

# Quality Model for STEM and STEAM Schools



This document was revised and updated in collaboration with the Ohio STEM Learning Network and the Ohio Department of Education October 2021.

## Foreword

Updated October 2021

[Each Child, Our Future](#) is Ohio's shared plan for ensuring that each student is *challenged, prepared* and *empowered* for his or her future by way of an excellent prekindergarten through grade 12 (preK-12) education. All work in the Department supports the vision of *Each Child, Our Future*: "In Ohio, each child is challenged to discover and learn, prepared to pursue a fulfilling post-high school path and empowered to become a resilient, lifelong learner who contributes to society." Options for meeting this vision include project- and case-based learning, STEM and STEAM (science, technology, engineering, the arts and mathematics) education and instructional techniques that challenge students to solve problems creatively through an integrated approach to learning. *Each Child, Our Future* promotes STEM and STEAM education through the four learning domains and 10 priority strategies.

Future economic growth and prosperity in Ohio depend on an education system that supports the state's economic development efforts and helps all Ohio students become innovators and inventors, self-reliant and logical thinkers, and technologically proficient problem solvers. In 2007, Ohio enacted legislation to create STEM schools, an initiative designed to better align education systems to ensure sufficient intellectual, entrepreneurial and technical talent for Ohio's future economic development.

In 2017, to mark the 10-year anniversary of this legislation, the Ohio Department of Education convened an informal STEM Innovation Working Group to build next steps in STEM education in Ohio. The purpose of the 2017 STEM Innovation Working Group was to assist the Department in identifying existing gaps in student readiness and teacher professional development and identifying priorities and goals for STEM education. Their research and work led to the creation of this document.

This document was revised and updated Summer 2021 in collaboration with the Ohio STEM Learning Network and the Ohio Department of Education. Updates reflect alignment to *Each Child, Our Future* and the updated STEM designation application template.

### How to Use this Document

The purpose of the Quality Model is to promote innovation and to assist schools aspiring toward high-quality STEM and STEAM implementation at the local level. The Quality Model is intended to provide clarity for schools applying for STEM or STEAM designation. The Quality Model can also be used by schools wishing to explore a student-centered approach that provides opportunities for students to engage in authentic, problem-based learning and design thinking.

Schools are encouraged to use the included descriptions and bullet points, in conjunction with other resources, as the basis of local discussion and professional development around school transformation and innovation. Space for notes is included with each criterion. A summary tool is included as an Appendix, to build the connection between the Quality Model, the STEM/STEAM Designation Application and [STEM/STEAM Application](#) for self-evaluation.

Schools are reminded that the bullet points should not be used as a checklist but are intended to assist schools in visualizing what high-quality STEM or STEAM implementation can look like. Currently designated STEM schools and aspiring STEM schools alike can benefit from focused professional development aligned with the essential criteria.

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**Vision for STEM in Ohio:** Ohio will be recognized as a leading state in having a well-qualified workforce to attract STEM-related investments in business and industry.

**Mission:** To create and promote initiatives that will pave the way for growth and economic development in Ohio, through multi-sector partnerships for STEM-related learning experiences for Ohio’s students.

<b>Goals</b>	<p><b>Alignment</b> <i>Align STEM Education efforts to regional economic development needs, emphasizing innovation and entrepreneurship.</i></p> <ul style="list-style-type: none"> <li>• In PK-12 STEM education, enhance the voice of Industry, Higher Ed and other agencies, by increasing the degree of collaborative, active engagement in the preparation of Ohio’s future STEM workforce.</li> <li>• Increase alignment of STEM educational programs to state and regional industry needs.</li> <li>• Increase emphasis and student participation in learning opportunities that focus on computer science.</li> </ul>	<p><b>Accessibility</b> <i>Work to ensure that all students in Ohio have access to a high-quality STEM education and promote STEM literacy for ALL students.</i></p> <ul style="list-style-type: none"> <li>• Increase STEM designation participation, especially in Northwest and Southeast Ohio, and in rural or small districts.</li> <li>• Increase student participation in authentic mentorship, internship and research opportunities in STEM, especially for underserved students and students in rural and small districts.</li> <li>• Decrease barriers to STEM designation and STEM literacy.</li> <li>• Increase accessibility to highly qualified educators knowledgeable in STEM subjects, especially for underserved students and in rural and small districts.</li> </ul>	<p><b>Advocacy</b> <i>Leverage and enhance existing networks to increase awareness and participation in quality STEM opportunities for students, educators and families.</i></p> <ul style="list-style-type: none"> <li>• Collaborate with other state agencies, organizations, industry and local advocates to increase awareness of opportunities for students, educators and families to engage in STEM-related activities.</li> <li>• Increase awareness of various pathways to STEM careers available to students, including 4-year and advanced degrees, 2-year degrees, certificates and apprenticeships.</li> <li>• Increase awareness of the benefits of STEM literacy for all students.</li> <li>• Increase awareness of the benefits of STEM as a vehicle for deeper learning.</li> </ul>
	<b>Strategies</b>	<p><b>Partnerships</b> <i>Work collaboratively with the STEM Committee, the Ohio STEM Learning Network, higher education and other public and private partners to develop a long-term plan for “next generation” STEM Innovation in Ohio.</i></p> <ul style="list-style-type: none"> <li>• Create a STEM working group, to provide feedback to the department of education regarding greatest achievements and greatest challenges for STEM education in Ohio. Utilize feedback to drive improvement efforts.</li> <li>• Examine alignment of STEM educational programs to state and regional industry needs and make recommendations for improvement.</li> <li>• Identify key indicators and pre-existing metrics and use them to monitor progress toward goals.</li> <li>• Utilize and enhance existing partnerships to identify and promote innovative and research-based best practices.</li> </ul>	<p><b>Pathways</b> <i>Identify and promote various pathways to STEM careers available to students and develop a metric for recognizing quality pathways and programs.</i></p> <ul style="list-style-type: none"> <li>• Create/identify and promote STEM career pathways leading to 4-year and advanced degrees, 2-year degrees, certificates and apprenticeships that promote the application of cutting-edge technology and the growth of innovative new industry in Ohio.</li> <li>• Consider an elementary designation.</li> <li>• Create metrics and programs for recognizing quality and level of immersion in STEM for schools, pathways and programs, to encourage participation where a whole-school commitment may not be feasible.</li> </ul>

## Introduction

The purpose of the Quality Model is to promote innovation and to assist schools aspiring toward high quality STEM and STEAM implementation at the local level. The Quality Model is intended to provide clarity for schools applying for STEM or STEAM designation. The Quality Model can also be used by schools wishing to explore opportunities for students to engage in authentic, problem-based learning and design thinking. Drawing from research on inclusive STEM schools, STEM school guidance documents from other states and additional resources, the initial STEM Innovation Working Group identified twelve criteria as essential for producing the desired outcomes, as shown in the Logic Model on the following page. These criteria have been organized into three overarching domains:

1. School Culture and Beliefs,
2. Learning and Teaching, and
3. Pathways to Success in Careers.

A summary is included on page 9, followed by elaboration for each essential criterion.

