NYC Department of Education

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SCIENCE | TECHNOLOGY | ENGINEERING | MATHEMATICS

STEM Framework

NYC Department of Education

NYC STEM Education Framework

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The New York City Department of Education
STEM Framework

An Introduction to the NYC STEM Education Framework

STEM is an acronym for the integration of the four disciplines of Science, Technology, Engineering, and Mathematics. In practice, STEM education involves both formal (classroom) and informal (after school) instruction across all grade levels (Pre-K–12). STEM education prioritizes the study of science and mathematics, plus the meaningful integration of technology and engineering design that offers opportunities for innovative problem solving while making science and mathematics relevant and engaging. STEM education includes a variety of course options that integrate curriculum across content areas such as computer science, robotics, sustainability, environmental studies, marine science, urban transportation, financial literacy, urban gardening and farming, communication, green construction, facility maintenance, and health and wellness, to name a few. Many advocates of STEM also incorporate the arts (as in STEAM), in addition to history and literacy.

Why STEM education?

"An editorial in the *New York Daily News* notes that "by 2020, the…" U.S. economy will demand 123 million high-skilled workers with strong backgrounds in science, technology, engineering and math—a set of skills commonly called STEM. The problem is, only 50 million Americans will qualify for those jobs." (**http://www.nydailynews.com/new-york/guest-stem-education-priority-article-1.1548624**) STEM jobs are overwhelmingly in high demand and will account for about 38% of all the high-skill jobs created; they are also typically among the highest paid. (**http://www.usatoday.com/story/money/2014/10/14/jobs-for-college-grads-by-metro/16046989/**) The jobs that are available today are not the jobs that were available to workers in the 20th, century and a 20th century education will not adequately prepare today's students for the world they will need to navigate. The "new" 21st-century jobs require a growth mind-set, the ability to solve problems, think critically, be innovative, multitask and work collaboratively with a diverse group of colleagues—colleagues who may be younger, older, of a different cultural or racial background, or with different levels of education and experience. As educators, it's important that we learn and embrace the content and skills our students need to be competitive not only in NYC or in the United States, but globally.

With almost daily advances in technology, the world keeps shrinking and becoming more and more accessible to its citizens. Today there are libraries with no visible books, and students make e-appointments with their advisors and take MOOCs (Massive Open Online Courses) to name a few ways in which technology has changed how people learn. Many younger students are known as "digital natives"—those who are born with a sixth sense for technology, as opposed to older adults who are viewed as "digital immigrants" in need of user guides and often the help of their students and children to operate everything from their smartphones to their entertainment systems. Being STEM-ready and digitally literate is what our students need to be prepared for this new global reality.

Which students need to be prepared for STEM careers?

The simple answer is that ALL students need to be prepared for STEM careers. Currently in the United States, there are concerns about the achievement gaps that exist among the various demographic groups, our rankings on international assessments, and the ability of all American students to meet the skills demanded by the 21st-century STEM labor force. *(Gonzalez and Kuenzi, 2012)* Although there has been an increase in the number of people working in STEM occupations, recruiting women and underrepresented minorities to complete degrees and pursue careers in STEM remains challenging. *(Chen and Thomas 2009)* The research suggests that many women and underrepresented minority students enrolled in college switch from STEM majors to non-STEM majors prior to graduation, citing a lack of pre-college preparation or sensitivity to their less-than-average grades received in STEM courses. *(Griffith, 2010)*

Because of these higher education challenges, STEM education in K-12 must provide access to students that have been traditionally disengaged. The goals for all learners to acquire the necessary content knowledge and skills in all core disciplines; become digitally literate, critical, and innovative thinkers; master 21st Century competencies; and to be ready and highly motivated to pursue college (two and four year degrees) and subsequently STEM careers. In 2010, 13 United States federal agencies invested over 10 billion dollars in programs designated to improve knowledge within STEM fields and to increase the attainment of STEM degrees. (*U.S. Government Accountability Office, 2012*). In May 2014, Mayor de Blasio announced the development of a tech talent pipeline to train New Yorkers for the tech sector, which represents 291,000 jobs and $30 billion in wages annually. (**http://www1.nyc.gov/site/forward/initiatives/tech-talent.page**)

continued

What is STEM education?

