional development supports teachers in improving the quality of instruction depends crucially on the types of activities in which teachers engage during that time. In addition to directly linking the content of job-embedded PD to district-wide PD (i.e., focus on the same focal set of practices), we suggest that it include a high proportion of activities that are likely to support teacher learning. Activities of this type include doing mathematics problems and comparing solution strategies, analyzing student work and classroom video-recordings, and debriefing challenges in implementation. Recent research also indicates that job-embedded PD is a useful setting for teachers to "rehearse" complex practices (e.g., launching a task without lowering the cognitive demand or orchestrating a whole class discussion given a set of student solutions in a controlled environment).

Our *second recommendation* is that job-embedded PD be organized such that teachers have frequent opportunities to meet as a whole department *and* by grade-level. We view meeting as a whole department and then breaking out into grade-level groups as having the greatest potential to provide opportunities for teacher learning. Meeting as a whole department can establish consistency in what teachers are working on instructionally (e.g., discussing key aspects of launching tasks without lowering the cognitive demand). It also provides opportunities for teachers to talk about the development of mathematical ideas across grades with more experienced and expert colleagues (who might not be assigned to their grade level). However, there are also benefits to collaborating around issues of instruction by grade level. It provides teachers with opportunities to focus more specifically on key elements of instruction (e.g., the development of mathematical ideas across a sequence of lessons, anticipating students' solutions to a particular task). For example, teachers might co-plan and rehearse how to introduce a particular task. After teaching that lesson, they could then reflect on the outcomes and adjust their plans for future instruction.

Our *third recommendation* concerns the leadership of job-embedded PD. Our findings and those of other studies indicate that the extent to which job-embedded PD supports teachers' learning depends crucially on the expertise of the facilitator(s). As described above, the RTs are the most expert in terms of their visions and knowledge for mathematics teaching, and they have considerable experience in supporting teachers' learning. Our findings indicate they are also recognized as experts by teachers. We therefore suggest that district RTs and SDs give priority to leading groups of mathematics teachers to work together on issues central to improving the quality of instruction. Given that RTs are few in number, we suggest that priority continue to be given to SDs leading work with groups of teachers as well. However, as we indicated above, our findings indicate that SDs are not much more expert in terms of their visions of instruction or mathematical knowledge for teaching than their fellow teachers. Therefore, they will need significant support to effectively lead groups of teachers (see recommendation 5).

Our *fourth recommendation* concerns RTs' and SDs' work with individual teachers. We suggest that the district provide more specific guidelines about how RTs and SDs can best spend their time when working individually with teachers. We recommend that priority be given to improving a focal aspect of teachers' instruction. For example, they might work together to co-plan a particular phase of a lesson (e.g., a launch), co-teach the phase together, and then de-brief afterwards in an effort to improve the same phase of subsequent lessons. In contrast, serving as an extra pair of hands is unlikely to improve teachers' instructional practices.

Our *fifth recommendation* concerns PD for RTs/SDs. We recommend that the content of the math-related PD for RTs/SDs (and school leaders) be tightly aligned with the focus of math teacher PD. For example, if PD for teachers, RTs/SDs, and school leaders all focus on the same aspect of instruction (e.g., launching CMP2 tasks effectively, conducting high quality whole class discussions during the summarize phase of lessons), then RTs/SDs (and school leaders) would be in a better position to support and press teachers to improve these specific aspects of their instruction in a coordinated manner. Furthermore, if RTs/SDs led job-embedded PD with the same focus, then they would be better positioned to focus their individual work with teachers on these specific aspects of instruction. In addition, PD for RTs/SDs should emphasize how to lead and support the learning of groups of teachers as well as how to effectively support individual teachers' learning.

PRINCIPALS AS INSTRUCTIONAL LEADERS

The district expects that principals, district RTs, and SDs will share responsibility for school-level instructional leadership for mathematics. In this section, we focus on principals as instructional leaders. Principals are expected to understand and advance the district's vision for middle school mathematics. Specifically, they are expected to communicate district expectations to teachers, monitor the depth of implementation of the curriculum, and support the improvement of teachers' instructional practices. Additionally, principals are expected to support school-based professional development by developing a school schedule that allows for embedded PD, providing regular collaborative time for math teachers, and encouraging teacher participation in professional learning communities. Finally, principals are expected to coordinate instructional leadership at the school site by facilitating collaboration between the district resource teacher assigned to the school, the math lead, and the school's instructional leadership team.