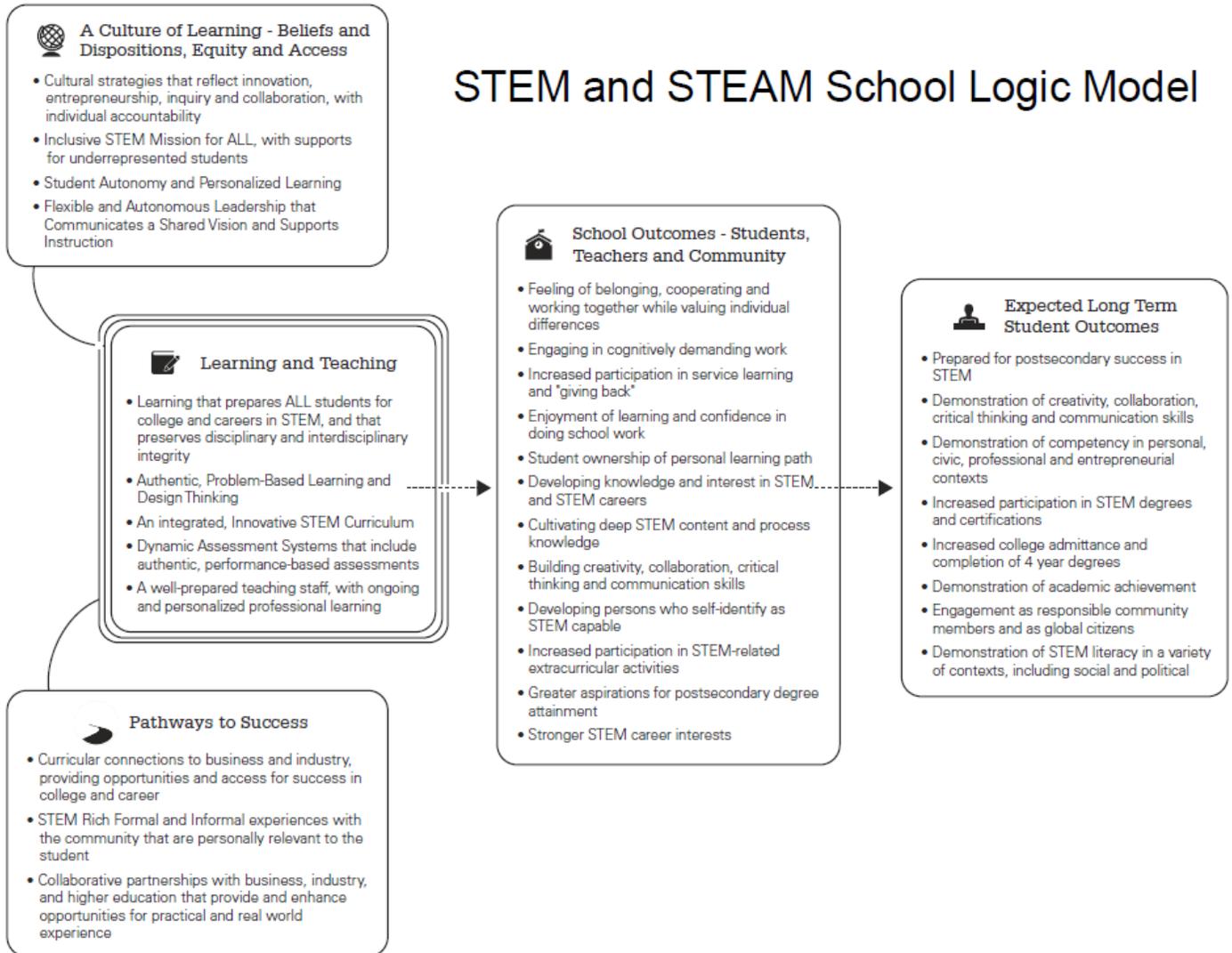
The elaboration for each criterion is designed to provide a description along with clarifying points. Schools should note that the bulleted lists are not intended to be checklists or to imply that a school must be doing everything listed to be considered for STEM or STEAM designation. Rather, the bulleted lists are included simply to provide clarification and examples to assist schools in visualizing what high quality STEM or STEAM implementation can look like.

It is the view of the Department and the Ohio STEM Learning Network that there is no “one right way” of designing and implementing high-quality STEM or STEAM programming. A good program will reflect community values and the unique culture of the school, which will vary depending on the local context. Additional resources with guidance around best practices are available on the Department’s STEM web page, at <https://education.ohio.gov/Topics/Career-Tech/STEM>.

