
Work to Do

The Role of STEM Education
in Improving the Tri-State
Region's Workforce



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Executive Summary

The ultimate promise of STEM education is to develop the next generation of collaborative problem-solvers as a means of closing the workforce gap of skilled workers in the region that includes Southwestern Pennsylvania and adjacent counties in Ohio and West Virginia. Although educators say that STEM education is becoming more of a priority across the region, a seminal finding of this study is that rural areas represent one of the greatest, yet under-exploited, opportunities for STEM education to impact workforce development. This rural perspective on STEM education, as separate and distinct from an urban or suburban perspective, is significant because rural areas have not yet been a major focus of STEM education initiatives.

This rural opportunity underscores the power of STEM education. By engaging all young people in science and math through a collaborative, hands-on, problem-solving and project-based approach to education, STEM education does not just inspire our future scientists but also elevates the prospects of all rural students, including those at small schools with limited resources—who, without STEM education, have fewer options. The challenge is to create separate pathways for different types of students so all can benefit from the promise of STEM education.

The good news is that parental attitudes about education and careers align with STEM fundamentals. Even though many parents are uninformed about STEM education and are intimidated by advanced math and science, nearly all embrace problem-solving and project-based learning, essential aspects of quality STEM education. This is especially true in rural communities where the need is greatest and where many of the opportunities lie.

Achieving this promise will take time and effort. Teachers and other educators raise numerous important obstacles inside and outside of the classroom, including key misperceptions about STEM among fellow teachers. Awareness of the term STEM is very low among parents in the region, and most are unable to recall ever having discussed the subject with a school official. Parents display a major lack of understanding about the objectives of STEM education and fail to associate many of the available technical and technology-related jobs and careers in the region with STEM education.

There is work to do in fulfilling the promise of STEM education to improve workforce development in the tri-state region. This report demonstrates that the will exists. Now comes the hard part.

Methodology

Research conducted for this report consisted of the following phases:

In-Depth Individual Interviews (IDIs): IDIs of approximately 45 minutes in length were conducted by phone with a total of 47 educators and business leaders. Educators included middle and high school teachers and counselors, superintendents and Allegheny Intermediate Unit professionals. All business leaders were senior-level officials directly involved in workforce development and hiring at regional industrial and manufacturing companies. Quotas were established to ensure that there was adequate representation by urban, suburban and rural locations as defined by the Census. School and business directories were used as the sample source and for recruiting purposes.

Parents Survey: A total of 978 surveys were completed with parents who had one or more children in elementary, middle or high school and resided in a 17 county area. Quotas were established to ensure that we had representation by county and by urban, suburban and rural locations within each county. The survey was administered online and by phone. The margin of error for the study was +/-3.1% at the 95th confidence interval level. Parents were provided with the following definition of STEM education: *STEM education refers to rigorous instruction in science, technology, engineering and math. Often STEM courses involved hands-on learning and participating in activities in which students collaborate with other students to solve problems.*

Family Dialogues: Professional moderators conducted a total of seven “Family Dialogues”—dinner home visits with parents and their children across the region—to discuss education and careers and to specifically assess awareness of and attitudes toward STEM education. Family Dialogues lasted approximately two hours and the researchers were invited into people's homes in rural, urban and suburban locations.

Student Survey: An online survey of 100 middle and high school students was conducted across the region.

The geographic scope of the project consisted of a 17 county area in Southwestern Pennsylvania and two adjoining states. Analysis for the report will focus on discussing similarities and differences between rural, urban and suburban areas, as defined by the Census.

Major Findings

- 1 Many parents, educators and business leaders believe that schools must do a better job of preparing tomorrow's workforce. The U.S. is perceived to be far behind in math and science.
- 2 Parents' awareness of and understanding about STEM education is low throughout the region. It is at its lowest in rural areas.
- 3 Educators and business leaders identify key prerequisites for robust STEM education, most important of which is making it engaging to students—collaborative, hands-on, problem-solving and project-based.
- 4 Parents' underlying attitudes about education and careers align with many STEM education fundamentals.
- 5 Educators and business leaders are adamant in their opinions that STEM education is for all students.
- 6 The current language around STEM education is not resonating with parents.
- 7 Business leaders believe that quality STEM education can help develop the next generation of collaborative problem-solvers as a way to close the regional workforce gap of skilled workers.
- 8 Most educators say that STEM education is becoming more of a priority, but there are differences by region. Rural areas represent the greatest opportunity for STEM education related careers in new industries.
- 9 Educators identify major obstacles to STEM education both inside and outside of school and the classroom.

01.

Many parents, educators and business leaders believe that schools must do a better job of preparing tomorrow's workforce. The U.S. is perceived to be far behind in math and science.

Workforce considerations are front and center in the minds of parents, educators and business leaders when discussing STEM education. In fact, every teacher, counselor and superintendent who participated in the study echoed the same sentiment: *It is a primary responsibility of our nation's schools to prepare young people for success in the work world.*

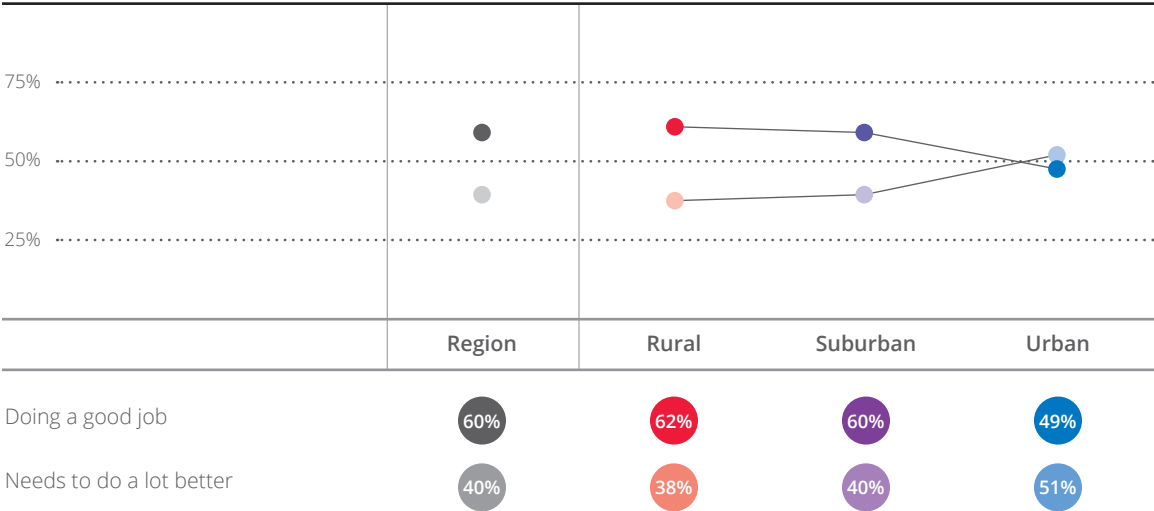
Parental attitudes about education align with this emphasis on preparing students for jobs and careers.

Parents Say Schools Must Improve Performance in Preparing Students for Life

Schools Can do a Better Job of Preparing Students to be Successful

Two in five parents (40%) say that local schools need to do a better job of preparing students to be successful as adults. Parents in urban districts (51%) are most likely to echo this sentiment.

