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Closing the Gaps between Leaders and the Public on Math, Science, & Technology Education

A Qualitative Research Report on the Kansas City Region

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Introduction

The Kansas City region is in many ways representative of the larger national economy. As with many cities of its size, the largest area of employment, other than in government, is in the healthcare sector. While biomedical research is a major growth area across the nation, Kansas City is also the national leader in the animal healthcare industry, in part because of the impact of major biomedical research organizations such as the Stowers Institute. This has given Kansas City a foothold for future development, and as Peter Levy, the President of the Chamber of Commerce noted, "It may be that the greatest challenge we have given ourselves as a community is to leverage our way up to be one of the leading communities in life sciences research in the country."[1]

While these areas of economic development have obvious and strong connections to math, science and technology (MST) education, business leaders we spoke with for this study also emphasized the extent to which more traditional jobs, such as construction, manufacturing and many others, require workers to have a stronger MST background simply because of the increasing role played by technology. Moreover, leaders stress that the kinds of analytic and collaborative skills that MST education inculcates, apart from specific content knowledge, are increasingly important to virtually *all* kinds of work in the modern economy. It's no surprise, then, that improving MST education is a driving concern of the region's leadership.

The research summarized in this report was conducted to help inform efforts in the region to improve math, science and technology education and outcomes for all students. It follows up on a national report that identified an "urgency gap" between leaders and parents on the importance of MST education. In 2006, Public Agenda found that public concern about math and science has declined since the mid-1990's, even as concern among experts and leaders has ramped up dramatically.[2] As American students continue to lag behind their international counterparts in MST achievement and as the number of American students pursuing careers in engineering and other MST related fields continues to decline, addressing this urgency gap has become critically important nationally. Does the same pattern apply in the Kansas City region? If so, what might be done about it?

From Research to Engagement

This qualitative study is the first step in a larger program of research and a public engagement campaign in communities across the region in the coming months and years. The present study is based on fieldwork conducted between June and December of 2006, in which Public Agenda convened twelve focus groups in and around Kansas City on the topic of math, science and technology education with parents, high school students and teachers. In addition, we conducted fifteen expert interviews with local business, education, and community leaders. (More details on the study's methodology may be found in Appendix 2.) While we elaborate on our findings in the pages below, a few key points may be summed up at the outset:

- The region's experts and business leaders are much more concerned about MST achievement than are parents (who have only a flimsy appreciation for the career opportunities afforded by MST preparation) or students (who tend to find higher level math and science utterly pointless).

- This “urgency gap” can be bridged by speaking the language of opportunity. Parents and students have very little understanding of the ways in which MST achievement can translate into meaningful and plentiful opportunity. The more they understand this, the more engaged they become in the enterprise of improving results.

- As people are given carefully crafted opportunities to engage the issue in deep ways and consider different solutions for improving MST results for students, they tend to gravitate toward several key themes:
    - Helping students appreciate real-world applications of MST disciplines and future career paths through partnerships between schools, employers and colleges.
    - Finding better ways to ensure teacher quality.
    - Getting students more involved in MST subjects beginning in the earliest grades.
    - Disentangling the MST disciplines and appreciating their differences when it comes to things like student motivation, teacher preparation, and testing.

The findings of qualitative research should be regarded as suggestive, rather than definitive, with respect to the views of wider populations. That said, we believe this report offers important clues for effectively engaging the public to improve MST achievement for all students in the Kansas City region.

The Urgency Gap

The views of Kansas City area parents and students on MST education diverge in key respects from those of local leaders, employers and experts. While the latter sound the alarm by declaring that students are simply not getting the MST preparation they, the region and the nation need for success in today's economy, parents and students are largely satisfied with the current state of MST education and believe it is adequate to their needs and aspirations.

Experts and Leaders: Students are Not Ready for the Future

When it comes to gauging the importance of MST education for individuals, communities and the nation, the experts we spoke with did not mince words.

