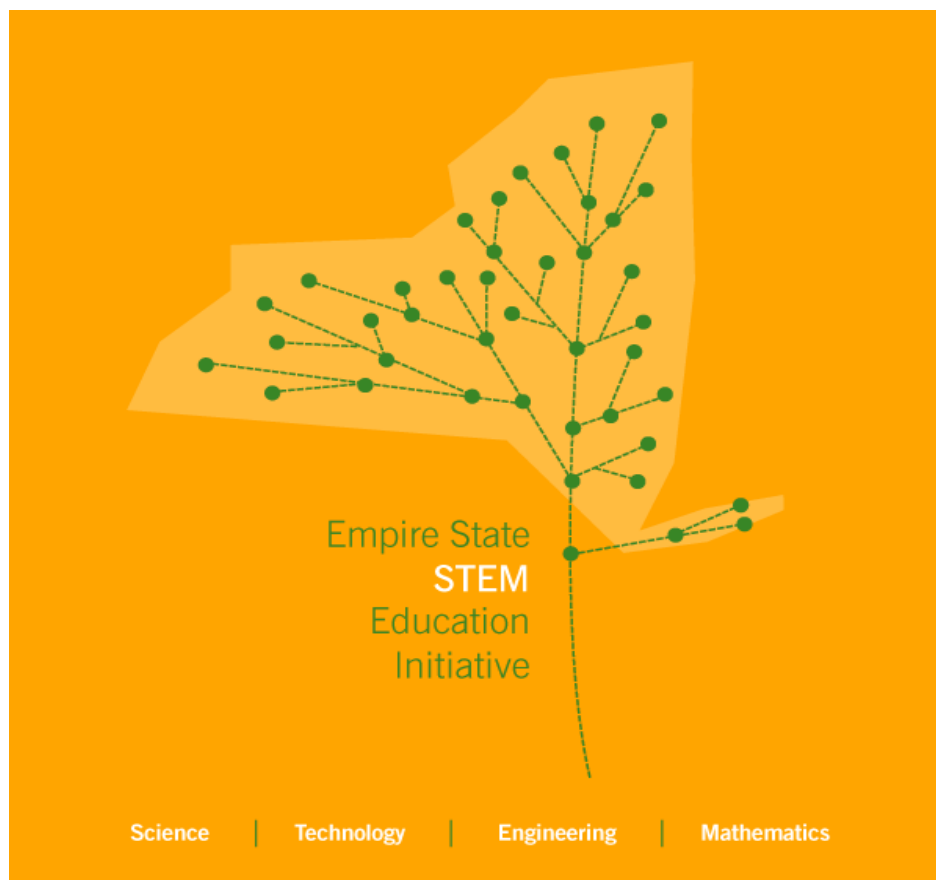


# Empire State STEM Education Initiative

## Progressive Dialogue – Buffalo Region

October 27, 2009

## Update for Dialogue Participants



Prepared by: Margaret Ashida, Rensselaer Polytechnic Institute  
Monica Hunter, PAST Foundation

## Buffalo Progressive Dialogue Update

The Empire State STEM Education Initiative, led by Rensselaer Polytechnic Institute and supported by grants from the Bill & Melinda Gates Foundation and the AT&T Foundation, has initiated a “progressive dialogue” to identify ways to advance PK-20 education in science, technology, engineering, and mathematics (STEM) across New York State, and thereby prepare the next generation of New York’s graduates to innovate and compete in the global economy. The progressive dialogue is engaging leaders from the public and private sectors in the design of a strategic public policy roadmap for increasing the number of students – from all backgrounds – aspiring to and prepared for STEM disciplines. Advice and participation in this work is being provided by leaders in industry, philanthropy, community-based organizations, and New York’s State Education Department (SED) and Deputy Secretary of Education.

The Progressive Dialogue was launched on the Rensselaer campus in June, 2009 in a convening of over 100 stakeholder leaders. The Dialogue continued in a series of 8 regional summits held in October-December, 2009 in the “Big Five” cities (Buffalo, Rochester, Syracuse, Yonkers, and New York City) along with the Capital region, Long Island, and the Southern Tier. In total, over 500 stakeholders participated from sectors including 40 companies, state and local government, public and private K-12 and higher education, corporate and family foundations, museums, public television, PTAs and school boards, professional associations in the STEM disciplines, and non-government organizations.

Dialogue participants recognized the need to act now, boldly to enhance and expand STEM education opportunities for students and teachers. They identified constraints and barriers to transition before developing recommendations for action at both the state and local level. In broad terms, the Dialogue generated the following findings:

### Constraints

- State and federal regulatory boundaries are rigid and constrain local scale educational reform.
- The STEM education concept is not commonly understood, and the values and benefits associated with STEM education are not well known in education, business and industry nor by the general public.
- The current system of incentives does not motivate key outcomes (ex., education funding tied to enrollment, not to student performance or teaching quality).
- There are shortages of STEM-qualified teachers and a lack of professional development in STEM (both pre-service and in-service), needed at the elementary, middle and high school levels. There is no STEM-specific certification at the state level.
- Current assessments do not measure mastery in project- and problem-based learning, and assessment innovation is limited by the Adequate Yearly Progress indicator.
- Time segments used in education – school year, school day, and class period – constrain classroom innovations that would be conducive to STEM learning. For example, the class period constrains project-based learning opportunities; seat-time requirements do the same.