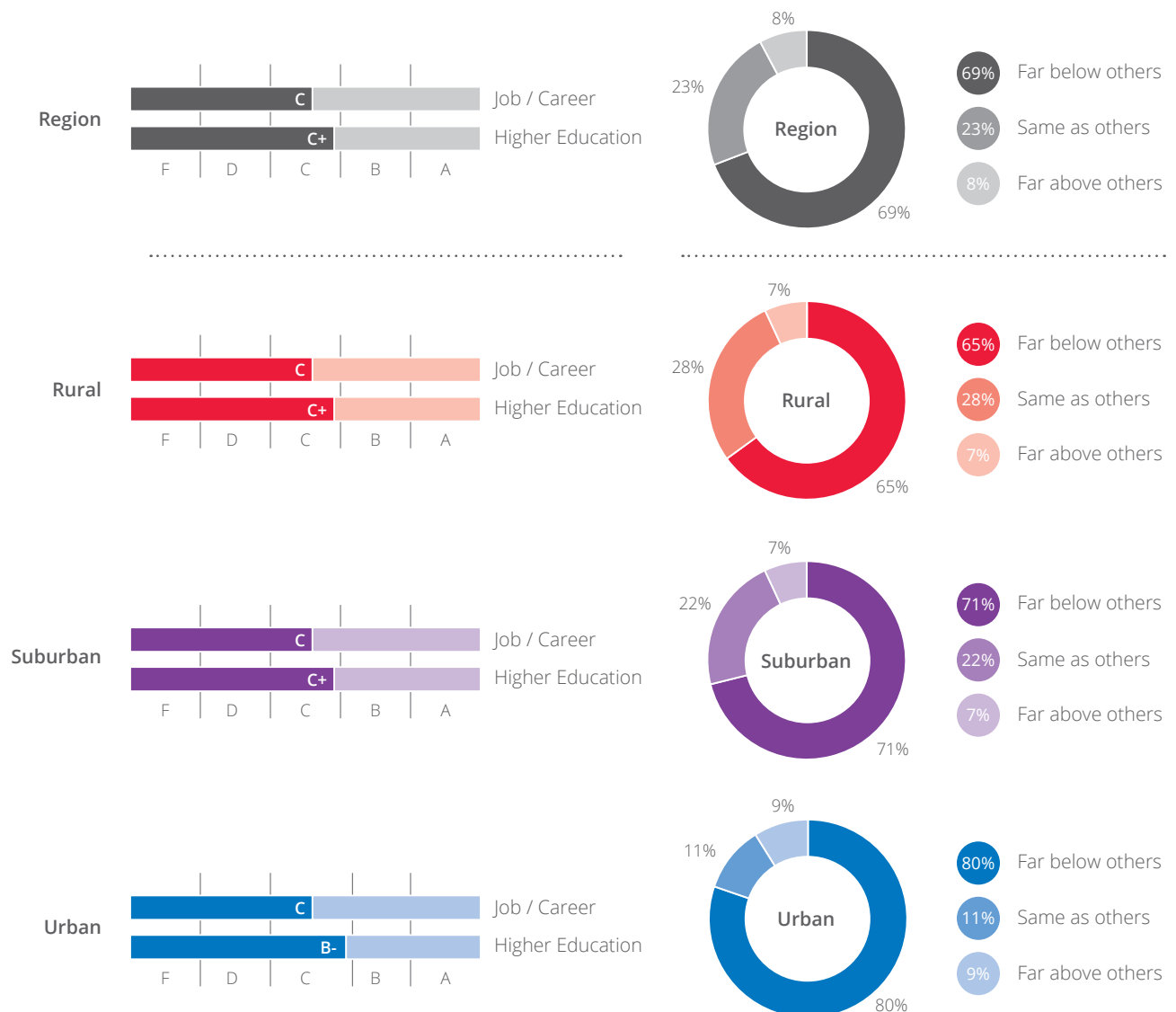
Local Schools: Good Job or Need to Do a Lot Better to Prepare Students for Success?



Local Schools Can do Better and the U.S. Needs to Catch Up in Science and Math

Parents give their children's schools a C in preparing them for jobs and careers, lower than the grade they give schools for preparing children for higher education (C+). The awarding of these average grades could be related to the attitude that the U.S. is falling behind other industrialized countries in educating our children in science and math (69%). Parents in urban locations (80%) are most likely to espouse this view.

Parents Grade Their Children's Schools and Compare US Math and Science Education to Others



Educators See Some Progress in Workforce Development but Business Leaders See Little

Educators Say STEM is Helping

According to educators, the answer to the question “are schools preparing tomorrow’s workforce?” is no, not right now, but we are making progress with STEM education and the outlook is getting better.

“We need to prepare every student for employment or jobs but there are many obstacles such as lack of parental involvement, lack of community involvement and mediocre teachers. Our schools are just slowly moving to STEM and the gas and oil industry is providing some helpful funding. But overall, we need to do a much better job.”

—Superintendent, Rural

“It’s a mixed bag. STEM is taking hold in some schools and these students are better prepared for technical-related jobs in the region. But lots of schools are struggling.”

—Intermediate Unit, Suburban

Business Leaders are Pessimistic

Business leaders say much more work needs to be done in preparing tomorrow’s workforce. They are less optimistic and feel that schools are doing a poor job of preparing students for jobs of the 21st Century.

“Schools are not preparing tomorrow’s workforce as students don’t have the requisite skills. Technology may be getting better—computers have helped—but more practical-based science and math is needed.”

—Business Leader, Rural

“Right now it is difficult and is getting desperate to find trained people who know basic math and vocational skills and these are the jobs of the future in this region. By vocational I mean mechanical aptitude skills in an age of computers. Schools are not preparing the workforce for jobs in this region.”

—Business Leader, Suburban

Parents' awareness of and understanding about STEM education is low throughout the region. It is at its lowest in rural areas.

"STEM"—defined as an emphasis on science, technology, engineering and math in education—is simply not part of parents' vocabulary. Teachers and counselors report quizzical looks from parents when discussing the subject. Even those parents familiar with the term displayed a lack of understanding about its objectives and failed to associate many technology- and technical-related jobs and careers with STEM. This low awareness and understanding of STEM can be traced to lack of communications about it—few schools have broached the subject with parents.

Parents Haven't Heard Much About STEM Education and They Have a Poor Understanding of It

Low Awareness of STEM Education Among Parents

Awareness of STEM education among parents in the region is low: only 42% heard of the term STEM, 25% said their children's school has an emphasis on STEM education, and 20% recall discussing STEM with school officials.

Awareness is lowest among parents in rural locations across all of these measures. Noteworthy is that in a poll conducted among 100 middle and high school students, less than half have heard of STEM and less than one-third recall talking to a school official about it.

Few Parents Have Heard of STEM and Schools are Not Talking



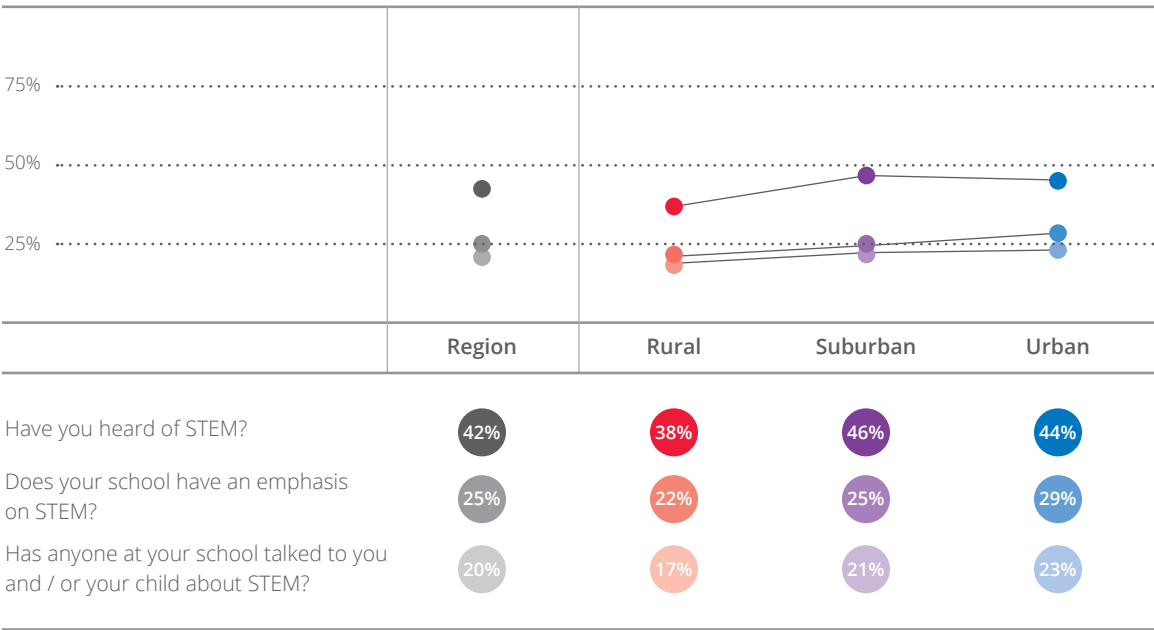
Only **2** out of 5 parents
have heard of STEM.