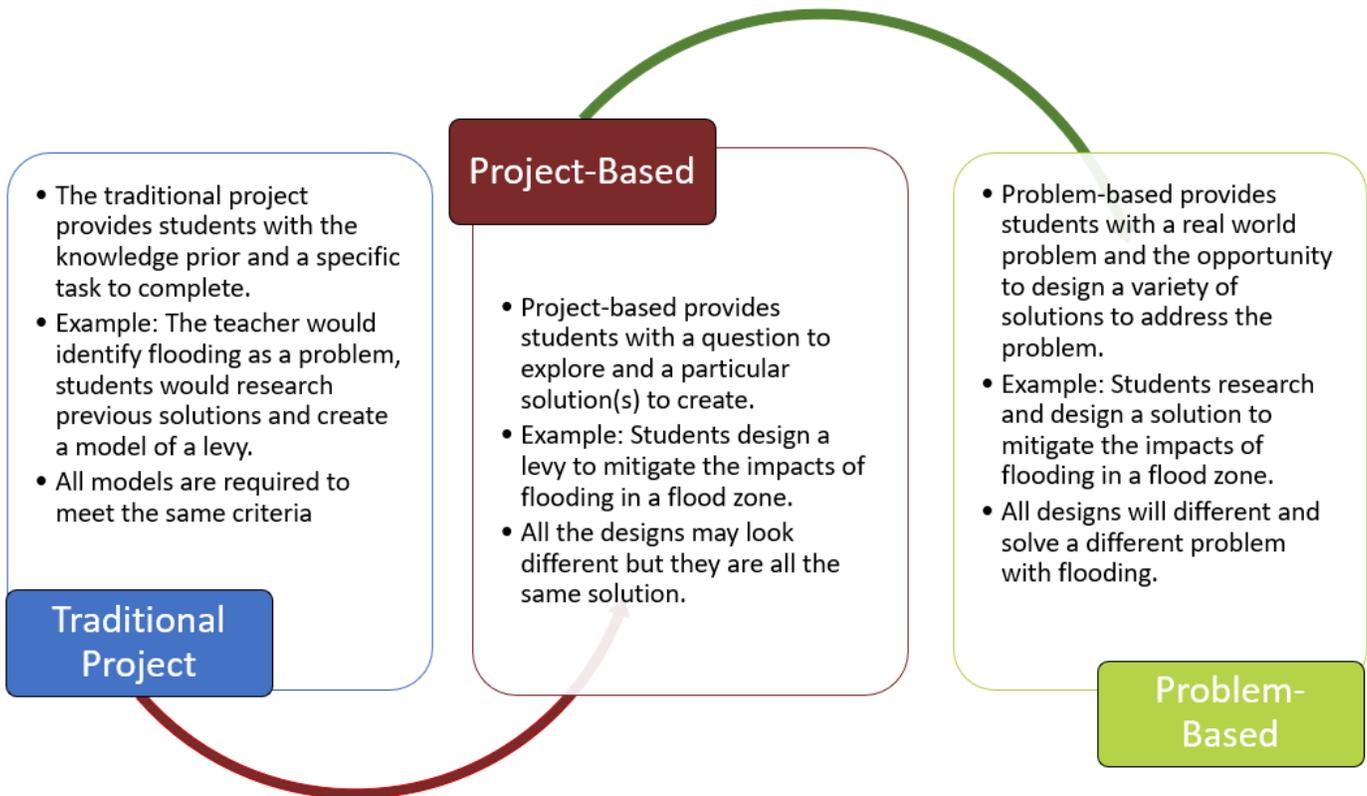
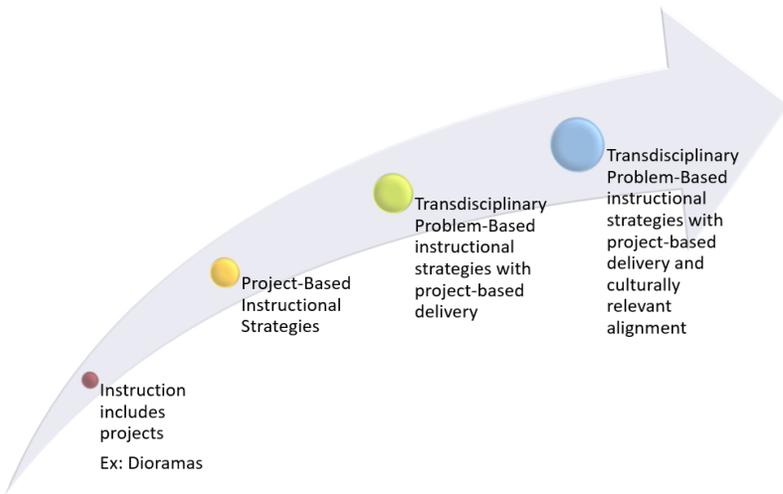


The STEM and STEAM Logic Model provides the blueprint for building a high-quality, integrated STEM and STEAM school model. Effective STEM and STEAM education requires a comprehensive approach that addresses creating an innovative school culture, implementing a student-centered approach to teaching and providing connections for postsecondary success for all students.

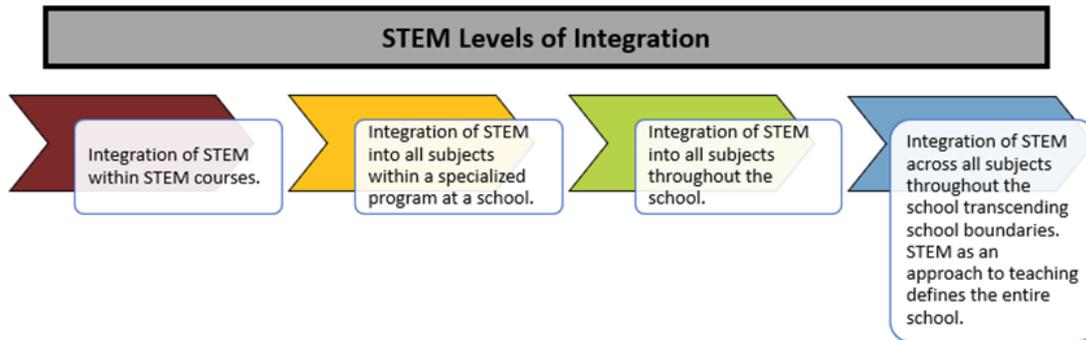
## STEM and STEAM School Logic Model



Central to STEM and STEAM schools is an instructional model that includes an innovative, integrated curriculum with multiple opportunities for students to engage in authentic, problem-based learning and design thinking. STEM- and STEAM-designated schools must demonstrate an integrated curriculum that is project-based. Schools aspiring toward this innovative instructional model should consider both the depth and breadth of integration, as exemplified in the below continua for transformation to authentic problem-based learning and level of STEM integration. At the deepest level, project-based learning is *embedded* in authentic problem-based learning opportunities that are transdisciplinary, transcend school walls and address issues relevant to the global or local community and the student. When deeply implemented, problem-based learning serves to define the school's instructional model – as opposed to occasional projects implemented by a few teachers.

