DESIGN PRINCIPLES

OVERARCHING PRINCIPLES

(A) Identify and target a compelling and well-defined need

- For example, help STEM teachers become more effective in improving student learning, help STEM students gain the skills they need to prepare for college and the workforce, or focus on populations underrepresented in the STEM education pipeline and STEM workforce.
- Avoid redundancy with existing efforts.

(B) Use rigorous evaluation to continuously measure and inform progress in addressing the identified need

- Establish a feasible and well-defined scope of work, set ambitious but manageable and measurable goals for this work, and hold programs accountable for reaching these goals.
- Recommend third-party evaluations which demonstrate a program's effectiveness in achieving its goals. New efforts that do not yet have evaluation data should be based in high-quality research on what is effective and have concrete plans to secure third-party evaluation.
- Continuously gather data on progress, program quality, and fidelity of implementation. Regularly review those data to address shortcomings, make adjustments, and improve performance.

(C) Ensure work is sustainable

- Commit to allowing enough time for an effort to have the intended sustained and substantial impact.
- Avoid programs that incur ongoing costs or leadership demands that communities, schools, or districts cannot sustain on their own after corporations withdraw support. Where necessary, build partners' capacity to sustain efforts, and ensure that their leaders are committed for the long term.

(D) Demonstrate replicability and scalability

- Ensure that efforts are scalable to new sites.
- Commit to communicating results to promote replication to new sites.
- Work with local partners to adapt successful programs to local conditions at new sites. Ensure local buy-in and leadership to sustain the project.

(E) Create high-impact partnerships

- If you lack expertise or competencies to plan or implement efforts, partner with organizations—non-profits, government organizations, or other corporations—that make up for those deficiencies.
- Involve partners as early as possible in planning or implementing initiatives.
- Where possible or appropriate, use your own core competencies to enhance STEM learning programs. Corporations can bring expertise in management, technology, public relations, strategy, or subject matter, for example.

(F) Ensure program capacity to achieve goals

- Ensure that the organization has the staff, resources, and expertise to accomplish its goals.
- If the organization has done similar work in the past, ensure that it has a track record of success.

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STEM-SPECIFIC PRINCIPLES

G Offer STEM content that is challenging and relevant for the target audience

- Move beyond minimum competency, and promote high expectations for all students.
- Align STEM content with local, state, or national STEM content standards, and provide access to the curriculum or materials students and teachers need to be effective.
- Where possible, focus on real-world applications of STEM.
- Focus on STEM literacy and fluency as well as on knowledge and skills.

H Incorporate and encourage STEM practices

- Encourage active, hands-on learning where students: ask questions; define and make sense of problems; develop and use models; plan and carry out investigations; analyze and interpret data; use mathematics, computational thinking, and abstract reasoning; construct explanations and/or design solutions; engage in argument from evidence; obtain, evaluate, and communicate information; and attend to precision.
- Build and promote crucial STEM skills, i.e., critical thinking, problem solving, creativity, collaboration, and teamwork.
- Foster students' ability to be innovative, to use what they learn to create new ideas or products.

I Inspire interest and engagement in STEM

- Create excitement and dispel negative misconceptions about STEM.
- Connect STEM to learners' own interests and experiences.
- Where possible, offer hands-on exposure to STEM content.
- Where possible, demonstrate the relevance of STEM by connecting it to real-world problems and real-world work.
- Where possible, create excitement about career opportunities that require a strong STEM background.

J Address the needs of underrepresented groups

- Ensure that programs address the needs of groups that are underrepresented in STEM fields, such as females, underrepresented people of color, and other underrepresented minorities.
- Accommodate diverse learners' needs through tailored instruction.
- Demonstrate that the program reaches underrepresented minorities through targeted recruitment efforts.

SOURCES FOR DESIGN PRINCIPLES:

- "Best in Class: How Top Corporations Can Help Transform Public Education" (Ernst & Young, 2008)
- "The SAI Guide to Building Effective STEM Education Programs" (NASSMC, 2007)
- "Introducing STEM Industries to K-12 Best Practice Programs" (Bayer, 2007)
- Strategic Ed Solutions, www.strategicedsolutions.org (BHEF)
- "Principles for Effective Education Grantmaking" (Grantmakers in Education, 2005)
- "A Compendium of Best Practice K-12 STEM Education Programs" (Bayer, 2010)
- "National Science Education Standards" (NRC, 1996)
- "What it Takes: Pre-K-12 Design Principles to Broaden Participation in Science, Technology, Engineering and Mathematics" (BEST, 2004)
- "A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas" (NRC, 2011)
- "Common Core State Standards for Math" (NGA/CCSSO, 2010)
- "Principles & Standards for School Mathematics" (NCTM, 2000)
- "Framework for 21st Century Learning" (Partnership for 21st Century Skills, 2009)