Only **1** out of 4 parents
think their school has an
emphasis on STEM.



Only **1** out of 5 parents
have talked to someone at
their child's school about STEM.



49% of students surveyed say that
they have heard of STEM.

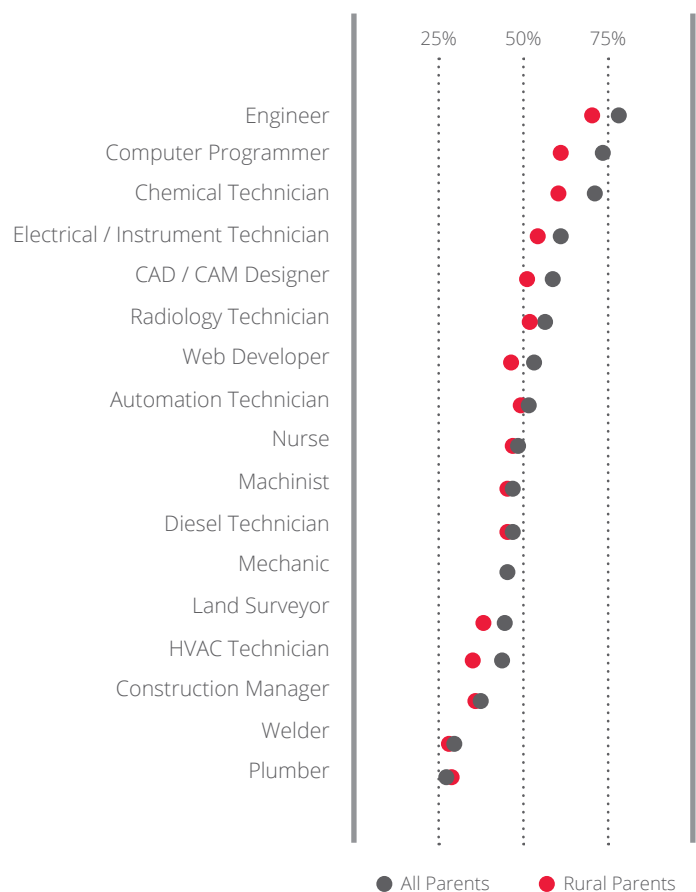


31% of students surveyed say someone
at their school had talked to them
about STEM.

Parents Don't Associate STEM Education with Non-College Degree Jobs

When provided with a list of occupations and asked which they associate with STEM education, parents tend to think that STEM careers are either professional—for the college-educated—or technical. They are less likely to associate such jobs as machinist, welder or plumber with STEM education. In almost all cases, association of jobs, outlined below, with STEM education is lower in rural areas—in some cases much lower.

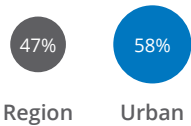
Association of STEM Education with Technical Jobs Lower in Rural Areas



Parents Don't Understand that STEM-Related Jobs Don't Require a 4-Year Degree

Less than half of parents (47%) are aware of the existence of STEM-related jobs in the region that require STEM-related skills in the areas of robotics controls, machining, welding, and precision fabrication but don't require a 4-year degree. Highest awareness, by far, is in urban communities (58%) —it is only here that the trend is reversed. What may help explain this: 65% of parents believe a student needs a 4-year degree to secure a good job. The difference between rural and urban parents in this regard is large.

Awareness of STEM Jobs that Don't Require
College Higher in Urban Areas



College Degree Needed for a Good Job



Educators and Business Leaders Concur that Parents Know Little About STEM Education

A consensus view among educators and business leaders is that parents are poorly informed about STEM, do not understand its value, and do not encourage their children to take STEM courses.

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"Parents are a barrier. They think of it as 'I don't know why you need to go to STEM, I didn't have that when I was in school.' Also, they might think that the science and math aspect is too hard for their kid. They discourage them from trying it. People don't understand the job opportunities that come with these subjects."

—Middle School Teacher, Rural

"Parents don't understand STEM at all. They didn't grow up at a time where engaging, hands-on activities were part of school. They don't want their kids taking them."

—Counselor, Urban

03.

Educators and business leaders identify key prerequisites for robust STEM education, most important of which is making it engaging to students—collaborative, hands-on, problem-solving and project-based.

Educators and business leaders discussed the conditions under which STEM education will be successful and flourish: STEM is collaborative, hands-on, problem-solving and project-based; STEM would start early; businesses are involved in STEM education; students are involved in STEM-related extracurricular activities; and teachers integrate STEM courses into curriculum that align with standards.

STEM is Collaborative, Hands-On, Problem-Solving and Project-Based

Educators Describe the Four Major Features of STEM Education

01. Collaborative

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Students not only learn best through collaborative learning in groups but this mimics the real-world setting they would encounter in a career. When instructors from different disciplines collaborate and teach as integrated teams, students get the benefits of different perspectives. An example would be a math and science teacher teaming up to teach probability based on genetics.

02. Hands-On

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A robust STEM program offers students a variety of ways to explore math, science and technology through hands-on activities. Students are far more engaged and learn better when offered the opportunity to create something such as a robot or bridge rather than simply taking tests and learning formulas independent of activities.

03. Problem-Solving

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Students are given a problem or challenge and they have to figure out how to solve that challenge. In this way they develop problem-solving skills that they could apply in a real-life setting. An example is where students are forced to drop eggs from varying distances as a method of learning how to measure time and distance.

04. Project-Based

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Project-based learning in which instructions are given to complete a project is a more effective method of maintaining a student's interest and encourages out-of-the box thinking. Students are encouraged to apply skills they have learned in an engaging way.

Educators and business leaders say that STEM education's collaborative, hands-on, problem-solving and project-based approach is beneficial to students in two very important ways:

1. It is the best way for students to learn math and science. "Project-based learning is much better in getting the students interested in STEM-related material because quite frankly math is a very hard sell here. Kids are afraid of it and parents of our students are not well trained in it—today's math to them is much harder than theirs was and they often don't see a reason to push their students into it." (Counselor, Rural)
2. It prepares students to learn skills that are important in a real-life, work setting. "Another good example of how quality STEM education would prepare students for the real world and for jobs would be to invite groups of students into the workplace, provide them with a project with established goals, and ask them to develop a solution. As they work through the process, they will be required to perform the math and science required to solve problems and will be more engaged to learn them because they are engaged in an interesting project. Students learn by doing and applying more than simply being instructed to and memorizing formulas on a chalk board. There are lots of business people I know who would work with teachers on this." (Business Leader, Urban)

Parents also Embrace Engaging STEM Courses

Children Learn Best Through Engaging STEM-Related Activities



91% of parents surveyed agree that participating in engaging activities is the best way to learn.



90% of parents surveyed agree their children would be more interested in STEM courses if they could participate in engaging activities.

Educators and Business Leaders Identify Additional Prerequisites for Robust STEM Education

In addition to STEM education that is collaborative, hands-on, problem-solving and project-based, educators believe that STEM education will be most successful if these additional requirements are met.

- STEM would start early—at least by middle school.
- Students must be involved in STEM-related extracurricular activities.
- STEM courses align with state standards.
- Businesses would be actively involved.

Business Participation Can Take Many Forms

Educators outlined how they felt businesses could best support STEM education in their schools.