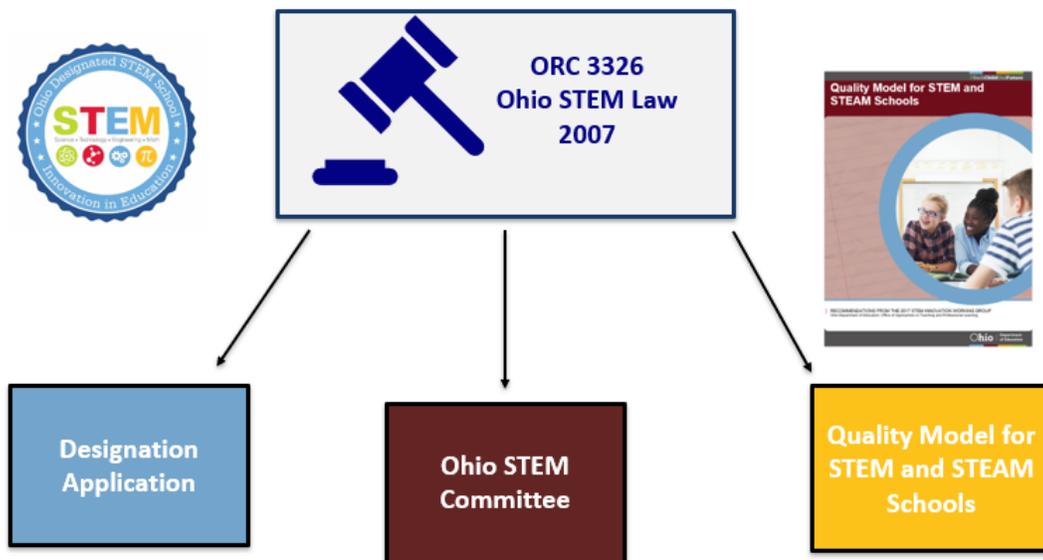


For schools aspiring toward STEM or STEAM designation, breadth of integration is also essential. This diagram points out an important difference between a STEM *program* and a STEM *school*. In a STEM or STEAM school, STEM is broadly integrated into all subjects throughout the school. In a STEAM school, the arts and design are also integrated into science, technology, engineering and math to catalyze STEM learning. [Ohio Revised Code 3326](#) and STEM Designation.



In 2007, the Ohio General Assembly passed Ohio law [3326](#) providing the structure and funding to open independent STEM schools across Ohio. The passing of this law laid the foundation for creating a network of schools leading with an innovative spirit, preparing students for Ohio's workforce and challenging the status quo of education.

Over a decade later, this [law](#) still provides the legislated requirements for Ohio's various designated schools. The Quality Model, Guidance Rubric and STEM/STEAM Designation Application are founded through the requirements outlined in Ohio law section [3326.03](#)



## Essential Criteria for High Quality STEM and STEAM Implementation

### Domain I. A Culture of Learning – Beliefs and Dispositions, Equity and Access

*STEM and STEAM Schools exhibit:*

- cultural strategies that reflect innovation, an entrepreneurial spirit, inquiry and collaboration with individual accountability.
- an inclusive mission that supports each child.
- opportunities for personalized learning.
- flexible and autonomous leadership that communicates a shared vision, and that supports innovative instruction.

### Domain II. Learning and Teaching

*STEM and STEAM Schools exhibit:*

- learning that prepares each child for college and careers in STEM, and that preserves disciplinary and interdisciplinary integrity.
- authentic, problem-based learning and design thinking.
- an integrated, innovative curriculum.
- dynamic assessment systems that include authentic, performance-based assessments.
- a well-prepared teaching staff, with ongoing and personalized professional learning.

### Domain III. Pathways to Success in Careers

*STEM and STEAM Schools exhibit:*

- curricular connections with business and industry, providing opportunities and access for success in college and career.
- collaborative partnerships with business, industry, arts and higher education that provide and enhance opportunities for practical and real-world experience.
- STEM-rich formal and informal experiences with the community that are personally relevant to the student.

## Domain I. A Culture of Learning – Beliefs and Dispositions, Equity and Access

**1.1:** *STEM and STEAM schools exhibit cultural strategies that reflect innovation, an entrepreneurial spirit, inquiry and collaboration with individual accountability.*

**Cultural Strategies** - Cultural strategies reflect a community's understanding of success. Community needs drive instructional and delivery strategies in each school. Habits of Mind reflect what a community values in a successful adult and are explicitly taught and continually utilized within the school.

**Habits of Mind** reflect what a community values and explicitly teaches.

**Innovation** - and risk-taking are encouraged on an ongoing basis, through:

- honoring all ideas and input.
- design thinking.
- empowering to instill responsibility and accountability.
- providing opportunities to demonstrate learning (for example, student exhibits on-site, online, in state and national forums and others).

**An Entrepreneurial Spirit** - is valued and encouraged, through:

- developing a shared mission and vision for creating new processes, products or ideas.
- establishing partnerships with higher education, local business/industry and community input.
- sharing new processes, products or ideas within the community.

**Inquiry** - is valued and encouraged through:

- encouraging an inclusive culture of creativity and exploration.
- facilitating student-driven investigations rather than teacher-driven learning.

### Reflect

Does your school have school-wide Habits of Mind or school-wide expectations for personal awareness?

How does your school promote school-wide Habits of Mind?

How do teachers integrate your Habits of the Mind in their classroom and daily practice?

**Collaboration and Communication** - are valued and encouraged through:

- community partners as peers in the learning process.
- teamwork.
- opportunities for authentic presentations.

**Individual Accountability** - is demonstrated by students:

- persevering through academic and non-academic challenges.
- understanding that setbacks are opportunities for growth.
- understanding that practice improves performance.
- through reflection and self-assessment.

### Alignment

**Application Questions:** How does your school culture promote innovation, entrepreneurialism, inquiry, and collaboration?

**STEM Designation Rubric:** Cultural Strategies

**1.2:** *STEM and STEAM schools exhibit an inclusive mission that supports each child.*

**Inclusive Mission that supports each child** - The school environment is open and validating to all students.

- The school provides multiple opportunities to inspire and inform students about careers and academic pathways in STEM/STEAM-related fields.
- The school supports students beyond the school day (for example, bridge programs, extended school day, extended school year, looping, social services and others).
- All students have access to age-appropriate interests (for example, shadowing experiences for younger students, internships for older students and others).
- Schools design and implement interventions aimed at closing gaps in academic and nonacademic skill areas.

**1.3:** *STEM and STEAM schools exhibit opportunities for personalized learning.*

**Personalized Learning** - Students have ownership of their own learning, set goals and make choices about how to accomplish them.