> *Today's global language for economic competitiveness is math and science…if we're illiterate in [these areas], we're not going to be able to compete globally…if students don't do well in high school, they're going to be relegated to jobs in the service industry. –Business leader, manufacturing*

> *We are creating a class society based on the gaps between those who are scientifically and mathematically literate and those who aren't. –Science education expert, working biologist*

In bringing the issues close to home, many business and community leaders stressed that, given the impact of technology on all sectors of the economy, workforce development is perhaps *the* key economic issue facing the KC region. From the perspective of business leaders, recruiting and retaining a high-quality workforce is the single greatest challenge today and for the foreseeable future. A main source of this challenge, they say, is that students are simply not emerging from high school and college with the background in MST required for success in the fields in which there is the greatest economic opportunity.

> *By and large, the biggest challenge we're facing is developing a high quality workforce to recruit from. –Business leader, construction/engineering*

> *We look for [workers] who are about to graduate from college in a lot of very technical fields…and often we just can't find anyone…You go to marketing, journalism, and communication departments and those fields are chock-full of people, but we go to the engineering schools, chemistry departments, biochemical and physics departments…and the people are just not there. –Working chemist*

> *What are we lacking the most today…in the workforce? It's those analytical, critical thinking, problem-solving, team-building skills. What do you do in math and science? You learn how to solve problems. What are we asking our generation to do when it comes to innovation? Solve problems. –Regional economic development expert*

Business leaders emphasized that a solid foundation in MST is not for the select few, but rather is important for *all* students, whether they are headed to four-year colleges, two-year degree programs, or straight into the workforce.

> *Because of computers and technology, the old 'arm and hammer' jobs of the past just don't exist anymore. Now they all require math. Almost every job now requires competency in algebra, for example. –Urban economic development expert*

> *We really need to update the perception about careers in manufacturing, and explain the kind of education and training that's required for today's manufacturing jobs. …Manufacturing is far different than it was in the past, and very heavy in the STEM [science, technology, engineering, and math] arena. –Business leader, manufacturing*

Parents and Students: What Problem?

The parents and students in our focus groups did not share the sense of urgency evinced by the leaders, though the dynamics underlying the complacency of each are somewhat distinct.

Parents have two perceptions that, in combination, appear to be causing them to be less exercised about MST achievement than experts and employers. First, although they are aware of the increasing technical skill requirements of many jobs, parents have only a weak appreciation of the linkages between MST achievement and opportunity in the emerging job market. And second, they tend to be impressed by the existing MST requirements in their children's schools. Together, these two perceptions tend to blunt their sense of urgency about the problem that leaders are so keen to see addressed.

It is true that when we asked parents if math and science is becoming more important, most said 'yes.'

> *I think every career needs [math and science] more and more—all the time it's being used. It doesn't matter what...everything. Construction workers. –Exurban parent*

> *Math and science is probably getting more and more important all the time, with the world changing so fast and all. –Urban parent*

It became apparent, however, that these sorts of ideas had not fully sunk in for parents. For instance, when we asked them if their *own* children should be required to take more math and science, most said 'no.' Our groups suggest that deep down many parents continue to think that math and science is important primarily for college bound students who already have an interest in the most obvious and traditional MST careers.

> *If you have a child that decides that they don't want to go to college, why should they have to take a bunch of math and science? Maybe they decide they don't want to become a doctor or computer whiz, or what have you. Maybe they're into*

something else. …I think the drive, ethics, and work ethic are more important than math or science per se. –Suburban parent

[Expecting more math and science for all students] is too limiting. Not every kid is, you know, into math or science. What if you have a kid that's an artist or a writer or something? –Exurban parent

Couple this relatively weak appreciation for the importance of MST in the modern workplace with another perception common among the parents we spoke with—that their children are learning a lot more about math, science and technology than they themselves ever did—and it becomes clear why parents are not terribly concerned about MST achievement.

I think the algebra that [my son] does as an 8th grader is the algebra I did as a freshman in college. It seems so much harder… –Suburban parent

I don't think I even had to take much more than one or two math and science classes when I was in high school. Now they have to take three of each in order to graduate. I'm thinking like, wow, things have changed a lot. –Exurban parent

My husband has a Master's in Economics. Even he couldn't keep up with some of the information that was given to our son. It's like they're just way ahead. –Urban parent

Turning to students, we found them to be even further out of step with the experts than parents. Where leaders trumpet the unprecedented importance of MST for individual success and collective competitiveness, most of the students we spoke with find most MST subjects to be utterly irrelevant.