- Funding STEM-related programs, courses and activities.
- Providing input on needed skills for course design.
- Speaking to students in classes about the importance of STEM.
- Setting up field trips and facility visits.
- Offering internships and job shadowing programs.
- Participating in career fairs.

Parents' underlying attitudes about education and careers align with many STEM education fundamentals.

It is ironic that parents know so little about STEM education because their underlying attitudes about education and careers match up well with STEM as an approach to teaching and learning and what they aspire for their children. Their attitudes also align well with projected STEM outcomes in terms of acquired skills and career opportunities. For a number of reasons, parents would likely be more vocal in supporting STEM education if they were better apprised to its form, function and intent.

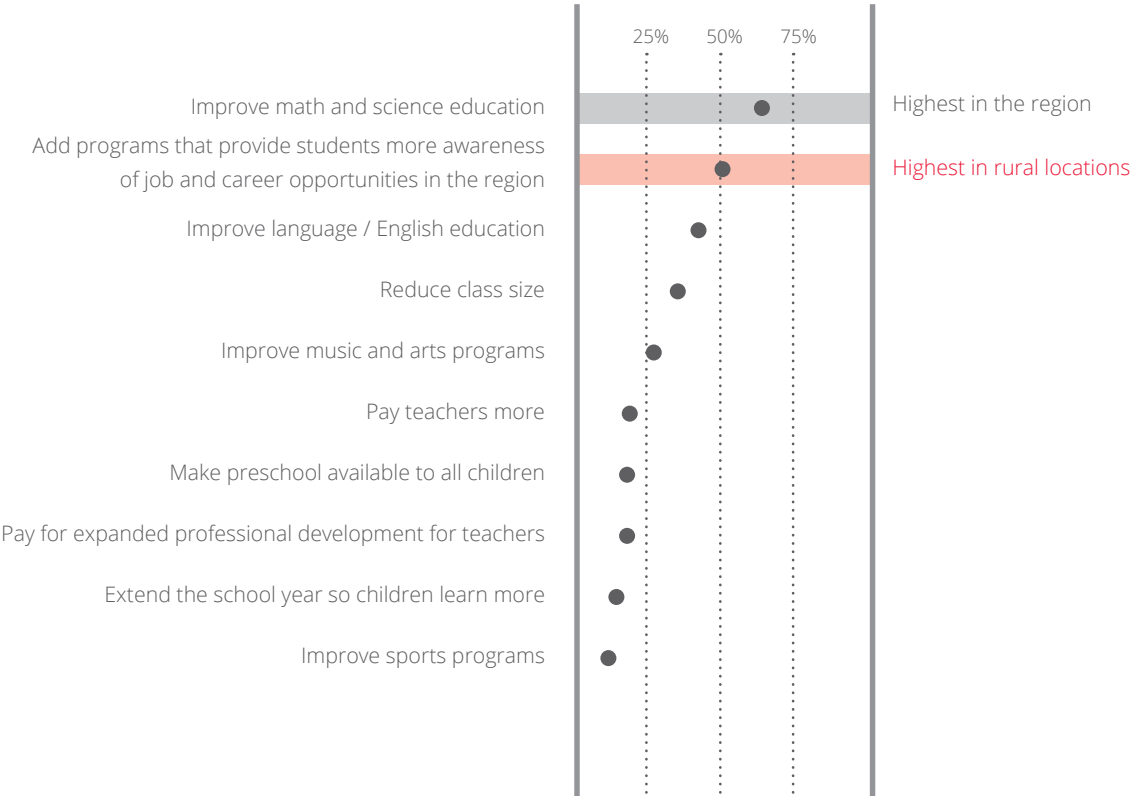
Parental Attitudes Align with STEM Fundamentals

Parents Recognize the Critical Importance of STEM Skills

If parents could decide how to spend extra money on their children's schools, they would opt for improving math and science education (64%) and adding programs that provide students more awareness of job and career

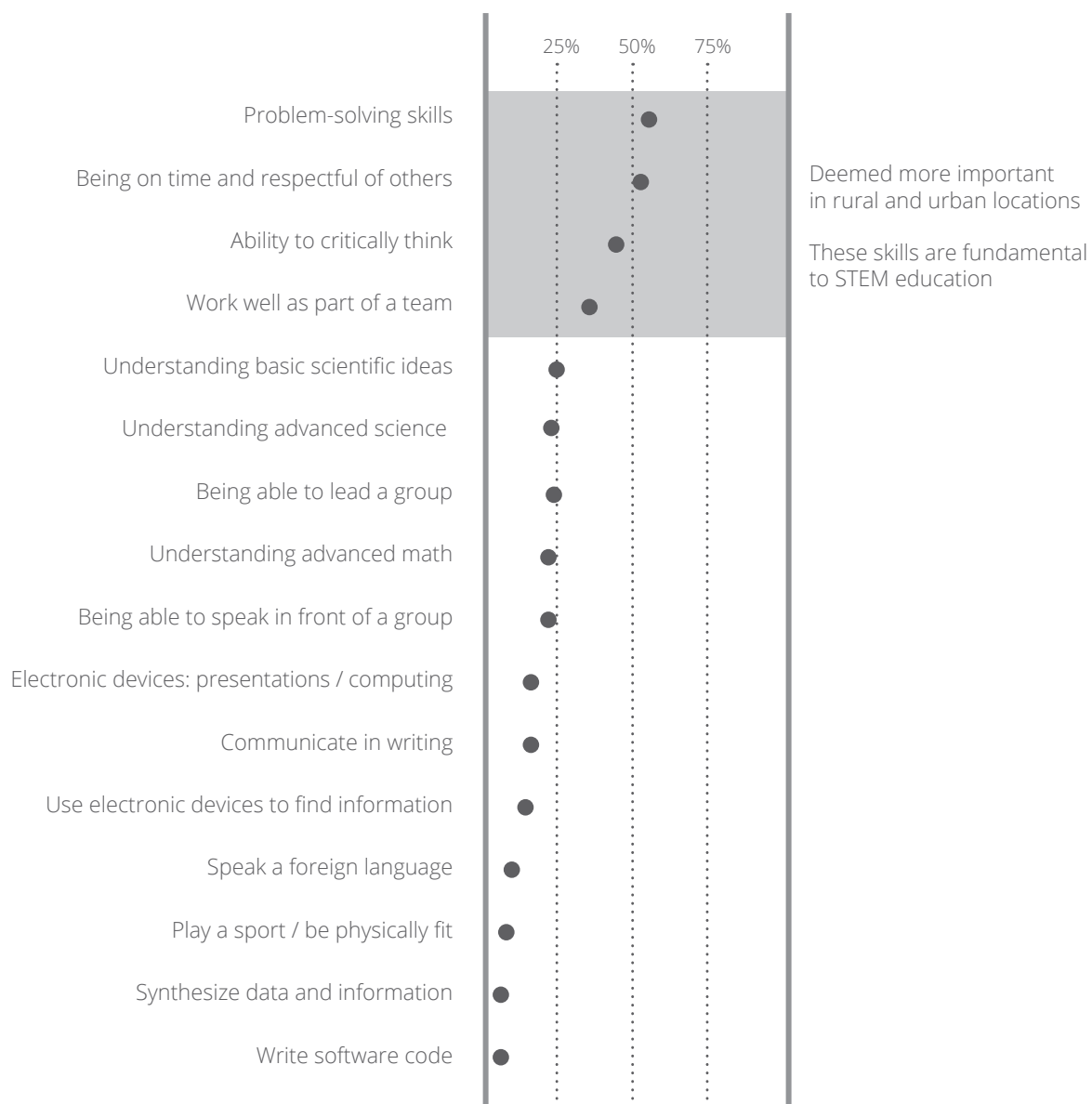
opportunities in the region (51%). Parents from rural areas (55%) are most likely to prioritize awareness of job and career opportunities in the region.

Improved Math and Science and New Career Awareness Programs are Priorities



“Problem-solving skills” (58%) top the list of skills identified as most important by parents for their children to learn for future success in the work world. The “ability to critically think” (44%) and “work well as part of a team” (36%) also ranked high. These STEM education fundamental skills were deemed more important for parents in rural and urban locations.

