Carnegie STEM Excellence Pathway

Planning for STEM Excellence

The Carnegie STEM Excellence Pathway initiative is built on the belief that school systems, individual schools, departments, or individual teachers can improve their STEM education practices through a positive, collaborative approach.

Designed to help the widest possible range of school districts and schools adopt best practices in STEM education, the Pathway includes:

– a tool and process for evaluating current STEM programming and creating a practical plan for improvement

– a guide to specific steps a school or district can take to improve STEM education

– supports for teacher professional development and district-to-district mentoring

– recognition for schools that are embracing and moving toward effective STEM education

CARNEGIE STEM Excellence PATHWAY®

CARNEGIE SCIENCE CENTER

One facet of the Carnegie STEM Excellence Pathway is an instrument through which participating schools and school districts first evaluate themselves in six areas:

- Teacher Qualifications
- Curriculum
- Instructional Practices
- Assessment and Demonstration of Skills
- Family Engagement
- Real-World Connections

Within each area are specific criteria and descriptions of levels of performance. After evaluating itself on each of these, a school or school district selects up to three Priority Areas and then formulates a timeline and an Action Plan to address these goals. After that, the cycle continues with a new Self-Evaluation and new Action Plan.

Through periodic re-evaluation and repetition of this process, schools and districts can progress to higher levels of STEM education excellence. This cycle is beneficial to all regardless of their current STEM offerings. The Pathway fosters thinking about long-term, strategic goals with a focus on continuous growth. It helps identify the tenets of quality STEM education and then implement them. The Pathway is non-punitive. Instead, it's envisioned as a long-term, goal-oriented, encouraging approach.

This resource tool is available through **STEMisphere.org**. Created by Carnegie Science Center as a community service, STEMisphere is the online hub for educational STEM resources for students in Pre-K through 12th grade. It acts as a portal for parents, educators, students, and potential partners to explore a universe of STEM opportunities.

Its long-range mission is to provide access to exceptional STEM education resources by collaborating with community stakeholders, providing resources to educators, and inspiring excitement among students through an enduring commitment from business leaders, government officials, educators, parents, and other stakeholders. Carnegie Science Center manages the website in partnership with other key regional and statewide STEM initiatives.

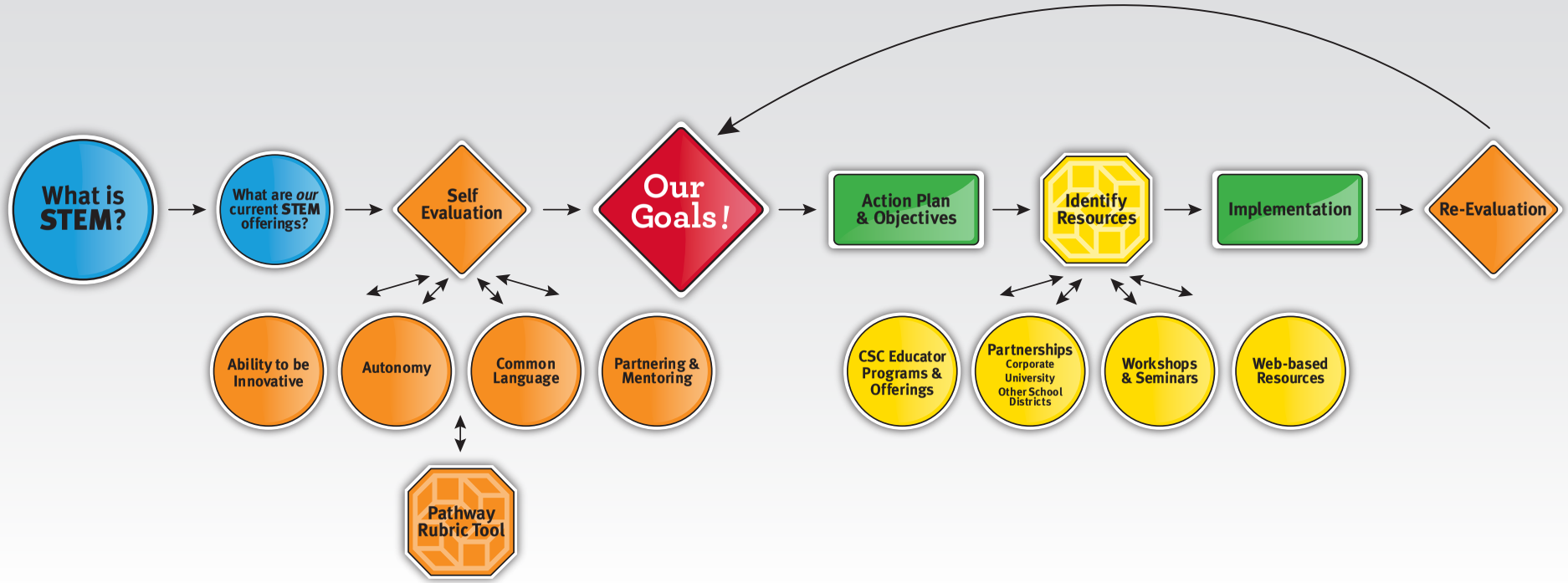
The Carnegie STEM Excellence Pathway is made possible through the generous support of The Heinz Endowments.

