

The Case for

STEMnetSM TEACHERS HUB

A NETWORK TO PROPEL INNOVATION IN
SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS IN MARYLAND

Maryland Business Roundtable for Education | October 2010



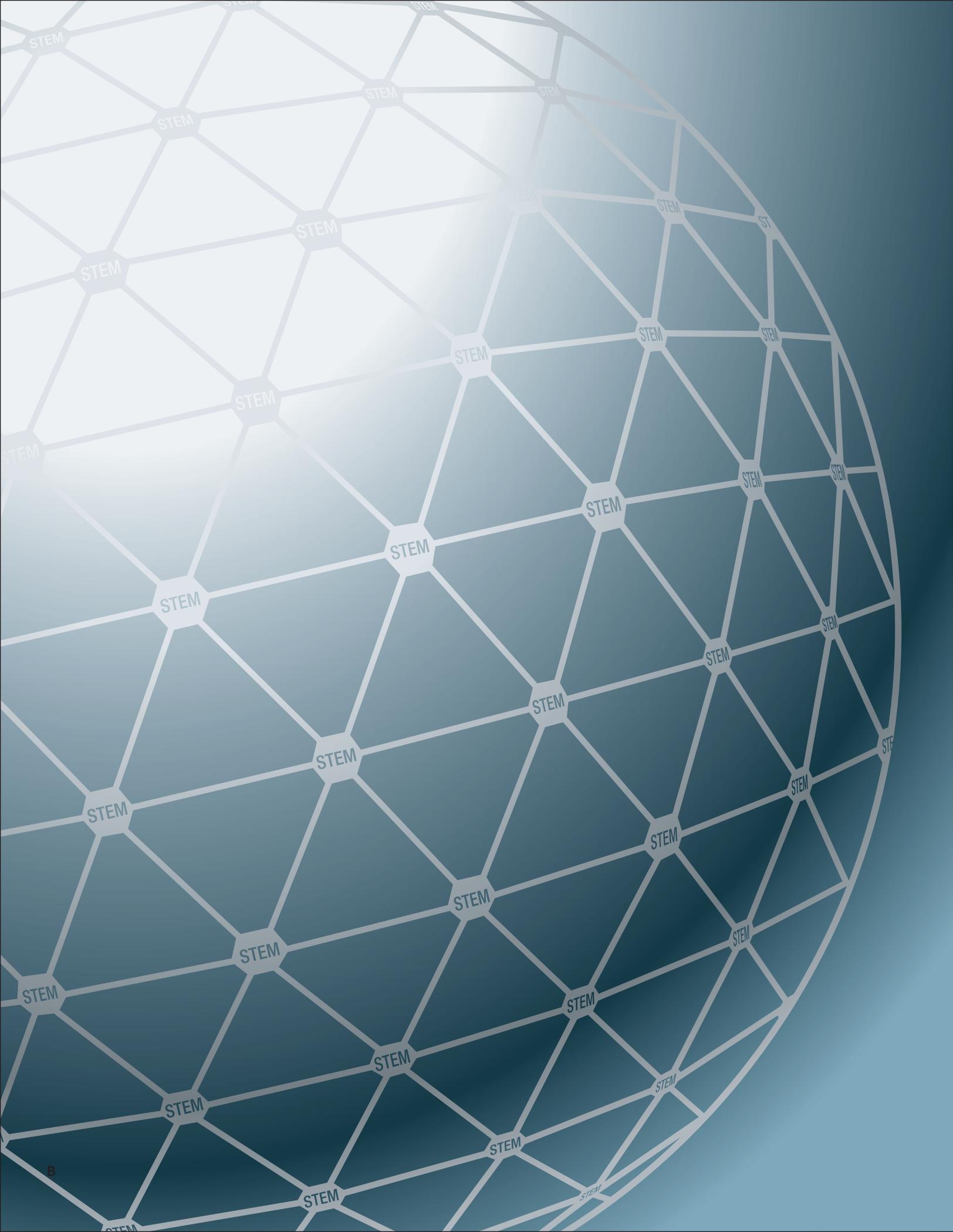


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EXECUTIVE SUMMARY

The Case for Creation of **STEMnet Teachers Hub**

In today's incessantly innovative world, education in science, technology, engineering, and mathematics (STEM) is absolutely critical to the future success of students, of Maryland's workforce, and of the state as a whole. For this reason, Maryland's Governor appointed and convened a STEM Task Force, which in 2009 offered seven bold recommendations for securing Maryland's future as a global leader in STEM-based education, research, and economic development.

The Task Force's seventh and final recommendation was to "create Maryland's STEM Innovation Network to make STEM resources available to all." The Maryland Business Roundtable for Education (MBRT) stepped forward as the leader charged with making this network — "STEMnet" — a reality. With funding from AT&T, Citi, Northrop Grumman, and IBM, MBRT will launch the first component of STEMnet: the STEMnet Teachers Hub, a "one-stop-shop" network where STEM teachers can find crucial resources, support, and professional connections enabling them to strengthen prekindergarten-through-12th-grade (P-12) STEM teaching and learning across the state. In designing STEMnet Teachers Hub, MBRT carried out market research to gain detailed input from STEM teachers themselves: via focus groups and an online survey.