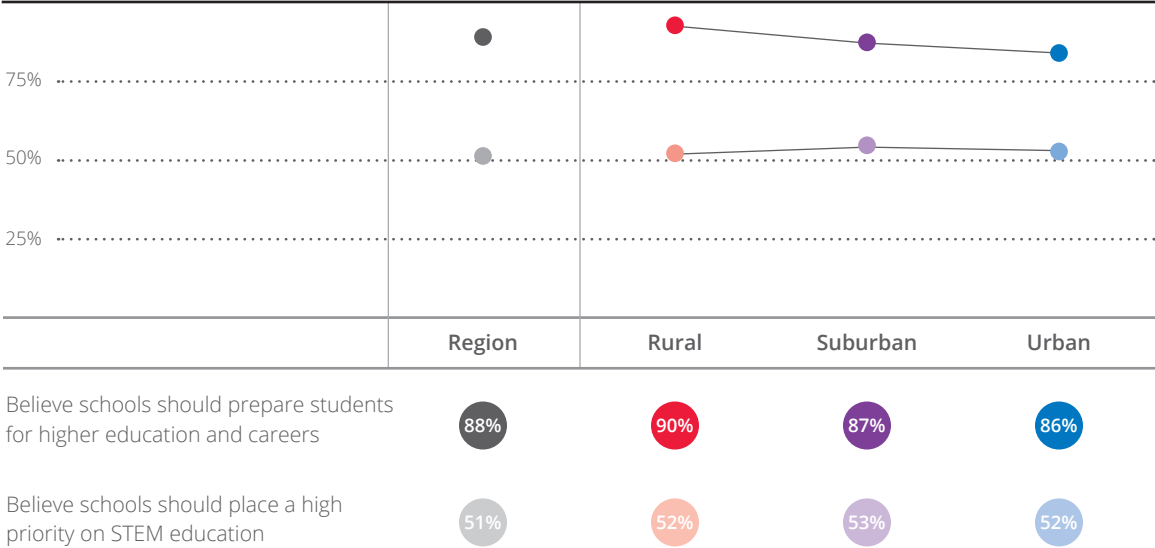
Skills Most Important for Future Success



A Career Focus for Schools, a High Priority on STEM Education

Nearly 9 in 10 parents (88%) think schools should focus on higher education AND careers. These attitudes are more prevalent among parents in rural locations (90%). Once STEM was defined, a majority of parents (51%) in the region believe schools should place a high priority on STEM education.

Schools Must Prepare Students for Careers and Prioritize STEM Education

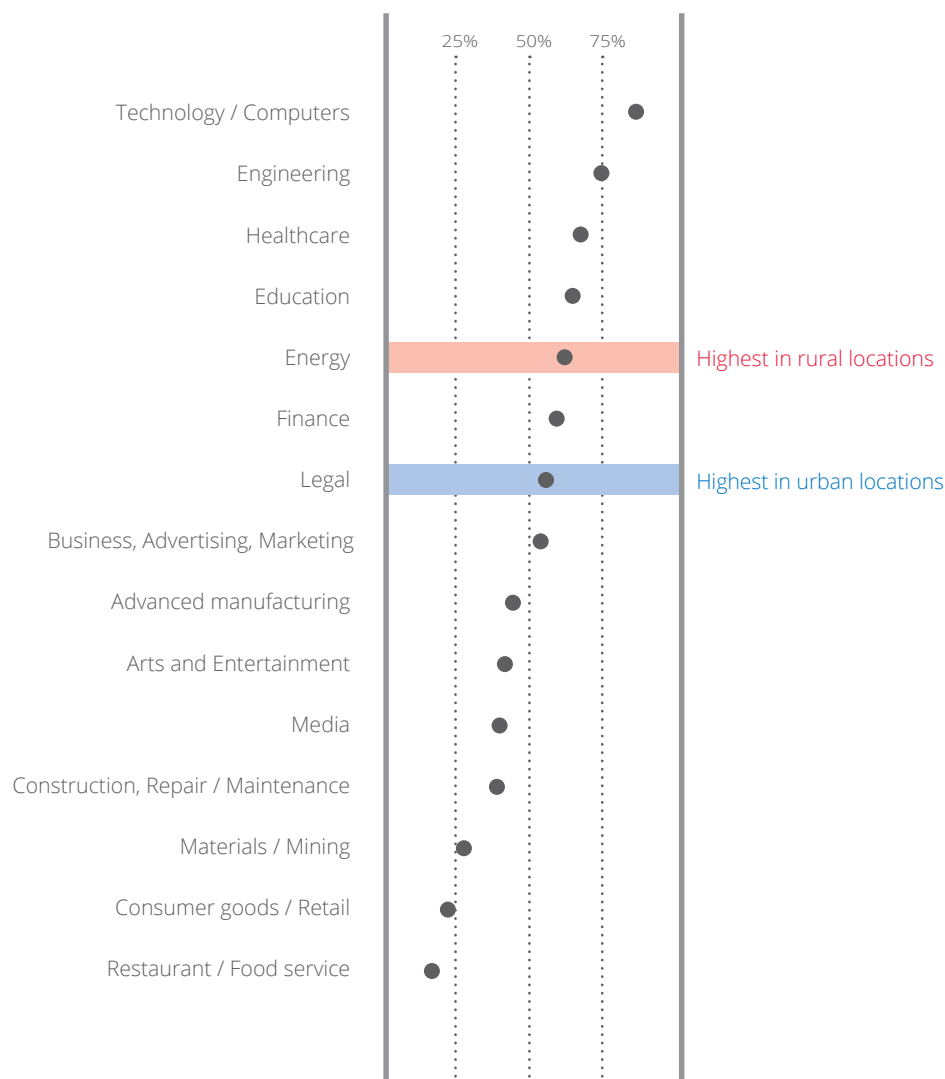


Parents Say STEM Industries and Jobs are Okay for Their Children

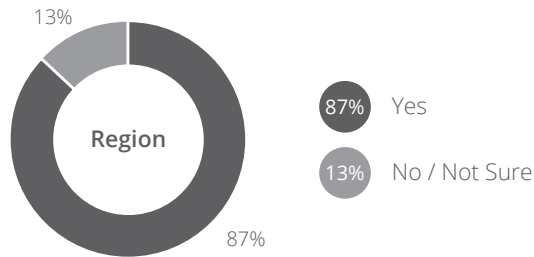
When parents were queried about fifteen industries as potential career options for their children, STEM-related industries such as Technology/Computers, Engineering and Energy ranked in the top five. Whereas interest in the Energy industry was highest among parents in rural areas, interest in the Legal profession was highest among parents in urban locations.

This high level of parental interest helps explain why nearly 9 in 10 parents (87%) say it would be acceptable for their children to work in a STEM-related career as a supervisor, mechanic, machinist, electrician, technician or welder.

