Official meeting agenda is available at:

The main handout for this meeting is the Strategic Re-envisioning for the Education and Human Resources Directorate document (see attached).

Incoming EHR Advisory Committee Chair
Francisco Rodriguez remarks:
Improvements can be made by the work EHR by focusing on uplifting people from poverty and address gaps
- Broadening the skills
- Strategic re-visioning report needed
- Focus on enhancing greater transparency and accountability from the EHR
- We need to capitalize on promising trends within STEM – Understanding the Brain has been a major initiative
- It’s important to maintain and foster connections with HBCUs and Hispanic 2-year institutions

**EHR Core Research (ECR) Program**
FY13 EHR Inaugurated ECR to continue to build the knowledge base and evidence needed to achieve excellence in STEM education and workforce development

ECR spans FY13, FY14, & FY15
55 projects totaling $45M awarded
275 proposals are currently under review since Feb 2015

Discussion comments/questions
EHR initiatives - Workforce and school projects
- How to measure and account for learned information and skills from school projects completed during undergraduate coursework.
- How do you evaluate what the workforce has done before?
- Evaluating things in the real world is tricky
- Hard to code what needs to be taught with the changing technologies
- New ways of training and evaluating are needed
- Micro-credentialing for professionals
- Cybersecurity Test beds
- Synthesis Research and presenting to policymakers doesn't really work – its important to consider the audience and communicate research based on that

**Committee of Visitors (COV)**
Division of Research on Learning (DRL) in formal and informal settings
The EHR strategic report plan – powerful data collection are needed

Committee of Visitors (ADVANCE)
The committee of visitors has outside evaluators who review around 30 programs every three years
- This helps ensure transparency and accountability
- Ensures that there is continuous improvements

Recommendations –
- More improved review process
- It is crucial to have a more diverse pool of Principal Investigators working on projects
- Its critical that new PIs are given clear instructions on how to lead and how to provide valuable feedback for future projects
- Diversify reviewer pool, minority and rural institutions
- Current PIs should nominate one new PI at the end of projects
- NSF should create reviewer data pool to select people more easily
- This program requires that many manage a heavy workload
- Rotating ADVANCE assistants was difficult and a permanent person to help is needed
- Distribute funding/budget models ensure monies are distributed across directives
- Recommended that NSF move to a more centralized budget model
- Distributed budgets make it difficult to start up new projects because money is already tied up in older projects making centralized budgeting an option to consider
- There are 45-47 ADVANCE projects
- Certain institutions could potentially use the ADVANCE label (through some sort of certification process) in order to get funded
- We need to look beyond traditional career trajectories for future careers
- Seek non-academic feedback to identify emerging areas of research that may lead to educational interest
- ADVANCE IT should expand to include participation from non-research I institutions.
- By opening up the non-Research I institution options, we can increase the diversity of PIs/CO-Is, geographic location diversity (more western schools will be represented), and more minority servicing institutions will have the ability to participate in more research programs

STEM Ed Indicators
*Please review the Stem Indicators for the next section*
Barbara Means – SRI
With cooperation from congress, SRI International became involved in the analysis of successful K-12 schools and building the criteria of what makes a successful K-12 institution?
- SRI International created recommendations for successful schools
- The report also pointed towards factors to consider such as the condition of schools and low and high-income areas.

Educational measures
- Accountability for problematic teachers and schools
- Theory development – test a theory about relations among conceptual variable
- Improvements – determine whether an educational change is an improvement
- Malleable factors that could be changed to aid in STEM learning for all

What action do we want to see?
- Society to adopt new scientific language and understanding
- Focus on actions to improve results
- Improve indicator results

How do we get stakeholders to reflect on the data and move toward making improvements?

Greg Camili – Rutgers University
Most won’t agree on the causes and measures because they are difficult to come up with much less the cause of those effects.
- Example – Singapore has a great STEM education program but they have low overall global impact to the US comparatively speaking.
- Maybe monitoring achievement is better
- Who is doing better/worse than expected? (Schools and districts)
- What is the cause of that effect?