STEM education is a methodology that encourages students to pursue inquiries and solve problems that are relevant to the world in which they live. Using the engineering design process, students identify problems, design possible solutions, and test and evaluate those solutions until an optimal one is found. Classroom experiences mimic real-world scenarios and expose students to problem-solving in a significant way. According to the National Research Council (2013), "providing students a foundation in engineering design allows them to better engage in and aspire to solve the major societal and environmental challenges they will face in the decades ahead" is pivotal. The integration of mathematics, science, and engineering practices in conjunction with digital literacy helps students recognize and utilize the variety of perspectives that can be tapped into to help unravel complex inquiries. These interdisciplinary forms of exploration are compelling, as they promote student engagement, agency, advocacy, and learning. *(NSF 2010)*

For teachers, STEM education provides unique opportunities to grow their practice with their peers. It encourages risk-taking, innovation, and collaboration that enhances their professional learning experiences and growth. Building a collaborative learning community, where teachers work together with each other, with partners, and across disciplines, is necessary for a school to develop a fully integrated STEM program. This includes providing opportunities for meaningful integration of technology, where technology is in the hands of the students and not controlled by the adults in the room. Providing computer science and digital literacy learning experiences at all grade levels helps students understand the technology they use every day, think creatively, communicate with others, persist in problem-solving, and gain skills that are critically important in the 21st century. Students are not only consumers of the World Wide Web but producers, innovators, and makers who contribute to the web and to the growing portfolio of social media tools. Computer science includes robotics, web and app design, programming, coding, media design, computational thinking, and more. Cornell University's Digital Literacy Resource website reminds us that "Digital literacy is the ability to find, evaluate, utilize, share and create content using information technologies and the Internet." (**https://digitalliteracy.cornell.edu/welcome/dpl0000.html**)

Digital literacy, real-world experiences, an understanding of the content of each discipline, authentic problem-based learning experiences, and the integration of technology and engineering design call for a transdisciplinary approach to learning that supports student inquiry and moves curriculum and instruction beyond content-area literacy and interdisciplinary connections. This moving beyond is a transdisciplinary approach that involves the organization of curriculum and instruction around authentic student questions where concepts and skills are developed within real-world contexts.

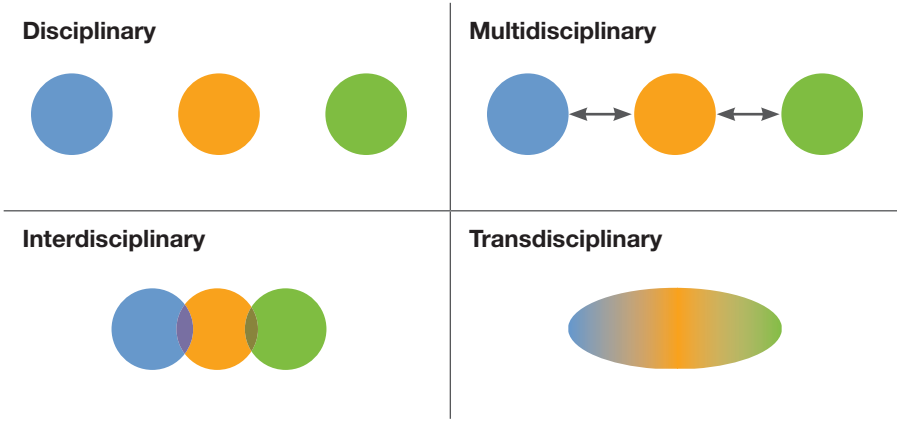
Inquiry is at the heart of the transdisciplinary approach, as students seek answers to questions raised by the curriculum and themselves. Within a transdisciplinary framework, students are still expected to meet content-area standards *(Stevens 2012)*, but this approach also nurtures a student's cognitive growth and involves a greater degree of collaboration than other instructional models. It also requires integrated teacher teams who share roles and systematically and intentionally plan to cross discipline boundaries. *(NCREL 1994)*

How is the NYC STEM Framework used?