- Use of technology in the classroom is 15-25 years out of sync with the real world, bound by traditional reliance on textbooks and other outdated classroom resources, and by lack of capital investment.
- The K-20 system is not structured to support STEM; many university faculty and administrators are not prepared for or willing to undertake joint program development with K-12 educators.
- Union contracts have established rules and practices that must be addressed to achieve certain STEM reforms.

### **Challenges to Transition**

- Stakeholders must be engaged across a broad spectrum of interests, expertise and capacities to contribute to the transition to STEM literacy
- Education must be cradle to grave to go beyond K-20
- Effective education must break with current practices that deliver siloed instruction in order to link with real world interests and needs that are meaningful to students who must achieve multiple literacies
- Education must become more entrepreneurial if it is to achieve long-term sustainability

### **Recommendations (preliminary):**

- **Regents / SED policies and programs:** Address STEM teacher needs across dimensions of human capital management (attract, recruit, develop, retain top talent; performance-based culture; alternative certification pathways); engage students in STEM (student-centered design, project-based learning, internships, apprenticeships); integrate STEM into the curriculum and assessments (project-based, experiential, multidisciplinary learning and assessment at all levels); integrate / expand the use of technology throughout the learning environment (open source models for access to content and expertise, “virtual worlds”, distance learning, mobile labs); pursue new models for schools (e.g., regional STEM schools, career academies)
- **State Government Administrative Structures:** Integrate education and economic development activities to eliminate silos / acknowledge links between all disciplines
- **Community Initiatives:** Develop partnerships involving business, schools, and higher education to ensure education outcomes resonate with local economy and community needs; access available resources to reshape schools, address teaching deficiencies; create alternative / creative STEM learning experiences for students; engage state policymakers and regulators to remove regulatory / legal barriers to change; engage parents in STEM education
- **Cross-sector:** Build community connections / capacity to address STEM needs through the creation of a statewide STEM Network to coordinate state and local STEM activities across Government, K-12 education, higher education, business, philanthropic and business disciplines

Prioritization of recommendations and briefings are underway to share findings and engage stakeholders in commitments required to move from dialogue to action.

The Buffalo progressive dialogue was held on October 27, 2009 at the Hauptman-Woodward Medical Research Institute in Buffalo, NY and was co-hosted by the New York State Board of Regents, the Buffalo Niagara Medical Campus, and the University at Buffalo. Over 60 stakeholders came together, representing diverse communities across Western New York. Context was provided by Robert Bennett, Chancellor Emeritus of the New York State Board of Regents; Eaton Lattman, Chief Executive Officer and Executive Director, Hauptman-Woodward Medical Research Institute; Robert Brady, Chairman and Chief Executive Office, Moog Inc; and University at Buffalo professors Douglas Clements and Julie Sarama. Participants went on to develop recommendations in small groups and share their top ideas in plenary session. They also interactively assessed each group's recommendation and four summary statements with the support of e-Instruction hand-held devices ("clickers").

Ethnographic observation of the small group and plenary sessions was led by the PAST Foundation with support of local undergraduate and graduate students. Their detailed notes have been transcribed and are being synthesized by PAST anthropologists. A preliminary ethnographic bullet point report has been completed for the Buffalo dialogue and is included in this document for your review. As a participant in this effort you will also receive a final ethnographic report for the full Progressive Dialogue that is being prepared by the PAST Foundation.

This update is being distributed to participants in the Buffalo region to provide a record of the ideas shared in plenary and in the small groups:

- Summary statements and ("clicker") response data for each breakout group with unedited transcription of the groups' flip charts (pp 5-10)
- Bullet Point Report – Summary of Break Out Sessions (pp 11-16)
- Participant assessment of four summary statements (p 17)
- Participant list (pp 18-20)

## Group 1 – Presented:

Rethink “school

- Longer school day / year
- Teacher reward systems
- Funding – break away from property values
- Continuing education of parents & community
- Make STEM culturally valuable



“Collaboratorium” – collective approach to community-based and integrated education

- Industry “adjuncts” in P-20
  - Externships / residency in industry
  - Strengthen elementary STEM skills
  - Integrated STEM Curriculum that integrates the teachers & works throughout P-20
  - Rethink “school”

Group 1 – Interactive assessment results:

Group 1	1	2	3	4		N/A
Low Priority	2%	7%	32%	48%	High Priority	11%
Requires NYS Policy Change	57%	27%	5%	7%	Implementable Locally	5%
Low Effect on Educ’l Reform	2%	7%	27%	57%	High Effect on Educ’l Reform	7%
Requires Identifying New Resources	11%	25%	34%	20%	Could Redirect Existing Resources	9%

Group 1 – Additional Notes:

- Better coordination locally of science initiatives; university; Buffalo library; Science Museum; K-12
- Must reach pre-K kids
- Math literacy is a skill that can be taught; must be brought back to real world concepts
- Make science culturally valuable
- Resources ?
  - How do we fund schools?