TO BEGIN YOUR JOURNEY ON THE CARNEGIE STEM EXCELLENCE PATHWAY, VISIT:

MySTEMPathway.org

With questions and for more information, contact:
Alana Kulesa, *Director of Strategic Education Initiatives*
412.237.1679 or KulesaA@CarnegieScienceCenter.org

CARNEGIE STEM EXCELLENCE PATHWAY



CARNEGIE STEM Excellence PATHWAY®

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Directions for Completing the Self-Evaluation on STEMisphere

Account Email Account Password

To complete the Self-Evaluation, the recording team member signs in to the team's STEMisphere account and clicks *Begin New Self-Evaluation*. Enter an appropriate title for the Self-Evaluation. The following process is repeated for all 20 Priority Areas in the Pathway's Self-Evaluation process.

- There are six STEM Learning Components indicated on the right-hand side of the web page:
  1. Teacher Qualifications and Development
  2. Curriculum
  3. Instructional Practices
  4. Assessment and Demonstration of Skills
  5. Family Engagement
  6. Real-World Connections

  There are up to four parts in each STEM Learning Component. These parts are referred to as 'Priority Areas.'

- Each Priority Area has five levels labeled *Pre-Emerging, Emerging, Progressing, Advancing,* and *Leading*. The team reviews the descriptions of all five levels and selects the one that best describes their current overall level of performance, identifying it as the *Current Overall Status*. It is likely that for some areas, there may not be a precise match to an exact description. In those circumstances, identify the closest level.

- There may be variations in how team members rate the current level of performance. Record those variations in the section entitled *Notes on variation in status within the district*. These variations may be important as a team plans for improvement in the action planning stage.

- It is helpful for a team to record notes on the evidence they used to determine their current level of performance. Record this evidence in the section entitled *Notes on evidence for current status*.

- When the team is finished evaluating the Priority Area, click *Next* to advance to the next Priority Area. Click *Previous* if you'd like to return to a Priority Area and modify or view it.

When all the Priority Areas have been evaluated, click *Review Responses*. After the team is satisfied with their responses, click *Submit Responses*.

The Pathway tool will list the 20 Priority Areas with the team's respective levels. The team will carefully review this information and choose up to three Priority Areas to improve upon by checking the box beside the Priority Area. Afterward, click *Submit Priorities* and the team's Priority Area choices will be locked.

At this point, the team leader will click *Your Action Plan*. After reviewing the Action Planning information, click *Next* to proceed to the creation of the Action Plan.