The NYC STEM Education Framework is a tool that provides a structured approach for schools seeking to organize and develop the implementation of a STEM initiative whose results are repeatable. It includes a readiness checklist of structures, criteria, and systems and is not intended to be judgmental or evaluative.

The architecture of the Framework is presented as a structure of domains, indicators, and criteria to support the evolution of a school's initiative over time. The Framework is designed to work alongside other data and qualitative tools to help schools develop a STEM culture that integrates well with a school's existing instructional mission and vision, while shifting the disciplinary paradigm from multidisciplinary and interdisciplinary toward instruction and learning that is ultimately transdisciplinary *[See Fig. 1]*.

Figure 1. Disciplinary Spectrum



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Architecture of the NYC STEM Framework

The architecture of the STEM Education Framework is based on four domains which are each subdivided into indicators with corresponding criteria.

Domain I: School Vision and Structures for Success articulates a coherent STEM vision that is clear to all school constituents and is successfully sustained by an innovative STEM culture, budget, and program evaluation system.

Domain II: Curriculum, Instruction, and Assessment encourages a transdisciplinary approach to curriculum and instruction that promotes student-centered inquiry, problem-based learning, and teacher collaboration.

Domain III: Strategic Partnerships engages community-based organizations (CBOs), higher education institutions, businesses, and other external partners who offer STEM education programs and support as a means of encouraging school communities (administrators, teachers, and students) and families in STEM learning.

Domain IV: College and Career Readiness prepares students for STEM post-secondary education and careers by providing equitable access to all students and provides STEM educational experiences, beginning in elementary school and continuing through middle and high school.

The criteria under each indicator describe the conditions necessary to maximize the domain's potential. The criteria suggest a continuum of evolution, development, and readiness which ranges from "Early" to "Emerging" to "Integrated" to "Fully Integrated." Building and sustaining a viable STEM program requires vital actions which include:

- articulating a coherent mission and vision for the STEM program that is integrated within the existing school's mission and vision and evident to all stakeholders;
- creating structures and time for strategic planning that builds capacity for continuous improvement; growing partnerships with families and external STEM organizations;
- ensuring the availability of STEM funding beyond the planning and implementation phase; and providing dedicated professional learning opportunities that allow for teacher support and transdisciplinary curriculum development. *(Hanover Research 2011)*
- implementing structured **Cycles of Learning** that allow schools to plan, implement, reflect, and adjust and to share lessons learned, thus creating an ongoing feedback loop that tracks, measures and modifies STEM instructional models and teacher professional learning based on student and teacher needs.

Domain I: School Vision and Structures for Success

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
1.1 STEM Mission and Vision **A STEM mission and vision is integrated into the existing mission and vision of the school and reflects a consensus among all stakeholders.**	a) The school's STEM mission and vision are being developed. There is little evidence of a sense of passion and urgency among staff members that focuses on preparing students to be STEM- and 21st-century ready.	a) The school's STEM mission and vision are developing and in the process of being integrated into school-wide goals. There is a limited sense of passion and urgency among selected staff members that focuses on preparing students to be STEM- and 21st-century ready.	a) The school's STEM mission and vision are established and are well-integrated into school-wide goals. There is a sense of passion and urgency among many staff members that focuses on preparing students to be STEM- and 21st-century ready.	a) The school's STEM mission and vision are established and explicitly integrated into school-wide goals. There is an obvious sense of passion and urgency throughout the school that focuses on preparing students to be STEM- and 21st-century ready.
	b) Discussions about the school's STEM mission and vision are still taking place among some staff.	b) The school's STEM mission and vision have been communicated and are known by some staff.	b) The school's STEM mission and vision are communicated to all staff and accessible to all stakeholders.	b) The school's STEM mission and vision are regularly communicated and articulated by all stakeholders.
	c) A few members of the school community are committed to STEM education and few understand the value of collaborative practices and problem-based learning for the overall benefit of the school community, especially students.	c) Some members of the school community are committed to STEM education, and some understand the value of collaborative practices and problem-based learning for the overall benefit of the school community, especially students.	c) Many members of the school community are committed to STEM education and understand the value of collaborative practices and problem-based learning for the overall benefit of the school community, especially students.	c) All members of the school community are committed to STEM education and understand the value of collaborative practices and problem-based learning for the overall benefit of the school community, especially students.