STEMnet Teachers Hub **Focus Groups**

In two focus groups in March of 2010, trained facilitators drew forth the needs, ideas, and comments of more than 30 secondary STEM teachers from across Maryland. The result of these in-depth sessions was a list of teacher-endorsed vehicles for high-impact support of STEM teaching and learning. These 11 proposed initiatives fell into two categories: support provided directly to students, and support provided primarily for teachers.

▶ Student-centered STEM support:

- 1 Specialists in the Classroom
- 2 Challenge Program
- 3 Tutors and Mentors
- 4 Field Trips
- 5 Work Experiences
- 6 Digital Student Hub

▶ Teacher-centered STEM support:

- 7 System-wide STEM Connections
- 8 Teacher Professional Development
- 9 Teacher Lifeline — Consultation and Mentoring
- 10 Technology Assistance
- 11 Resource Clearinghouse

STEMnet Teachers Hub **Online Survey**

In April of 2010, MBRT furthered its market research with an online survey that homed in on five of the 11 key ideas that surfaced during the focus group meetings. The survey collected teacher comments and quantitative data reflecting teachers' interest in STEM through:

- ▶ Specialists in the Classroom
- ▶ Digital Student Hub
- ▶ System-wide STEM Connections
- ▶ Teacher Lifeline — Consultation and Mentoring
- ▶ Resource Clearinghouse

RECOMMENDATIONS FOR ACTION

A comprehensive review of the focus group and online survey results led MBRT to identify three STEM support initiatives as those most needed and favored by teachers, and to recommend that these three initiatives be carried out as Phase 1 of the STEMnet Teachers Hub. These include:

- ▶ **Resource Clearinghouse**
- ▶ **System-wide STEM Connections**
- ▶ **Specialists in the Classroom**

With investments from AT&T, Citi, Northrop Grumman, and IBM, implementation of Phase 1 — comprised of these three top-ranked support vehicles — will begin in the 2010–11 school year.

The remaining eight initiatives will be phased in over several years with support from stakeholders statewide whose shared interest in advancing STEM teaching and achievement will transform Maryland's ability to compete successfully on the international stage.

A STEM EMERGENCY



“Whether it’s improving our health or harnessing clean energy, protecting our security or succeeding in the global economy, our future depends on reaffirming America’s role as the world’s engine of scientific discovery and technological innovation. And that leadership tomorrow depends on how we educate our students today, especially in mathematics, science, technology, and engineering.”

President Barack Obama, January 2010



Elected officials from the President on down, business leaders at all levels, and educators from pre-kindergarten through graduate school see the urgency: America is losing competitive ground in the fields of science, technology, engineering and mathematics (STEM). Even as the U.S. economy continues to be resilient, productive, and innovative, it faces a challenge of unprecedented proportions. If America is to remain competitive, we must transform not only the way we work but also the way we educate and prepare all of our students, especially those who come from poor and historically disadvantaged backgrounds.

It is no exaggeration to say that our national and global economic standing depends on whether we are able to improve achievement by all students in STEM fields and to attract more people to STEM careers.

Years of research prove it: STEM is where the global economy is moving, and the quality of pre-kindergarten through 12th grade (P-12) mathematics and science teaching is the single most important factor in improving P-12 student achievement in these disciplines. At the same time, there is a growing awareness that we all have a responsibility for assuring the strongest possible mathematics and science education. In President Obama’s words, “All of us have a role to play in building an education system that is worthy of our children and ready to help us seize the opportunities and meet the challenges of the 21st century.” Across the nation, the private and public sectors are coming together to prepare, support, reward, and retain good P-12 STEM teachers. In Maryland, the Maryland State Department of Education, the Maryland Higher Education Commission and the University System of Maryland are collaborating to improve the STEM pipeline of new and existing teachers.

Maryland is part of the solution

In September of 2008, Governor Martin O’Malley appointed a cadre of Maryland business, education and policy leaders as the Governor’s STEM Task Force: a body that would make recommendations to ensure that “Maryland will be a national leader and globally competitive in STEM education, in STEM workforce development, and in STEM-based economic growth and job creation.”

The Task Force, co-chaired by William E. Kirwan, Chancellor of the University System of Maryland, and June Streckfus, Executive Director of the Maryland Business Roundtable for Education (MBRT), presented to the Governor in August of 2009 a far-reaching action plan for enhancing the quality and quantity of Maryland's future STEM workforce and creating a research and development infrastructure to make Maryland one of the world's leading knowledge-based economies.

The Task Force made seven recommendations, ranging from aligning Maryland's P-12 curriculum with college and workplace requirements to promoting in-state STEM entrepreneurs and STEM research. One of those seven recommendations was to create something unprecedented in Maryland: a physical and virtual STEM network — STEMnet — to share invaluable resources among all P-12 teachers, students, parents, higher education faculty, business and community leaders, economic development officers, researchers, and policymakers. STEMnet would connect, for the first time, all of Maryland's STEM stakeholders to one another. It would also link them to regional and national networks of innovation and policy.