Carnegie STEM Excellence Pathway Self-Evaluation

Teacher Qualifications and Development — Item 1 of 4

Teacher Credentials and Training

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Fewer than 25% of teachers responsible for STEM content have additional formal training in STEM-specific content and pedagogy.
- ☐ **Progressing**
  26% to 50% of teachers responsible for STEM content have additional formal training in STEM-specific content and pedagogy.
- ☐ **Advancing**
  Majority of teachers responsible for STEM content have additional formal training in STEM-specific content and pedagogy.
- ☐ **Leading**
  All teachers responsible for STEM content have additional formal training in STEM-specific content and pedagogy.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Teacher Qualifications and Development — Item 2 of 4

Professional Development Commitment

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.

- ☐ **Emerging**
  School or district is formally exploring the feasibility of implementing a STEM leadership training and is researching possible models.

- ☐ **Progressing**
  School or district is in the process of creating a professional development plan with progressions in STEM content and advanced pedagogy. The plan addresses new teacher induction, established teacher training, and sustaining progress through ongoing teacher mentoring or coaching. Mechanisms are in place for the plan to be sustained and implemented over time.

- ☐ **Advancing**
  School or district has an early-stage professional development plan with progressions in STEM content and advanced pedagogy. The plan addresses new teacher induction, established teacher training, and sustaining progress through ongoing teacher mentoring/coaching. Mechanisms are in place for the plan to be sustained and implemented over time, and this process has already begun.

- ☐ **Leading**
  School or district has a fully developed professional development plan that is being implemented with progressions in STEM content and advanced pedagogy. The plan addresses new teacher induction, established teacher training, and sustaining progress through ongoing teacher mentoring/ coaching. There is clear evidence that implementation of the plan is underway.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Teacher Qualifications and Development — Item 3 of 4

STEM Teacher Leadership

(Mark current district status overall)

☐ **Pre-Emerging**
There is no current action in this area.

☐ **Emerging**
Schools and districts have identified STEM teacher leaders and provided organizational support, professional development, and resources for the STEM initiative. The STEM teacher leaders provide internal support and act as liaisons for external STEM resources.

☐ **Progressing**
Schools and districts have identified STEM teacher leaders and provided organizational support, professional development, and resources for the STEM initiative. The STEM teacher leaders provide internal support and act as liaisons for external STEM resources. The district provides at least one form of support such as: extra planning periods, stipends, committed financial resources, and/or dedicated physical space.

☐ **Advancing**
Schools and districts have identified STEM teacher leaders and provided organizational support, professional development, and resources for the STEM initiative. The STEM teacher leaders provide internal support and act as liaisons for external STEM resources. The district provides at least two forms of support such as: extra planning periods, stipends, committed financial resources, and/or dedicated physical space.

☐ **Leading**
Schools and districts have identified STEM teacher leaders and provided organizational support, professional development, and resources for the STEM initiative. The STEM teacher leaders provide internal support and act as liaisons for external STEM resources. The district provides three or more forms of support such as: extra planning periods, stipends, committed financial resources, and/or dedicated physical space.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Teacher Qualifications and Development — Item 4 of 4

Peer Mentoring and Coaching of Teachers

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Peer mentoring mechanism is encouraged and occurs on an informal level, but formal mechanisms are not yet in place.
- ☐ **Progressing**
  Teachers are engaged at least twice per year in STEM peer mentoring mechanisms (such as regular meetings, peer teaching observations, online discussion groups, professional development, and/or curriculum analysis) that allow teachers to discuss and work to improve STEM curriculum, instruction, and assessment. Peer mentoring mechanisms are in place and used.
- ☐ **Advancing**
  Teachers are engaged at least once in each grading period in STEM peer mentoring mechanisms (such as regular meetings, peer teaching observations, online discussion groups, professional development, and/or curriculum analysis) that allow teachers to discuss and work to improve STEM curriculum, instruction, and assessment.
- ☐ **Leading**
  Teachers are engaged at least monthly in STEM peer mentoring mechanisms (such as regular meetings, peer teaching observations, online discussion groups, professional development, and/or curriculum analysis) that allow teachers to discuss and work to improve STEM curriculum, instruction, and assessment.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Curriculum — Item 1 of 3

Diversity and Breadth of STEM Curriculum Offering

(Mark current district status overall)

☐ **Pre-Emerging**
There is no current action in this area.