- How do we train teachers?

#### Paradigm shifts

- Look outside schools (adjuncts in K-12; community-based organizations (CBO's)
- Make STEM culturally important and relevant
- “Integrate” ... “Collaboratorium”
- Beef up science ed for elementary teachers
- Place a value on STEM in society; need a science “literate” society
- Need more collaboration among science teachers; break down barriers; team teaching
- “Collaboratorium” = links STEM disciplines
- Collaboration among higher ed departments too
- Common ways to teach skills (ex. graphing)
- Change paradigms in schools, esp. in public schools
- Build interest in primary ed. from industry & university (K-2)
- Pique interest in STEM for younger grades
- “Adjuncts” in K-12
- Teach “special topics” in schools
- Capture retirees as teachers
- Look at a model that looks @ a range of skill sets
- Look outside traditional ed. settings and school day – CBO's, etc.
- Integrate STEM initiatives into teacher training; how will teachers engage students? Ongoing professional development

### Group 2 – Presented:



Large scale collaboration between business\*\*\*, government, parents/caregivers, and schools (PK-20) to identify the needs in these STEM careers, the economic benefit / impact of these skills, knowledge etc. to be successful in these areas and policies that allow for flexibility\* to meet the needs of learners to achieve in this area!

\* Seat time, assessments, single standards vs. integrated standards

\*\*\* internships, open to teachers, etc.

Group 2 – Interactive assessment results:

<b>Group 2</b>	1	2	3	4		N/A
Low Priority	0%	14%	30%	55%	High Priority	2%
Requires NYS Policy Change	7%	27%	43%	18%	Implementable Locally	5%
Low Effect on Educ'l Reform	5%	20%	41%	30%	High Effect on Educ'l Reform	5%
Requires Identifying New Resources	7%	25%	36%	25%	Could Redirect Existing Resources	7%

Group 2 – Additional Notes

Parents

- More info on careers available – skills needed, etc.
- “Math” was not my best subject either
- More info on where jobs really are

Policy

- Seat time
- Standards
- Assessments
- CTE – CDOS “not required” because not assessed

Careers, Motivation, Content:

Business Involvement

- Internships (MET school model)
- Early preparation & involvement
- Ease the bureaucracy of schools
- Teacher/admin knowledge for real world connections

Schools – P-12

- More time to math, sci curriculum
- Problem/inquiry based learning
- Cross content learning
- Use students to teach other younger students
- Harness the power behind athletics to push focus into these areas
- Change order of science courses
- K-12 prep only for college?

Colleges

- Discussions between P-12 & colleges
- Change pre-service programs? Generalist in Elem Ed?
- STEM work as an emphasis but is that too late?

**Group 3 – Presented:**

Collaborative innovation: Redistribute resources (and accountability) to drive a local model:



- Culturally driven
- Sustainable, replicable
- Partnership between business/industry, higher education, local social agencies
- Needs business internships
- Character development needs to be part of it (critical thinking)
- Higher standards in science and technology – holistic approach
- Weekly assessments by teachers – accountability is needed

Group 3 – Interactive assessment results:

<b>Group 3</b>	1	2	3	4		N/A
Low Priority	5%	14%	39%	43%	High Priority	0%
Requires NYS Policy Change	14%	11%	23%	45%	Implementable Locally	7%
Low Effect on Educ'l Reform	2%	11%	50%	30%	High Effect on Educ'l Reform	7%
Requires Identifying New Resources	5%	11%	43%	30%	Could Redirect Existing Resources	11%

Group 3 – no additional flipchart notes

### Group 4 - Presented



Vision: Redesign state assessments to be authentic interdisciplinary project-based assessment

- Restructure educational structures to allow for interdisciplinary teams rather than content / grade level teams
- Utilize rigorous instructional practices, formative assessment
- Focus on critical thinking as essential curriculum
- Structural changes to include opportunities for higher education
- Driven by a clearly articulated VISION to develop innovators

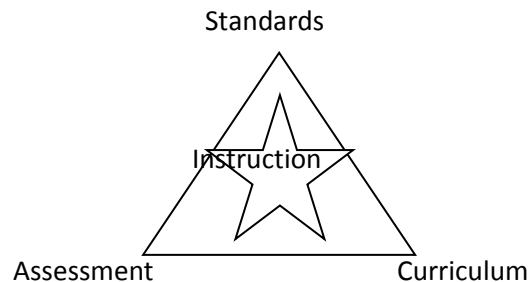
Group 4 – Interactive assessment results:

<b>Group 4</b>	1	2	3	4		N/A
Low Priority	0%	7%	30%	52%	High Priority	11%
Requires NYS Policy Change	73%	7%	2%	9%	Implementable Locally	9%
Low Effect on Educ'l Reform	5%	11%	25%	48%	High Effect on Educ'l Reform	11%
Requires Identifying New Resources	20%	18%	20%	32%	Could Redirect Existing Resources	9%