- Personal learning pathways are student-driven, and students are given multiple ways to show what they know.
- Students participate in work-based learning experiences to make connections between the content they are learning and their lives.
- Staff support students in developing and maintaining student-created learning plans and monitoring progress toward future goals.
- Instructional strategies, materials and pacing are flexible and based on needs of students.
- Students can earn credit based on mastery and are not penalized for taking additional time to demonstrate learning.
- Students have voice and choice when developing learning opportunities.

**Reflect**

How does your school provide STEM best practices to all students?

What structures are provided to students that empower choice in their learning journey?

How is mastery learning implemented in your school? How does your school provide remediation to students still reaching mastery?

**Alignment**

**Application Questions:** Describe how your school culture demonstrates an inclusive mission that supports all students.

Describe how you provide students the opportunity to have ownership of their own learning, set goals and make choices about how to accomplish them.

**STEM Designation Rubric:** Inclusive Mission and Personalized Learning

**1.4:** *STEM and STEAM schools exhibit flexible and autonomous leadership that communicates a shared vision, and that supports innovative instruction.*

**Flexible and Autonomous Leadership** - School leaders are open, agile and driven by a vision for learning. They lead by example and create an environment of high expectations, sparking a passion for learning and preparing students both academically and socially for their futures.

**Communicates a Shared Vision** - Leaders create, clearly articulate and follow a shared vision. Leaders:

- establish a STEM advisory committee for ongoing monitoring of the school's mission, vision, and scope, that includes parents and representatives from the school, community, governing board, higher education institutions and industry.
- develop and promote a consistent understanding of STEM among all stakeholders.
- establish and sustain connections to local business, industry and higher education.
- collaborate with stakeholders to measure the effectiveness of the program, including measures of self-efficacy and continued interest in STEM.

**Supports Innovative Instruction** - Leaders empower teachers to facilitate inquiry and problem-based learning. Leaders support:

- a culture of teacher autonomy and professional accountability.
- structures for teachers, including common planning time within the school day to support cross-curricular collaboration and professional learning.
- a culture within the school where staff and students are unafraid to take risks.
- school structures that focus on personalizing the student experience.
- opportunities for sharing research and best practices related to STEM program goals.
- applied learning and work-based learning experiences for teachers.
- a school strategic plan and annual action plan that prioritizes investment in professional development for teachers, that includes cross-curricular integration, community partnerships, connections with higher education and industry, STEM pedagogy and/or applied technology.

### Reflect

How are your teachers encouraged to be innovative risk takers in designing learning experiences and be promoted as leaders in STEM best-practices?

What professional supports are provided to teachers and staff to support their personal growth in STEM best practices?

**Leaders are encouraged to participate in:**

- STEM-related professional development and networking that addresses integrated content, community/industry partnerships, connections with postsecondary education, pedagogy and/or digital learning, to ensure progressive expectations for educators' application of content knowledge, curriculum design and delivery.
- externships and mentorships with higher education and industry.

## Alignment

**Application Questions:** Describe how your leadership team exhibits flexible and autonomous leadership, communicates a shared vision and supports innovative instruction.

What school structures are in place to support innovative, problem-based learning throughout the entire school (such as common planning time and professional development funds)?

**STEM Designation Rubric:** School Leadership and Governing Body/STEM Advisory Group

### 1.5: Governing Body, Advisory Team and Curriculum Team

Ohio law section [3326.03](#) outlines the requirements of STEM schools to have the following teams created to support a school-wide STEM approach.

	Role	Guidance Rubric	Application Questions
<b>Governing Body</b>	Oversees entire school. For a traditional school district, the school board serves as the governing body.	1.4 Governing Body/STEM Advisory Group The school has a governing body/STEM advisory group consisting of a diverse group of individuals selected for their expertise in STEM pedagogy. The governing body/STEM advisory group meets throughout the school year to discuss the progress of the school in STEM practices. The governing body/STEM advisory group plays a pivotal role in determining and supporting the STEM practices implemented within the STEM school.	Describe how your school's governing body (and/or STEM/STEAM advisory group) is selected and their level of support for the operation of a STEM/STEAM school.
<b>Advisory Team</b>	School-wide or district team created with leaderships, teacher leaders and community partnership to develop and implement a strategic plan and curriculum around STEM implementation as outlined by the Quality Model and ORC 3326.		STEM/STEAM Advisory Group Members (if applicable):  Describe how you selected the members of your advisory group and how they have contributed to the growth of STEM/STEAM in the building.

<b>Curriculum Team</b>	<p>School-based team with administration, teachers and community partners creating curriculum aligned to STEM best practices, Ohio’s learning standards and community needs.</p> <p><b>**Advisory team and curriculum team can be the same committee or have members being leaders in both.</b></p>	<p><a href="#">ORC 3326.09</a></p> <p>Subject to approval by its governing body or governing authority, the curriculum of each science, technology, engineering, and mathematics school and of each community school or chartered nonpublic school that is designated as a STEM school equivalent under section 3326.032 of the Revised Code shall be developed by a team that consists of at least the school's chief administrative officer, a teacher, a representative of the higher education institution that is a collaborating partner in the STEM school or school designated as a STEM school equivalent, and a member of the public with expertise in the application of science, technology, engineering, or mathematics. In the case of a STEAM school or a STEAM school equivalent, the team also shall include an expert in the integration of arts and design into the STEM fields.</p>	<p>Describe how the school’s curriculum will be developed by a curriculum team* consisting of, at minimum: 1) the chief academic officer, 2) a higher education partner, 3) a teacher and 4) a member of the public with expertise in the application of science, technology, engineering or mathematics. Describe how the team will develop an innovative curriculum.</p> <p><b>*If the proposal is for a STEAM school or STEAM school equivalent, the curriculum team must also include an expert in the integration of arts and design into the STEM fields.</b></p> <p><b>**Sometimes the STEM/STEAM Advisory Team and the Curriculum Team can be the same.</b></p>
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## Domain II. Learning and Teaching

**2.1:** *STEM and STEAM schools exhibit learning that prepares each child for college and careers in STEM and preserves disciplinary and interdisciplinary integrity.*

**Scholarship** - All stakeholders are engaged in learning, where STEM and STEAM disciplinary practices and habits of mind are explicitly and intentionally integrated to effectively participate in a global society.