☐ **Emerging**
STEM course content is available in all core science areas (life, earth, and physical science) and in computer/technology literacy. At HS level, math courses through at least pre-calculus are available. All STEM course content is aligned with state standards.

☐ **Progressing**
STEM course content is available in all core science areas (life, earth, and physical science) and in basic computer programming. At the HS level, math, including pre-calculus, is available. A second year of coursework is available in at least one science or technology area. Courses are designed to more rigorous standards such as Next Generation Science Standards. Vocational Education curriculum reflects targeted workforce development needs.

☐ **Advancing**
Meets all previous criteria and offers post-secondary or AP level in at least one area. At least one course is offered in a broader range of STEM areas such as engineering, computer programming, technical design, and/or computer-aided machining. Other areas of intensive vocational training are available.

☐ **Leading**
STEM courses are available in all core science areas (life, earth, and physical science), including calculus at the post-secondary or AP level. A broader range of STEM coursework such as engineering, computer programming, and/or technical design are readily available. Capstone courses that incorporate true interdisciplinary approaches, such as environmental science, public health, and/or vocational certifications, are available.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Curriculum — Item 2 of 3

Curriculum Integration

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Curriculum integration occurs occasionally. May be limited to a few teachers or to only a few subject areas.
- ☐ **Progressing**
  Curriculum integration is frequent, but episodic. Most teachers integrate STEM and non-STEM curriculum areas, at least in special projects.
- ☐ **Advancing**
  Curriculum integration is consistent, and STEM and non-STEM course content are explicitly connected in at least one lesson per grading period.
- ☐ **Leading**
  Curriculum integration is consistent, and STEM and non-STEM course content are explicitly connected in two or more lessons per grading period.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Curriculum — Item 3 of 3

Collaborative Planning of STEM Curriculum

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  STEM teachers work together to ensure alignment of STEM curriculum with state standards.
- ☐ **Progressing**
  Teachers jointly discuss content for their STEM courses and agree upon learning objectives to be met to prepare students for subsequent coursework.
- ☐ **Advancing**
  Teachers meet all previous criteria and explicitly plan learning objectives that integrate math and science courses. Interdepartmental planning and cross-grade level planning occur within the district.
- ☐ **Leading**
  Teachers jointly create a curriculum map to sequence the entire STEM curriculum. Essential questions and key understandings are defined. Collaboration and sharing of best practices occur across the district.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Instructional Practices — Item 1 of 4

Inquiry-Based Teaching

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  STEM coursework occasionally is based on student- or teacher-initiated questions that are clearly linked to students' learning experiences.
- ☐ **Progressing**
  STEM coursework frequently is based on student- or teacher-initiated questions that are clearly linked to students' learning experiences.
- ☐ **Advancing**
  STEM coursework is largely based on student or teacher-initiated questions that are clearly linked to students' learning experiences.
- ☐ **Leading**
  STEM coursework is nearly always based on student- and teacher-initiated questions that are clearly linked to students' learning experiences.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Instructional Practices

Student Participation

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Students regularly participate in classroom activities, with some classroom time involving active research and inquiry-based, hands-on exploration.
- ☐ **Progressing**
  Students regularly participate in classroom activities, with at least half of classroom time involving active research and inquiry-based, hands-on exploration.
- ☐ **Advancing**
  Students regularly participate in classroom activities, with more than half of classroom time involving active research and inquiry-based, hands-on exploration.
- ☐ **Leading**
  Students at all academic levels are involved consistently in inquiry-based STEM learning. Special opportunities are available for girls and other groups underrepresented in STEM fields.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Instructional Practices — Item 3 of 4

Project-Based Learning Applied in Real-World Settings

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  STEM courses include occasional short-term projects with real-world applications.
- ☐ **Progressing**
  Up to half of students' STEM learning time involves extended projects that directly address real-world issues.
- ☐ **Advancing**
  Majority of students' STEM learning time involves extended projects that directly address real-world issues.
- ☐ **Leading**
  Majority of students' STEM learning time involves extended projects that directly address real-world issues. Students have direct experience applying their knowledge in a community setting.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Instructional Practices **Item 4 of 4**

Flexible Scheduling for STEM Projects, Events, etc.

