MATHEMATICS CURRICULAR DECISION-MAKING:

THE NATIONAL LANDSCAPE

SURVEY HIGHLIGHTS

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I. INTRODUCTION

Inverness Research Associates has served as the external evaluator for the K-12 Mathematics Curriculum Center (K-12MCC) at EDC for the past three years. As the sole implementation and dissemination center supporting all twelve of the NSF-funded mathematics curricula for grades K-12, the K-12MCC offers a diverse menu of services related to the selection and use of "standards-based" mathematics curricula. The focus of the evaluation has been two-fold: 1) to study the nature and impact of the Center's work, and 2) to document the realities of the field the Center serves. As part of the latter focus, Inverness conducted a nation-wide survey of mathematics curriculum decision makers for grades K-8 in the spring of 2001. The study was designed to complement a similar one[1] that focused on curricular decision-making in high school mathematics, conducted under the auspices of the COMPASS implementation center, which has a similar mission to the K-12MCC but serves only grades 9-12.

In both studies – K-8 and high school – Inverness Research designed a survey instrument aimed at documenting the status of the mathematics education across the United States in terms of mathematics curricula and the curricular decision-making process. In particular, the surveys posed questions about how school and district leaders think about curricular decisions, how curricula are actually chosen, who makes these decisions, what factors contribute to these choices, and what values or beliefs influence the process. The data enable us to portray what we refer to as the "mathematics curricular decision-making landscape."

This report summarizes the general findings from the survey conducted for the K-12MCC, targeting grades K-8. It also includes references and comparisons to the COMPASS high school study whenever the inclusion of high school data is feasible and affords a more complete perspective on the topic at hand. Survey graphs clearly identify which data sources they represent.

Following a description of the data collection process, the summary of findings is organized around the following questions that provided a general framework for the survey:

- How are mathematics texts used?
- How satisfied are math leaders with their current programs and texts?
- What is the current level of interest in changing the mathematics program?
- How are mathematics curricula selected by districts and schools?
- What factors influence the choice of mathematics curriculum materials?
- What is the stance of respondents and their districts towards mathematics reform?

[1] See the report *High School Mathematics Curricular Decision-Making: A National Study of How Schools and Districts Select and Implement New Curricula,* Inverness Research Associates, Winter 2000, http://www.inverness-research.org/reports/ab_compassmonog.html

- What is the level of familiarity with elementary and middle school math textbooks and materials?
- What is the level of awareness and familiarity with the NSF-funded Curriculum Implementation Centers?

The report concludes with a brief discussion of the implications of these results for the larger field of mathematics education and curriculum implementation.

II. DATA COLLECTION

The Survey

In May 2001, Inverness Research administered a survey to 12,000 elementary and middle school mathematics education leaders. Survey recipients were drawn from three categories – NCTM members (2,290), supervisors of K-8 mathematics randomly selected from the NCSM list (3,158), and mathematics department chairs and school principals randomly selected from the NCES database (6,052). To keep the length of the survey short, and to gather data on a wide range of questions, we designed six different versions of the survey, each with different questions. Copies of the survey versions can be found in Appendix A of this report. In this way we were able to cover the entire mathematics curricular decision-making landscape. Each version was mailed to 2,000 recipients across the groups listed above.

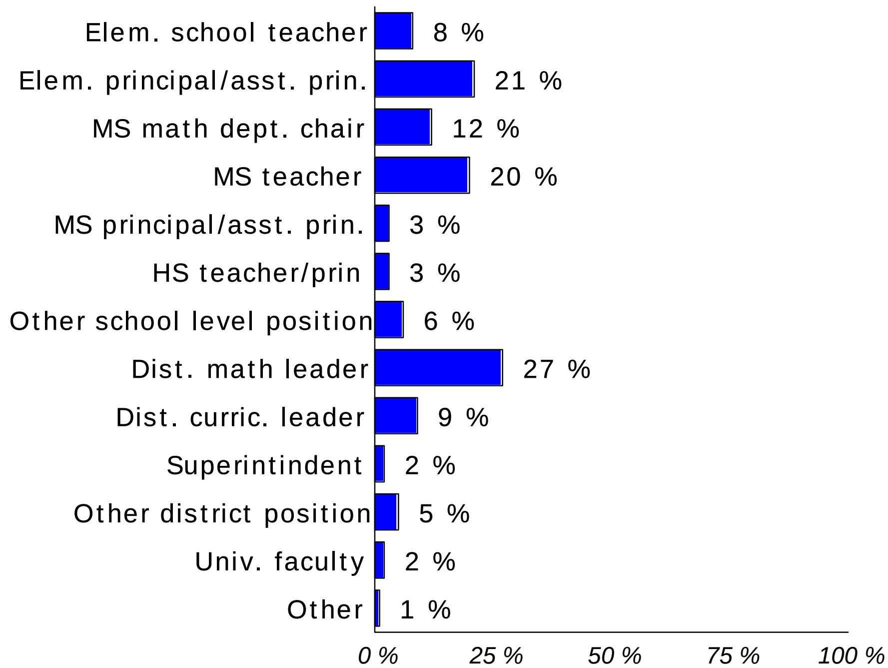
The Respondents

Response rates[2] remained relatively consistent across all six forms of the survey, ranging from 10 to 13%, with a total of 1,386 returned surveys. The vast majority of respondents held either a school position (54%), or a district position (38%). We received responses from all 50 states and the District of Columbia. By locale, 21% represented a school or district in an urban area, 19% represented a small city, 35% a suburban area, and 25% represented a rural region. This is somewhat similar to the percentages of all U.S. schools, which includes 24% of schools in a large and mid-size city, 49% in suburban or small city areas, and 27% in rural areas.

In terms of grade levels, responses were roughly broken in thirds, with 35% holding an elementary school or district position, 31% with a middle school or district placement, and 34% in a position to answer for both elementary and middle school. The graph on the next page presents a breakout of the survey respondents by professional role.

[2] Details about the administration and response rate of the high school mathematics landscape survey data can be found in the report *High School Mathematics Curricular Decision-Making: A National Study of How Schools and Districts Select and Implement New Curricula,* Inverness Research Associates, Winter 2000, http://www.inverness-research.org/reports/ab_compassmonog.html

Figure 1. K-8 Survey respondents by professional role(s)



Note that some respondents have multiple roles. District math leaders include math coordinators, specialists, Teachers on Special Assignment, math lead teachers, etc. District curriculum leaders include assistant superintendents, directors of curriculum, etc.

We should note here that we consider our respondents to be typical of U.S. mathematics curricular leaders, with one exception. We do believe that they represent a group that is more familiar with the vision of mathematics reform laid out in the NCTM *Standards*[3] and the NSF mathematics curricula than the average U.S. mathematics coordinator and/or department chair. Our reason for this belief is that their knowledge of the NSF-funded Curriculum Implementation Centers and of the curricula is greater than the national average, when compared with data gathered from national surveys.[4] Hence, in this case, we believe our sample represents a group that is slightly skewed towards the reform side. For this reason we think of these results as representing what we call the "attentive" audience – those district leaders who are interested in or at least paying attention to national reform efforts.

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[3] *Curriculum and Evaluation Standards For School Mathematics*, National Council of Teachers of Mathematics (Reston, VA: 1989) and *Principles and Standards for Mathematics*, National Council of Teachers of Mathematics (Reston, VA: 2000).

[4] See *Report of the 2000 National Survey of Science and Mathematics Education*, by Iris R. Weiss, Eric R. Banilower, Kelly C. McMahon, and P. Sean Smith; Horizon Research: December 2001, http://2000survey.horizon-research.com/reports/status.php

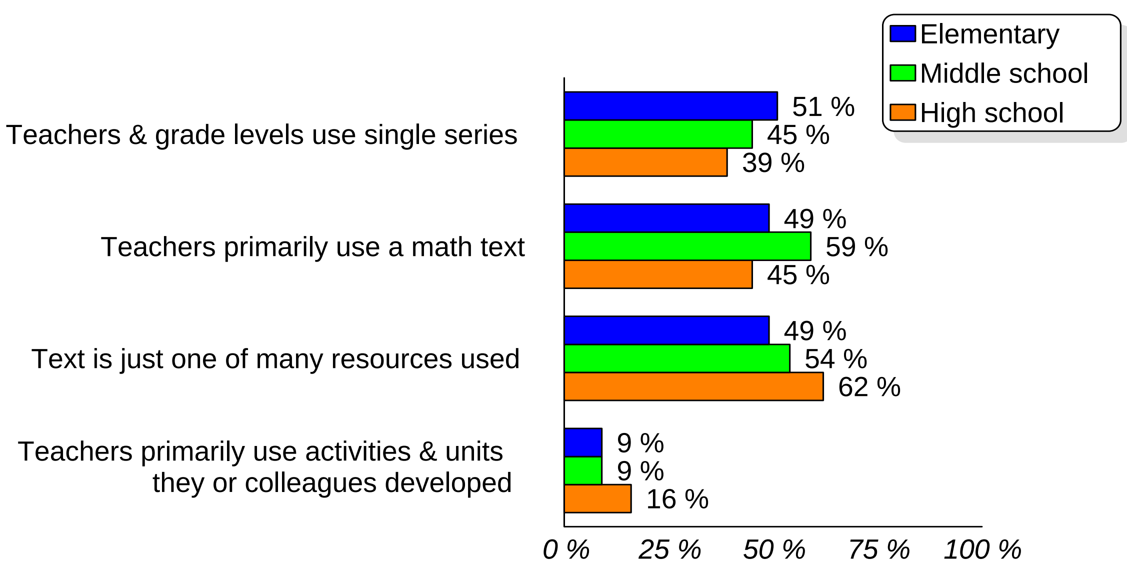
III. SUMMARY OF FINDINGS

In this section of the report we present the general findings from the K-8 study along with the high school data according to the main categories of the survey. We have organized our findings around a set of general questions, and for each question we have provided a description of our findings, data in graphical form, and a few key points that we believe should be highlighted. A complete set of data in graphical form is included in Appendix B of this report.