This became apparent from the beginning of our group discussions with students. Before telling them the subject of the session, we asked the following open-ended question: "You're probably learning some things in school right now that you think will be useful to you later in life and you're probably learning some things that seem totally useless. What is the most useless subject you're learning in school now?" Whether they were from urban, suburban or exurban schools, an overwhelming majority of students named higher level MST (most often geometry and chemistry) as the least relevant of the subjects they're learning.

I hate math just because it's hard for me to understand how that's ever going to come back and help me. There's just not a point. –Suburban student

I guess if you were going to go into like architecture or something, geometry would be useful. For me, when I'm doing the homework, it just seems pretty pointless. –Urban Student

Science doesn't matter unless you want to become a doctor or something like that. –Exurban student

Just because there's so much technology doesn't mean people are going to choose professions where they're going to use math and science. There's tons of professions that don't use math or science at all. So what's the point of having to take so much? –Suburban student

Even more than parents, our student respondents did not grasp the actual career opportunities afforded by a strong background in math, science, and technology. When we asked students about specific career opportunities made possible by high proficiency in MST, they barely had a clue. The gap between them and business leaders on this score could hardly be wider.

The Teachers' Perspective

If parents and students do not perceive a big problem in MST education, teachers of those subjects certainly do. The student attitudes recounted above resonated troublingly with the views of MST teachers who told us that student apathy and lack of motivation are among the most serious challenges they face in the classroom.

Probably the same amount of teachers anywhere across the country would say that apathy has got to be 100% the biggest problem with American students. –Exurban high school science teacher

The value of education just isn't there in the student body. …Having a good education is not what they want or care about. –Urban high school math teacher

We would be bazillionaires if we could say, "This is the way to motivate students." –Suburban high school science teacher

These comments by teachers in the trenches suggest that addressing the urgency gap is not only a matter of creating public will to support education reform. It is a matter as well of student motivation and its impact on teaching and learning in the classroom, and this makes closing the urgency gap a doubly urgent task.

Closing the Urgency Gap

Speaking the Language of Opportunity

While education experts and business leaders often talk about MST achievement in terms of regional and national competitiveness, we found in our focus groups that parents and students are not particularly moved by this argument. They are more likely to be motivated by the idea that a strong MST education can open up opportunities for students by preparing them for good-paying jobs or by helping them get into better colleges.

We saw this plainly among the students we spoke with. As noted earlier, the vast majority of them had come to the focus groups feeling that higher-level MST coursework could not be more irrelevant to their futures—a posture that MST teachers identified as the key impediment in their classrooms. But every one of these students also said they'd be willing to take more MST and work harder at it if they knew it would significantly increase their chances for good paying jobs, help them get scholarships to pay for college, or help them get into a better college than would otherwise be the case. Some were moved more by the job prospects, some by help with their college careers, but all of them responded to at least one of these means for improving their future possibilities and prospects.

Among the experts we interviewed, community leaders working in lower-income urban settings were most in-tune with the parents and students by seizing on increased opportunity as the key motivator.

> *People make choices based on defined opportunity. …If we start showing kids the things that can happen if they achieve certain levels of [MST] competency then they'll start studying harder, they'll start seeing the value of doing their homework, of taking more advanced classes. –Urban community leader*

> *The opportunity-equation has to be answered…because you're in competition, whether it's competition with the television or competition with their friends, [kids] have got to see the reason why they're doing [math homework] rather than something else that might seem more enjoyable. –Urban economic development expert*

Opening Minds through Dialogue and Deliberation

A core strategy for bridging the gaps between experts, educators, parents and students, and for finding ways to work together for student success, is community-based dialogues. Whether in large public forums or small-group meetings, whether in face-to-face settings or via the Internet, such dialogue among citizens and across different perspectives can be a key to building public understanding and the will for change by getting all the stakeholders on the same page.

In one instance, a randomly selected participant who happened to be a working chemist was enormously helpful to the rest of the group as they considered the relevance of MST education in today's world. Essentially, this individual became a kind of "maven," able to inspire the rest of

the group to brainstorm more effectively about the relationship between MST education and opportunity.