Barabara Means- SRI
The goals
- Prepare students to continue towards the STEM pipeline (Undergrad and graduate education)
- STEM Field careers (Less than graduate degree career paths) – there are fewer variables on impact with this path
- Create a STEM literate society

Greg Camili – Rutgers University
- Equity is important with these STEM indicators (Please see list of STEM Indicators in the attachment). Do these indicators capture things downstream?

Mark Lipey – Peabody Institute/Vanderbilt
Process indicators such as science achievements, education I’m helping with the proposal preparation for the SPAN STC proposal. We need everyone’s biosketch to be in NSF format. Can you please send me your NSF biosketch by no later than Wednesday, June 3rd? Please let me know if you have any questions.
The RFA can be found here-
Thanks, choices and selection of majors is important.
What is the unit of analysis?
State, teacher or school?

It is hard to determine Complex systems and their relationships – no way of knowing if specialist are teaching elementary school math and science courses or if their primary teachers are doing so

It’s important to try and uncover levels hidden in the “black box” that make this task frustrating.

Congress has asked that NSF monitor these factors/STEM Indicators. This is likely to turn into funding opportunities.

If the sample is not nationally represented then the report/outcome will be biased.

There needs to be a way to deconstruct the word STEM so the disciplines can be identified more smoothly.

Maybe if we focus on what we don’t want to happen (seeing who doesn’t have science courses) will lead to better outcomes. There is data available on what high schools are and are not offering STEM courses.

Indicator idea – maybe perform a Gallup poll, from a nationally represented sample of parents, that asks basic questions like do your kids like science and mathematics?  
- There is evidence that kids start-disliking math around second grade.

Non-Cognitive skills
Hard to name non-cognitive traits/skills
Cannot be measured through traditional academic outcomes/measures
- More intrapersonal skills – self-monitoring
Non-cognitive skills/traits can be defined as:
- Grit, determination, motivation, skills that are cultivated and measured based on varied social and cultural experiences

Cognitive disequilibrium
Something breaks down – intermix between confusion and surprise
Some may experience confusion and stop while others experience confusion and consider the work they are doing a challenge and continue on with a task
- “Continuing on” during a challenging period is part of training.
- There is a social/cultural aspect to this
- People learn from this state – confusion can help learning
- People are always facing impasses’, issues, etc.

Strategic sampling –
- Track emotions through facial expression, conversational interactions and speech
- Learning centered emotions are not just the “big6” information skills model; they also include high engagement, boredom, disengagement, confusion, delight, surprise, anxiety
- There is modest reliability in tracking this or detecting this
- Changing boredom to engagement can be done by highlighting to students the benefits of the course they are taking, showing career paths and what necessary skills they learning for those careers

Article—“Measurement Matters” by Duckworth and Yeager was discussed (see attached)

Engineering fields often consider non-cognitive skills as “soft” skills
- They are skills necessary for STEM, collaboration, communication, creative, group skills, one on one interpersonal skills and project management. It takes tenacity to get an engineering degree because of the educational ramp up time and periods of boredom.

Non-cognitive skills for people with disabilities –
- Children with disabilities don’t receive the level of socialization as kids without disabilities – STEM students are relegated to note takers and others roles that are not able to fully participate because of accessibility.
- Sometimes there is greater time required to do simple things, such as getting ready, so those with disabilities have better time management skills.
- They also have resilience because of their disability.
- They often have technology skills that haven’t been explained to them, how to use electronic chairs at 3 and maneuvering.
- Team-work
- Resilience

Non-cognitive malleability and scalable – challenging because most past work has been done on kids.
- Once in a job after college, its about 2 years until they are productive and mostly because of the non-cognitive skills, fitting into the corporate culture and understanding the company