How are mathematics texts used?

The intent of this question is to understand the curricula and materials that are currently being used in U.S. classrooms. Responses to this question varied slightly by grade level. The lower the grade level, the more likely the respondents are to use a single textbook series. The higher the grade level the more inclined teachers are to use a variety of resources. At the elementary level, 51% of our respondents reported that teachers and grade levels use a single series. At middle school, 59% indicated that teachers primarily use a math text. By comparison, 62% of high school respondents reported that the text is just one of many resources used.

Figure 2. K-8 and high school teachers' current use of math curricula: comparisons by grade level



Percentages are based on those who checked at least one response to this item regarding practices at each level.

When we interpret this data we believe there are several key points to note:

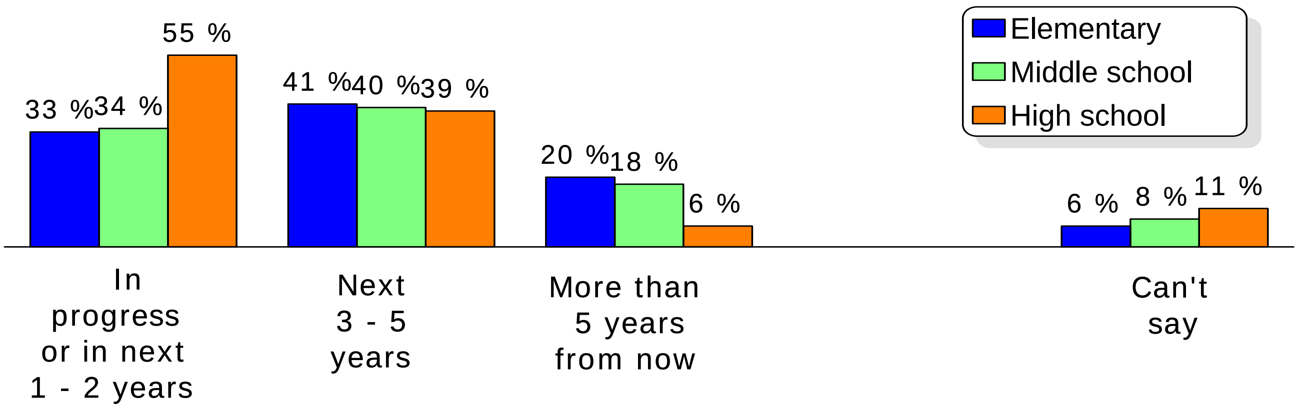
- The textbook is still very central in terms of defining the curriculum and providing the materials that are used in U.S. schools.
- About half of U.S. math teachers attempt to augment the text in significant ways.

- A small minority of teachers try to create their own curriculum and/or materials.
- There is slightly more of a tendency for teachers at the secondary level to go beyond the usage of a single textbook.

Next Textbook Adoption

We asked respondents about their adoption cycles and when they next would be adopting new textbooks. More than one-half the high school respondents (55%) told us they would be adopting new texts in the next one to two years. At the elementary and middle school levels it appears that adoption takes place roughly and evenly over the next five years (15 to 20% per year). There are fewer places where adoptions will not take place for at least five more years (about one-fifth of all elementary and middle schools and 6% for high schools).

Figure 3. K-8 and high school next textbook selection or adoption: comparison across grade levels



Percentages are based on a 3 point scale, plus "can't say". "Can't say" groups responses by respondents who were not part of the decision-making process and those who could not answer because of local factors.

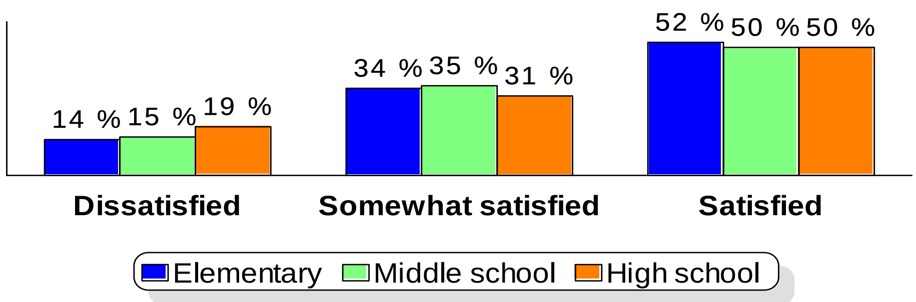
What is interesting here includes:

- There is an opportunity to influence half of the high schools and one-third of all elementary and middle schools through the adoption process in the next two years.
- There are some schools and districts where the curriculum is fixed for at least the next five years.
- High schools apparently make textbook changes on a more frequent basis. We speculate that this difference may be due to the nature and variety of high school mathematics courses offered and because the selection of instructional materials often occurs by course offering not by grade level.

How satisfied are math leaders with their current programs and texts?

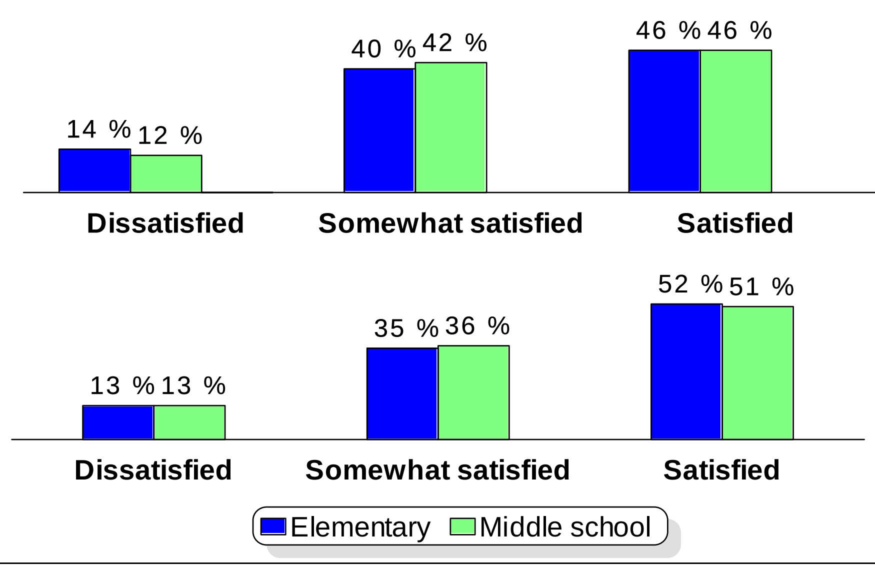
Respondents were asked to rate their personal satisfaction with their own current mathematics program and their perception of satisfaction among their colleagues. Responses were fairly consistent across grade levels with a large majority indicating they are satisfied with the current program. In terms of personal satisfaction, elementary and middle school rated being either "very dissatisfied" or "somewhat dissatisfied" 14% and 15% respectively. The high school rating for dissatisfaction was slightly higher at 19%. The percentages are similar for satisfaction among colleagues.

Figure 4. K-8 and high school personal satisfaction of respondents with the current mathematics program: comparison across grade levels



Responses are grouped into 3 categories: those checking "1" or "2"; those checking "3"; and those checking "4" or "5" on a 5 point scale where 1 = "very dissatisfied" and 5 = "very satisfied".

Figure 5. K-8 colleagues' satisfaction with the current math program: comparison across grade levels



Responses are grouped into 3 categories: those checking "1" or "2"; those checking "3"; and those checking "4" or "5" on a 5 point scale where 1 = "very dissatisfied" and 5 = "very satisfied". This question was not asked at the high school level.

The key points to note here include:

- Half the respondents are satisfied with their current math programs.
- Less than one in five respondents say they are dissatisfied.

Thus, it appears that the demand for change is relatively small, and that any such demand is not going to arise from widespread dissatisfaction with the current status of mathematics programs or texts.

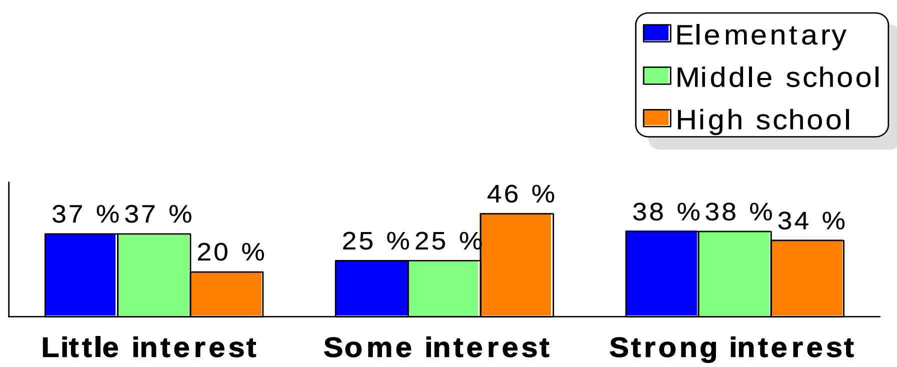
What is the current level of interest in changing the mathematics program?