Group 4 – Additional Notes

- Communication is key
  - Vertical & horizontal
  - Interdisciplinary
  - Graduate School – more communication between departments
- Structural changes needed
  - Opportunity for higher education
- Keeping STEM a priority in Early Education
- Innovation is restricted by high stakes tests
- Need for a clearly defined vision of what we want students to be
- Habits of mind
  - Curiosity
  - Creativity
  - Questioners
- Need to create higher engagement and connections to childrens lives



- Need for depth not breadth of knowledge

Strategic Partnerships

Education needs to move beyond walls of school

2<sup>nd</sup> Order Changes in School

- Remove time constraints of “periods”
- Create integration of classes, ex. Math & Science together

- Embed education of habits of mind
- Higher level of rigor in instruction & assessment
- Higher order thinking must be K-12

Ownership for STEM by all needed

Closer look at existing partnerships

- Which are successful?
- How can they be replicated?
- Why are they “grant dependent”?

Technology

- Rethink digit divide – look at what kids are using now



Idea # 2 - Can students develop standards for teachers?

- What do they need to know?
- Are they getting what they need from teachers?
  
- More education about career opportunities
- Need business leaders involved in discussion (strategic partnerships)
  - What skills and thinking are needed to keep jobs & services in the U.S.?
- Look at who is doing well in implementing STEM
  - How is that defined? Measured by what?
  - Will STEM be core?
- How inclusive is STEM? How do we make sure it is for ALL?

## Group 5 – Presented:

Top idea: STEM project-based assessment with systemic benchmarks from elementary through college



Matrix

Local/regional	State
<ul style="list-style-type: none"> <li>• Summer schools at business locations</li> <li>• Regional center for professional development</li> <li>• Master-based progress vs. seat-time</li> <li>• Regional STEM schools</li> <li>• Business-partnered</li> <li>• Regional STEM resource center</li> </ul>	<ul style="list-style-type: none"> <li>• Increase content requirements for teaching degree</li> <li>• STEM certification</li> <li>• Summer STEM education conference</li> <li>• STEM project-based assessment with systemic benchmarks (this had arrow to left, also local/regional)</li> </ul>

Group 5 – Interactive assessment results:

Group 5	1	2	3	4		N/A
Low Priority	2%	14%	43%	34%	High Priority	7%
Requires NYS Policy Change	57%	16%	18%	5%	Implementable Locally	5%
Low Effect on Educ'l Reform	5%	16%	50%	25%	High Effect on Educ'l Reform	5%
Requires Identifying New Resources	20%	30%	25%	23%	Could Redirect Existing Resources	2%

Group 5 – Additional Notes

- STEM literacy at ALL levels of school
- Students can be STEM capable
- Habits of mind
- Regents exams are limiting – currently don't support integration
- Standard 6 = Interconnectedness for graduation
- Performance assessment
  - Project-based
- Centralized statewide system collecting data of P.D.
- Get the public on our side
- What is the "T" in STEM for interpretation?

- Separation of business & schools;  
Graduates lack info about jobs  
How DO we get them engaged between business & school?
- Middle school – elem school needs more programs for exploration of the community
- Get teachers in the business world;  
Get business people in the schools
- Junior Achievement model for STEM

## Group 6 – Presented:

### Pre service teachers



1. Change certification requirements
  - a. Ex.: no overlap in elementary (k-6); make it K-3, 4-6
2. STEM focus (concentration)
  - a. Possible certification?
3. Utilizing community partnerships (i.e. Informal science institution to help pre-service teacher)
4. Certification programs – STEM focus
5. Outreach to parents and community
6. Policy for continued P.D.

### Group 6 – Interactive assessment results:

<b>Group 6</b>	1	2	3	4		N/A
Low Priority	5%	16%	34%	39%	High Priority	7%
Requires NYS Policy Change	59%	27%	2%	5%	Implementable Locally	7%
Low Effect on Educ'l Reform	9%	11%	43%	23%	High Effect on Educ'l Reform	14%
Requires Identifying New Resources	14%	18%	30%	30%	Could Redirect Existing Resources	9%

### Group 6 – Additional Notes

- Technology integration sequence for pre-service instruction

### Educate community

#### 1. Marketing

- Changing attitudes
- Business/industry partnership

2. Partnership with community

- Church, library, community service center
- Adequate funding for informal educational institutions (ex. Non-profit)
- Summer and after school opportunities for students and families

Professional Development

1. Policy change and resources for sustained and on-going P.D.

- Facilitated time built in
- Model mentoring program
  - Partnerships that are cross districts, higher ed, and informal science institutes

**Bullet Point Report**  
**Summary of Meeting, October 27, 2009**  
(DRAFT 11-27-09)

The following summary of issues and suggested actions for implementing STEM education in Buffalo have been compiled from the ethnographic observations of the meeting conducted on October 27, 2009.