Parents Identify STEM-Related Industries as Career Options



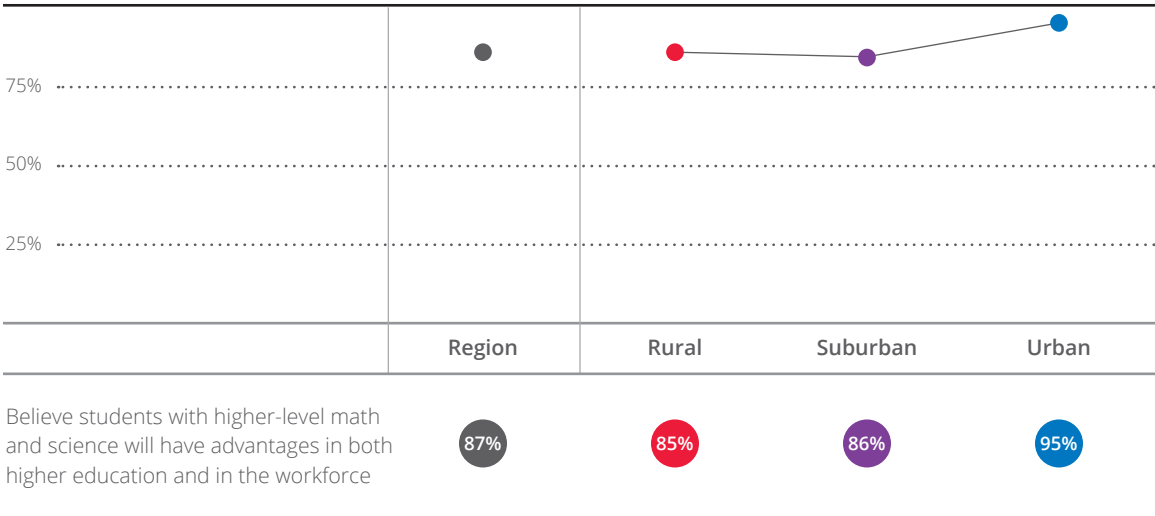
STEM-Related Technical Jobs are Acceptable



Advanced Courses Offer Advantages and Students Like Math and Science

Most parents (87%) believe higher-level math and science offer advantages for higher education and careers. Although these courses intimidate many parents, only 35% say their children actually dislike math and 22% of parents say their children dislike science. This bodes well for STEM education.

Urban Parents Most Likely to See Advantages of Higher-Level Math and Science



Only 1 out of 3 parents say their children dislike taking math.



Only 1 out of 5 parents say their children dislike taking science.

05.

Educators and business leaders are adamant in their opinions that STEM education is for all students.

All teachers, counselors, superintendents, curriculum directors and Intermediate Unit professionals and business leaders interviewed for the study agreed with one central proposition about STEM: *STEM education is for ALL students—the college-bound, young people going to community colleges or technical schools, those who enroll in certificate programs, and students entering the workforce right out of high school.*

STEM Prepares All Students for the Technology-Related Jobs of the 21st Century

"The impact would be the development of life skills for all students no matter what career they decided upon and whether or not they went to college. I think about it as personal development that all kids can benefit from because learning practical skills—problem-solving skills, basic reasoning skills and the ability to internalize and analyze—is something that can always be applied."

—High School Teacher, Urban

Business Leaders Say Technical Skills are Needed in Today's Economy

"The idea of advanced manufacturing is a misnomer—it should be called the rise of the technician. It is technical jobs that will drive our economy and all students have to be taught technical skills associated with STEM or they will not succeed or even get a job."

—Business Leader, Rural

Most Jobs Require STEM Skills

"The reality is that there are very few jobs that don't require STEM skills."

—Intermediate Unit, Rural

There are STEM-Related Careers for All Students

"Those with more advanced STEM skills will go into professional occupations like engineers and architects and those good at biology and physical sciences into research and medicine. STEM also leads to jobs in oil and gas and manufacturing for students not headed to college that require some technical skills."

—Superintendent, Rural

This Region Offers Many STEM-Related Career Opportunities

"There's energy, advanced manufacturing, medical, engineering, computers, pharmaceuticals, financial and chemicals. In this region alone look at the jobs in oil and gas and in and advanced manufacturing."

—Counselor, Rural

"The steel mills and advanced manufacturing jobs are coming back and the oil and gas industry is strong. Technicians are badly needed with STEM skills in these areas. STEM could not have come along at a better time."

—Counselor, Urban

The current language around STEM education is not resonating with parents.

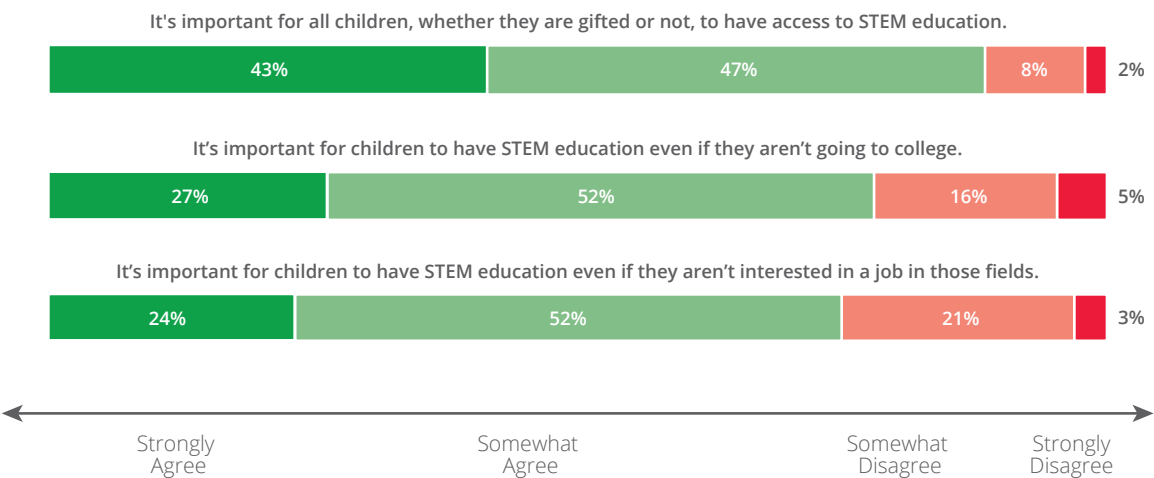
While parents clearly and highly value problem-solving skills, critical thinking and collaboration for their children, they are not making the connection between STEM and these skills. More often, parents relate STEM education to advanced mathematics and science, which they want their children to have access to, but do not feel is necessary for all children to be successful in life. Rather, these rigorous types of courses are perceived to be for the college-bound students who intend to make a career in these areas.

Parents Say STEM Education is Only for Some Children

Soft Support for STEM Education for All Students

Most parents somewhat agree with the statement that all students should have access to STEM education, but support for this sentiment could be considered “soft” given the low number of parents who strongly agree with the following statements.

STEM “Possibly” for Certain Types of Students:

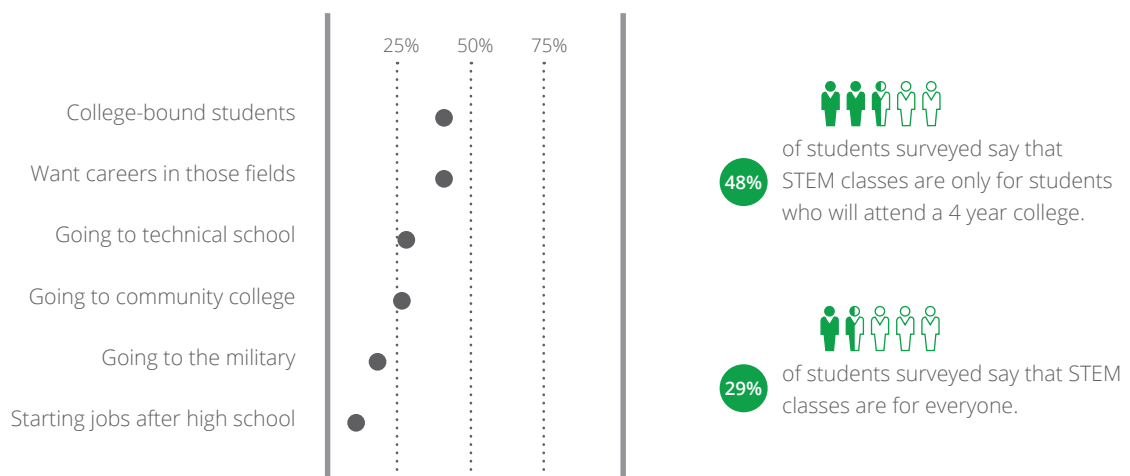


Advanced Math and Science Not Even for the College-Bound

When asked which types of students should take advanced or higher-level math and science classes like calculus, physics and chemistry, fewer than half of parents identified students attending a 4-year college or students who want careers in those fields (43% for both). The

percentages are much lower for other types of students. Noteworthy is that in a poll conducted among 100 middle and high school students, less than half (48%) said that STEM classes are for the college-bound and only 29% said these classes were for all students.