We also asked directly about the level of demand for change or improvement, and a number of questions from the survey pertain to this category. They can be clustered into four groups: the level of interest in making changes in the mathematics program, the agreement about the direction of change, the mode of change, and the perception of the quality among current mathematics programs.

Interest in Making Changes

Across all grade levels, approximately a third of our respondents indicated a strong interest for change in their own settings. A large minority (37%) of elementary and middle school respondents expressed little interest in changing their programs, while only one-fifth of high school respondents felt the same.

Figure 6. K- 8 and high school interest in the school or district in changing the mathematics curriculum: comparison across grade levels



Responses are grouped into 3 categories: those checking "1" or "2"; those checking "3"; and those checking "4" or "5" on a 5 point scale where 1 = "very little interest" and 5 = "very strong interest".

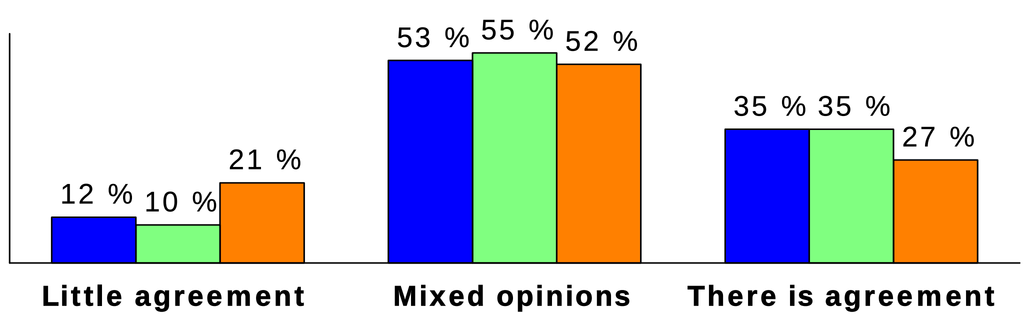
The key points to note here are the following:

- For elementary and middle school, roughly one-third of all respondents at all levels express a strong interest in making change; about a third show no interest, and another third are in the middle.
- High school respondents seem to be the most interested in making at least some changes.

The Direction of Change

We asked respondents not only about their interest in making change but also the degree to which they felt there was consensus in their districts or departments about the nature and direction of change needed to improve their math programs. About one-third of the respondents felt there was, in fact, a shared vision about the kinds of changes needed for improvement. Over half of all respondents felt that there were mixed opinions about the changes necessary.

Figure 7. K-8 and high school agreement about the nature and direction of change needed in mathematics: comparison across grade levels



Responses are grouped into 3 categories: those checking "1" or "2"; those checking "3"; and those checking "4" or "5" on a 5 point scale where 1 = "strong disagreement" and 5 = "strong agreement".

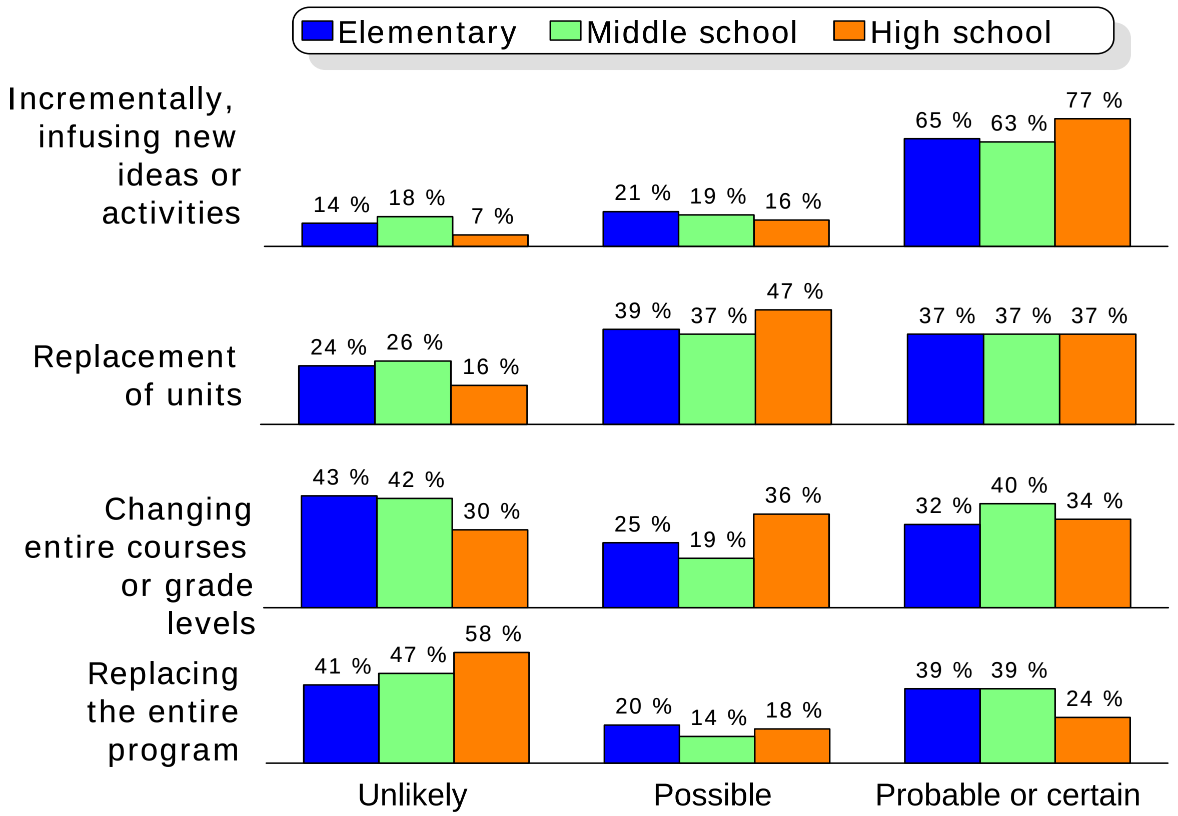
We note a few key points:

- The combination of the fact that only one-third of all respondents have a strong interest in change (as shown on the previous page in Figure 6) and only one-third have agreement about the kind of changes that are needed, indicates that there are few places where there is a strong, clear mandate for change.
- While there may be slightly more interest in change at the high school level, there is less consensus about the kind of changes that will lead to program improvement.

The Mode of Change

The most favored scenario across grade levels for making curricular change and for introducing new instructional materials is incremental change – that is, by infusing new ideas or activities into the existing curriculum (65% elementary, 63% middle school, and 77% at high school). The likelihood of using replacement units, changing entire courses or grade levels, and replacing the entire program ranked close together, ranging from 32% to 40% across grade levels with the exception of the likelihood of high school replacing an entire curriculum, only 24%.

Figure 8. K-8 and high school likelihood of various scenarios for introducing new mathematics instructional materials: comparison across grade levels



Responses are grouped into 3 categories: those checking "1" or "2"; those checking "3"; and those checking "4" or "5" on a 5 point scale where 1 = "very unlikely" and 5 = "certain".

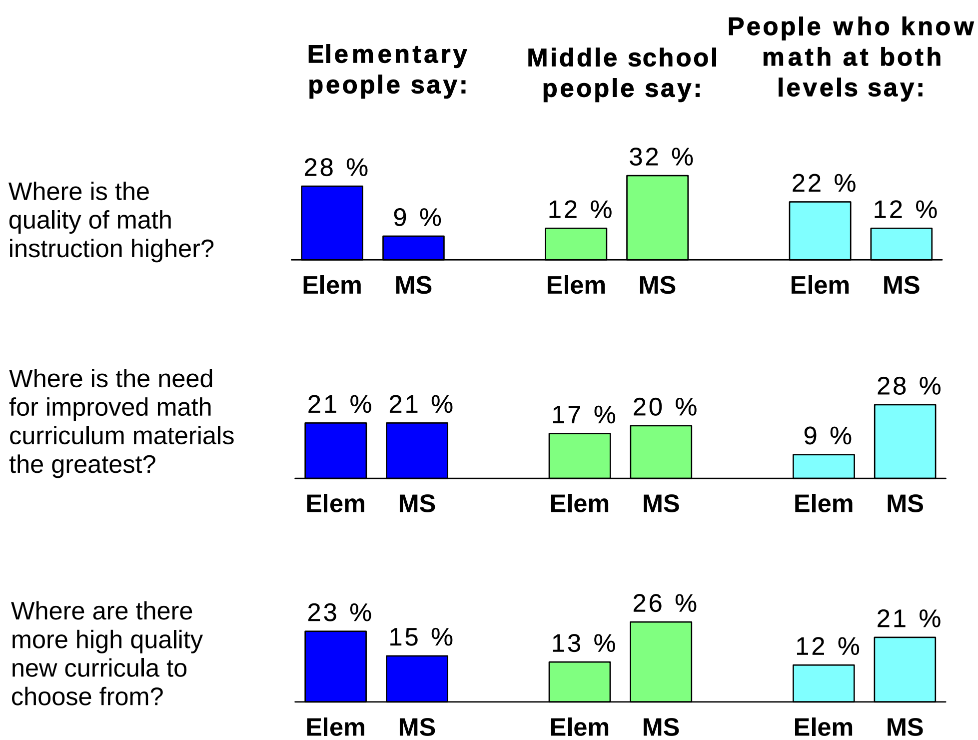
These results suggest some important points:

- The smaller the "grain size" of change, the more likely it is to happen. Most districts and departments will be changing their curricula through small incremental changes. It is less likely that schools and departments will be using replacement units, and even less likely that they will be replacing courses or entire programs.
- Elementary and middle schools seems to think more often in terms of a single textbook series. Hence, for many, changing a program means adopting a new textbook series. At the high school level, where there is a large variety of mathematics courses combined with more autonomy among individual teachers, there is less tendency to think of a single curriculum serving an entire four-year mathematics program.