Artifacts that demonstrate a STEM-infused Mission and Vision

- Agendas and minutes of meetings evidencing discussions of STEM integration into mission and vision
- Evidence of the integration of STEM education within the Comprehensive Education Plan
- Visibility and articulation of a STEM-infused mission and vision by stakeholders (e.g., social media postings, posters, newsletter, bulletin boards)
- Explicit opportunities for planning and professional learning to enhance STEM education within the school community

Domain I: School Vision and Structures for Success

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
1.2 **STEM-centric Culture** **A school fosters an environment of innovation, risk-taking, and transdisciplinary collaboration that supports student-centered inquiry use of engineering practices, digital literacy and project-based learning.**	a) There is a positive atmosphere supportive of innovation and risk-taking among a few members of the school community.	a) There is a positive atmosphere supportive of innovation and risk-taking among some members of the school community.	a) There is a positive atmosphere supportive of innovation and risk-taking among most members of the school community.	a) There is a positive atmosphere supportive of innovation and risk-taking among all school stakeholders, including students.
	b) The school rarely encourages the importance of a growth mind-set and the role of failure and productive struggle in STEM education.	b) The school occasionally encourages the importance of a growth mind-set and the role of failure and productive struggle in STEM education.	b) School leaders and staff often encourage the importance of a growth mind-set and the role of failure and productive struggle in STEM education.	b) School leaders and staff understand and emphasize the importance of a growth mind-set and the role of failure and productive struggle in STEM education.
	c) Few school leaders, staff, students, and parents understand the importance of leaving the school building to explore the built and natural world and the amazing resources NYC offers.	c) Some school leaders, staff, students, and parents understand the importance of leaving the school building to explore the built and natural world and the amazing resources NYC offers.	c) Most school leaders, staff, students, and parents understand the importance of leaving the school building to explore the built and natural world and the amazing resources NYC offers.	c) School leaders, staff, students, and parents understand the importance of leaving the school building to explore the built and natural world and the amazing resources NYC offers.
	d) School leaders and staff are developing a process to evaluate the quality of their STEM-centric culture and how goals and expectations are developed and shared among school stakeholders.	d) School leaders and staff occasionally monitor the quality of their STEM-centric culture and how goals and expectations are developed and shared among school stakeholders.	d) School leaders and staff regularly monitor and review the quality of their STEM-centric culture and how goals and expectations are developed and shared among school stakeholders.	d) School leaders and staff consistently monitor and refine the quality of STEM-centric culture and how goals and expectations are communicated among school stakeholders including students.

continued

Domain I: School Vision and Structures for Success

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
1.2 STEM-centric Culture (continued)	e) Few or no classrooms/labs are designed and arranged with flat tables and access to electricity to support group work, project-based learning, and collaboration.	e) Limited classrooms/labs are designed and arranged with flat tables and access to electricity to support group work, project-based learning, and collaboration.	e) Some classrooms/labs are designed and arranged with flat tables and access to electricity to support group work, project-based learning, and collaboration.	e) Most classrooms/labs are designed and arranged with flat tables and access to electricity to support group work, project-based learning, and collaboration.
	f) Few structures for interdisciplinary and transdisciplinary work are established, such as teacher teams, Professional Learning Communities (PLCs), and Cycles of Learning. There are few opportunities for educators to collaborate on the development of interdisciplinary lessons, units, and curricula.	f) Limited structures for interdisciplinary and transdisciplinary work are established, such as teacher teams, Professional Learning Communities (PLCs), and Cycles of Learning. There are limited opportunities for educators to collaborate on the development of interdisciplinary lessons, units, and curricula.	f) Some structures for interdisciplinary and transdisciplinary work are established, such as teacher teams, Professional Learning Communities (PLCs), and Cycles of Learning. There are regular opportunities for educators to collaborate on the development of interdisciplinary lessons, units, and curricula.	f) Multiple structures for interdisciplinary and transdisciplinary work are established, such as teacher teams, Professional Learning Communities (PLCs), and Cycles of Learning. There are regular opportunities for educators to collaborate on the development of interdisciplinary lessons, units, and curricula.