- Mastery/competency is a core construct of learning expectation.
- Topics are investigated for an extended period of time, allowing for more depth and complexity.
- Emphasis is placed on reasoning and problem solving (for example, scientific reasoning, engineering design, computational thinking, design thinking, argument from evidence) embedded throughout the curriculum.
- Learning targets higher-order thinking and deep engagement, collaborative efforts and effective communication.
- Students have opportunities to engage in advanced learning beyond school walls.

**Integrity of Academic Disciplines (Content)** - Learning experiences are content-accurate, anchored to the relevant content standards and focused on the big ideas and foundational skills critical to future learning in the discipline(s).

- Students engage in interdisciplinary STEM/STEAM content as the focus of the school curriculum.
- Curriculum is vertically and horizontally aligned and is centered on educational and/or industry standards or other recognized frameworks.
- Learning experiences and environments are immersive and reflective.
- Students engage in diverse curriculum offerings that incorporate relevant technologies (for example, research, engineering, computer science, design, digital fabrication and others).

### Reflect

How does your school use engineering design process/design thinking to prepare students to participate in a global society?

Do you use a school-wide design cycle, or expect all students to be familiar with the Engineering Design Process?

If you do not use engineering design process/design thinking, what are your plans to start integrating these?

### Alignment

**Application Questions:** Show how reasoning and problem solving (e.g., scientific reasoning, engineering design, computational thinking, design thinking, argument from evidence) are embedded throughout the curriculum to prepare students to participate in a global society. Please include your design cycle/process image (if available) the school/district utilizes and integrates into learning experiences.

**2.2:** *STEM and STEAM schools exhibit authentic, problem-based learning and design thinking.*

**Authentic** - Students learn by doing and regularly engaging in activities that connect learning to real-world issues, situations and problems. Students acquire critical thinking, creative problem solving, research and effective communication skills.

- Connections to local and real-world contexts are evident.
- Contextual learning includes field experiences that directly connect to standards.
- Classrooms and schools are designed for collaborative work.
- Students connect and work with community partners (for example, organizations, business and industry, post-secondary institutions and others), and have opportunities to contribute to the knowledge base, increasing authenticity and accountability.
- Students regularly exercise skills used in the workplace (for example, demonstrating leadership and responsibility, presenting information effectively, exercising time management, organizing their work, and others).

**Problem-based Learning** - Problem-based learning requires a process of inquiry (often interdisciplinary) that builds knowledge through immersive projects. Students experience research, problem-solving and project documentation, and participate in presentations of learning to authentic audiences multiple times throughout the academic year.

- Problem-based learning drives instruction and curriculum.
- Authentic problem-based learning is student-directed, open-ended inquiry that results in the development of a solution or product that contributes to the larger community.
- PBL units include a culminating project that integrates content areas.
- Students design solutions with, and incorporate feedback from, a variety of authentic audiences (for example, community members, peers, higher education, experts, industry, teachers, families and others).

**Design Thinking** - Design thinking involves an iterative process (for example, researching, defining, ideating, prototyping, testing, modifying, sharing) and is referenced in all classes as a possible strategy for addressing a problem.

- Students demonstrate thinking skills in employing the design process, including opportunities to experience the recursive nature of the process.
- Entrepreneurial components are encouraged when appropriate.
- Design thinking develops solutions or products to address a human need identified by potential end users, in contexts that include but also extend beyond STEM topics (for example, aesthetics, social issues and others).
- Design thinking provides opportunities to think and explore novel ideas (what is not already known), possibly using innovative approaches that are not already developed.

### Reflect

How do staff provide students the opportunity to learn and solve real-world problems through project or problem-based learning experiences? Do staff understand the difference between a project, project-based learning and problem-based learning? Are staff members encouraged/expected to create interdisciplinary learning experiences for students? How is project-based learning embedded into the cultural fabric of your school?

### Alignment

**Application Questions:** Describe how problem-based learning problem-based learning drives instruction and curriculum. Provide samples of learning experiences.

**2.3:** *STEM and STEAM schools exhibit an integrated, innovative curriculum.*

**Integrated** - Students are regularly engaged in units that articulate interdisciplinary connections. Students can identify ways that disciplines are interrelated, reinforced, and complement one another.

- Learning experiences are planned and aligned by all grade levels and content areas, spiraling in increased complexity and rigor.
- Learning experiences require students to connect one or more disciplines and includes instructional support for quality performance.

**Innovative** - Technology connects students with information systems, databases and research, mentors and social networking resources for ideas during and beyond the school day. The school's structure and use of technology has the potential to change relationships between students, teachers and knowledge.

- Learning is supported and enhanced with authentic, relevant use of technology.
- Technology is integrated to promote creativity and innovation.
- Students identify and use the tools they need to solve problems.
- Technology is used to engage students in community, state and global learning opportunities that extend beyond the classroom.

### Reflect

How are teachers provided time and capacity to create standards aligned, interdisciplinary learning opportunities?

How does your school use technology to amplify and support student learning experiences?

### Alignment

**Application Questions:** Describe how your school implements a curriculum with interdisciplinary connections and frequently uses technology to enhance student learning. Be sure to include how the arts and humanities are integrated in the STEM/STEAM disciplines.

**STEM Designation Rubric:** Instructional Design

**2.4:** *STEM and STEAM schools exhibit dynamic assessment systems that include authentic, performance-based assessments.*

**Dynamic Assessment Systems** - Teachers augment traditional assessment with a variety of techniques, including authentic, performance-based assessments. Assessment recognizes teachable moments. It is active, ongoing, flexible and adaptable.

- Teachers use information on current student understanding to inform and plan future instruction. Formative assessment informs summative assessment and teaching efforts.
- Qualitative assessments, student self-assessments, reflection, peer observation, portfolios and dialogue (for example, student interviews, TED talks, classroom conversations) are included.
- Assessment may be supported and enhanced with authentic, relevant use of technology.
- Students have opportunities to choose how to demonstrate their learning and its relevance to society.

**Authentic Performance-based Assessments** - Assessment practices require students to make a meaningful connection between course content and the world around them. Assessments may be ongoing, cross-curricular and/or project-focused.

- Assessments allow students to demonstrate understanding of content, entrepreneurial thinking and employability skills.
- Assessments are linked to desired outcomes of authentic problem-based learning and design thinking activities.
- Student expressions of learning (artifacts) reflect the importance and impact of interactions with groups or individuals outside of the classroom (informal STEM/STEAM organizations, non-profit agencies, other students, museums, universities, business and industry partners and others).
- Students portray their learning process through collections of personal work and reflections.