Potential area of study - Correlation between cognitive and non-cognitive
- High Non-cognitive skills showed they stayed in school and attained a degree
- Interesting research area for many prompting potential studies
- Emphasis is placed too much on the product and not the outcome
- First generation and second-generation students have different levels of “grit” or more tenacity then other students with fewer resources
Policymakers stress the importance of STEM education to our country’s economy, yet much work is needed to measure the key components of K-12 STEM education. The National Research Council (NRC) released the report *Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics* (2011), which offers recommendations to achieve important improvement goals for STEM education. A second NRC committee report, *Monitoring Progress Toward Successful K-12 STEM Education: A Nation Advancing?* (2013), proposes methods for tracking progress toward the recommendations through 14 indicators related to students' access to quality learning, educators' capacity, and policy and funding initiatives in STEM (see table below).

<table>
<thead>
<tr>
<th>Recommendations from Successful K-12 STEM Education (NRC, 2011)</th>
<th>Indicators from Monitoring Progress (NRC, 2013)</th>
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</thead>
<tbody>
<tr>
<td>Districts should consider multiple models of STEM-focused schools.</td>
<td>1. Number of, and enrollment in, different types of STEM schools and programs in each district.</td>
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<tr>
<td>Districts should devote adequate instructional time and resources to science in grades K-5.</td>
<td>2. Time allocated to teach science in grades K-5.*</td>
</tr>
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<td>Districts should ensure that their science and mathematics curricula are focused on the most important topics in each discipline, are rigorous, and are articulated as a sequence of topics and performances.</td>
<td>3. Science-related learning opportunities in elementary schools.</td>
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<td>Districts need to enhance the capacity of K-12 teachers.</td>
<td>4. Adoption of instructional materials in grades K-12 that embody Common Core State Standards in mathematics and <em>A Framework for K-12 Science Education.</em></td>
</tr>
<tr>
<td>Districts should provide instructional leaders with professional development that helps them to create the school conditions that appear to support student achievement.</td>
<td>5. Classroom coverage of content and practices in Common Core State Standards in mathematics and <em>A Framework for K-12 Science Education.</em></td>
</tr>
<tr>
<td>Policy makers at the national, state, and local levels should elevate science to the same level of importance as reading and mathematics.</td>
<td>6. Teachers’ science and mathematics content knowledge for teaching.*</td>
</tr>
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<td>States and national organizations should develop effective systems of assessment that are aligned with <em>A Framework for K-12 Science Education</em> and that emphasize science practices rather than mere factual recall.</td>
<td>7. Teachers’ participation in STEM-specific professional development activities.</td>
</tr>
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<td>National and state policy makers should invest in a coherent, focused, and sustained set of supports for STEM teachers.</td>
<td>8. Instructional leaders’ participation in professional development on creating conditions that support STEM learning.</td>
</tr>
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<td>Federal agencies should support research that disentangles the effects of school practice from student selection, recognizes the importance of contextual variables, and allows for longitudinal assessments of student outcomes.</td>
<td>9. Inclusion of science in federal and state accountability systems.*</td>
</tr>
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<td></td>
<td>10. Inclusion of science in major federal K-12 education initiatives.</td>
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<td></td>
<td>11. State and district staff dedicated to supporting science instruction.</td>
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<td></td>
<td>12. States’ use of assessments that measure the core concepts and practices of science and mathematics disciplines.</td>
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<td></td>
<td>13. State and federal expenditures dedicated to improving the K-12 STEM teaching workforce.</td>
</tr>
<tr>
<td></td>
<td>14. Federal funding for the research identified in <em>Successful K-12 STEM Education.</em></td>
</tr>
</tbody>
</table>

*Priority indicators

SRI Education supports the National Science Foundation’s efforts to implement the system of 14 progress indicators by mapping pathways for measuring and reporting on the indicators, recommending an agenda to support the collection of enhanced data in the future, and raising awareness about the work.

Questions? Contact: Barbara Means (barbara.means@sri.com)

[www.stemindicators.org](http://www.stemindicators.org)

SRI Education