This preliminary report is intended to provide a brief overview of key themes developed during five breakout sessions. Breakout groups consisted of participants representing higher education, K-12 education, business, government, nonprofit organizations and STEM proponents from the Gates Foundation and the PAST Foundation. The issues are organized by eight categories that include:

- 1) Federal and State Policy, Regulations and Standards
- 2) Regional Issues and Local School Districts
- 3) Teachers: Training and Professional Development
- 4) Student Needs and Potential Engagement in STEM Education
- 5) Partnering: Learning Community Stakeholders
- 6) Curriculum and Instruction
- 7) Assessment (Measurement)
- 8) Models/Strategies for Action (STEM implementation)

**Federal and State Policy, Regulations and Standards**

- Statewide policy is necessary in order to initiate STEM at local level
- State should be involved in developing industry-based professional development for teachers
- National education mandates (and funding) make it difficult to drive state and local change
- Political action is needed to address minority and low SES student needs
- State level aid leads to short-term gains only, must add a long-term pathway that also includes a system of incentives or changes will not be implemented
- Legislature should change policy on assessments that inform tenure practices

**Regional Issues and Local School Districts (SDs)**

- K-12 education does not require adequate preparation in math and science for students; need to increase number of required courses
- New leadership needs to be identified that breaks with the long-standing tradition of those “most removed from the classroom” leading the way (e.g., principals)
- SDs should redirect funding to develop math and science academies
- The City of Buffalo has invested millions in funding for computers, but failed to provide teacher training to achieve computer/tech literacy, as a result teachers are not able to use equipment
- SDs need to develop internet access policies that address student abuses without banning internet access for all
- SDs that are well funded can lead the way in STEM implementation; this includes low SES SDs that are primarily federally funded (e.g., Allegany County)

- PD should continue to be developed at the SD level to assure a good “fit” with existing infrastructure, but should also develop standards that raise the quality of current PD provided for teachers
- There needs to be standards for School Board members that measures their proficiency in areas related to STEM
- Focus on streamlining management in the classroom for Buffalo public schools (BPS) should not decrease subject area teaching in order to meet management goals
- Urban SDs are focused on skills/drill teaching to reach performance goals focused on math and science that have not worked; need to shift focus to k-4, integrated hands-on learning that could significantly improve performance outcomes
- Buffalo public school statistics show a graduation rate of 90% for students in computer/tech education programs, when overall graduation rate for BPS is 50%; demonstrates value of tech education in engaging students in ways that they can connect their interests with their education
- National standards are “washed away” by local concerns that drive individual school standards

### **Teachers: Training and Professional Development (PD)**

- Librarians should be engaged in teacher PD that includes k-12
- Provide tech training for teachers and administrators; they are lagging behind student proficiency with digital technology
- Develop PD for middle school teachers
- Elementary school teachers lack competence in math and science and are not ready for STEM (fear math); need to strengthen math/science instruction in k-6 (by 6<sup>th</sup> grade students have been exposed to 6 teachers who do not love math)
- Consider best use of teacher expertise: should teachers be teaching workplace skills?
- Centralize teacher PD by developing a resource network; Buffalo State teacher training is inconsistent in approaches and creates confusion for students; math and science teaching should be based on common approach
- Math teachers are not informed on career options for students; need to be exposed to business and industry to understand career options
- Teachers should be required to have real world (RW) experience before entering the classroom (e.g., teachers at a Daimler Chrysler summer internship program could not perform job tasks)
- Teachers should be compensated for PD
- Change pre-service teacher training to accommodate interdisciplinary training, including math/science/technology; should be conducted by a panel across higher ed departments
- Expand teacher training beyond current focus on reading, writing and classroom management; teachers need to be computer literate and have a facility with classroom equipment
- Innovation in teaching is essential to STEM instruction but schools do not support context for innovation; teachers should know how to create a “condition of inquiry” in the classroom; new teachers are encouraged by the union to follow “safe” methods until they achieve tenure (3 years)
- PD should reflect a vision of what we want for students
- Develop a cadre of tech teachers among retired professionals (training can be completed in one year)

### **Student Needs and Potential Engagement in STEM Education**

- BOCES students are stereotyped as “stupid” and the program is considered a “dumping ground” for failing students; develop a new strategy that elevates the value of vocational education (e.g., not all tech careers require college); help parents and community to see the value of vocational education and potential careers
- Great educational experiences need to be developed for all students, not just students at the top
- Need to provide real world STEM role models (RM) e.g., women and people of color in the professions; bring career RM to the school to give students and parents information about other options beside athletics; guidance counselors should be able to assist students to understand career options
- Teaching students math without career context is meaningless for students
- Students are not prepared for math and science required for many careers that result in changing majors early in college (e.g., students who want to go into medicine drop out because they can’t handle the math); at least 20% of college students require remedial work in science and problem-solving skills
- Ask students why they drop out of school to understand necessary changes that will make a difference to graduation rates; can’t reach them once they drop out
- Consider what interests younger students and build programs to engage their curiosity; reach students as early as pre-K
- There is a big difference between high school and college that students find difficult, most need remedial instruction or tutoring in math; students of color, women, low SES are not as likely to succeed in college; at least half of current enrollment at UB (16 students in the program – what program?) will change their major because the math is too hard for them
- Consider importance of producing college graduates with math skills at different levels (Ph.D., Masters, B.A.), but also need high school students with math skills
- Recruitment of underrepresented students at Buffalo State has not reached potential despite STEP Program and funds to support targeted outreach for fully funded four-year college enrollment, had to turn funds back for lack of interest
- American students are not interested in engineering, demonstrated by the fact that 80% of students enrolled at Buffalo State are foreign
- Middle school students are not ready for math and science, no lab experience or familiarity with equipment and procedures causes teachers delays in grade-level program implementation; girls are not ready and need additional preparation for middle school science courses
- Change the paradigm that math and science are for “smart” students