### Reflect

What assessment practices do teachers use to gather data to drive instruction and learning?

Do you use a variety of assessments (in other words, performance based)?

How are students provided opportunities for re-assessment to demonstrate mastery?

### Alignment

**Application Questions:** Describe how student learning is assessed.

**STEM Designation Rubric:** Dynamic Assessment

**2.5:** *STEM and STEAM schools exhibit a well-prepared teaching staff, with ongoing and personalized professional learning.*

**Well-prepared Teaching Staff** - Teachers effectively and consistently use best practices in STEM/STEAM pedagogy. Teachers are well-prepared either through education or work experience. Teachers facilitate authentic application of STEM/STEAM content and skills. Teachers design curricula that demonstrate real-world connections, with learning experiences that stimulate curiosity and creativity, and that facilitate transfer of knowledge and skills to new situations.

- School staff are well-versed in how to create and implement project/problem-based learning modules and design challenges to address real world problems.
- Teachers demonstrate a growth mindset disposition and willingness to learn.
- Teachers intentionally incorporate creativity, collaboration, communication and critical thinking skills into curricula and model these skills for students.
- Teachers understand students' needs, and collaborate to facilitate flexible, personalized learning.
- Cross-disciplinary teams meet regularly to discuss research, integrative best practices, successes and opportunities for improvement toward STEM/STEAM school goals.

- Teachers work with business, industry, arts and academic partners to facilitate meaningful connections to workforce and the community. This may include co-teaching with industry-trained professionals.
- Teachers model use of relevant technology in real-world contexts.

**Ongoing and Personalized Professional Learning** - Professional development is ongoing, aligns with STEM initiatives and includes support across the school year.

- Teachers regularly participate in STEM/STEAM-related professional development, which addresses integrated content, community/industry partnerships, arts, connections with postsecondary education, pedagogy and/or digital learning.
- Teachers identify personalized professional development goals and select learning opportunities that meet their needs.
- Teachers participate in externships and mentorships with higher education and industry to ensure progressive expectations for educators' application of content knowledge, curriculum design and delivery.

### Reflect

What qualities are non-negotiable when hiring new talent? How are teachers supported to use STEM best-practices in their classrooms? How are staff informed of and encouraged to attend professional development aligned to STEM best-practices (Design Cycle Thinking, Habits of the Mind, Project/Problem-based learning, Authentic Assessment, Mastery Learning, Personalized Learning)?

### Alignment

**Application Questions:** Describe how the school recruits and retains faculty members with a high interest in STEM/STEAM education and experience with innovative instructional methods. Describe how teachers effectively and consistently use best practices in STEM/STEAM pedagogy. Highlight any **professional development sessions on STEM/STEAM best practices that school staff have attended.**

## Domain III. Pathways to Success in Careers

**3.1:** *STEM and STEAM schools exhibit curricular connections with business and industry, providing opportunities and access for success in college and career.*

**Curricular Connections with Business and Industry** - Learning experiences, during and outside of the school day, provide business and industry awareness and exploration, leading to career preparation, planning and training.

### Opportunities

- The school facilitates opportunities for students to be prepared to enter the workforce or college in STEM/STEAM.

- The school provides opportunities for applied learning in professional STEM/STEAM workplaces.
- Students have opportunities to learn about the pervasiveness of STEM/STEAM in society and careers.

### Access

- Student career interests are developed through active student involvement in STEM/STEAM activities such as researching, shadowing and mentorships, and (for older students) apprenticeships and internships.
- High Schools provide access for students to complete certifications, credentials and/or credit completion at community colleges, colleges and/or universities.
- As appropriate for the grade level, schools provide access to students for course credit opportunities (advanced placement courses, international baccalaureate courses, early college, college credit plus and others).
- Schools promote awareness of post-secondary preparation (development of effective study skills and self-regulation skills, and (for older students) college tours and assistance with the application process and others).

### Reflect

How does your school integrate career exploration for all students?

What work based opportunities do you provide your students?

How are students provided opportunities to prepare for their postsecondary journey during their school experience?

### Alignment

**Application Questions:** What access does the school provide to students to support career exploration/interests? If applicable, provide details about student participation in College Credit Plus/certification programs.

**STEM Designation Rubric:** Career Access/Exploration

**3.2:** *STEM and STEAM schools exhibit collaborative partnerships with business, industry, arts and higher education that provide and enhance opportunities for practical and real-world experience.*

**Collaborative Partnerships** - The school collaborates with business, industry, arts and higher education partners to ensure alignment to intended pathways and local business and industry needs. Partners are part of the decision-making process. There is a business/industry and educator working advisory group.

- Partners support instruction (ideas for design challenges and problem-based learning, learning standards evaluation (industry), work-based learning development, credential alignment and

- others).
- Partners assist in providing ongoing, active work-based learning experiences each year, either during or outside of the school day (quality shadowing, internships, apprenticeships and others), so that students have direct experiences with STEM/STEAM professionals in authentic environments.
  - Partners share resources (lab/design space, mentors, speakers, equipment, current industry information, expertise, meeting facilities and others).

**Opportunities for Practical and Real-World Experience** - Students and teachers have opportunities for contextualized learning, comparable to what they would find in business, industry and other professions.

- Students have frequent interactions with STEM/STEAM professionals outside the regular school day.
- Students and teachers collaborate with partners for mentorship, shadowing, consultation and feedback opportunities that enhance learning experiences.
- The school creates and supports opportunities for STEM/STEAM work-based learning experiences for students and teachers.
- Students actively work with employers in realistic problem-solving situations, relevant to students and the community.
- Students have opportunities to participate in STEM/STEAM-related competitions.

### Reflect

What community entities provide direct and continued support in curriculum development, work-based learning experiences and student/school support?

What opportunities do you currently provide at your school that would benefit from a community partnership?

### Alignment

**Application Questions:** Detail the established community partners and their role within your school.  
\*STEAM applicants must provide an art/humanities partner

Describe how partners are involved with curriculum development, provide practical, work-based learning experiences and student support and/or share resources with the school.

