Formal and Informal STEM Education Core Indicators of Quality

Intentionality is key to effective teaching -- especially when teaching the adults who in turn teach our young people. For STEM education, whether inside or outside the formal classroom, the scope of skills and concepts to be addressed is at its widest. There are many moving parts when designing, implementing and leveraging PD around STEM. Breaking them down into best practices allows PD providers and the practitioners they serve to consider specific aspects of what they do to maximize their ultimate impact.

The principles and framework below are a product of the multi-sector partnership of the DC STEM Network and offer guidelines on what those aspects of best-practice and the indicators within them are. These guidelines have informed the shaping of three specific tools, all focused on increasing the intentionality of PD in STEM education.

- The first is a tool for framing that important initial conversation between a potential consumer of STEM PD and the organization that provides it.
- The second tool is a survey for providing STEM PD providers with incisive feedback after training delivery.
- The third tool is a self-assessment for providers of PD with links that can be used as a resource guide for finding further supports in developing their trainings.

It is our hope that as a citywide community of practice, we can collaborate to leverage and grow these tools to better serve our young people.
High Quality STEM PD

High-Quality STEM PD addresses the interaction between the STEM PD provider – and program or school educators – and the program or classroom participants it will serve. Its offerings are intentional in their selection and planning, and are tailored to the needs and interests of the participant. In addition, high-quality STEM PD will address the following three questions:

1. For whom is the professional activity intended?
2. Why is the topic of concept important to be addressed?; and
3. What is the intended outcome the activity or experience will have on the participants?

High-quality STEM PD offerings should reflect the following core principles:

Developmentally Appropriate -- Fits PD Participants’ Backgrounds and Experience

High-Quality STEM PD activities reflect an understanding of the different stages of the professional educator continuum and are appropriately aligned to the experience and skill level of participants.

- Fits the education and science backgrounds of the staff being trained
- Is “mission-appropriate” to the organization or school receiving trained
- Meets the STEM PD goals of the organization or school receiving trained
- Coordinates STEM content and instructional approaches to meet the need of the participants
- Includes a pre- and post-survey to assess both the baseline level of PD participants’ knowledge/experience, as well as impact of training
- Addresses expectations to make clear what the training will and will not address
- Provides tools for differentiating implementation for different grade and skill levels
- Asks initial questions of program to establish its young people’s interests and experience

Continuous and Ongoing Experiences -- Promotes and Extend Effective Facilitation of Content

High-Quality STEM PD offerings are comprehensive and sufficiently extensive and intensive. They provide tools and opportunities for participants to apply what they have learned in their own instructional settings. They guide participants as they refine their practice over time through additional learning modules, coaching, or facilitation of ongoing communities of practice.

- Provides ongoing modes of communication between participants and the provider after the training is over
- Provides ongoing access to STEM professionals and/or resources
- Provides additional and continuous resources after the training (e.g. Google hangout, suggested materials for further exploration, recommendations on how to dig deeper, etc.)
- Provides a “required” reconnect within a week or two for the training group with a set of specific questions that it will ask (including reports on specific benchmarks that users should be seeing and general inquiries on how different aspects of the training are working)

Differentiated experiences -- Leverage a Variety of Approaches to Instruction and Engagement
High-Quality STEM PD opportunities present learners with a variety of instructional modes and experiences that take into account the diversity of interest, preferred learning format, and experience of participants.

- Uses a variety of teaching best-practices for making meaning and personalizing instruction
- Addresses different learning styles, profiles, and taps multiple intelligences
- When appropriate, tiers its activities and differentiates instruction to accommodate learners at different levels and models or suggests how participants can facilitate the material in the field
- Uses a variety of instructional approached to provide multiple entry/access points to the STEM content
- Ensures that training is appropriate for the demographics and culture of the school or program
- Provides hands-on opportunities mixing approaches and activities for maximum engagement
- Incorporates check-ins or formative assessments during the training itself to keep track of understanding and modify instruction as needed
- Moves individual learners to increased comfort and independence

**Sustainability -- Connects Young People to a Wider World of STEM Relevance and Potential**

High-Quality STEM PD opportunities provide participants with the necessary tools to impart essential cross-cutting knowledge and skills that will benefit students throughout their academic careers.