The descriptions that all school leaders we interviewed gave of high quality mathematics instruction were aligned with the district's *Vision for Mathematics Teaching*. This indicates a greater understanding of inquiry-based mathematics than was the case last year. Their descriptions of math instruction typically emphasized that students should explore problems that allow for multiple solutions and that teachers should facilitate this process. Similar to last year, principals indicated the importance of student discussion, but continued to vary in their understandings of the function of discussion in supporting

students' learning. A minority of principals expressed the importance of essential math skills and success on assessments.

Although the principals' descriptions of high quality math instruction align with the district's vision, a tension could easily develop between improving learning outcomes in the short-term (e.g., raising test scores) and improving the quality of instruction in the long-term. This year, a majority of the principals we interviewed reported a district expectation to raise test scores, a marked increase from last year when it was mentioned infrequently. In contrast, less than half of the principals reported they were expected to be in classrooms, and only a small minority reported that they were expected to ensure that teachers implement the curriculum with fidelity. Our experience in working with other districts indicates that, in the context of high-stakes testing, it is important that district expectations for principals foreground the principal's role in improving classroom instruction.

Teachers in all of our study schools reported being observed by one or more school leaders and receiving feedback. However, the frequency of observations ranges from weekly to once every six weeks, and duration of observations ranges from a few minutes to a full class period. There is also considerable variation in the quality of feedback both within and among schools. In most schools, school leaders divide evaluation responsibility by grade (e.g., 6^{th} grade team, 7^{th} grade team). As a consequence, several school leaders conduct mathematics classroom observations, and no single school leader has primary responsibility for mathematics instruction.

Similar to last year, much of the feedback teachers report receiving is not content specific (e.g., whether learning objectives are posted on the board, whether the teacher is working with students and walking around the classroom, classroom management, student engagement, amount of time spent on various parts of the lesson). Only a few school leaders also provide feedback around core aspects of instruction such as questioning strategies. In general, the content of the feedback seems unlikely to support teachers' development of instructional practices that are consistent with the district's goals. While it is important for school leaders to provide feedback on issues of management, we suspect that additional press on key aspects of mathematics instruction is necessary to support the effective implementation of CMP2.

There was variation in principals' descriptions of the role of the district RT, SD, and in-house resource teacher. Principals' expectations for RTs/SDs/in-house resource teachers included providing resources, helping teachers improve instruction by working with them in the classroom (model, co-teach, observe instruction and give feedback), helping with lesson planning (including pacing), providing job-embedded PD for teachers, supporting teachers in examining student performance data, helping struggling students in pull-out instruction, and planning intervention classes. RTs and SDs indicated that principals are supportive. However, they also reported that they do not work closely with the principals in their schools, in part because most do not have regularly scheduled meetings with the principal that focus on mathematics instruction. The district expects that principals will facilitate collaboration between the district resource teacher assigned to the school, the

math lead, and the school's instructional leadership team, but we did not find evidence that this is happening.

Most principals did not attend math-specific PD because district-led professional development has focused on science this year, although a minority mentioned attending a mathematics specific session during the "Magic in the Middle" PD. Several principals also referred to the math-specific Vanderbilt PD conducted in 2009.

Recommendations

Principals and assistant principals need to continue to develop a deeper understanding of high quality math instruction if they are to support instructional improvement effectively. Our *sixth recommendation* is therefore that school leaders receive PD that is aligned with teacher and RT/SD PD and that focuses on a small number of high leverage instructional practices (e.g., launching CMP2 tasks effectively, conducting whole class discussions). The goal of this PD should be to 1) improve their visions of high quality instruction, 2) help them to support the work of the RTs/SDs, and 3) enable them to press for instructional improvement by communicating CMP2-specific instructional expectations by providing constructive feedback to teachers. We also recommend that RTs and SDs participate in this PD with their school leaders in order to foster the development of shared responsibility for instructional improvement. This PD would also be an excellent setting for district leaders to clarify the role of the RT/SD with principals.

Given the inconsistent nature of the feedback that teachers are receiving, our *seventh recommendation* is that each school designates a school leader (principal or assistant principal) who is primarily responsible for mathematics. This person would have primary responsibility for classroom observation, evaluation, and support for all mathematics teachers. In addition, we would recommend that this school leader work closely with the RT or SD and attend mathematics department meetings and school-based professional development. We also suggest that the school leader who is responsible for mathematics collaborate with their resource teacher or staff developer to ensure that regularly scheduled embedded PD activities focus on helping teachers improve their CMP2 instruction.