#### **Partnering: Learning Community Stakeholders**

- The role of business is not clear, what’s in it for them?
- Union issues must be addressed, e.g., they have not been supportive of programs that threaten to reduce numbers of teaching or aide positions (such as college students teaching k-12 courses); need to be involved early in building collaborative processes; need to address union concerns with developing adjunct faculty (e.g., retired professionals)
- Involvement of parents is limited; parents should be educated about STEM before their children even begin school; parents must be educated about career choices, stereotyping leads to narrow view of professional career choices, e.g., doctors and lawyers; consider developing “continuing education” courses for parents and others in the community
- Develop a vision of what is needed for students before bringing in partners; expand vision of who should be involved to support the “vision”



- There is a generational/digital divide that must be addressed among broader partners
- Industry must be at the table and in the classroom; manufacturing is seeking opportunity to “shine up” their image through engagement with schools
- Higher education is not willing to engage with k-12; higher education is not willing to engage with vocational education
- Neither higher education nor business are interested in lower level science education, they need to rethink importance of cultivating early interest in science and math
- Must engage the full community to succeed or fail together
- Drug use is a factor in addressing workforce needs, affecting both students and employees (75% of employees cannot pass a drug test), need parents and broader community to work on the problem, not just a school problem
- Partner with business to develop single semester courses taught by industry professionals funded by employer
- Educate people to value of science in meeting societal needs (e.g., stem cell research is seen as evil and scientists as mad men); people want science on their own terms (uninformed on the issues)
- Coordinate across the various community activities that relate to science and math, e.g., Body Worlds, upcoming exhibit on Darwin jointly developed by UB and the library; these can help to change people’s perspective on science
- Form a “*collaboratorium*” to partner outside the schools to include people with soft skills, culturalists (libraries, museums), adjuncts from other fields

### **Curriculum and Instruction**

- Teaching math is a major problem in public schools
- Science literacy not as valued as reading literacy
- No opportunity for innovation in teaching given current high school content and teaching standards; school day timeframe is not conducive to innovation
- Develop core curriculum that is flexible and integrates student interests; students are embedding critical thinking in their approach to tech, how to capitalize on what is already happening?
- Current school year only addresses core curriculum, need to add 60 days to accommodate expanded learning experiences
- In NYS, curriculum development is locally developed
- Increase required math courses from single high school math course currently required
- Develop more “non-regents directed courses” which do not speak to the exam but to (STEM) content
- Increase higher education involvement in lower level science instruction
- Focus efforts on the 200 schools in the district that are not meeting minimum test levels (versus 300-400 schools that are meeting test levels)
- Change the infrastructure of C & I to allow for introduction of “best practices”

### **Assessment (Measurement)**

- Assessments do not meet career development needs; disconnect between education and industry
- Conduct core assessments early, high school is too late
- Include STEM readiness, service projects as requirements for high school graduation

- At the higher education levels, teachers are motivated by assessments, “teachers own the assessment”
- Unpack innovation in the classroom in order to assess; shift focus from assessment of teaching to assessment of learning
- Focus on measurement does not create innovation in teaching
- Students should be assessed more often – don’t wait for the state test to assess; progressive schools assess students more frequently to capture different aspects of learning
- Assessments should include measurement of both process and outcomes
- Stop “social promotion” of students (e.g., don’t advance students that are not ready because they need to move to the next grade level) this does not help students to learn what they need to know
- Parents and students expectations for math and science are low, OK to fail math and science, but not the assessment (grade); reading literacy is important to parents and students, science literacy is not as important, there is no stigma for failing math or science

### **Models/Strategies for Action (STEM Implementation)**

- Charter schools are short-term response to long-term timeframe for implementing change in the public school system
- Eliminate NYS caps set on charter schools that are due to expire in the spring
- Redirect funds to achieve goals versus seeking new funding
- Identify local engineers to act as mentors and role models
- Develop a junior achievement model for students to pursue
- Develop industry-based incentive/mentoring programs for teachers
- Middle school “Future City” competition can be model for others to follow; includes competition that involves engineers and students in project development
- Charter school program uses career model beginning with kindergarten; students and teachers required to complete business internships; career counseling conducted by industry professionals brings business professionals to the school on a regular basis, exposing teachers and students to working professionals (role models)
- Consider UB gifted math program to scale for access by “at risk” students
- Create mentoring programs for college students to teach physics to 3<sup>rd</sup> and 4<sup>th</sup> grade students
- Consider Rhode Island program where students learn through internships, or Bronx program where students match curriculum and courses to internships
- Consider charter school model where teachers are given 5% or greater increase in pay based on high test scores where review is conducted by a panel that includes other teachers, administrators and school board members
- Start an “alumni hall of fame” for former students who are now STEM professionals
- Create a plan for change that works backwards from what we want for students, defined by important factors that lead to becoming a scientist
- Message should include the idea that learning goes beyond the classroom and is part of all aspects of life, so that students move out of the classroom ready to continue their experience of learning and exploring
- Buffalo has 30 middle school teachers who are teaching “multi-modally using cameras and probeware”; need school district support for ongoing PD
- STEM means diversity in access to a good education, where the graduation rate far exceeds 35%
- Replace “pipeline” analogy with DNA model; pipeline includes barriers and unknowns to achieving outcomes