- Includes guidance on making cross-curricular connections
- Use up-to-date research based best practices for STEM PD
- Convey up-to-date STEM content
- Uses appropriate technology
- Communicates to achieve buy-in and support from administrative staff
- Is transparent about the breakdown of skills the curriculum nurtures and develops
- Provides strategies on parent and family engagement around the programming

**Content Knowledge Aligned with Student Learning Standards -- Aligns with Accepted Standards and Skill Sets**

High-Quality STEM PD not only presents participants with new and exciting content in the STEM disciplines, but it also imparts research-based practices and strategies aimed at preparing participants to teach this content in new ways required by the Common Core State Standards (CCSS) and Next Generation Science Standards (NGSS).

- Explicitly states what standards and skills the PD training supports and nurtures
- Clearly articulates how the PD supports NGSS and three-dimensional teaching and learning through the coordination of disciplinary core ideas, science and engineering practices, and crosscutting concepts
- Also frames information in “I can” statements or other ownership language that concretely frames what young people will be able to do as the result of the programming
● If training is for informal educators, provides them with connections to how skills and concepts may also connect to classroom practice

**Evaluation and Accountability -- Bases Success on Outcomes and Data**

High-Quality STEM PD supports teachers’ ability and promotes positive attitudes toward holding themselves and colleagues accountable for the success of every student. Such experiences assess participants’ knowledge and abilities at the start of the professional learning experience and hold them accountable for their learning through active engagement and ongoing demonstration of mastery, post-training. Evaluation of the efficacy of professional learning experiences informs the design and delivery of later PD opportunities.

- Provides data to prospective participants that attests to the effectiveness of the material and training
- Provides contact information for prospective consumers to get input from previous training participants
- Uses evaluative tools to assess impact of PD and the programming it includes
- Gives specifics on how user will be able to measure or judge success with programming implementation
- Provides tools and strategies to share with young people, so that they can both give feedback and self-assess their own growth as a result of the programming implementation.
- Uses outside evaluation to assess its own effectiveness

**Authentic Learning Experiences -- Makes STEM Education Come Alive**

High-Quality STEM PD activities encourage participants to expand their knowledge and skills through the process of inquiry, where real-world problems and challenges are solved and connected to the instructional setting. Use of authentic professional learning activities translate to increased application of authentic classroom learning activities, aimed at boosting students beliefs and attitudes about the value and importance of STEM learning.

- Prepares participants to implement Hands-on STEM activities in their classrooms or programs
- Maintains a focus on doing, thus better ensuring youth engagement
- Maintains a focus on problem solving – through a focus on science and engineering practices – thus identifying and growing skills in young people that transcend programmatic material or topic
- Maintains a positive focus on learning from both failure and success
- Illustrates how skills used in programming transcend material and topic and are relevant to a real-world context
- Provides information about the careers and professions and the pathways that leverage the skills and practices addressed by the programming
- Provides strategies for connecting programming concepts to the actual lives and understandings of the young people it will serve and provides tie-ins to issues that they care about or that affect them
• Provides programs/schools with information about the kinds of roles possible for young people within activities
• Provides opportunities for staff and youth to break down processes and articulate thinking involved
• Provides opportunities and strategies for young people to communicate, present, or teach-back findings and reflections from their experiences with the programming in domain-specific language
• If appropriate, includes strategies to connect programming to service-learning projects
• If appropriate, includes suggestions for related field trips
• Provides suggestions for further experiences, resources and curricula for young people who respond well to the programming
• Includes opportunities to recognize staff success and progress during training