Artifacts that demonstrate a STEM-centric Culture

- Evidence of lesson plans, unit plans, course descriptions, and/or curriculum maps that integrate STEM content
- Analysis and application of school survey data to support the development of a STEM-centric culture
- Evidence of STEM-centric Professional Learning Communities and opportunities for participants to share their ongoing learning
- Student STEM-centric work posted throughout the school and shared with stakeholders and families

Domain I: School Vision and Structures for Success

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
1.3 **STEM Program Evaluation** **A school assesses the level of implementation of its STEM-integrated mission and vision and is able to make adjustments as needed to increase the coherence of policies and practices across the school's daily functions.**	a) The school is developing a process to monitor, evaluate, and/or adjust STEM curricular and instructional practices in response to student learning needs, progress, and achievement.	a) The school has a process in place to monitor, evaluate, and/or adjust STEM curricular and instructional practices in response to student learning needs, progress, and achievement.	a) The school has a process in place to regularly monitor, evaluate, and adjust STEM curricular and instructional practices in response to student learning needs, teacher team feedback, and student progress and achievement.	a) The school has a process in place to purposefully and effectively monitor, evaluate, and adjust STEM curricular and instructional practices in response to student learning needs, and teacher team feedback, and student progress and achievement.
	b) The school is establishing a STEM leadership team including families and school administration to engage in the implementation of STEM education initiatives.	b) The STEM leadership team includes families and school administration and meets infrequently, which fosters limited implementation of STEM education initiatives.	b) The STEM leadership team includes families, school administration, and key stakeholders and meets regularly to foster implementation of STEM education initiatives.	b) The STEM leadership team includes families, school administration, and all key stakeholders and meets regularly to effectively support and direct the implementation of STEM education initiatives.

Artifacts that demonstrate STEM Program Evaluation

- Needs assessment and reflections by the school community (including but not limited to administrators, teachers, students, and families) that represent the implementation of STEM education
- Evidence of adjustments and/or modifications of STEM-centric curricular resources
- Evidence of a STEM leadership team implementation plan

Domain I: School Vision and Structures for Success

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
1.4 **Budget/Management of Resources** **School-based decisions regarding the allocation of STEM funding develop and sustain an integrated STEM mission and vision to address students' learning needs.**	a) The STEM leadership team, including families and school administration, has been assembled to support discussion of funding needs, allocations, and resources for STEM education.	a) The STEM leadership team, including families and school administration, meets to support a STEM program's long-term funding needs, allocations, and resources; these individuals may include but are not limited to the school leadership team, community partners, and other stakeholders.	a) The STEM leadership team, including families and school administration, meets regularly to support a STEM program's long-term funding and resource needs. These individuals may include but are not limited to the school leadership team, community partners, and other stakeholders.	a) The STEM leadership team, including families and school administration, meets regularly to effectively support a STEM program's long-term funding and resource needs. These individuals may include but are not limited to the school leadership team, community partners, and other stakeholders.
	b) There are no discussions about working with other schools or partners and sharing costs.	b) Discussions to work with other schools or partners and share costs are considered.	b) Decisions have been made to work with other schools or partners and share resources and/or costs. Plans are in place to visit nearby schools with similar STEM initiatives to discuss possibilities.	b) The school is part of a collaborative partnership. Decisions have been made to work with other schools and partners and share resources and/or costs. Regular opportunities to visit and plan with schools and partners with similar STEM initiatives are in place.
	c) Plans are not in place to secure needed funding.	c) A plan is in place to secure needed grants, donations, and other outside funding to support a variety of initiatives, but the plan is not STEM-specific.	c) A plan is in place to secure needed grants, donations, and other outside funding to support and advance the dedication to STEM education initiatives.	c) Needed grants, donations, and other outside funding are in place to support and advance the implementation of STEM education initiatives.
	d) Limited tax levy funds are allocated to STEM education initiatives.	d) Moderate tax levy funding is allocated to STEM education initiatives.	d) Sufficient tax levy funds are allocated to STEM education initiatives.	d) Ample tax levy funds are allocated to STEM education initiatives.