Quality of Current Mathematics Programs

In the K-8 survey we asked about differences between elementary and middle schools in terms of the quality and needs of current math programs. When asked to compare and rank where the quality of math instruction is higher, 28% of elementary people indicate that instruction is of higher quality at their grade level and only 12% say it is higher at the middle school level. This same pattern holds for the middle school respondents: 32% say quality of instruction is higher at their grade level and only 9% say it is higher at the elementary level. For those respondents knowledgeable of both levels, elementary was ranked higher, 22% compared to middle school at 12%. There was more agreement in terms of the greatest need for improved math curriculum materials. Elementary rated both grade levels the same at 21%. Middle school respondents rated elementary 17% and middle school 20%. However, for those who know both levels, improved curriculum materials are needed more at the middle school level, 28% than at elementary 9%.

Figure 9. Relative status of math at elementary and middle school levels



Responses represent those checking "1" or "2" and those checking "4" or "5" on a 5 point scale where 1 = "definitely greater at the elementary level" and 5 = "definitely greater at the middle school level". [Responses of "3", meaning "same for the two levels," are not reported.] This question was not asked at the high school level.

There are two main points to mention here:

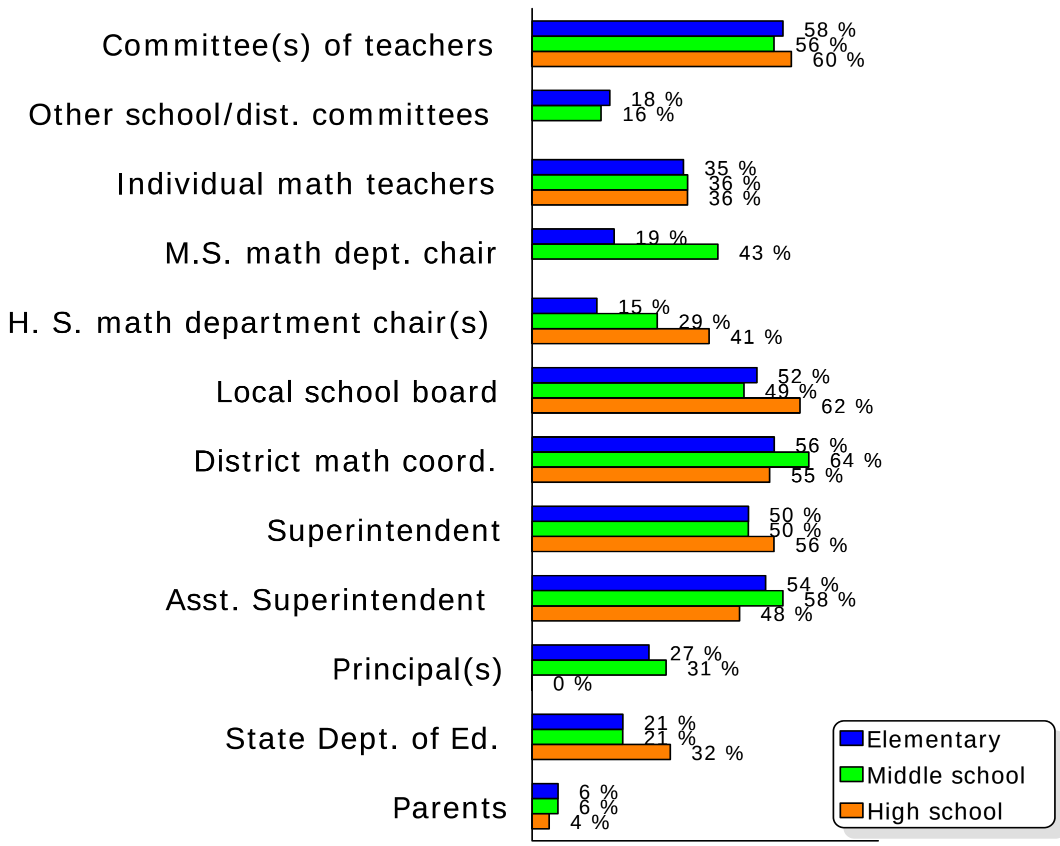
- People perceive the quality of instruction to be lower in grade levels other than their own (e.g., middle school people see elementary instruction as weak and vice versa).
- For respondents who work at both levels the need for improved materials and instruction seems greatest at the middle school level.

How are mathematics curricula selected by districts and schools?

Major Decision Makers

We asked respondents about the role and importance of various decision makers in the process of selecting curriculum and instructional materials. We learned that across grade levels the most important decision makers include committees of teachers (56-60%) and the district mathematics coordinator (55-64%). Across grade levels, the three groups that ranked lowest were principals (0-30%), other school or district committees (16-18%), and parents (4-6%).

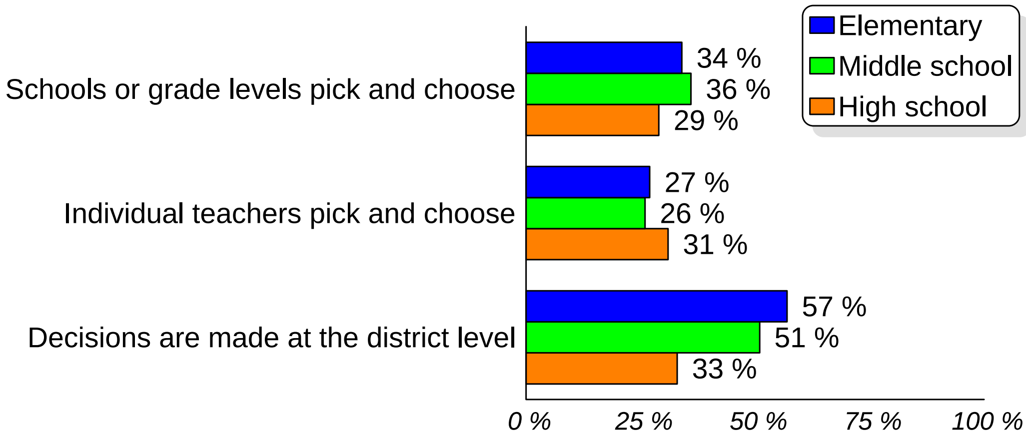
Figure 10. K-8 and high school major decision makers in math texts and related materials



Percentages represent those who checked "4" or "5" on a 5 point scale where 1 = "involved very little if at all", 4 = "major decision maker", and 5 = "can approve or veto".

We also see in our data that the process of curriculum adoption is complex. It takes place in multiple stages at multiple levels. Hence, respondents report that individual teachers are involved in picking and choosing the materials they use (26-31%); schools and grade levels are involved in the choice (29-36%); and decisions are made at the district level (33% high school, 51% middle school and 57% elementary).

Figure 11. K-8 and high school groups who make decisions about the selection of mathematics curriculum: comparisons across grade levels



Respondents checked all that apply.

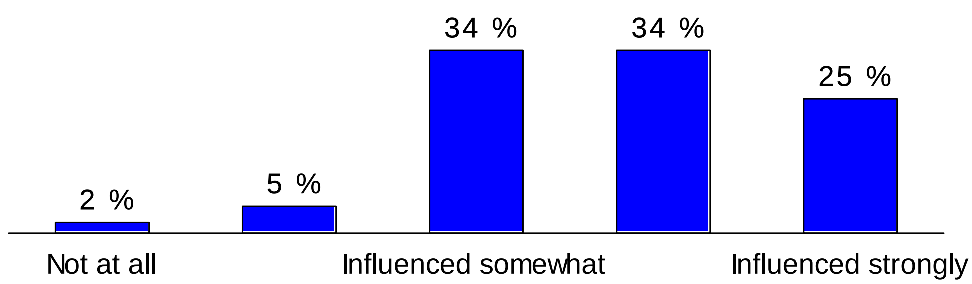
The key items to note here include:

- Teachers – individually or as part of a committee – can have a strong voice and play an important role in curricular selection processes.
- Teachers and math coordinators play an initiating role in the selection of curricula.
- Local school boards and superintendents can play a strong role, but it is usually one of approving or vetoing choices that have been made by teachers and math coordinators.
- In general, in spite of the publicity of the “math wars,” parents currently are a minor factor in the selection of mathematics curricula.
- Districts play the strongest role in choosing curriculum at the elementary and middle school level; at the high school level there is about equal input from teachers, school departments and districts.

The Role of Teachers

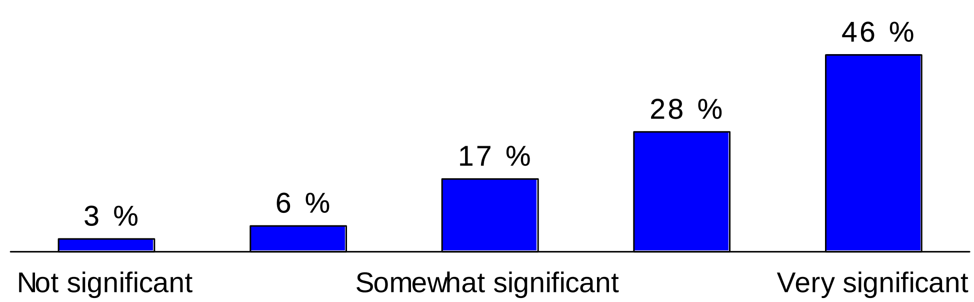
In the K-8 survey we asked questions regarding the specific role of teachers in curriculum selection. Our data indicate that teachers' opinions about curricula are influenced by involvement with professional development. Respondents state almost all teachers have their vision of good curricula somewhat or strongly influenced by their professional development activities (93%). And again almost all respondents (91%) describe the role teachers' opinions play in the ultimate selection of curricula as ranging from somewhat significant to very significant.