- Need to consider a different school day framework to accommodate PBL
- Buffalo public schools currently include math/science consortiums that are partnered with lower level schools which function as feeders; older students work with younger students, including grades K,1,2; high school students doing half-day field research internships
- Consider model programs from outside the state
- Workforce needs are immediate – don't wait for the perfect program before implementing change
- Charter schools include Stiner outside of NYS: Massachusetts state integrating multiple agencies and developing a more holistic approach
- Build upon existing "Character Development" PD
- Build upon the recent program funded by Engineers for the Future (\$2m) that supported a summer program conducted by a math/science/tech collaborative for 400 teachers to work with engineers and scientists to develop lessons in robotics, cloning and the environment
- Build upon the recent formation of a NYS STEM Collaborative supported by the NYS Teachers of science, math and tech; they are planning a summer institute (teacher training or student summer sessions?)
- Coordinate across programs outside the school to link community interests and ongoing informal education, e.g., "Body Worlds," museum exhibit on Darwin
- Consider teaching at Williamsville, Orchard Park, Amherst Elementary for integrated lessons and instruction

**Participant survey to launch breakout groups**

Four statements were assessed.

1. Economic development and vitality can only be realized through STEM education by broadening collaborative partnerships inclusive of stakeholders in education, business and industry, and the community.

Statement 1	1	2	3	4		N/A
Strongly Disagree	3%	7%	21%	69%	Strongly Agree	0%
Low Priority	0%	5%	50%	41%	High Priority	3%
Requires NYS Policy Change	24%	41%	19%	16%	Implementable Locally	0%
Low Effect on Educ'l Reform	2%	12%	45%	41%	High Effect on Educ'l Reform	0%
Requires Identifying New Resources	12%	38%	33%	17%	Could Redirect Existing Resources	0%

2. Comprehensive STEM education approaches to teaching and learning in all content areas provide opportunities preparing all learners for citizenship, higher education, and careers required of a more scientifically and technologically demanding and complex global community.

Statement 2	1	2	3	4		N/A
Strongly Disagree	0%	0%	7%	59%	Strongly Agree	34%
Low Priority	0%	7%	28%	62%	High Priority	3%
Requires NYS Policy Change	31%	48%	12%	7%	Implementable Locally	2%
Low Effect on Educ'l Reform	3%	7%	34%	53%	High Effect on Educ'l Reform	2%
Requires Identifying New Resources	16%	43%	19%	17%	Could Redirect Existing Resources	5%

3. A network of PreK-20 data systems that collect, analyze, and synthesize data using multiple measures is necessary to implement systemic change in STEM education.

Statement 3	1	2	3	4		N/A
Strongly Disagree	10%	24%	40%	22%	Strongly Agree	3%
Low Priority	7%	31%	36%	21%	High Priority	5%
Requires NYS Policy Change	33%	33%	19%	14%	Implementable Locally	2%
Low Effect on Educ'l Reform	9%	21%	33%	28%	High Effect on Educ'l Reform	10%
Requires Identifying New Resources	36%	24%	21%	10%	Could Redirect Existing Resources	9%

4. Amendments to existing legislation, regulation, and policy are necessary to provide multiple and varied opportunities for students to engage in STEM education.

Statement 4	1	2	3	4		N/A
Strongly Disagree	9%	17%	28%	40%	Strongly Agree	7%
Low Priority	7%	14%	45%	33%	High Priority	2%
Requires NYS Policy Change	48%	21%	19%	9%	Implementable Locally	3%
Low Effect on Educ'l Reform	3%	19%	41%	34%	High Effect on Educ'l Reform	2%
Requires Identifying New Resources	21%	22%	31%	26%	Could Redirect Existing Resources	0%