At the start, individuals in the group seemed unwilling or unable to talk about the relationship between MST education and adult life, and our questions about MST career opportunities were mainly met with uncomfortable shrugs. Then, the chemist chimed in, saying:

> *From my perspective there's just [so many opportunities in MST fields]. It's everywhere. You know, a pharmacist has to take numerous hours of chemistry. Architecture is science based, math based. I tend to think that everything is science based. –Working chemist*

He also went on to talk about a chemist he knows who works on the science of color, and the relevance of that to painting and the arts—a particular interest of a recent high-school graduate in the group. As a result of his sharing his real-world experience and knowledge of the many careers that MST education can open up for students, the same participants who were initially taciturn began turning the discussion in new directions in exchanges like this:

> *[Kids today] may not even know that if they take these particular classes that these particular businesses look for these particular skills. –Male, general public*

> *See, I would have loved it if, when I was in high school, we had more career direction because when I graduated I was like, "I don't know what I want to do." And maybe there would be more science and technology people now. Maybe I would be one of them. –Female, general public*

> *You have to get into these kids' minds that there are opportunities out there and these are the things in front of you. You know, present it to them in a way that they can understand that there is opportunity at the end of the line. –Male, general public*

This is but one of many examples of how well-designed dialogue and deliberation can help people appreciate the importance of MST education, and motivate them to work together to improve results.

Working toward Solutions

Closing the urgency gap between leaders and the public is not, of course, an end in itself. Rather, it is an important step toward engaging people to work together for better educational results. In this section we examine what our research suggested with respect to people's thinking about improving student achievement.

Helping People Think It Through: The Power of "Citizen Choicework"

This section draws not only on the focus groups and interviews we've discussed so far, in which we talked to students, parents, teachers and experts/leaders separately. It also reflects three heterogeneous sessions that included parents, teachers, students, and members of the general public without children in school, all in the same setting. These "mini-town meeting groups" (as we sometimes call them) were discussions organized around a Citizen Choicework discussion guide we developed to aid people's deliberations on improving MST education. This guide is designed to help people understand the strengths and tradeoffs associated with trying to improve results through better teaching, a stronger curriculum, and a smarter system of assessment and accountability. The guide also suggests ways in which schools, families and the broader community can work together in support of different approaches to student success. (See the print version of the MST Choicework Guide in Appendix 1. For a video version, contact Public Agenda.)

Several key themes tend to emerge as people think about and discuss ways to improve MST results. These are:

- The potential for partnerships between schools, businesses and colleges to help students appreciate real-world applications of MST disciplines and future career paths.
- The critical importance of quality teaching for student motivation and success.
- The benefits of starting young in order to build a strong foundation for, and appreciation of, these subjects.
- The need to disentangle the MST disciplines and appreciate their differences when it comes to things like student motivation, teacher preparation, and testing.

Making the Curriculum Relevant Through School-Community Partnerships

Parents, students, teachers, education experts and business leaders all say that they want closer and more creative partnerships between schools and community institutions, especially businesses. They see this as key to driving home the real-life applications and opportunities that the MST disciplines represent, and as ways to bring the material to life.

> *Manufacturers are consistently telling us 'we would like to have more relationships with schools, particularly high schools.' High schools were saying, teachers and administrators, 'boy, we'd love to have more relationships with manufacturers. They could bring real-world examples into the classroom.' Both*

were saying the same thing; they just haven't gotten together. –Business leader, manufacturing

If math teachers could just kind of think of things that would apply to a person in their actual life, like real careers, or have people come in who work in those careers and help us think about that, instead of just "Do this problem." That would help a lot. –Exurban student

Instead of just telling students, "You need [to know this], you have to learn it," tell them why you're going to need it, or what businesses or what companies would use this knowledge and how that's going to work in the workforce. –Urban parent

All of the different things that students can do with the computer, the different software, and all of that stuff is pretty amazing. Some of my students can do tons more than I can do, but they don't even think that's something that would go on a resume because they don't know how these things connect up with the real-world. That's a problem. –Urban high school technology teacher

The community organizations, the faith community, and the business community should play a greater role…helping to get students exposed to experiences that they have no access to, because they live in hyper-segregated communities where there are layer upon layer upon layer of poverty and lack of education. We need to show kids in our community role models of scientists and engineers and nurses, people who have come from the same place. –Urban community leader

Attracting and Retaining Talented Teachers: A Special Challenge

Not surprisingly, another area of very broad agreement is that high caliber teachers are crucial for MST achievement.