The STEMnet Teachers Hub is on its way

Maryland's vision of such a powerful network is becoming a reality. MBRT stepped forward to lead the effort, and with generous funding and technical support from AT&T, Citi, Northrop Grumman and IBM, the initial hub of STEMnet — known as STEMnet Teachers Hub — will be developed in the 2010–11 school year. This first stage, developed in partnership with the Maryland State Department of Education, will offer teachers in a “one-stop shop” three sets of resources that are aligned with recently adopted Common Core Standards:

- ▶ **STEM Resource Clearinghouse**, which gives teachers online access to STEM curriculum materials, lesson plans, webinars, tutorials, classroom-ready experiments, professional development, and more.
- ▶ **System-wide STEM Connections**, through which teachers can link with STEM educators at all levels — elementary, middle, high school, college, and postgraduate — and with private-sector STEM professionals, to share knowledge and resources.
- ▶ **STEM Specialists in the Classroom**, enabling teachers to call upon an impressive roster of STEM practitioners from federal agencies, industry and higher education to visit their classrooms and inspire and inform their students about real-world STEM work.

This is just the beginning

Most excitingly, STEMnet Teachers Hub is poised to grow, as it attracts additional support, to a statewide network offering a total of 11 innovative sets of resources for all STEM teachers in Maryland. As this Report's next section explains, these 11 elements are all based on meticulous interviews through which MBRT asked Maryland teachers what resources and support they need in order to most effectively impart strong STEM knowledge to students. Just as important, STEMnet Teachers Hub will be steadily enhanced as MBRT continues to assess STEM teachers' expressed evolving needs.

With so much of our state's growth and prosperity riding on STEM knowledge and expertise, STEMnet Teachers Hub is a “must-do” investment for Maryland. STEMnet Teachers Hub is the gateway to harnessing and expanding Maryland's vast wealth of STEM education expertise: a one-of-a-kind collaborative connection of stakeholders and resources to strengthen STEM teaching and learning throughout the state.

“Stronger science, technology, engineering, and mathematics education will not only boost student learning throughout the curriculum, but will help propel Maryland's economic growth. STEMnet provides a nexus for educators, linking them to the newest and best resources to help strengthen classroom instruction, and MSDE is pleased to be working with MBRT on this effort.”

Nancy S. Grasmick, Maryland State Superintendent of Schools

What teachers want to support Science, Technology, Engineering, and Mathematics instruction

Just as Science, Technology, Engineering and Mathematics (STEM) are keys to Maryland's future job growth and competitiveness, teachers are central to the STEM knowledge of Maryland's prekindergarten-through-12th-grade (P-12) students and future workers. Strengthening Maryland's STEM advantage means providing teachers with all the support they need for engendering strong STEM skills in future graduates. This is the core imperative propelling the first stage of Maryland's statewide STEMnet network: the STEMnet Teachers Hub.

Clearly, any teacher-support network must build on direct input from STEM teachers themselves. So Maryland Business Roundtable for Education (MBRT), as leader of Maryland's STEMnet initiative, began development of the Teachers Hub by inviting high school STEM teachers to offer guidance on what elements would best support their instructional work and equip students with the strongest possible STEM skills.

MBRT carried out, in succession, two forms of information gathering: in-depth teacher focus groups, and a detailed online survey. Both assessed what would most help teachers to connect with one another, with students, with resources, and with "real-world" STEM practitioners in rigorously preparing students for success.



“How our graduates perform in science, technology, engineering, and mathematics will help define how Maryland performs in the world economy. The correlation is clear.”

Governor Martin O'Malley, 2009

STEMnet Teachers Hub focus groups

In March of 2010, MBRT brought together more than 30 high school biology, chemistry, physics, technology, and mathematics teachers from districts across the state — Baltimore City, Baltimore County, Carroll County, Harford County and Howard County — for two focus group sessions. Participants had been identified by their supervisors as forward-leaning and enthusiastic teachers who had ideas on how to motivate and inspire students.

The teachers were asked to:

- ▶ “dream big” and to identify opportunities, resources, and experiences that could be offered on the STEMnet Teachers Hub over the next several years.
- ▶ provide advice on how best to build upon MBRT’s existing assets to create a STEM-focused program, in support of STEM teachers, that could be piloted in several schools or districts in the coming year.

Design of the focus groups

The focus groups were deliberately held in an informal setting, and began with a plenary session to put the teachers at ease and to give them background information about MBRT. After opening remarks and introductions, questions were posed to the group to stimulate conversation, elicit feedback, and prepare the teachers for more detailed discussions and brainstorming to take place in breakout sessions. Every effort was made to help teachers feel comfortable expressing their best ideas on the kinds of support they would find most helpful. Teachers were guaranteed anonymity, and supervisors were purposefully not invited. Representatives from business, government, MBRT, and STEM fields observed the proceedings.

The breakout sessions grouped teachers by subject area — biology, chemistry, mathematics, technology, and physics — and were facilitated by trained professionals from Lockheed Martin, Northrop Grumman, Citi, and the University of Maryland Baltimore County. The intent was to:

- ▶ engage teachers in intensive brainstorming on STEM resources, activities, and programs that would support STEM teaching and learning.

- ▶ illuminate how MBRT’s existing programs might better support teachers.
- ▶ identify potential obstacles.
- ▶ propose strategies and actions to implement the teachers’ ideas.