Few Students Should Take Advanced Math or Science



An inference from this data is that when parents say that most students should have access to STEM education, they are NOT thinking about STEM as advanced or higher-level math and science. Many parents are intimidated by calculus, physics and chemistry and fewer than half

believe that even college-bound students should take these courses. If STEM education is equated with taking these subjects, many parents may not encourage their children to take them.

Educators Say the Way STEM is Described Influences Parental Attitudes

Educators say the fault partially lies in the way STEM education is described—as “rigorous” and “advanced.” Many students—girls especially according to teachers and counselors—already fear math and they associate STEM courses as being very difficult and something to avoid.

Feedback from teachers and counselors is that parents and students are more receptive to STEM when it is defined as collaborative, hands-on, problem-solving and project-based education. Additionally, if parents understood the relationship between STEM and problem-solving skills they may be far more receptive to STEM education.

.....

“I think the name itself is a big hurdle. It turns them off. They hear it and it’s just boring to them. Intimidation is a factor. People hear about it being all science and math and figure that, if they’re not good at either of those subjects, then STEM just isn’t for them. But it’s not necessarily true, because it’s not the same kind of math or science as they do in the classrooms.”

—Middle School Teacher, Rural

“The biggest hurdle is that “M” in there. I wish we could just take the M out of STEM, because math scares people off, and it shouldn’t.”

—High School Teacher, Suburban

Business leaders believe that quality STEM education can help develop the next generation of collaborative problem-solvers as a way to close the regional workforce gap of skilled workers.

Business leaders are strongly supportive of STEM education because it provides students with the skill set necessary to fill vacant technical- and technology-related positions in the region. There is a causal relationship between STEM education and technical jobs. STEM promotes workforce development because it is a method of teaching that encourages hands-on, collaborative problem-solving within the context of a project.

Collaborative Problem-Solvers are Needed in Real Life, Work Settings

"Teach kids hands-on courses that stress collaborative problem-solving by giving them a project and telling them to complete it. Support that project with regular textbooks that teach equations, basic engineering concepts, have the students fail or succeed and show the rest that success or failure is based on scientific principles. Kids want to succeed but we do not make it engaging for them. They will learn the course work by doing."

—Business Leader, Suburban

"I work for a family company of 100 employees which does well and the owners are benevolent and want to help young people. But they come and when asked how they might approach solving this problem—we're not looking for an answer but an approach—they have no idea. How can you hire someone that can't formulate in any way? What are they teaching students in high school?"

—Business Leader, Suburban

STEM Education Addresses the Pressing Workforce Gap in Entry to Mid-level Technical Jobs

"Right now it is difficult and is getting desperate to find trained people who know basic math and vocational skills and these are the jobs of the future in this region. Schools are not preparing the workforce for jobs in this region. I'm not talking about engineers; I am talking about entry to mid-level employees who have opportunities to advance within the company."

—Business Leader, Urban

"I needed someone for a fairly senior position with an advanced degree in Engineering and for that job I received over 100 applications. Now, we're beefing up our facilities and need young people with technical skills, computer numerical control (CNC) training, good at computers and with a basic understanding of math and science. Not college graduates necessarily, just smart young people with an aptitude. I bet we could fill 20 to 30 such positions. We got 5 applications. There just are no people in this market with these skills because schools are not teaching them STEM education."

—Business Leader, Suburban

Most educators say that STEM education is becoming more of a priority, but there are differences by region. Rural areas represent the greatest opportunity for STEM education related careers in new industries.

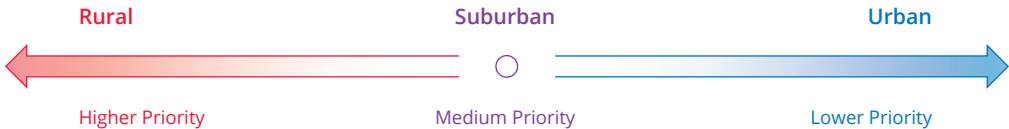
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There is a sense among educators that school districts in the region are progressing in their efforts to prioritize STEM education. Feedback does suggest two things: first, rural districts are placing the highest priority on STEM education and urban districts the least; and second, teachers and administrators from suburban and urban districts can hold differing views about how much priority is being given to STEM in their districts.

STEM a Priority in Rural Areas

Most teachers from rural districts are of the opinion that STEM is being given a “pretty” high priority and Marcellus Shale and the accompanying growth in the energy sector is by far the major contributing factor. Rural

administrators are a little more realistic than teachers about progress-to-date with STEM, but overall there is much more optimism than pessimism among them.



“It’s a huge priority in our rural area, and I think it’s becoming more of a national push, too. I’m glad the district has made it a priority, and I’m looking forward to being certified.”

—Middle School Teacher, Rural

“Elementary schools need more science and math, and we’re playing catch up in grades 4 and 5. But we’re committed to teaching creatively and committed to STEM. It’s a work in progress.”

—Superintendent, Rural

“We’re making headway and the superintendents and teachers are behind it.”

—Intermediate Unit, Rural

“There are many jobs that students and the public aren’t aware of with CONSOL Energy and the gas well companies. Students may not know the pathways to those jobs. I think STEM can get them on the right track—it’s a God-send.”

—High School Teacher, Rural

Suburban Districts Present a Mixed Picture

Suburban districts present somewhat of a mixed picture where teachers and counselors offered divided opinions and district administrators were outspoken about STEM being a high priority. Feedback suggests that— for

whatever reason—suburban teachers are not getting the message from administrators that STEM is a major priority.

“It is not a priority because of standards. It is a personal priority for me.”

—Middle School Teacher, Suburban

“It is minimal priority here.”

—Middle School Teacher, Suburban

“It is not a top priority, but it should be. Keystone Testing and state rankings are priorities.”

—High School Counselor

“STEM is a very high priority. I deal with both curriculum and reporting of state testing to the state.”

—Curriculum Director, Suburban

Urban Districts are Trying to Make Headway

Teachers and counselors from urban districts question whether STEM is given enough of a priority. A recurring theme was declining budgets and lack of necessary resources. There is not the sense of optimism that you

find among educators in rural areas. Urban administrators say they are progressing as best they can toward prioritizing STEM in the face of budgetary concerns and believe they are on the right track.

"The Board of Education limits what we can do if money is involved, so it's up to me, the teacher, to find ways of bringing STEM into the classroom or even ways to embrace it outside of the classroom. They are not paying enough attention to STEM at the district level."

—High School Teacher, Urban

"It is kind of a priority, but there is a lack of funding."

—Middle School Teacher, Urban

"It is my priority, but not as important to my district which closed South High School, a trade school where students could learn HVAC, carpentry, food service, cosmetology."

—Counselor, Urban

"It is a high priority in our district, even though we have a long way to go. Money is an issue."

—Superintendent, Urban

Educators identify major obstacles to STEM education both inside and outside of school and the classroom.

Educators are in the best position to assess obstacles to STEM. Many who participated in the study offered their first-hand experiences with STEM courses and how they incorporated these into core curriculum. Others shared their frustrations about unsuccessful attempts to implement STEM in the face of obstacles. These shared experiences provide a body of knowledge to draw upon in identifying obstacles to STEM and strategies to overcome them.

Five Categories of STEM Obstacles

01. Common Parental and Public Misperceptions

STEM is only for “smart” students— An “old way of thinking” that only students who can perform elaborate calculations associated with advanced math can benefit from STEM. STEM education is about learning through problem-solving based on collaborative hands-on activities that all students can benefit from.

Only the college-bound student benefits from STEM— A common misperception is that only students planning on going to college need to take STEM education courses. There is a lack of knowledge about the types of technology- and technical-related jobs available in the region that do not require a 4-year college degree.