I have an interest in math primarily because I've had great teachers in that field. –Suburban student

I think Earth Science is great. I had a great teacher and, to me, that made it seem interesting. …The teacher made that subject something that I would look forward to. –Urban student

With my son, he's had two bad math teachers two years in a row, so it's just thrown him off. He's a very good student. It's just he had bad teachers and now he says he doesn't like math anymore. That's not right. –Exurban parent

Given the negative attitudes of many students toward higher level MST, it is reasonable to assume that inspiring and knowledgeable teachers are especially important in these subject areas. Unfortunately, according to education experts, it can be especially hard to attract and retain talented teachers with solid MST backgrounds, simply because the private sector offers so many high-paying opportunities in these areas.

It's particularly hard to recruit science and math teachers because there are other opportunities, [especially when] working conditions and expectations make [teaching] not a very attractive path. –Teacher training expert, math and science

[Teachers] have so many responsibilities, so much paperwork, I have no doubt that a conscientious teacher can work 12-14 hours a day. It's especially impressive, given how many other opportunities [science] teachers with strong content mastery have in the workforce today. –Science education expert

In addition to the challenge of attracting teachers with strong MST backgrounds, many stressed the importance of professional development opportunities that help teachers keep up with their disciplines and better connect their content areas to the real world in ways that bring the material to life for students.

I would love…the opportunity…to spend some time with people in corporate, industrial, and research settings. Just see what they are doing, just be a part of that. I can come back and bring that real-world application, the job setting, and all of those things that are really important to our students. –Exurban High School Science Teacher

Teachers have lost track of what the real world is like, and they're teaching in silos and not connected to the real world. Therefore, they can't even make the curriculum relevant to students. –Community leader

It seems to me that in a lot of ways, a lot of schools are still teaching math and science classes the way they did 20–30 years ago. We don't allow our doctors to perform medicine the way they did 30 years ago. Why would we let our teachers teach the same thing? –Urban Parent

To Improve MST Achievement, Start Young

Yet another area of strong common ground concerns the importance of getting kids excited about math and science in elementary school, and providing a strong foundation for later success.[3]

I think everyone should learn more and learn it earlier. At a younger age, start them off and do more…if you want them to be successful later on. –Urban parent

Starting young…is the most important thing you can do. Little kids are so easy to get excited and that's what school should do for them. Maybe they won't be so turned off in middle school. –Exurban parent

I think at the high school level it is almost too late. For instance, my son is a junior and he is taking chemistry and struggling with it. Maybe…if it had been introduced intermittently in the years leading up to that and he had more exposure to it [he'd be doing better now]. –Suburban parent

One of the challenges here is that while elementary school teachers tend to be prepared as a matter of course to teach mathematics, this is not the case at all for science education. According to experts we spoke with, many elementary school teachers simply do not have the background that would allow them to teach science effectively and ignite young students' imaginations.

> *I think the biggest area of difficulty that we see is elementary teachers who have maybe one course in teaching science and are deathly afraid of it, and so they just teach straight out of the book and teach memorization and don't get kids curious and involved and excited about science. –Science education expert*

Disentangling the Disciplines

Another lesson we learned from students, teachers and education experts is that it is important for people to be sensitive to the differences between math and science and not simply lump them together as they think about how to improve results. When it comes to things like student motivation, teacher preparation and testing, there appear to be real differences among the MST disciplines.

For instance, we found in our groups that sometimes students who like math dislike science, and vice-versa. Students who prefer math tend to stress its precision and certainty. They say things like, "I really like that there's one right answer and you go step by step to get there." Those who prefer science, however, seem to bask in the complexity and uncertainty of things and are more prone to enjoy open-ended inquiry. They say things like, "I like how science shows you how interconnected everything is, and how you get to experiment with things."[4]

If such intrinsic differences between math and science learning are really significant, one would think they would show up for teachers as well as students. One expert with whom we spoke emphasized exactly that point:

> *[Math and science] are really different. The instructional approaches, the way that science and math teachers are developed, is different. The math curriculum can be very linear and very sequential with benchmarks, but with science the curriculum is very broad and…those concepts are not necessarily best presented in a linear sequence. –State level education expert*

Assessment and testing is yet another place where it appears to be important to disentangle the disciplines. According to a number of experts and science teachers, the very nature of standardized testing can have a negative impact on teaching and learning in science education in particular.