**STEM Designation Rubric:** Partnerships Extend Learning Opportunities

**3.3:** *STEM and STEAM schools exhibit STEM-rich formal and informal experiences with the community that are personally relevant to the student.*

### **STEM-rich formal and informal experiences with the community**

- Students have opportunities to engage in STEM/STEAM-related activities that have relevance to the community.
- Students and teachers partner with community members and families to take on service roles for students, classrooms or teachers to enhance learning experiences.
- Students seek and incorporate feedback on their work from a variety of authentic audiences in their community (for example, community members who have knowledge of the problem/issue and others).

### **Personally relevant to the student**

- The learning environment is student-driven and designed to challenge the minds and stimulate the imaginations of learners.
- On-site/online STEM/STEAM exhibits, and/or in local, state and national STEM/STEAM forums.

#### **Reflect**

What opportunities do students have to engage in personally relevant STEM/STEAM related activities?  
How do you use community partners to create real-world context for classroom lessons?

#### **Alignment**

**Application Questions:** Describe how your school provides STEM/STEAM-rich formal and informal relevant experiences with the community to your students.

**STEM Designation Rubric:** Relevant Community Experiences

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## Appendix – Reflection Rubric for School Self Evaluation

### Ohio STEM Designation Rubric with Reflection Questions and Application Questions

STEM and STEAM Attributes	Initial	Approaching	Accomplishing	Model
<b><u>A Culture for Learning- Beliefs and Disposition, Equity and Access</u></b>				
1.1 Cultural Strategies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.2 Inclusive Mission and Personalized Learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.3 School Leadership	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.4 Governing Body/ STEM Advisory Group	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>Learning and Teaching</u></b>				
2.1 Disciplinary and Interdisciplinary Integrity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2 Instructional Design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.3 Dynamic Assessment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.4 Staff Expertise and Continued Learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b><u>Pathways to Success in Careers</u></b>				
3.1 Career Access/Exploration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2 Partnerships Extend Learning Opportunities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3 Relevant Community Experiences	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Alignment between Ohio's Quality Model for STEM and STEAM Schools, STEM Designation Guidance Rubric, STEM Designation Application and Ohio Revised Code 3326

Quality Model	STEM Designation Application	STEM Designation Rubric	Ohio Revised Code 3326
<b>Culture</b>			
1.1 Habits of Mind	1.1 How does your school culture promote innovation, entrepreneurialism, inquiry and collaboration?	1.1 Cultural Strategies	ORC 3326.04 (4)
1.2 Inclusive Mission	1.2 Describe how your school culture demonstrates an inclusive mission that supports all students.	1.2 Inclusive Mission and Personalized Learning	
1.3 Personalized Learning	1.3 Describe how you provide students the opportunity to have ownership of their own learning, set goals and make choices about how to accomplish them.	1.2 Inclusive Mission and Personalized Learning	ORC 3326.03
1.4 Leadership	<p>1.4a Describe how your leadership team exhibits flexible and autonomous leadership, communicates a shared vision and supports innovative instruction.</p> <p>1.4b What school structures are in place to support innovative, problem-based learning throughout the entire school (i.e., common planning time, professional development funds)?</p> <p>1.4d Please provide a link to the listing of your school board members, or list below:</p> <p>1.4e STEM/STEAM Advisory Group Members (if applicable):</p> <p>1.4f Describe how you selected the members of your advisory group and how they have contributed to the growth of STEM/STEAM in the building.</p> <p>1.4e Describe how the school's curriculum will be developed by a curriculum team* consisting of, at minimum: 1) the chief academic officer, 2) a higher education partner, 3) a teacher and 4) a member of the public with expertise in the application of science, technology, engineering or mathematics. Describe how the team will develop an innovative curriculum.</p> <p>*If the proposal is for a STEAM school or STEAM school equivalent, the curriculum team must also include an expert in the integration of arts and design into the STEM fields. The STEM/STEAM Advisory Team and the Curriculum Team can be the same.</p>	1.3 School Leadership	
1.4 Governing Body	1.4c Describe how your school's governing body (and/or STEM/STEAM advisory group) is selected and their level of support for the operation of a STEM/STEAM school.	1.4 Governing Body	ORC 3326.03

Quality Model	STEM Designation Application	STEM Designation Rubric	Ohio Revised Code 3326
<b>Curriculum</b>			
2.1 Design Cycle and STEM Disciplines	2.1 Show how reasoning and problem solving (for example, scientific reasoning, engineering design, computational thinking, design thinking, argument from evidence) are embedded throughout the curriculum to prepare students to participate in a global society. Please include your design cycle/process image (if available) the school/district utilizes and integrates into learning experiences.	2.1 Disciplinary and Interdisciplinary Integrity	ORC 3326.03 (5)
2.2 Problem-based Learning	2.2a Describe how problem-based learning (PBL) drives instruction and curriculum. 2.2b Sample of PBL	2.2 Instructional Design	ORC 3326.03 (5)
2.3 Integrated Innovation Curriculum	2.3 Describe how your school implements a curriculum with interdisciplinary connections and frequently uses technology to enhance student learning. Be sure to include how the arts and humanities are integrated in the STEM/STEAM disciplines.	2.2 Instructional Design	ORC 3326.03 (5)
2.4 Assessment	2.4 Describe how student learning is assessed.	2.3 Dynamic Assessment	
2.5 Staff Support and Preparation	2.5a Describe how the school recruits and retains faculty members with a high interest in STEM/STEAM education and experience with innovative instructional methods. 2.5b Describe how teachers effectively and consistently use best practices in STEM/STEAM pedagogy. 2.5c Highlight any professional development sessions on STEM/STEAM best practices that school staff have attended.	2.4 Staff Expertise and Continued Learning	
<b>Connections</b>			
3.1 STEM curricular connections to industry	3.1 What access does the school provide to students to support career exploration/interests? If applicable, provide details about student participation in College Credit Plus/certification programs and others	3.1 Career Access/Exploration	ORC 3326.03 (9)
3.2 Collaborative Partnerships	3.2a Detail the established community partners and their role within your school. *STEAM applicants must provide an art/humanities partner 3.2b Describe how partners are involved with curriculum development, provide practical, work-based learning experiences and student support and/or share resources with the school.	3.2 Partnerships Extend Learning Opportunities	ORC 3326.03 (9)
3.3 STEM Community Experiences	3.3 Describe how your school provides STEM/STEAM-rich formal and informal relevant experiences with the community to your students.	3.3 Relevant Community Experiences	ORC 3326.03 (9)

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