Facilitators launched the breakout discussions with such questions as:

- ▶ Imagine, in a ‘perfect world’ sense, if STEM volunteers played a role in your classroom instruction. What would that look like?
- ▶ What is your highest priority in furthering STEM teaching and learning?
- ▶ Where do you think business support could best align with course content?
- ▶ What would best match your needs to MBRT’s resources?
 - ▶ Having STEM volunteers in the classroom?
 - ▶ Posing a real-world problem to which students could apply their learning throughout the year?
 - ▶ A webinar or other form of online support?
- ▶ In what areas do students have the most difficulty understanding and/or retaining concepts? How could those areas be reinforced?
- ▶ Would MBRT’s support resources be best used with highly-motivated students, or with less-motivated students?
- ▶ Do you or your school have a working relationship with local employers? What kinds of services and resources do they currently provide and how?
- ▶ How could we minimize obstacles to student learning and to school partnerships with industry?

At the conclusion of the lively and productive breakout sessions, each group gave a summary of its ideas to the larger gathering.

FOCUS GROUP FINDINGS

The P-12 STEM support initiatives that emerged from the focus groups fall into two categories: support for students and support for teachers.

STUDENT-CENTERED SUPPORT ACTIVITIES

1 STEM Specialists in the Classroom

This topic generated great interest and detailed discussion. The idea is to create a database, modeled on MBRT's highly-successful Speakers Bureau of "real-world" working adults, that would provide a roster of STEM practitioners from federal agencies, higher education and business to visit STEM classes. Teachers could easily procure pre-screened and -trained STEM experts to talk to students on topics identified by each teacher as relevant to his/her class. These experts would:

- ▶ assist in teaching an element of the curriculum where reinforcement/relevance is needed.
- ▶ speak to the class on topics aligned with the core STEM curriculum.
- ▶ highlight the relevance of what students learn in school to the realities of the world of work.
- ▶ discuss the field they represent, including different jobs within the industry, levels of required education, expected compensation, and the industry's short- and long-term needs for workers.
- ▶ describe the importance of hard work in STEM-related fields, the process of working as part of a team, and the importance of critical thinking and applying knowledge to solve problems.

In the focus groups, the teachers offered detailed suggestions for developing this database, screening and training the STEM experts, assisting teachers in preparing for a visit, and outlining successful teaching strategies for presenters. Teachers felt strongly that presentations needed to be on-grade-level and motivational — able to "hook" the students, be interactive and hands-on — and needed to expose students to technologies and workplace tools used by the speaker. Teachers said they wanted in-class, electronic or web-based "short" activities that were outside the normal purview of the classroom. They encouraged the idea of continued student interactions with the experts after the presentation.

TEACHER COMMENTS INCLUDED:

"...I can't tell you how awesome it would be to have a central resource of people who can help me paint the pictures for students."

"Teachers are the *content* experts, and we need to continue to be. But it would be really nice to have *applied* experts available to us."

"It's important for kids to hear what skills they'll need from the people actually doing [the job]. Especially kids without much support at home. We can't be the only ones telling them."



2 STEM Challenge Program

This program matches a STEM practitioner with a team or class of STEM students to investigate a real-world STEM problem presented by the practitioner. The challenge would last at least a semester, and perhaps an entire school year. Students would ultimately prepare a report and/or presentation on their investigative process, findings, and conclusions. The practitioner would be available to answer questions, review the students' work, and discuss its relevance to their education and to STEM research in general.

3 STEM Tutors and Mentors

This support already exists in some schools and school districts. Teacher opinions varied as to which students would most benefit from the added personal attention of outside experts. Some felt this most appropriate for under-performing students, while others wanted this support for strong students who could use research guidance for AP science projects or for activities such as preparing for state, regional, and national STEM competitions. Teachers showed interest in both in-person and electronic interactions, on or off the school campus. They also entertained the idea of having STEM college students tutor and mentor high school students.

TEACHER COMMENTS INCLUDED:



"Kids don't get it at all: people work together to solve problems. Bring us teams, let kids jump into them. Solve something, small, but real. Demonstrate the PROCESS of working with others."

TEACHER COMMENTS INCLUDED:



"Kids are curious at all levels, AP to general. Maybe outside people would be most valuable to the general level."

"I need my best students, my faster learners, to get this service. They get bored and bogged down. Those who got it early should be engaged with the outside people."



STUDENT-CENTERED SUPPORT ACTIVITIES



4 STEM “Field Trips”

Some teachers in the focus groups felt that field trips are impractical because of logistical, financial, and transportation problems and time constraints. These teachers encouraged classroom exposure to STEM experts and projects, and supported the expansion of programs such as the Biotechnology Institute’s MDBio Lab, a tractor-trailer with a fully-equipped lab that visits high schools across the state.

Those who favored field trips felt the experience is an important opportunity for students to step beyond their comfort zones and to experience interactions with STEM experts in a work environment. Interest in field trips was highest among physics, chemistry, forensics, and technology teachers, who do not face the time constraints associated with High School Assessments.

TEACHER COMMENTS INCLUDED:



“Field trips for students take too much time away from class, are too expensive, and are hard to coordinate. Need a chemistry bus like the biology bus — take a field trip to the school parking lot.”

“Going into the field is so valuable. Learning changes in the real world.”

Strengthening Maryland’s STEM advantage means providing teachers with all the support they need for engendering strong STEM skills in future graduates. This is the core imperative propelling the first stage of Maryland’s statewide STEMnet network: the STEMnet Teachers Hub.