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Little flexibility exists in scheduling extended blocks of time. Teachers have arranged this on occasion, but it is very rare and not encouraged.
- ☐ **Progressing**
  Schedules can be modified to allow for blocks of STEM time if needed, but it requires extensive effort and negotiation by teachers. Approximately 25% of STEM teachers feel they can make use of this option if needed.
- ☐ **Advancing**
  Procedures are in place for modifying student schedules to allow for extended time blocks if needed for special STEM projects or out-of-school opportunities. Approximately 50% of STEM teachers feel they can make use of this option if needed.
- ☐ **Leading**
  Clear procedures are in place for modifying schedules to allow for extended time for special STEM projects or out-of-school opportunities. Approximately 75% of STEM teachers feel they could make use of this option if needed.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Assessment and Demonstration of Skills — Item 1 of 2

Authentic Quality Assessments

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Students' STEM skills are evaluated through assessments, including local benchmark assessments and standardized tests.
- ☐ **Progressing**
  Students' STEM skills and competencies are evaluated through multiple methods, including standardized testing (such as AP tests) and project reviews. Assessments reflect content knowledge as well as students' mastery of inquiry-based processes.
- ☐ **Advancing**
  Students' STEM knowledge, skills, and competencies are evaluated through multiple methods, including testing and project reviews. Students are engaged in using assessment results to plan and shape their learning experiences.
- ☐ **Leading**
  Meets all previous criteria. Additionally, students' STEM skills and competencies are evaluated through demonstration over time in real-world, project-based learning applications.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Assessment and Demonstration of Skills — Item 2 of 2

Student Achievement

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  40% to 60% of students meet expected levels of proficiency on local benchmark assessments or standardized tests in at least one STEM area.
- ☐ **Progressing**
  61% to 75% of students meet expected levels of proficiency on local benchmark assessments or standardized tests in two or more STEM areas.
- ☐ **Advancing**
  More than 75% of students meet expected levels of proficiency on local benchmark assessments or standardized tests in two or more STEM areas.
- ☐ **Leading**
  Program meets all previous criteria and at least 25% of age-appropriate students participate in AP or postsecondary coursework and/or career-related certifications or are offered similar advanced work appropriate for their developmental level and age.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Family Engagement — Item 1 of 2

Regular Communications

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Families are informed of the definition and importance of STEM, as well as coursework goals and activities, at least once during the year.
- ☐ **Progressing**
  Families receive updates on STEM coursework goals and activities a few times per year and can readily pose questions to appropriate personnel.
- ☐ **Advancing**
  Families receive updates on STEM coursework goals and activities multiple times per year and can readily engage in discussion with teachers and other families.
- ☐ **Leading**
  Families receive regular communication on STEM coursework goals and activities and have many opportunities to give and receive information on their child's learning.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Family Engagement — Item 2 of 2

Opportunities for Families to Engage in STEM Learning

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Families are informed of school and community activities that promote lifelong STEM learning.
- ☐ **Progressing**
  Families have regular opportunities to observe and participate in STEM learning activities.
- ☐ **Advancing**
  Families have regular opportunities to contribute their expertise to STEM learning activities for students. Specific events are offered to engage families.
- ☐ **Leading**
  A broad range of families, with diverse skill sets, have regular opportunities to contribute their expertise to STEM learning activities. Family-specific events are offered. Families can serve on STEM advisory groups.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Real-World Connections — Item 1 of 5

Corporate Connections

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Corporate partners provide occasional support by sharing technical expertise or resources with STEM teachers.
- ☐ **Progressing**
  Corporate partners provide regular support by sharing technical expertise or STEM resources with teachers or students.
- ☐ **Advancing**
  Corporate partners provide regular and longterm mentoring relationships with teachers and students in which they share STEM resources.
- ☐ **Leading**
  Corporate partners are engaged through a formal, structured commitment (for example, a memorandum of understanding or documentation of desired outcomes) to provide technical assistance, share staff expertise, and provide students with first-hand experience in STEM workplaces.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Real-World Connections — Item 2 of 5

Other Community Partners
such as Universities, Science Centers, STEM trade associations, etc.