INTERVENTIONS FOR LOW-ACHIEVING MATH STUDENTS

The district aims to support low-achieving middle school mathematics students through interventions targeted to improve their mathematics achievement. Middle schools throughout the district employ several interventions to support students who are identified as low-achieving based on test scores (including both state assessments and district diagnostic and proficiency assessments) or who are in danger of failing classes.

One strategy is the deployment of intervention teachers who work with groups of struggling students. We found that the responsibilities of intervention teachers varied across schools. In some schools, intervention teachers taught second mathematics classes, in other schools they supported individual groups of students in the classroom, whereas in

still other schools they pulled individual students identified as needing greater support out of the classroom.

A second strategy is the use of the district-purchased, computer-based tutorial program, SuccessMaker®. The use of SuccessMaker® also varied across schools. Teachers in five of the seven schools in our study reported using SuccessMaker with struggling students. However, there was variation in how these students were identified (e.g., the previous year's state assessment, teacher reports), when they should use the program (e.g., as part of a second mathematics class, in lieu of a related arts class), and for how long (e.g., six-week period, indefinitely).

In addition to intervention teachers and computer-based tutorial programs, we found that all seven schools in our study offer a second mathematics class for low-achieving students. The second mathematics classes are generally taught by an intervention teacher or by grade-level math teachers. Teachers reported that there is no district-wide curriculum and little guidance has been given about what to do in second mathematics classes. Teachers in most of the study schools reported searching for materials or adapting their own materials, often on a week-by-week basis. At some schools, content is determined by looking at data from DAs and PAs, whereas in other schools the instructor determines the content by collaborating with the mainstream CMP2 teacher. In a couple schools, teachers do not create materials but instead require students to work on SuccessMaker until they are above grade level as measured by SuccessMaker.

Recommendations

Given the prevalence of second mathematics classes, and the challenges teachers face in determining the focus of the classes and in finding suitable materials, our *eighth recommendation* is that the district develop a district-wide strategy for second mathematics classes, including a suggested curriculum. Admittedly, the research base on how to organize second mathematics classes is thin. In our view, the goal of second mathematics classes should be to enable struggling students to succeed in mainstream CMP2 classes. We suspect that most supplemental instruction focuses on procedural competencies. Although we view developing procedural competencies as crucial, it would be more advantageous to students if the content of the second mathematics class was deliberately coordinated with the content of the mainstream CMP2 class (e.g., focusing on skills necessary to engage productively in upcoming CMP2 lessons) and if expectations were consistent across the two classes (e.g., providing mathematical reasoning, comparing solution strategies). We suggest that district RTs be involved in the development of such a strategy, as they have considerable experience in working with struggling students and are familiar with these students' needs.

Developing a consistent approach for second mathematics classes will necessarily require professional development for teachers specific to supporting struggling students. Throughout this report we have suggested the importance of organizing teacher PD around a set of focal instructional practices. We suggest that teachers of second mathematics classes also would benefit from additional, on-going PD that centers on the

specific instructional materials they will use in the second mathematics classes, typical student difficulties in particular mathematical domains, and how to address those difficulties in ways that are oriented toward developing both conceptual understanding and procedural fluency. We view the DAs and PAs as key resources for identifying student difficulties given their alignment to CMP2.

CONCLUSION

JCPS has implemented a number of supports to help teachers improve their knowledge and practice, including district and job-embedded PD and RTs/SDs. Our findings indicate that JCPS teachers have improved in their visions of mathematics instruction, their mathematical knowledge for teaching, and the quality of their instructional practices. However, these findings also indicate that teachers need more explicit support on specific aspects of instruction (e.g., how to launch cognitively demanding tasks without lowering the rigor, how to orchestrate concluding whole-class discussions that further students' conceptual understandings of key mathematical ideas). We have therefore recommended that all forms of teacher PD focus on a small number of high-leverage teaching practices that contribute to the effective implementation of CMP2. We have also recommended that the content of the mathematics-related PD in which RTs/SDs and school leaders participate should be tightly aligned with the focus of teacher PD, thereby enabling RTs/SDs and school leaders to support and press teachers to improve their instruction in a coordinated manner. Given the improvements we have documented over the past four years, we are hopeful that with a greater alignment of the supports for various role groups (i.e., teachers, RTs/SDs, school leaders), JCPS teachers will continue to improve the quality of their instructional practices, thus realizing JCPS's goals for student learning and achievement.