5 STEM Work Experiences

Teachers in the focus groups agreed that STEM work experiences such as internships and job shadowing are valuable for average as well as gifted students, and that the experience needn't be long or complicated. They suggested summer or school-year experiences at a STEM-related workplace or at a school that has partnered with a STEM-related company. Teachers lamented that summer internships have decreased and have become very competitive, and they are aware that businesses and many government facilities face regulation, security, and organizational constraints in providing high school STEM internships.

TEACHER COMMENTS INCLUDED:



“Offsite, in the workplace, even brief cookie-cutter projects would help a great deal.”

“Kids need to feel their actions contribute to SOMETHING.”

6 STEM Digital Student Hub

Teachers saw real value in establishing a STEM internet portal, exclusively for students, that would offer real-world STEM applications of interest to students and relate directly to the STEM core curriculum. Teachers would work with STEM practitioners to develop interactive internet modules on such topics as the space shuttle launch and space station hookup, the “how” of a retractable sports dome, and the trajectory of a thrown football. This portal would also support the interactions between students and STEM practitioners in the Student Challenge program and the Tutoring and Mentoring program. It would serve, further, as a clearinghouse for information on STEM internships, careers, college scholarships, majors, and research opportunities.

TEACHER-CENTERED SUPPORT ACTIVITIES



7 State-wide STEM Connections

Teachers in the focus groups favored establishing a communications link connecting all STEM teachers across the state — elementary, middle, high school, college, and postgraduate educators — along with private-sector STEM professionals. This would:

- ▶ increase understanding of STEM expectations for success at every level: from elementary school to college and graduate school and the workplace.
- ▶ similarly, increase understanding of the needs and problems at all levels, including teacher preparation, support, and professional development and the interaction between educators and industry.
- ▶ provide a means for teachers to obtain and share STEM information, research, experiences, and ideas.
- ▶ create “communities of peers” to pursue STEM-related discussions, projects, and policies across the STEM education spectrum.
- ▶ provide an open channel for teacher feedback on STEM student achievement throughout the educational system.

TEACHER COMMENTS INCLUDED:



“I’d like to have teacher input: Who tried this? Does that work? Is this worth my time?”

“It would be great to have a group of people I could call or email or whatever and have a brief conversation about a topic I’m about to introduce. They could help trigger an exciting, current way to bring it to life. That would be a huge resource for so many teachers.”



8 STEM Teacher Professional Development

Teachers asked for more exposure to STEM practitioners on college campuses and in the workplace. They wanted a better understanding of real-world applications and recent scientific advances in their content areas — topics not taught in their undergraduate or graduate training. Many felt that working with STEM experts “doing science” would move them beyond “lecture delivery” in their classrooms to project-based instruction. Ideas included:

- ▶ summer teacher externships in STEM-related industries.
- ▶ STEM research opportunities for teachers on college/university campuses.
- ▶ teacher field trips to business/government/university STEM facilities.
- ▶ STEM-expert-led professional development classes (in a school, or web-based) on STEM applications or project-based work environments.

9 STEM Teacher Consultation and Mentoring — Lifeline

This would give teachers informal access to STEM practitioners for “just-in-time” consultations and for longer-term advising or mentoring related to course content and real-world applications.

TEACHER COMMENTS INCLUDED:



“Physics and chemistry teachers could benefit from field trips (Aberdeen Proving Grounds, etc.) to see new labs, see how things relate to students. It’s important for us to know what’s out there.”

TEACHER COMMENTS INCLUDED:



“I really benefited from an informal relationship between higher education faculty and high school teachers. [The college professor and I] worked together for five days to prepare for his visit to my classroom. It lit up the students.”

TEACHER-CENTERED SUPPORT ACTIVITIES

10 Technology Assistance

Maintaining classroom hardware and software is a major problem for many STEM teachers. It often limits the use of technology in the classroom. Teachers in the focus groups, however, also expressed their needs for technology assistance beyond maintenance issues, including:

- ▶ learning and seeing what kinds of scientific equipment and technology are in use in industry, college, and research facilities.
- ▶ having STEM facilities donate or lend excess equipment from their laboratories.
- ▶ receiving technology training from external STEM experts to increase teachers' familiarity with software packages, hardware, and scientific equipment.

11 STEM Resource Clearinghouse

Teachers enthusiastically embraced this idea, which would give Maryland teachers constant online access to a vast up-to-the-minute inventory of STEM resources: curriculum materials, teaching units, lesson plans, webinars, simulations, demonstrations, tutorials, projects, and experiments. The Clearinghouse would also connect teachers to STEM professional development opportunities, STEM-related websites, Maryland STEM education organizations, recent STEM education research findings, and local, state, and national funding opportunities for STEM projects. It would even include a way for teachers to rate the Clearinghouse offerings.

TEACHER COMMENTS INCLUDED:

“Technology is NOT embraced because [teachers] are unsure; they think the technology will fail and they’ll look foolish — diminished in students’ eyes.”

“For any technology to work for 80% of the teachers:

- 1 It must work 100% of the time;
- 2 It must be placed directly into their hands, [be] simple;
- 3 It must line up directly with curriculum.”

TEACHER COMMENTS INCLUDED:

“We need one portal to experts, curriculum, lessons, etc.”