STEM is about math and science and therefore not for girls— Misperceptions that girls do not perform as well in advanced math and science taught through traditional instruction. It is slowly receding but still exists among some educators and parents.

02. Misperceptions Held by Teachers

STEM requires a lot of training and certification is difficult— Many teachers imagine a difficult training and certification process but experienced teachers disagree: A teacher can be certified in STEM during a “2-week” course or simply by teaching project-based learning modules available through Intermediate Units or local colleges. If STEM training is a mystery, teachers will avoid it.

STEM is difficult to teach, especially given the emphasis on core curriculum— Uninitiated teachers believe STEM involves an entirely new method of teaching and is difficult to integrate into core curriculum. STEM teachers comment that all it takes is a little ingenuity and embracing activities and project-based learning. Many courses are available that are linked to state standards.

STEM is way too expensive to implement— Many teachers perceive STEM to be so expensive that they give up or do not reach out to the district. Superintendents—including those in small rural districts—point out that they have implemented STEM programs within existing budgets.

03. Obstacles Inside the Classroom

There is a culture of apathy and teaching to the test— A minority of each audience—including teachers themselves—say that there are teachers who are simply not motivated to embrace STEM. This is said to be the case especially among older teachers. This culture is not viewed as widespread, but is important to address through education and training.

Teachers lack the time to incorporate STEM into classes— Most middle and high school teachers describe a work day in which they have very little time to do anything but teach the core curriculum, and administrators tend to agree with this assessment. Counselors share stories about how they can rarely find time in classes to have business professionals visit classrooms.

Teachers are inexperienced with STEM and students are unprepared— Many teachers simply lack knowledge about STEM, and too few have received training. Especially in urban districts, too many students are so far behind that they must take remedial classes, not STEM.

04. Capacity Issues Outside the Classroom

Declining education budgets— Money or funding was identified as a major barrier and not only funding for technology or STEM-related professional development. Budget cuts have forced many school districts to cut back programs. Cuts are hurting smaller rural districts and urban districts of all sizes harder.

There is a lack of STEM curriculum that aligns with state standards— Although STEM curriculum is available—Project Lead the Way and modules offered by Allegheny Intermediate Units and universities—most teachers identify a lack of standard STEM curriculum as a major obstacle to embracing STEM. Many teachers are also unaware of how STEM courses align with state standards.

05. Obstacles External to the School

Lack of business support— Many examples were given of local businesses and national companies aiding schools. But a perception exists that business can do much more, especially since STEM is designed to provide them with a skilled work force. Many educators are intimidated by the process of reaching out to business.

There is too little collaboration with colleges and universities— Many universities and colleges are prioritizing STEM education, but educators say instances in which they work with these schools are too few and far between. This is a critical issue because many schools lack access to STEM curriculum as well as professional development opportunities.

Lack of extracurricular activities that support STEM— The Carnegie Science Center and other organizations offering summer camps and after-school programs in science were cited by teachers as STEM-related extracurricular activities. However, representatives from smaller and more rural districts said they often lacked access to such activities.

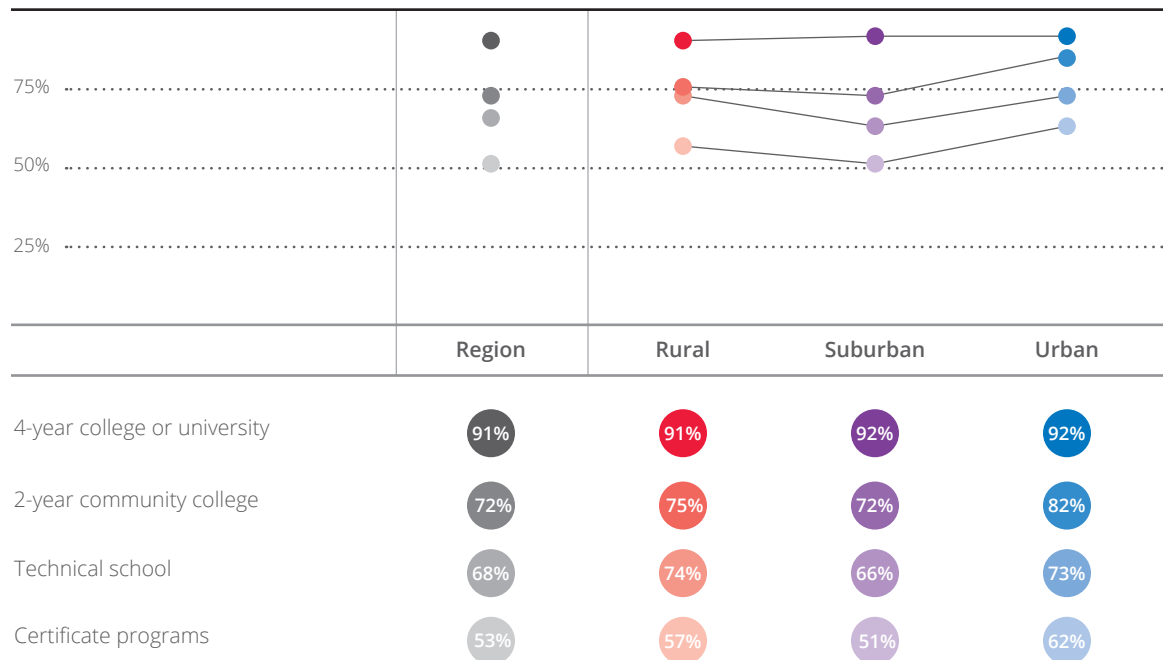
Is the “Go-to-College” Imperative an Obstacle to STEM Education?

Parents Say Higher Education Includes Much More Than a 4-year Degree

One goal of this report was to assess attitudes about the “must-go-to-college” imperative or the attitude that students must earn a four-year college degree to be successful. Educators cite this as an obstacle—schools too focused on preparing children for college as opposed to careers—but data from the parent survey indicates that issue has more to do with how higher education

is defined rather than a deep-seated belief that a four-year degree is a prerequisite for success. When provided with options and asked which terms they would include under higher education, large majorities of parents included 2-year community colleges and technical schools.

Parents Define Higher Education Inclusively

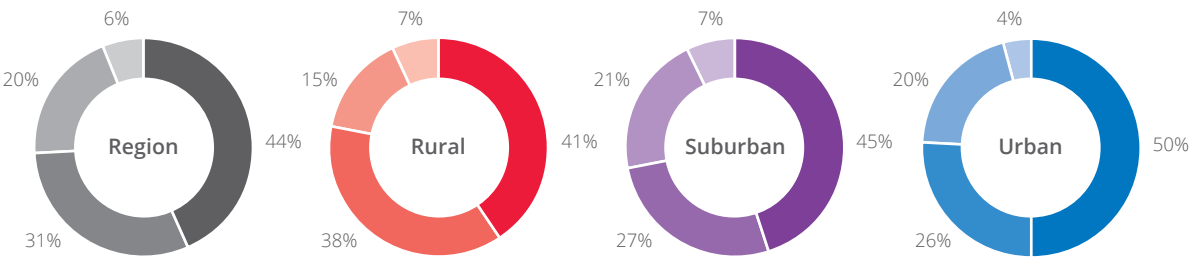


Few Parents Disappointed if Children Don't Pursue 4-year Degree

A related conclusion based on survey data is that most parents want their children to pursue education after high school, but only a small minority of parents (20%) would be disappointed if their child did not pursue a four-year college or university degree. Noteworthy is that parents

from rural locations (38%) are much more likely to leave decisions about their future to the children themselves and the least likely to be disappointed in something other than a four-year degree.

Parents Want Children to Pursue "Education" After High School



I want my child to have some sort of education after high school whether that be community college, technical school, certification, the military, etc.

The decision is theirs

Anything other than a 4-year college or university would be a disappointment

Learning a trade or skill in high school would be a good option for my child

44%

31%

20%

6%

41%

38%

15%

7%

45%

27%

21%

7%

50%

26%

20%

4%



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