> *The classroom has really become a restricted environment, and between testing and related expectations science teachers say the fun has gone out of classroom teaching. This oppressive environment is driving science teachers to early retirement, because it's just not a good environment for investigation and curiosity, which is what science is all about. We're going to lose half the*

biology teachers in the state of Kansas to retirement in the next 10 years. –Science curriculum expert

Obviously, I can drill kids on facts and vocabulary a lot quicker and maybe stuff a lot more facts in their heads, but if I really want them to understand a scientific principle or concept I'm going to use some kind of inquiry method. And that's certainly harder to test, and it's very time consuming. –High school science teacher

For math, however, the story is different. According to experts, standardized tests, if properly designed, do not necessarily pose a problem for math instruction, and in fact we did not find math teachers complaining the way science teachers did that standardized testing is by its nature somehow counterproductive. We did, though, find that math teachers, along with math students and their parents, were concerned about the *amount* of testing they are experiencing. In short, for math the problem appears not to be standardized testing per se, but simply that there may be too much testing going on. Such "testing fatigue" presents less of a problem in the science classroom for now, although some science teachers worried that it soon could prove to be a problem if science becomes an object of NCLB testing, as is currently planned.

Conclusion: Working Together for Student Success

The themes discussed in the last section (creating school partnerships, ensuring teacher quality, starting young and disentangling the disciplines) are ideas that people gravitate towards once they've come to appreciate the importance of improving MST achievement and begun to think about solutions. Identifying such areas of common ground is a start—but only that—to developing ways in which schools, families and communities can work together more effectively. The real work that schools and communities must undertake is to engage these sorts of ideas in sustained and concrete ways that lead to programs and practices that build better conditions and opportunities for student success.

This phase of qualitative research suggests ways to bridge the urgency gap between leaders and the public, as well as ways to help very diverse stakeholders, each with something to offer the larger cause, to engage in serious dialogue on solutions. Such dialogue, we believe, would serve the region well in its efforts to increase student success in the critical and fast-growing math, science and technology fields.

Appendix 1: Citizen Choicework Discussion Guide

Ready for 21st Century Careers:
Making Sure Students Get the Math and Science They'll Need to Succeed in the New Economy

Introduction

Whether they're planning to attend a four-year university, a two-year degree program or enter an on-the-job training program, today's students will be living in a world of rapid technological change where more and more good jobs and promising careers will require a solid background in math, science and technology. From nursing to auto-mechanics to marketing, workers will need a greater mastery of these subjects than ever before. Even many jobs that do not directly involve math or science will require the kinds of analytic skills that these subjects help students to develop.

A solid grasp of math and science can also help students become more capable citizens, better able to understand important issues such as cloning, global warming and the latest economic trends.

Finally, better achievement in math and science is important to our region and to our country if we are to compete successfully in the new global economy.

Unfortunately, recent studies suggest that we are not doing a good enough job teaching math and science to today's students. For example,

- Fewer than half of all high school graduates are prepared for basic college-level math.
- It is estimated that 60% of all new jobs in the 21st century will require the kinds of math and science skills that are possessed by only 20% of the current workforce.
- The U.S. ranked 24 out of 29 industrialized nations in an international standardized test of mathematics skills and knowledge.

How can we change these trends and make sure that all students who graduate from our high schools have the math and science they'll need? To help you and your neighbors talk about this, we present three approaches to improving student achievement in math and science. Among these choices there are probably some ideas that you'll like and some you won't. The main point is that we can't do everything at once. We need to make choices and set priorities. Which ideas make the most sense to you—and why?

1) Invest in Great Teachers

Skilled, enthusiastic teachers with a deep knowledge of their subject area are the key to helping students master math and science. Knowledgeable and inspiring teachers bring the material alive, fine-tune it to the needs of different kinds of learners, and motivate them to work hard. Unfortunately, too many math and science teachers don't know their subject matter well enough to help students develop the background they'll need to succeed in college or job-training programs after high school.