“We are so glad and grateful that you’re trying to [give] order to resources. Could even include supplies/ materials and co-teachers.”



Time and technology are key issues for teachers

Two pivotal issues expressed by STEM teachers in the focus groups were classroom time constraints and technology limitations:

Time: Teachers struggle to cover the Maryland core curriculum, especially algebra and biology teachers who have the added pressure of preparing students for Maryland’s High School Assessments. While keen for external learning experiences, teachers voiced concern about sacrificing the time needed for the required curriculum, as well as finding the time to investigate, prepare, deliver, and follow up on “added” classroom activities. Teachers therefore suggested that MBRT adopt specific “quality-control” criteria for STEMnet Teachers Hub:



Activities should be strictly aligned with the Maryland core curriculum to assure that they “add value” to students’ achievement.



Resources for teachers should be easily accessible, well-organized, and user-friendly.



Finding and using these support activities should be efficient, simple, and involve little or no red tape.

Technology: Teachers noted the inequities of available technology to support some proposed activities for students. (For example, webinars, teleconferences, video, etc. are not possible in some classrooms because of the lack of required equipment.) Teachers also cited their own lack of access to computers due to school shortages or lack of regular availability. In some schools, slow download rates hinder internet access, and security controls restrict access to websites. Teachers also reported that computers and other technology equipment are often non-functional.



Teachers suggested that equipment, and setup and operating assistance, be made available by whatever means necessary when needed.



They also encouraged business to help to maintain classroom hardware and software, since many teachers do not have the time or expertise to do so, and maintenance through their system’s computer support network is slow.

STEMnet TEACHERS HUB ONLINE SURVEY

In April of 2010, MBRT expanded its market research on the proposed STEMnet Teachers Hub to include an online survey of a broader range of STEM teachers from across the state. It sought feedback on the findings of the focus group meetings, primarily from middle and high school STEM teachers, in order to:

- ▶ introduce MBRT's STEMnet Teachers Hub to a larger and more diverse cross-section of Maryland's STEM teachers.
- ▶ get the reactions of more STEM teachers to proposed support initiatives that emerged from the STEM focus group meetings.
- ▶ "dig deeper" for ideas, comments, and insights from STEM teachers on ways that business can support STEM teachers' efforts and instruction.



Design of the online survey



MBRT used the well-established SurveyMonkey online tool to carry out the survey, which was available online to teachers for 10 days in April. The anonymous survey consisted of seven questions. One question ascertained participants' affiliations with Maryland education, five probed for potential student or teacher interest levels in specific activities proposed during the focus group sessions, and the last enabled participants to share their ideas on how MBRT can support STEM teaching and learning.

From the 11 student-centered and teacher-centered activities proposed in the focus group sessions, the five activities in which teachers showed greatest interest were chosen for inclusion in the online survey. Online survey participants, for their part, were asked to rank these five activities on a scale of perceived interest: "Not at all interested" (1 point), "Somewhat interested" (2 points), "Interested" (3 points), and "Very interested" (4 points).

Content of the online survey



The online survey consisted of the following questions:

- 1 Please tell us your connection to Maryland education.
 - a Teacher — Mathematics
 - b Teacher — Science
 - c Teacher — Technology and pre-Engineering
 - d Teacher — other field
 - e Administrator
 - f Other (non-teacher)
- 2 In recent focus groups, teachers asked us to develop a "STEM Expert" database [the STEM Speakers Bureau]. The idea is to create a central resource of science, technology, engineering, and mathematics practitioners to support teachers and students. Each person would be pre-screened and trained before coming into your classroom ... One-stop shopping.
 - ▶ How would these class visits be received by students?

- 3 Teachers suggested we create a "Digital Student Hub."

This hub would be an outgrowth of our STEM Speakers Bureau. The hub would make available online real-world applications, related to core curriculum that would be of interest to students.

- ▶ How would this "Digital Student Hub" resource be received by students?

- 4 Teachers asked for a communications method to link STEM educators across the state with STEM colleagues in business and the workplace.

- ▶ How would this resource be received by teachers?

- 5 Teachers asked for a "Lifeline."

This would provide teachers with just-in-time access to experts in STEM fields for consultation and mentoring. It may be delivered online, via phone, etc.

- ▶ How would this "Lifeline" resource be received by teachers?

- 6 Teachers called for a "STEM Clearinghouse."

This would provide teachers with online access to an accurate inventory of Maryland's STEM resources (curriculum materials, teaching units, lesson plans, webinars, simulation, etc.)

- ▶ How would this "STEM Clearinghouse" resource be received by teachers?

- 7 Last question ... the floor is yours...

- ▶ Please share your general comments, ideas, and insights on STEM education with us.

Thanks for your thoughts. We appreciate it. If you would like to stay personally connected to this project as it develops, please let us know.

▶ To learn about STEMnet
mbrt.org/STEM

ONLINE SURVEY FINDINGS



Survey results reflect a diverse representation of STEM teachers.

More than 265 Maryland teachers and administrators responded to the survey. Those who responded to the district affiliation question (188) represented 11 of Maryland’s 24 school districts. Teachers accounted for the overwhelming majority of responders: close to 95 percent.

Although some responders identified themselves as teachers in multiple fields (e.g., mathematics and science teachers, science and technology teachers), mathematics teachers were a clear majority of survey takers (close to 50%), followed by science teachers (30%) and technology and pre-engineering teachers (under 15%). Survey participants ranged from first-year teachers to veterans with more than 40 years of service.