Figure 12. K-8 extent to which teachers' current opinions about elementary and middle school mathematics curricula have been influenced by their involvement in professional development or reform efforts



Percentages are based on a 5 point scale where 1 = "not at all", 3 = "influenced somewhat", and 5 = "influenced strongly". This question was not asked at the high school level.

Figure 13. K-8 role of teachers' opinions in the math curriculum and selection process



Percentages are based on a 5 point scale where 1 = "not significant", 3 = " somewhat significant", and 5 = "very significant". This question was not asked at the high school level.

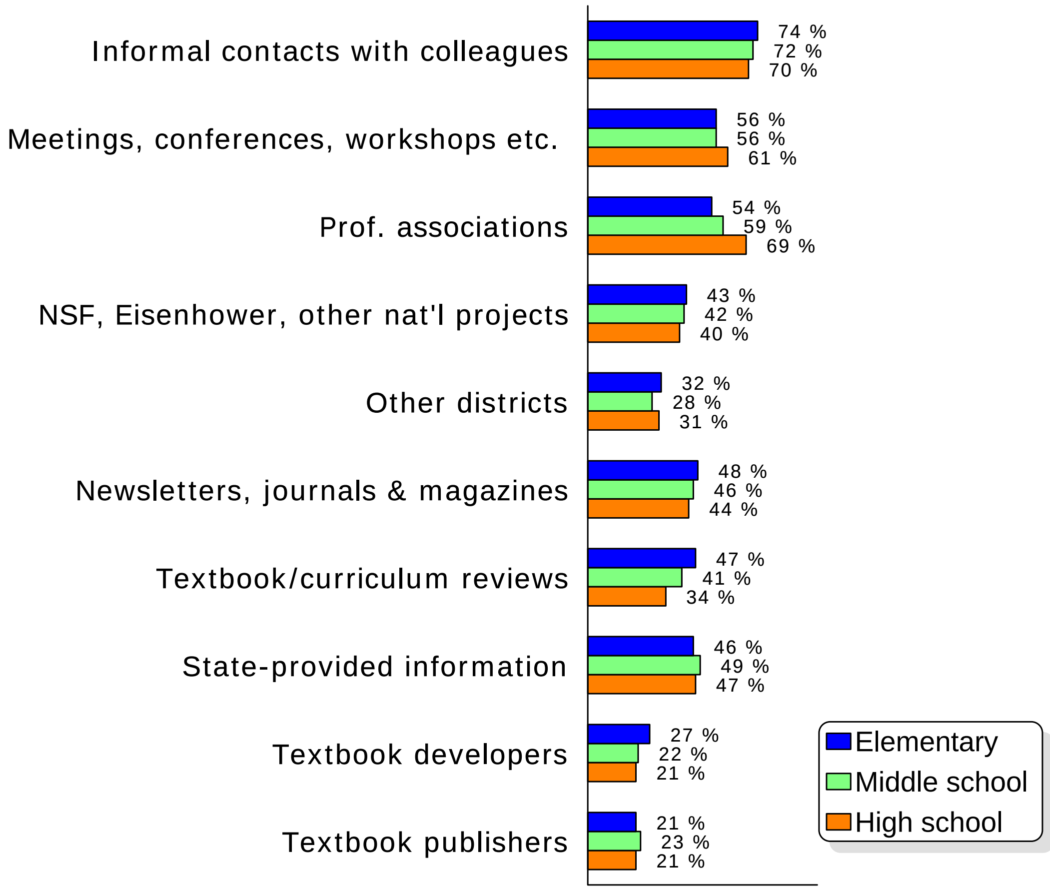
We note the following key points:

- The impacts of professional development are seen not only in the classroom, but also in the views of teachers in terms of their vision of mathematics teaching and learning. These views then shape the curriculum adoption and implementation process.
- Teachers' opinions can have a significant impact on the curricula that is selected. Hence, their views matter greatly.

Frequently Used Sources of Information

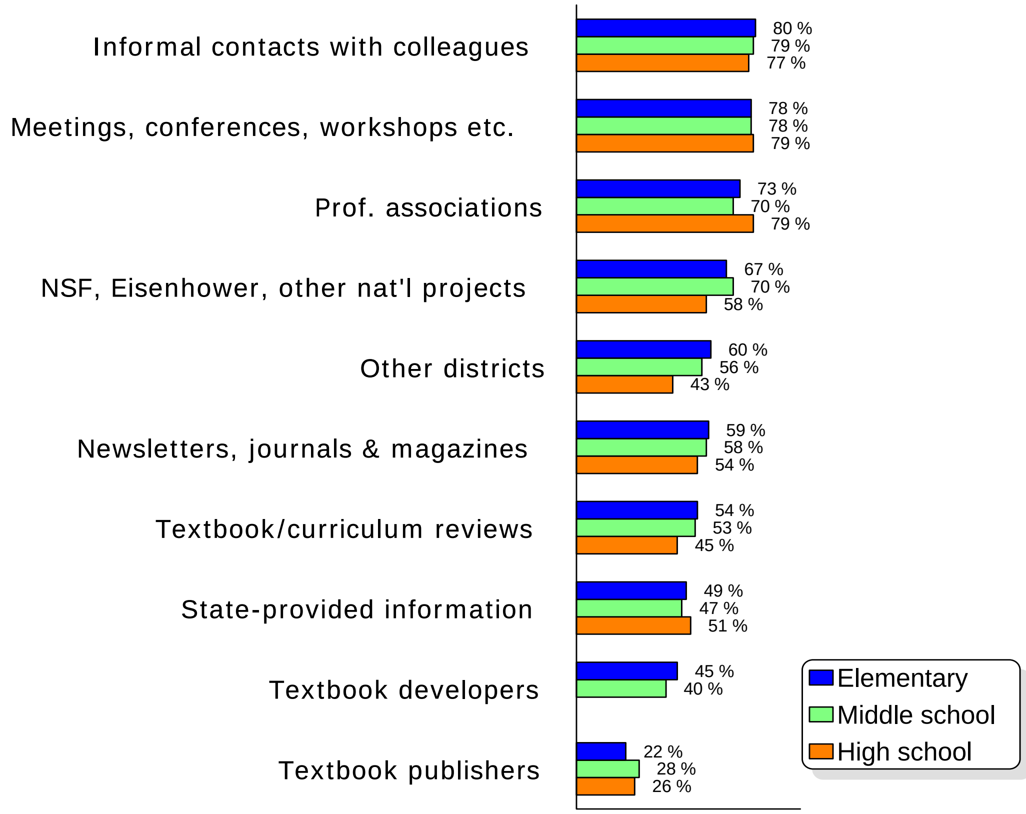
Both the K-8 and high schools surveys asked questions pertaining to sources of information used and valued when learning about mathematics curriculum materials. Survey respondents indicated that they learned about curriculum through their informal contacts with colleagues (70-74%), their participation in meetings and conferences (56-61%), and through professional associations (54-69%). Least used sources of information included the textbook developers and publishers of the textbooks (21-27% and 21-23% respectively). In terms of the value of these sources of information, the pattern was the same with collegial connections at the top of the list (77-80%), and publishers at the bottom (22-28%).

Figure 14. K-8 and high school *frequently used* sources of information: grade level comparisons



Percentages represent those who checked "3" on a 3 point scale where 1 = "never use" and 3 = "often use" this source of information.

Figure 15. K-8 and high school *valuable* sources of information: grade level comparisons



This graph portrays the responses of those who reported on the previous item that they "sometimes" or "often" use a particular resource. Percentages represent those who checked "4 or 5" on a 5 point scale where 1 = "little value" and 5 = "great value".