## Participant List

Name	Organization	Title
Cheryl Aldrich	Sweet Home High School	Elementary Science Coordinator
Margaret Ashida	Rensselaer Polytechnic Institute	Project Director, Empire State STEM Education Initiative
Raymond (Buzz) Bartlett	Teaching Institute for Excellence in STEM	Consultant to Bill & Melinda Gates Foundation
Kelly Baudo	Buffalo Public Schools	Science Supervisor
Robert Bennett	NYS Board of Regents	Chancellor Emeritus
James Bialasik	Sweet Home High School	Mathematics Teacher
Mary Borgognoni	Niagara University	Associate VP for Academic Affairs - Operations and Outreach
Robert Brady	Moog, Inc.	Chairman and Chief Executive Officer
Lori Byrne	Invent Now Kids	Regional Program Manager
Cesar Cabrera	NYS Department of Labor - Western Region	Commissioner's Western Region Representative
Michael Cambria	Buffalo Public Schools	School Library System Director
Doreen Casacci	Erie 1 BOCES	Acting Director, Exceptional Education Programs & Services
Reggie Clark	Roswell Park Cancer Institute	Director of Diversity
Douglas Clements	University at Buffalo, Graduate School of Education	State University of New York - Distinguished Professor, Department of Learning and Instruction
Debra Colley	Niagara University	Dean, College of Education
Rosemary Conley	Erie 1 BOCES	Associate Director
Annalies Corbin	PAST Foundation	Executive Director
Tim Cox	Staff/Curriculum Development Network	BOCES: Cattaraugus Allegany
John Craig	WNED	VP Education and Outreach
John Darby	Niagara Transformer Corp.	President
Anthony Day	Sweet Home High School	Assistant Superintendent
Matthew Dow	St. Joseph's Collegiate Institute- High School	Chair of the Science Department, Biology and Chemistry
Robert Fetter	Western Maritime Charter School	Assistant Director of Academics and Administration; Science Teacher
Mark Gallo	Niagara University	Associate Professor of Biology
Stephen Goss	c/o PAST Foundation	Observer
Jenevieve Goss	c/o PAST Foundation	Observer
Clark Greene	Buffalo State College	Technology Education Program Coordinator
Mary Gresham	University at Buffalo, Graduate School of Education	Dean
Sarah Ham	Buffalo Niagara Partnership	Business Development Manager

<b>Name</b>	<b>Organization</b>	<b>Title</b>
Robert Hazen	Association of Math teachers of NYS	MST Representative
Sam Hoyt	New York State Assembly	Assemblymember 144th Assembly District
Mara Huber	University at Buffalo, Center for Educational Collaboration	Special Asst. to the President on Educational Initiatives, Director UB-Buffalo Public Schools Partnership
Michael Jabot	State University of NY - Fredonia	Director, Institute for Research in Science Teaching
Margaret Jones-Carey	Erie 1 BOCES	Chief Academic Officer
Carrie Kahn	Erie Community College	Executive Dean of Workforce Development
Merridy Knips	c/o PAST Foundation	Observer
Carol Kostyniak	Diocese of Buffalo	Secretary of Education
Eaton Lattman	Hauptman Woodward Medical Research Institute	CEO
Marnie Lavigne	University at Buffalo	Director, Business Development; UB Center for Advanced Biomedical & Bioengineering Technology; NYS Center of Excellence in Bioinformatics & Life Science
Vince Marrone	Public Strategies, LLC	Consultant to Bill & Melinda Gates Foundation
Efrain Martinez	Charter School for Applied Technologies	Superintendent
Nancy McGlen	Niagara University	Dean, College of Arts/Sciences
Phillip Miano	Erie 1 BOCES	Coordinator/Staff Development
Phyllis Miller	St. Dominic Savio Middle School, Niagara Falls	Middle School Science Teacher
Michelle Okal	NYS Association for Computers and Technology in Education	At Large Director / Erie 1 BOCES
MaryJo O'Sullivan	Erie 1 BOCES	Supervisor, Career Development
Walter Pangborn	Hauptman Woodward Medical Research Institute	Executive Vice President
Vivian Pokrzyk	Science Teachers Association of NYS	Past President
Bridget Quinn-Carey	Buffalo & Erie County Public Library	Director
Deborah Rae	Mt. St. Mary's Academy- High School	Chair of the Science Department
Gerald Rising	University at Buffalo	Director Emeritus, Gifted Math Program and columnist, the Buffalo News
Bonnie Rose	Niagara University	Executive VP/VP for Academic Affairs
Fred Saia	Charter School for Applied Technologies Board of Trustees	President of Board of Trustees
Julie Sarama	University at Buffalo	Associate Professor
Catherine Sedota	St. Margaret School, Buffalo	Middle School Science Teacher
Mark Severson	Buffalo State College	Dean, School of Natural and Social Sciences
Tanika Shedrick	Oracle Charter School	Secondary Science Teacher
Larry Slanovich	eInstruction®	New York Representative
Sheli Smith	PAST Foundation	Anthropologist

<b>Name</b>	<b>Organization</b>	<b>Title</b>
Sylvia Smyntek-Gworek	c/o PAST Foundation	Observer
Debra Sykes	Buffalo Public Schools	Assistant Superintendent of Math, Science & Technology
Charlotte Tahk	Nativity of Our Lord School, Orchard Park	Middle School science teacher
Lititia Thomas-Rogers	University at Buffalo	Assistant Vice-Provost
Lynne Tompkins	Teacher Resource Center-Niagara	District STEM coordinator
Karen Wallace	Buffalo Museum of Science	Director, Center for Science Learning
Brian Wheat	Buffalo Academy of Science Charter School	Science Teacher