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Community partners provide occasional support by sharing technical expertise or resources with STEM teachers.
- ☐ **Progressing**
  Community partners provide regular support by sharing technical expertise or STEM resources with teachers or students.
- ☐ **Advancing**
  Community partners provide regular and longterm mentoring relationships with teachers and students in which they share STEM resources.
- ☐ **Leading**
  Community partners are engaged in a long-term commitment to provide technical assistance, share staff expertise, and provide students with firsthand experience in STEM workplaces.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Real-World Connections — Item 3 of 5

Citizen Decision-Making / Civic Engagement

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Community-level issues are referenced as examples in STEM coursework.
- ☐ **Progressing**
  Community-level issues are occasionally integrated into project work in STEM courses.
- ☐ **Advancing**
  Community-level issues are consistently integrated into project work in STEM courses.
- ☐ **Leading**
  Students are encouraged and supported to apply STEM knowledge from relevant project work and act individually and/or as a group on community-level issues.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Real-World Connections

Career Awareness

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  Students are exposed to STEM speakers and may complete research to increase their awareness of a wide variety of STEM fields.
- ☐ **Progressing**
  Students have access to STEM field trips or group visits to STEM workplaces with a chance to interview workers about their job responsibilities, training, and career path.
- ☐ **Advancing**
  Students have multiple opportunities for individual internships or job shadowing in Stem-related fields and are supported in connecting the experience to STEM coursework.
- ☐ **Leading**
  STEM coursework meets all previous criteria and consistently engages students in researching and preparing for longterm regional workforce opportunities. Special opportunities are available for girls and other groups underrepresented in STEM fields.

Notes on variations in status within the district

Notes on evidence for current status

Carnegie STEM Excellence Pathway Self-Evaluation

Real-World Connections — Item 5 of 5

College and Career-Ready Skills

(Mark current district status overall)

- ☐ **Pre-Emerging**
  There is no current action in this area.
- ☐ **Emerging**
  On rare occasions, students have opportunities to demonstrate creativity, innovation, problem solving, teamwork, and communication skills.
- ☐ **Progressing**
  Students have occasional opportunities to demonstrate creativity, innovation, problem solving, teamwork, and communication skills.
- ☐ **Advancing**
  Students have frequent opportunities to demonstrate creativity, innovation, problem solving, teamwork, and communication skills.
- ☐ **Leading**
  Students have ongoing opportunities to consistently demonstrate creativity, innovation, problem solving, teamwork, and communication skills.

Notes on variations in status within the district

Notes on evidence for current status

Priority Area Selection

Teacher Qualifications and Development

- Teacher Credentials and Training
- Professional Development Commitment
- STEM Teacher Leadership
- Peer Mentoring and Coaching of Teachers

Curriculum

- Diversity and Breadth of STEM Curriculum Offering
- Curriculum Integration
- Collaborative Planning of STEM Curriculum

Instructional Practices

- Inquiry-Based Teaching
- Student Participation
- Project-Based Learning Applied in Real-World Settings
- Flexible Scheduling for STEM Projects, Events, etc.

Assessment and Demonstration of Skills

- Authentic Quality Assessments
- Student Achievement

Family Engagement

- Regular Communications
- Opportunities for Families to Engage in STEM Learning

Real-World Connections

- Corporate Connections
- Other Community Partners
- Citizen Decision Making/Civic Engagement
- Career Awareness
- College and Career-Ready Skills