Important ideas emerging from this data include:

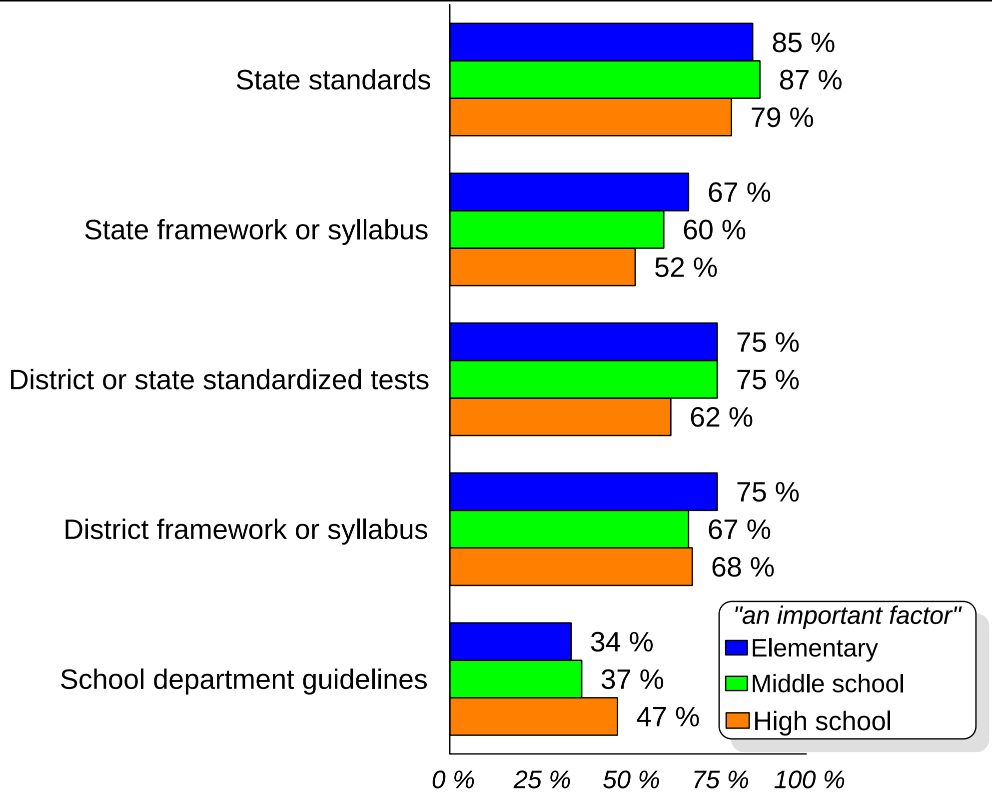
- "Word of mouth" in this domain, as in many others, is one of the most powerful channels by which people learn about curricula.
- The professional connections that people have – associations, newsletters, meetings, workshops – provide the majority of input for curricular decision-making purposes.
- More formal channels – reviews, state-provided information, and publisher-provided information – are both used less and valued less.

What factors influence the choice of mathematics curriculum materials?

Standards and Tests

Across all grade levels, state standards rank highest as a factor when selecting and using mathematics instructional materials (85%, 87% and 79%). District and state standardized tests rank second for elementary and middle school (75% for each). For high school, district framework or syllabus takes second place (68%). School department guidelines are a less important influence at all levels, having the least influence at the lower levels.

Figure 16. K-8 and high school, influence of standards and tests on the selection and use of mathematics instructional materials: comparison across grade levels



Percentages represent those who checked "4" or "5" on a 5 point scale where 1 = "not a factor" and 5 = "a key or central factor in our school/district".

There are a few key ideas that emerge from this data:

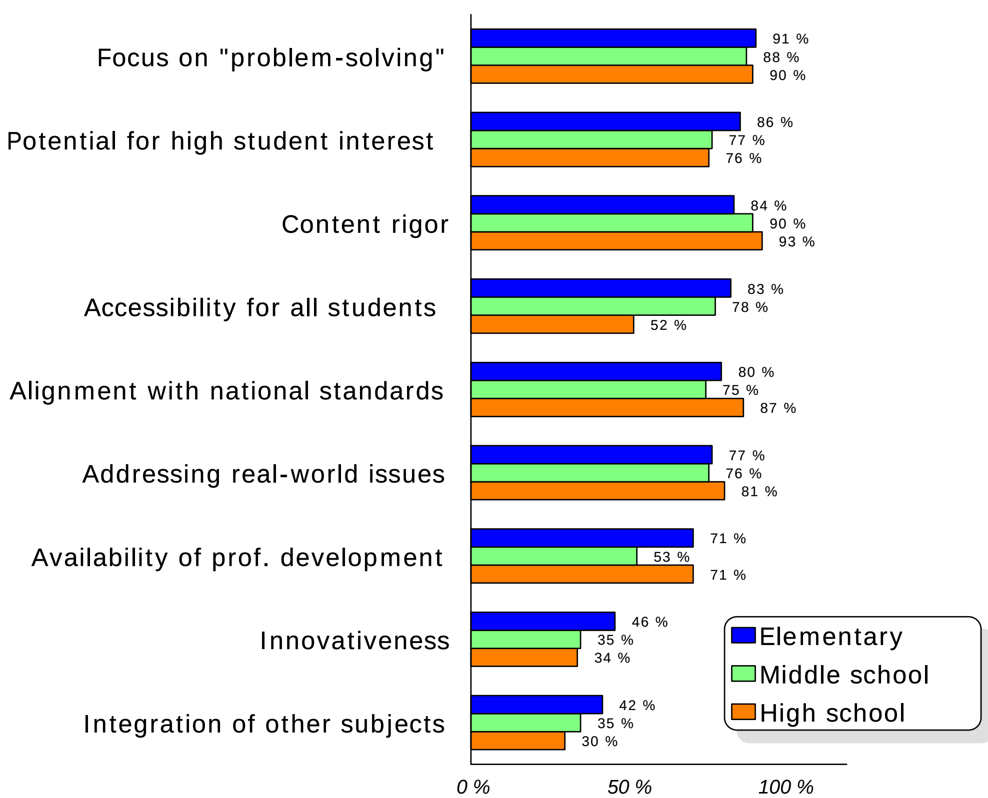
- The state is the dominant context, more than national and more than local. This finding may be even stronger now than when the survey was administered given the even greater emphasis on state testing due to policies such as high school exit exams and federal mandates such as No Child Left Behind.
- Not surprisingly, district frameworks very often closely mirror state requirements.
- At the high school level, there is more weight assigned to departmental guidelines than there is in middle school or, even less, in elementary school. This may be a result of the

fact that there are multiple external factors that shape high school programs – high-stakes tests like SAT, AP, college entrance exams, etc. In addition, there are a number of internal factors, such as dedicated mathematics faculty with autonomy, in-depth mathematical knowledge, and strong beliefs about the design of mathematics instruction.

The Qualities and Design of Curricula

There are other factors that have to do with the internal qualities and design features of the curricula themselves. Among such qualities, the highest ranked item for elementary respondents was a focus on the notion of "problem solving" (91%). This item remained highly rated among middle school and high school ratings, 88% and 90% respectively. However, the item of content rigor ranked highest at 90% and 93% for these two groups. Innovativeness and integration of other subjects ranked relatively low with percentages ranging from 46% to 34% and 42% to 30% respectively.

Figure 17. K-8 and high school selection considerations for math: comparison across grade levels



Percentages represent those who checked "4" or "5" on a 5 point scale where 1 = "not a consideration" and 5 = "a key consideration".

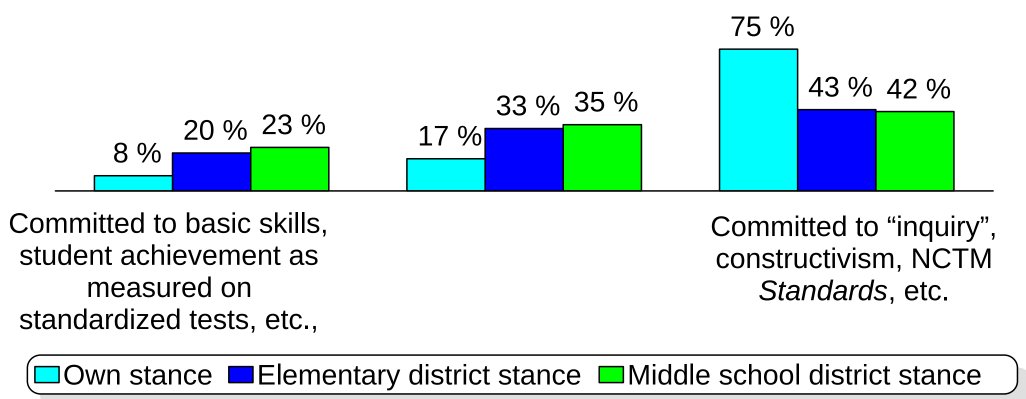
There are two things to note about the factors respondents list as important influences on their curricular selections:

- Mathematics educators have several criteria when considering mathematics curricula – rigor, a focus on "problem solving", accessibility to all students, addressing real world issues, etc. In some cases there are different definitions and interpretations of these terms. Sometimes these criteria may conflict or involve potential tradeoffs. Thus, curricular decision-making is complex and heavily value-laden. As a result many textbook series are deliberately designed to appeal to a wide range of audiences, criteria, values, and interests.
- Math leaders in districts are not in general looking for innovative materials. Nor are they looking for integration with other subject areas. Hence, there is a tendency to stick to the traditional; there is not widespread or strong interest in pursuing innovative new approaches to mathematics curricular design.

What is the stance of the respondents and their districts toward mathematics reform?

On the K-8 survey, we asked participants about their attitudes toward mathematics reform, as well as what they thought their district and department attitudes were. Perhaps not surprisingly they ranked themselves very favorably disposed toward inquiry, constructivism and the NCTM *Standards* (75%). By contrast, they felt their own districts were as a whole less positively disposed toward the reform effort (42-43%).

Figure 18. K-8 stance of respondents and their districts toward mathematics reform



There are few things to note here:

- As we pointed out earlier, our respondent group probably represents a sample that is biased toward a vision of improvement that is consonant with the NCTM *Standards*.