TEACHER EXPERIENCE

YEARS OF SERVICE	NUMBER OF TEACHERS	% OF TOTAL
1 – 5	51	27.6%
6 – 10	31	16.8%
11 – 15	32	17.3%
16 – 20	13	7.0%
21 – 25	15	8.1%
26 – 30	20	10.8%
31 – 35	9	4.9%
36 – 40	11	6.0%
40+	3	1.7%

Teachers rated their interest in the five proposed activities (see table on page 19).

The clear standout of the five proposed activities (found in questions #2 – #6) was the STEM Clearinghouse teacher-centered support activity. Nearly 90% of all 265+ participants indicated that they were interested or very interested in this resource. Many of the comments in question #7 reflected excitement about this activity among teachers and administrators.

Comments often contained suggestions on how to optimize use of the database by teachers.

“Time and ease of access to information is the key. Teachers want to use the latest and best materials and ideas, but they often do not know that they are out there. The clearinghouse idea, with prescreened and well-documented information, is great.”

“Cross-referencing the STEM materials with the course curricula would be the best thing you could do to help teachers apply the resources quickly.”

“I’d like to have the STEM resources organized by the objectives that we teach.”

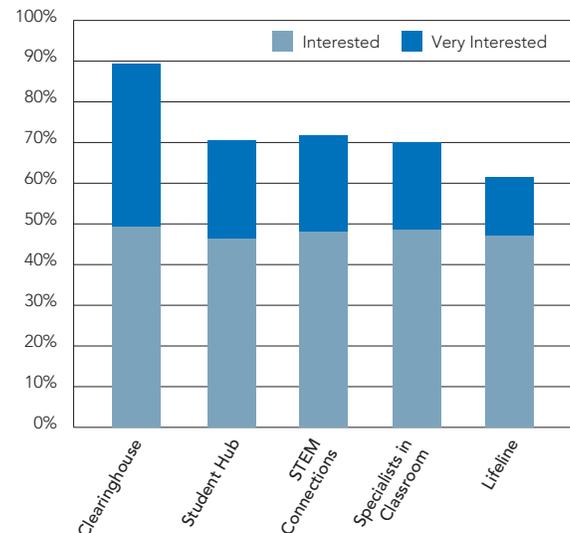


RATINGS OF PROPOSED SUPPORT INITIATIVES

		NO INTEREST	SOME INTEREST	INTERESTED	VERY INTERESTED	PRIORITY FOR TEACHERS
Clearinghouse ▶	Responses	0	29	132	107	1
	% of Total	0.0%	10.8%	49.3%	39.9%	
Student Hub ▶	Responses	2	77	124	64	2
	% of Total	0.7%	28.8%	46.4%	24.0%	
STEM Connections ▶	Responses	6	70	129	63	3
	% of Total	2.2%	26.1%	48.1%	23.5%	
Specialists in Classroom ▶	Responses	5	75	130	58	4
	% of Total	1.9%	28.0%	48.5%	21.6%	
Lifeline ▶	Responses	8	95	126	39	5
	% of Total	3.0%	35.4%	47.0%	14.6%	

“Anything that provides easy-to-access articles, question sheets, tests on the material that best fit STEM would be welcome. I’m getting tired of inventing the wheel and writing my own curriculum to advance my students’ knowledge about water towers, bridges, cranes, mechanical advantage, etc.”

Nearly 90% of all 265+ participants indicated that they were interested or very interested in a STEM Clearinghouse resource.



ONLINE SURVEY FINDINGS

Student-centered support findings

Of the two student-centered activities, the Digital Student Hub and the STEM Specialists in Classroom were statistically even with an interested/very interested rate of 70.4% compared with 70.1%.

Despite its outscoring the STEM Specialists in Classroom by a small margin, there were no comments on the Digital Student Hub in question #7. The STEM Specialists in Classroom, however, received many positive comments and suggestions on how to make a practitioner’s classroom visit more meaningful. Two comments cited the need to find ways to dispatch practitioners to the Eastern Shore and Western Maryland: most STEM practitioners are located in Central Maryland and some are limited as to where they can travel. In general, online survey comments on the STEM Specialists in Classroom mirrored suggestions from the focus groups, and revealed high interest in this activity.

“Real world connections are always appreciated. It is important for them to tie into the curriculum since there is usually very little time for ‘extra’ projects that don’t have curriculum tie-in.”

“The students seem to do best when given a physical problem to solve. Anything that gets more of this in the classroom would be phenomenal.”

“Something like this would be very useful with my gifted students. To have an expert they could communicate with as they research information for different projects would be great.”

RATINGS FOR STUDENT-CENTERED INITIATIVES

	NO INTEREST ▼	SOME INTEREST ▼	INTERESTED ▼	VERY INTERESTED ▼	PRIORITY FOR TEACHERS ▼
Student Hub					
Responses	2	77	124	64	1
% of Total	0.7%	28.8%	46.4%	24.0%	
Specialists in Classroom					
Responses	5	75	130	58	2
% of Total	1.9%	28.0%	48.5%	21.6%	



Teacher-centered support findings



After STEM Clearinghouse, which was the clear favorite, the next-most-popular teacher-centered activity was STEM Connections, which beat out STEM Consultation and Mentoring — Lifeline by a wide margin. 71.6% of responders reported that they were interested or very interested in STEM Connections, while just 61.6% said the same for the Lifeline proposal.

