Building Quality STEM Programs

Out-of-school time (OST) programs are a powerful tool for youth to explore their interests in science, technology, engineering, and math (STEM) that they feel connected to and excited about. OST programs are strong tools for positive youth development but only if they are high quality. The question of what quality looks like for OST in Arizona has been addressed by the Arizona Quality Standards for Out-of-School Time Programs.

With increasing need for STEM focused skills and abilities in tomorrow's workforce, many OST programs are either adding STEM to their offerings or focusing on STEM entirely. This means that in addition to the traditional quality needed in OST programs, a new layer is added with the STEM focus. Quality STEM afterschool programming inspires youth to build their skill sets, develop their identity, and connect to their broader community in science, technology, engineering, and math.



Standard I: Skills

Key Principle: Youth build age-appropriate STEM-related skills, helping them impact their world regardless of career path.

1. Essential Skills
    i. Youth think critically and solve problems using science and engineering practices to tackle challenges or problems that relate to everyday experiences
    ii. Youth collaborate and share ideas in a team environment to identify challenges and problems as well as potential solutions
    iii. Youth use visual or non-visual representation to communicate their ideas
    iv. Youth collect input and feedback from others
    v. Youth use creativity to think about potential solutions to challenges or problems
2. Practical Skills
    i. Process Skills
    ii. Youth collect, analyze, and interpret data
    iii. Youth are encouraged to ask questions about the world around them or the current topic at hand
    iv. Youth have hands-on, interactive experiences
    v. Youth use science and engineering practices and know when they are using it

Examples of the Standard in Practice:

- Lesson plans include space for youth to be curious about related topics beyond the scope of the planned activity.
- During the activity, adults verbally note how the activity relates to a STEM field or practice and acknowledge that youth are actively doing STEM.
- Youth create their own iterations of a project and have the opportunity to share what went well and what could improve in their original designs.
- Activities are hands-on and interactive.
- Guest speakers receive guidance from OST staff on how to develop age-appropriate language and activities.
- Youth see themselves in the guest speakers who engage the group. This could be through shared community, identity markers, or a tone that makes the presenter approachable.



Standard II: Identity

Key Principles: Youth form and grow positive STEM identities.

1. Personal Connections
    i. Youth self-reflect and develop areas of STEM interest
    ii. Youth are inspired by activities they are involved in
    iii. Youth have new experiences in STEM that continue to drive their fascination
    iv. Programs solicit youth feedback to feed youth fascination
    v. Programs help youth make connections to areas of interest in STEM
    vi. Programs intentionally integrate STEM representations of youth's various identities
2. Active Engagement
    i. Youth are engaged in figuring out how things work
    ii. Youth use science and engineering practices to move from failure to success
    iii. Youth have freedom to be creative regardless of success or failure
    iv. Youth share ideas freely, even if no one else has thought the same
    v. Programs are designed to encourage discovery and exploration
    vi. Programs set aside time to celebrate innovative thinking regardless of success or failure
3. Relationships and Community
    i. Programs connect hands on activities with the value of STEM in action in communities
    ii. Program offers youth opportunities to share their interest with the broader community and/or caregivers
    iii. Programs tie STEM skills to their success regardless of career path
    iv. Programs provide opportunities for youth to identify STEM in their everyday life including their own family structure, community, and culture

Standard III: Community

Key Principles: Youth benefit from positive relationships and mentorship in their community that validate the application of STEM in their own lives

1. Youth identify and address needs and action steps within their local STEM learning ecosystem
2. Youth connect STEM to different parts of their community and identify STEM in their community, including in the workforce
3. Programs develop and nurture family, school and community partnerships to leverage and support the youth and families served
4. Programs help youth make connections so they feel a sense of belonging in the broader STEM community (Ex. Shadowing a STEM professional)
5. Programs center youth voice so they can share their ideas, findings and strategies with the community

Defining Key Terms

STEM

A way of thinking about science technology, engineering, and math that combines all content areas using experimental, real world kinesthetic experiences that develop students' curiosity and creativity to build skills, address relevant problems, and develop solutions.

Essential Skills

Skills people need to work, learn, and live.

Process Skills

"A set of broadly transferable abilities, appropriate to many science disciplines and reflective of the behavior of scientists." (https://narst.org/research-matters/science-process-skills)

STEM Identity

How individuals "think about themselves as science learners and develop an identity as someone who knows about, uses, and sometimes contributes to science." (https://nap.nationalacademies.org/catalog/12190/learning-science-in-informal-environments-people-places-and-pursuits)

STEM Learning Ecosystem

A system that "unite(s) people, groups, and resources to create science, technology, engineering, and math (STEM) engagement and education experiences for all people throughout their lifetimes." (https://www.nisenet.org/STEM-learning-ecosystems-project)

Science

"Observing the world by watching, listening, observing, and recording. Science is curiosity in thoughtful action about the world and how it behaves." (https://spaceplace.nasa.gov/science/en/)

Engineering

"Engagement in a systematic practice of design to achieve solutions to particular human problems" (https://nap.nationalacademies.org/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts)

Community

A group of people with commonality (Ex. geography, profession, etc.) that brings them together within a larger society



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Pilot Sites/Programs:

- Children's Museum of Tucson
- Future Stars
- Kids Zone
- Phoenix Herpetological Society
- SARSEF Summer STEM Camps
- Viney Jones Public Library

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