Therefore, we should do things like:

- Raise salaries to attract and retain talented math and science teachers—even if this means paying them more than teachers in other subject areas.
- Place the most experienced and capable math and science teachers in the toughest schools.
- Provide strong professional development in math and science, so that teachers can keep up with advances in their fields, and provide training to elementary school teachers—who may not be very strong in math or science at all.
- Create better ways for teachers to communicate with parents by scheduling teacher/parent conferences at different times of day and by creating websites where teachers and parents can interact online.

People who like this approach say, "The human touch is what counts. You can't have great schools and motivated students without great teachers."

But others say, "It's not realistic to expect every teacher to be a superstar."

2) Create Smart Accountability

The key to better results is demanding more of our teachers, students and schools through *a strong and smart system of accountability*. We need to know how well all of our students are doing, which of our teaching methods are really working, and how best to encourage the results that we want. By carefully assessing student achievement on a regular basis, and by putting the right mix of incentives in place, we'll motivate everyone to try harder, work smarter and get the job done.

Therefore, we should do things like:

- Measure student progress regularly through a variety of well-crafted tests and assessments.
- Create incentives that reward or penalize school leaders and teachers based on student performance.
- Allow students to graduate from middle and high school only if they demonstrate that they've learned their coursework in core math and science subjects.
- Encourage families to expect high student achievement in math, science and technology.

People who like this approach say, "High expectations coupled with a smart system of assessment and accountability will motivate students to perform at high levels."

But others say, "How do we know that tougher math and science graduation requirements won't just create more drop-outs rather than better-motivated students?"

3) Implement a 21st Century Curriculum from Kindergarten through High School

Accountability doesn't mean much if we haven't decided what to teach. The real key to student success is developing an *innovative, up-to-date, math and science curriculum* that, beginning in elementary school, gets students excited and prepares them for the opportunities of today's world. Such a curriculum should be engaging, demanding and carefully focused on the essential knowledge and skills appropriate to each level of schooling. And as much as possible, it should be a common curriculum across schools and districts, as some other countries have, to help make sure all students are mastering the core concepts required for success after high school.

Therefore, we should do things like:

- Get kids excited about these subjects early on in elementary school while making sure they learn the fundamentals so they are ready to succeed in middle and high school.
- Develop an innovative and challenging curriculum that, rather than trying to cover too much, concentrates on a select number of essential areas each year.
- Implement the curriculum as consistently as possible across classrooms, schools and districts so all students have the same opportunities.
- Create partnerships with businesses and colleges so students see real-world applications and emerging career opportunities.

People who like this approach say, "We should start young with a relevant, engaging, common curriculum designed to prepare all students for the real world."

But others say, "An overly-detailed curriculum will stifle the creativity of teachers."

The Choices in Brief and their Tradeoffs

Great Teachers

Skilled, enthusiastic teachers with a deep knowledge of their subject area are the key to helping students master math and science. We should:

- Pay math and science teachers more than teachers in other subject areas.
- Place the most experienced and capable teachers in the toughest schools.
- Provide strong professional development opportunities and require subject-area mastery.
- Create better ways for teachers to communicate with parents.

Challenges, tradeoffs and questions for this approach:

- It is not realistic to expect every teacher to be a superstar; they are already spread thin.
- Other subjects are equally important and other teachers work equally hard, so it's not fair to pay MST teachers more.
- How are we going to pay for this very expensive solution?
- Is it really fair or smart to put the best teachers in the worst schools?

Better Accountability

The key to better results is demanding more of our teachers, students and schools through *a strong and smart system of accountability*. We should:

- Measure student progress regularly through a variety of well-crafted tests and assessments.
- Create incentives that reward or penalize school leaders and teachers based on student performance.
- Allow students to graduate from middle and high school only if they demonstrate that they've learned their coursework in core math and science subjects.
- Encourage families to expect high student achievement in math, science and technology.

Challenges, tradeoffs and questions for this approach:

- There is no point in measuring progress until we know that we have the right curriculum.
- Isn't this more likely to produce a nation of test-takers, rather than a nation of thinking, educated people?
- What's to keep exit exams from resulting in higher dropout rates rather than better performance?
- Penalizing schools and teachers isn't fair unless we are willing to fund all of our schools adequately and equally.