Comments in question #7 were supportive of STEM Connections. There were some concerns associated with the Lifeline activity.

“Many teachers are developing and implementing fantastic STEM lessons. Unfortunately, they are isolated and have little contact with each other. This will give us a true cohort.”

“Local school systems must develop a STEM program as opposed to promoting random acts of STEM when any teacher or department feels motivated.”

“More work needs to be done to accommodate cross-curricular development between the STEM content areas. As a teacher, I would like some mathematics and science refresher courses to enhance my knowledge of the other areas.”

RATINGS FOR TEACHER-CENTERED INITIATIVES



	NO INTEREST	SOME INTEREST	INTERESTED	VERY INTERESTED	PRIORITY FOR TEACHERS
Clearinghouse					
Responses	0	29	132	107	1
% of Total	0.0%	10.8%	49.3%	39.9%	
STEM Connections					
Responses	6	70	129	63	2
% of Total	2.2%	26.1%	48.1%	23.5%	
Lifeline					
Responses	8	95	126	39	3
% of Total	3.0%	35.4%	47.0%	14.6%	

RECOMMENDATIONS FOR ACTION

After a careful review of observers' notes and teachers' comments from the two focus groups and online survey results, MBRT ranked the proposed initiatives to directly reflect the explicitly-stated needs of Maryland's STEM teachers.

Since survey ratings among all initiatives were fairly close, MBRT gave serious consideration to teachers' interest and enthusiasm in focus group discussions, as well as to the depth and breadth of teachers' suggestions in the focus groups and online survey comments.



MBRT recommends that the initial phase of **STEMnet Teachers Hub** include:

- ▶ **STEM Resource Clearinghouse**, which gives teachers online access to STEM curriculum materials, lesson plans, webinars, professional development and more.
- ▶ **Statewide STEM Connections**, through which teachers can link with other STEM educators at all levels — elementary, middle, high school, college, and postgraduate — and with public and private-sector STEM professionals to share knowledge and resources.
- ▶ **STEM Specialists in Classrooms**, enabling teachers to call upon an impressive assemblage of STEM practitioners from industry, government and higher education to visit their classrooms and work together with students on relevant, rigorous learning “moments” and real-world STEM work that will help prepare students for access to and success in college and the world of work.

With investments from AT&T, Citi, Northrop Grumman, and IBM, implementation of Phase 1 — comprised of these three top-ranked initiatives — will begin in the 2010–11 school year.

This first stage, developed in partnership with the Maryland State Department of Education, will offer teachers — in a “one-stop shop” — three sets of resources that are aligned with recently adopted Common Core Standards.

The remaining eight initiatives will be phased in over several years with support from stakeholders statewide whose shared interest in advancing STEM teaching and achievement will transform Maryland’s ability to compete successfully on the international stage.

MBRT

Founded in 1992, the Maryland Business Roundtable for Education (MBRT) is a nonprofit coalition of leading employers that have made a long-term commitment to improve education and student achievement in Maryland.

MBRT works to achieve meaningful, measurable and systemic improvement in schools and student learning. We believe the keys to this improvement are high standards, quality teaching, rigorous assessments and strong accountability. Working at both the policy and grassroots levels, MBRT brings the voice of business to decision makers, students, educators, parents and others who influence students, to help shape Maryland's future workforce.

STEM

MBRT believes that widespread competency and strong innovation in Science, Technology, Engineering and Math will ensure Maryland's — and the nation's — ability to compete internationally, prosper economically and provide opportunity for its young people.

STEM Innovation Network — STEMnet

The Governor's STEM Task Force developed seven major recommendations to strengthen STEM teaching, learning, research and workforce/economic development. Recommendation 7 — creation of a STEM Innovation Network — is critical in accomplishing all of the Task Force recommendations. MBRT is leading the charge and has committed, leveraged, and solicited resources — human, technical and financial — to create Maryland's STEM Innovation Network.

STEMnet will:

- ▶ provide universal access to STEM information, resources, and opportunities in Maryland.
- ▶ establish a virtual environment in which “communities of practice” will emerge to promote new and innovative programs and share critical information.
- ▶ lead to extraordinary results in student preparation for 21st century jobs.

STEMnet Teachers Hub

Preparing today's students for college and tomorrow's jobs is a complex task and a tremendous responsibility that requires the greatest resources we can muster. Teachers cannot do it alone. Students and teachers must have access to — and benefit from — the best information and the brightest minds. These resources exist — in the workplace, in higher education, in government agencies, and in the community. Finding and deploying them is the challenge.

STEMnet Teachers Hub will:

- ▶ provide teacher and student access to Maryland's rich inventory of STEM resources.
- ▶ deliver programs, services and support to teachers and students.
- ▶ facilitate communication and collaboration among partners.
- ▶ translate new knowledge into meaningful results and accelerated solutions.
- ▶ establish a vibrant human network to support Maryland's world class teachers and students.
- ▶ turn on and turn up our pipeline of STEM workers.

▶ **To learn about STEMnet**
mbrt.org/STEM



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