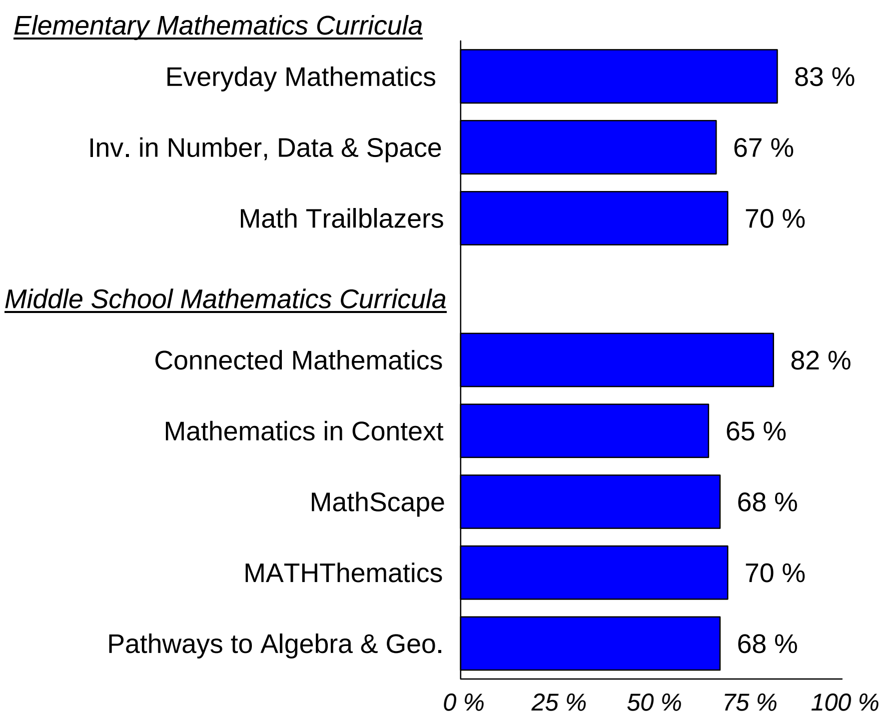
- These mathematics leaders and decision makers perceive themselves as "out in front" of their own districts, and hence may be looking for curricula and professional development that can help promote a reform vision locally.

What is the level of familiarity with elementary and middle school math textbooks and materials?

National Awareness

In terms of awareness of the elementary and middle schools curricula represented by the K-12MCC, the most well known are Everyday Mathematics at the elementary level (83%) and Connected Mathematics at the middle school level (82%). Overall, survey respondents were quite aware of the NSF-funded curricula (68-83%).

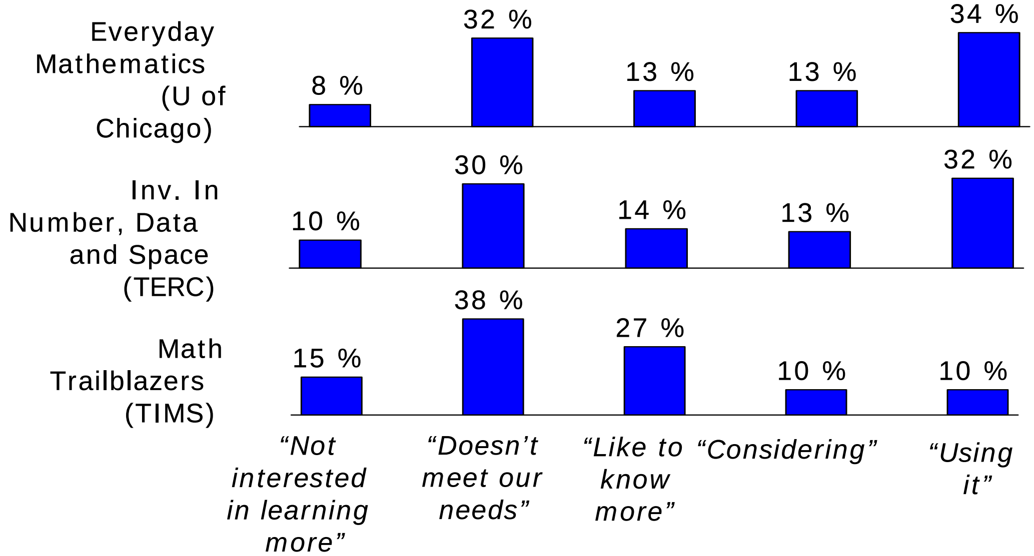
Figure 19. K-8 percentage of survey respondents who are aware of elementary and middle school mathematics curricula supported by K-12MCC



Familiarity with and Stance Toward the Curricula

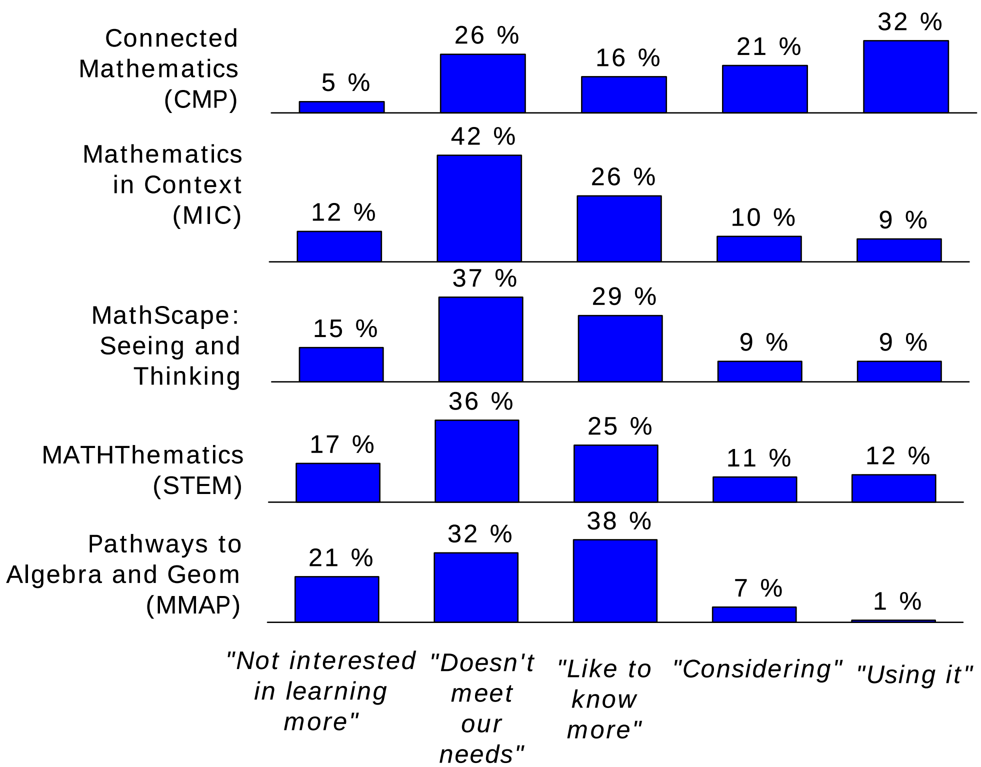
For respondents who were aware of each curriculum, we asked them to describe their current stance toward that curriculum. With respect to the elementary mathematics programs, approximately 50% of the respondents in our sample said that they were considering or already using Everyday Mathematics or Investigations in Number, Data and Space. 20% indicated that they were considering or already using Math Trailblazers. Interestingly, a number of respondents reported that these materials did not meet their needs or were not interested in knowing more (40-53%). And there is another group in the middle that would like to know more about these curricula (13-27%).

Figure 20. K-8 degree of familiarity with elementary math curricula for those people who are aware of them



For those who indicated they were aware of the middle school math curricula, 53% are either considering or using Connected Mathematics. The range of responses for the other four curricula – Mathematics in Context, MathScape, MATHThematics, and Pathways to Algebra and Geometry – are somewhat lower (8-23%). A large number of respondents reported they are not interested in learning more about the five middle school curricula or it did not meet their needs (31-54%). A smaller but still significant group was interested in learning more (16-38%).

Figure 21. K-8 degree of familiarity with middle school math curricula for those who are aware of them



Sources of Information About the Curricula

How did people learn about these curricula? The main channels of information are personal and professional. Workshops, conferences, and interactions with colleagues combined gain the top rankings (44-98%) of all respondents and all curricula. The services offered by the Curriculum Implementation Centers show up mostly in the 4% to 18% range, and the publications of the Centers reached a audience of 8-18%.

Figure 22. K-8 sources that helped respondents learn about curricula

	Colleague / inservice	K-12 MCC Session	The ARC Center	The Show-Me Center	Other conference or workshop	Textbook publisher	Implem. center website or brochure
Elementary Mathematics Curricula							
Everyday Mathematics (UChicago)	43%	4%	4%	6%	55%	34%	16%
Inv. in Number, Data, and Space (TERC)	40%	3%	3%	6%	58%	30%	18%
Math Trailblazers (TIMS)	27%	3%	3%	3%	47%	23%	13%
Middle School Mathematics Curricula							
Connected Mathematics (CMP)	17%	3%	1%	12%	38%	21%	10%
Mathematics in Context (MIC)	25%	4%	1%	18%	46%	26%	12%
MathScape: Seeing and Thinking	22%	3%	0%	15%	46%	27%	13%
MATHThematics (STEM)	12%	2%	0%	12%	32%	16%	8%
Pathways to Algebra. and Geo. (MMAP)	6%	6%	10%	86%	54%	25%	0%

The data on awareness and familiarity yield some confirmation of earlier data from other studies and reinforce the following findings:

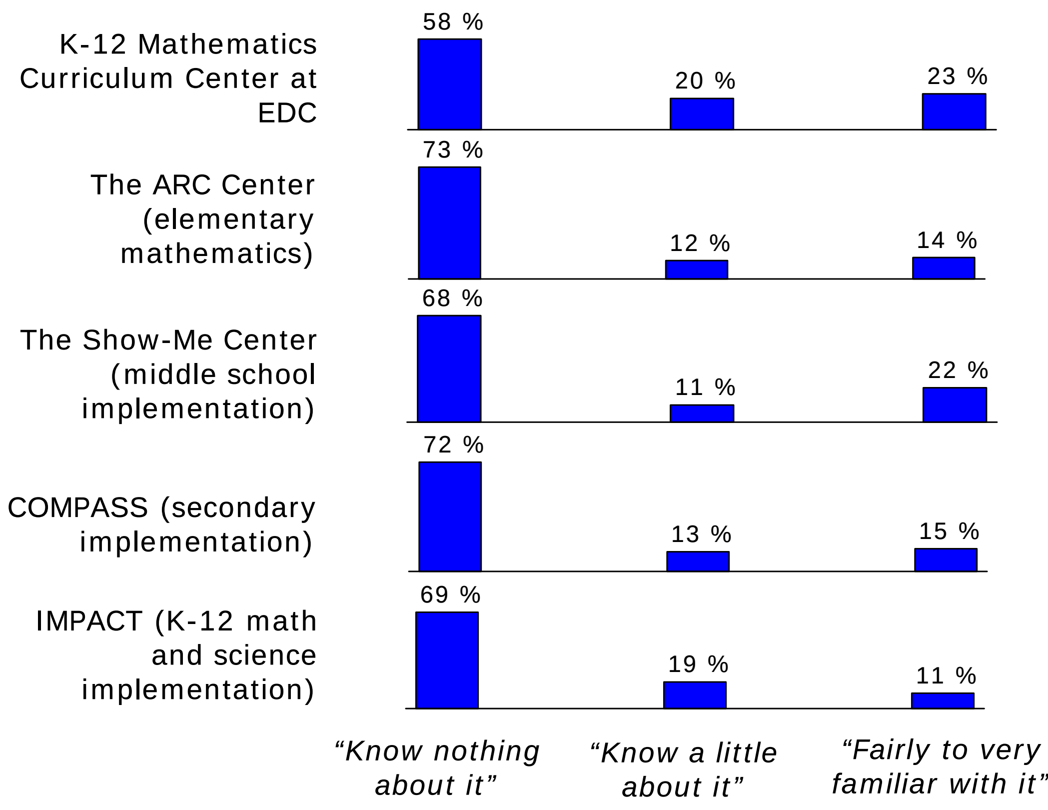
- The NSF-funded curricula have achieved national visibility.
- Those who are aware of the curriculum have largely decided whether or not it is likely to suit their purposes. There is a small yet significant group that is enthusiastic about and committed to the curricula; and there is another group that is not interested in learning more about the materials or has decided that they do not meet current needs.
- There are multiple pathways through which curriculum decision makers receive information. Most used and trusted are those pathways that are part of their professional interactions.

- At the national level, the NSF-funded Curriculum Implementation Centers have played a significant role in terms of helping schools and districts learn about and assess these curricula for their own purposes.

What is the level of awareness and familiarity with the NSF-funded Curriculum Implementation Centers?

Finally, we asked respondents about their awareness of the five mathematics Curriculum Implementation Centers (CICs). Most respondents had not heard of the Centers or at least did not recognize the Center's name (58% to 73%). Best known amongst the Centers ("fairly to very familiar") were the K-12 Math Curriculum Center at EDC (23%) and the middle school Show-Me Center (22%).

Figure 23. K-8 degree of familiarity with math CICs



Responses are grouped into 3 categories: those checking "1" ("This is the first I have heard of this center"); those checking "2" ("I have heard of it") or "3" ("I know a little about it"); and those checking "4" ("I am fairly familiar") or "5" ("I am very familiar with this Center").

These data suggest the following:

- ♦ There is a group of mathematics education leaders (11% to 23%) across the country that has worked with or is familiar with the Centers.
- ♦ There is nonetheless a large group that has not yet learned about nor recognize the Curriculum Implementation Centers.

IV. SUMMARY AND IMPLICATIONS

Looking across the data gathered in this survey, we see a picture that complements and re-enforces the findings of the earlier landscape study of high school mathematics. While one might expect great differences between high school, middle school and elementary school, in fact, there is remarkable uniformity across the responses of people working at different grade levels. This suggests that there may be a deep structure of curriculum implementation – that the context and processes of curriculum selection and adoption are largely similar in spite of grade or even subject-matter differences.[5] All of this indicates that it is both important and possible to study curricular decision-making as a process that has it own integrity and dynamics. How people think about curriculum, and what factors and contextual forces shape their thinking, is a key piece of knowledge if one is to continue to support the improvement of mathematics education through curriculum development and implementation.

There are some findings that emerge from this study that have important implications for NSF and other funders of innovative curricula. First, it is clear that there are a few but significant number of places where there is interest in change, agreement about the nature of change, and a willingness to pursue curricular change on a larger scale. That is, there are a few districts and schools who exhibit an interest and "readiness" for curricular change that goes beyond the incremental. These are the places that are likely candidates for NSF-funded programs. They are ready to seriously pursue a new vision of teaching and learning mathematics, which requires large-scale school and/or departmental changes. These are the schools and departments who will be on the forefront of trying to create instructional change of a more fundamental type. The survey data also show that, by contrast, most schools and departments in the United States are not ready for or interested in such fundamental change. They are unwilling to alter the status quo to that extent. Most departments and districts in the United States will seek to continue to improve their programs through a slow and diverse process of infusing new activities into existing curricula.

It is also clear from the survey that mathematics education leaders have to live in several very different worlds simultaneously. They have to respond to both external (system) pressures and at the same time adhere to their internal (professional) beliefs. They also have their own personal histories and beliefs to guide them. In this sense they want curriculum that meets three types of

[5] The results of these surveys are quite similar to a high school science landscape survey done at approximately the same time.

standards – what we have come to call public, professional and personal standards.[6] In terms of public standards they want to be sure that their curriculum will cover required topics and will allow their students to meet state standards and do well on state tests. They want curriculum that will meet the requirements of the next grade level, and university entrance requirements. In terms of professional standards they want instruction to match a vision that is compatible with the NCTM *Standards*, that provides their students with rich experiences in problem solving and real world applications. And in terms of personal standards they want curriculum that agrees with the beliefs that come out of their own teaching history and supports their own visions of good teaching. And in many cases they have personal visions that have been shaped not only by their own personal teaching experience but also by their history of professional development activities. Hence we see our respondents, the mathematics leaders throughout the country, choosing curriculum that will meet the external constraints they face, but also, to the greatest degree possible, meet their personal and professional standards as to what good curriculum should look like.

Another major finding coming out of the data is the power of the professional domain in which these leaders work and interact with each other. They learn about the NCTM *Standards*, mathematics content, and the nature of student learning through their professional associations and their involvement in professional development offerings. The Curriculum Implementation Centers are part of this professional infrastructure and provide a vehicle by which these mathematics education leaders can continue to learn about the *Standards*, curricula, and curriculum implementation. The Centers also can help these leaders identify, address and resolve the tensions and conflicts that are inherent as they work to make curricular choices that attempt to meet public, professional, and personal standards.

There are some implications coming out of this landscape study for the work of the K-12MCC, as well as other Curriculum Implementation Centers:

- There are a small but significant number of districts and departments who are ready to undertake the work of curricular review and selection of new and innovative instructional programs. There is a great need for the support of an external Center as they address the many issues involved in identifying, piloting, adopting, implementing and refining the use of a new innovative curriculum.
- There is also an ongoing need for Curriculum Implementation Centers to provide a range of curricular supports to large numbers of the other districts and departments. These Centers are not so much purely about "implementation" as it is more broadly in the business of offering "curricular supports." Districts involved in incremental change need and value support as much as those involved in the more radical work of changing their courses or programs in a wholesale fashion.

In working with both groups, those engaged in the implementation of an innovative curriculum and those engaged in curricular improvement that is more incremental in nature, the Center is well positioned to engage in a kind of "action research." That is, we see the EDC K-12

[6] For a fuller description of these three standards see *Teachers Inquiring Into Standards, Teaching, And Learning: Lessons Learned From The National Writing Project's Focus On Standards Project*, http://www.inverness-research.org/reports/ab_nwpfosstudy.html

Mathematics Curriculum Center not only as a service center but also a Center for curriculum research. This research would be applied in nature and involves studies that contribute to the knowledge base in important ways. The goal is to contribute to what is known about all facets of curriculum reform and improvement. It is clear from this survey that our current models of thinking about "curriculum" are too simplistic. We need to know much more about the processes and forces of curriculum – what might be thought of "curriculum dynamics." (We would suggest the type of survey study reported here is one kind of research the Curriculum Implementation Centers are well positioned to carry out.)

Finally, we end with a broader thought about the role of the Curriculum Implementation Centers in this mathematics education landscape.[7] The process of improving mathematics education is a complex one. And, as the survey has shown us, the nature and quality of mathematics programs in U.S. schools is very curricular dependent. It is not enough for reformers to focus on "student achievement" – or even on "teacher quality." Just as no curriculum is teacher proof, no teacher is curriculum proof. And if the improvement of mathematics education depends upon curricular improvement, then it will be necessary to have a national infrastructure that can support local districts in addressing curricular issues. Such an infrastructure needs to provide a wide range of supports to districts and departments, as well as contribute research to the field. The infrastructure needs to help those districts engaged in radical curriculum reform, and it needs to help those who are just beginning to think about curriculum change. The EDC K-12MCC is, in our mind, a good contribution to such an infrastructure.

[7] For more discussion of the role of the Centers see *The NSF Implementation and Dissemination Centers: An Analytic Framework,* http://www.inverness-research.org/reports/ab_cic_reprt0602.html