21st Century Curriculum

A challenging, engaging, world-class math and science curriculum that will help all students meet the challenges of today's world is the real key to student success. We should:

- Start in the early grades with a strong emphasis on math and science.
- Concentrate on a select number of essential areas each year.
- Implement the curriculum as consistently as possible across schools and districts.
- Create partnerships with businesses and colleges to directly expose students to the real-world applications of what they are learning.

Challenges, tradeoffs and questions for this approach:

- A highly detailed curriculum will stifle the creativity of teachers and make it harder for them to fine-tune their classes to different teaching and student learning styles.
- Promoting a common curriculum will diminish local control and ignore the different needs of different schools and communities.
- Might students miss out on important educational experiences if we put too much emphasis on the MST curriculum?
- Do we really want to tie the school experience so closely to business? After all, an education is about more than making money, isn't it?

Appendix 2: Methodology

The fieldwork for this study took place in the Fall of 2006. Twelve focus groups were conducted:

- Three were suburban groups, one each with parents of school-age children, high school students, and math and science teachers. These groups were recruited from three school districts in Johnson County, KS: Blue Valley, Shawnee Mission, and Olathe.
- Three urban groups, one each with parents of school-age children, high school students, and math and science teachers, recruited from the Kansas City, MO school district.
- Three exurban groups, one each with parents of school-age children, high school students, and math and science teachers. These were recruited from four districts in Clay County, MO: Excelsior Springs 40, Kearney R-I, Liberty 53, and Missouri City 56.
- Additionally, three heterogeneous groups were conducted to help us develop and refine the Choicework discussion guide (Appendix 1). These groups were comprised of parents of school-age children, teachers, high school students, and a cross-section of members of the general public.

The groups were recruited by professional market research firms in the Kansas City area according to Public Agenda's specification and moderated by senior Public Agenda researchers.

Additionally, twelve in-depth expert interviews were conducted either over the phone or in person with business, education, and community leaders in the Kansas City region. Some of these individuals also have held or currently hold state-level positions.

- Mary Brock, President, Science Pioneers
- Steve Case, Asst. Director, Center for Science Education, University of Kansas
- Terry Dunn, President, Dunn Construction
- Gwen Grant, President, Urban League
- Bernard Franklin, President, Penn Valley Community College
- Linda Lacy, State of Missouri Department of Elementary and Secondary Education, Math and Science Partnership Director
- Peter Levy, President, Chamber of Commerce
- Bob Marcusse, President, KC Area Development Council
- Clyde McQueen, President, Full Employment Council
- Elizabeth Petersen, President, Science Teachers of Missouri
- Paul Scianna, President, Alliance for Innovation in Manufacturing
- James Spigarelli, Midwest Research Institute

Email surveys were also completed by ten members of the faculty and staff of the University of Missouri, Kansas City, School of Computing and Engineering.

Notes

1. In addition, Kansas City has recently received a grant through the U.S. Department of Labor's WIRED (Workforce Innovation in Regional Economic Development) initiative. Through this initiative, the U.S. Department of Labor will invest $195 million in thirteen regional economies to assist with "implementation of new efforts designed to drive integration among workforce, economic development and education systems; innovation in addressing challenges; and utilizing and building upon existing structures, resources and legislatively funded programs" (from the U.S. Department of Labor website). Through its WIRED grant, KC will be focusing on developing three major industry sectors: advanced manufacturing, biotech, and healthcare.

2. In 1994, 52% of parents thought their children were not getting enough math and science compared to only 32% of parents thinking the same in 2005. ("First Things First," Public Agenda, 1994; "Reality Check: Are Parents and Students Ready for More Math and Science," Public Agenda, 2006.)

3. In their report to the Kauffman foundation titled "Improving Math, Science, and Technology Education: A Plan for Action" DCA emphasized the extent to which "the earliest decisions have the greatest effect on a child's future." Their research yielded the recommendation that "strategic weight be given to parents, teachers and environmental influencers of children ages 3 to 12.

4. A question that we were not able to explore in this series of focus groups, but which future research should address, is whether there are also students who naturally like technology courses more than either math or science, and if so, why?