continued

Domain I: School Vision and Structures for Success

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
1.4 Budget/Management of Resources (continued)	e) Funds for STEM education are limited to the cost of needed materials. Teachers often compete for funding.	e) Funds for STEM education are limited to the cost of materials and STEM-specific resources.	e) Funds for STEM education include, but are not limited to, the cost of personnel, materials, STEM-specific resources, and professional development.	e) Funds for STEM education include, but are not limited to, the cost of personnel, materials, STEM-specific resources, professional development, new technology, funding for STEM partners, and for travel to STEM conferences and events.
	f) Staff has limited access to technology and maintenance. Equipment is often inoperable for extended periods of time.	f) Technology is sometimes inoperable for extended periods of time. Support is lacking.	f) Technology is regularly maintained. Support has to be requested.	f) Staff has on-demand access to needed technology, maintenance, and support.
	g) No other resources are aligned to STEM activities and a STEM-centric culture.	g) Some other resources are aligned to STEM activities and a STEM-centric culture.	g) Other resources are aligned to STEM activities and a STEM-centric culture.	g) Many other resources are aligned to STEM activities and a STEM-centric culture.

Artifacts that demonstrate Budget/Management of Resources

- Budget including the allocation of funds used for STEM education initiatives
- STEM leadership team meeting agendas, minutes, etc.
- Evidence of keeping accurate records of STEM resources being maintained
- STEM grant award letters and records of donations given to STEM programs

Domain II: STEM Curriculum, Instruction, and Assessment

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
2.1 **Academic Rigor and Instructional Quality** **A well-defined STEM education program promotes cognitively challenging, relevant, and authentic learning experiences that encourage students to apply STEM concepts to real-world situations.**	a) A culture of inquiry, engineering design and practice, innovation, and risk-taking is developing in selected classrooms. Instruction is usually teacher-centered, and students are often unable to clearly articulate the purpose and content of their work.	a) A culture of inquiry, engineering design and practice, innovation, and risk-taking is developing in some classrooms. Instruction is sometimes student-centered, and some students are able to clearly articulate the purpose and content of their work.	a) A culture of inquiry, engineering design and practice, innovation, and risk-taking exists in many classrooms (including with students). Instruction is often student-centered, and most students are able to clearly articulate the purpose and content of their work.	a) A culture of inquiry, engineering design and practice, innovation, and risk-taking is evident across the school community (including with students) and among all stakeholders. Instruction is always student-centered, and all students are able to clearly articulate the purpose and content of their work.
	b) STEM curricula and instructional supports do not adequately provide emphasis on academic rigor and the use of 21st-century skills. Supports for differentiation to improve the achievement and inclusion of female students, underrepresented minorities, English Language Learners, students with disabilities, and struggling students are not evident.	b) STEM curricula and instructional supports provide limited emphasis on academic rigor and the use of 21st-century skills. Some supports are provided for differentiation to improve the achievement and inclusion of female students, underrepresented minorities, English Language Learners, students with disabilities, and struggling students.	b) STEM curricula and instructional supports emphasize academic rigor and the use of 21st-century skills. Adequate supports are provided for differentiation to improve the achievement and inclusion of female students, underrepresented minorities, English Language Learners, students with disabilities, and struggling students.	b) STEM curricula and instructional supports consistently emphasize academic rigor, the use of 21st-century skills and provide effective and high-quality supports for differentiation to improve the achievement and inclusion of female students, underrepresented minorities, English Language Learners, students with disabilities, and struggling students.
	c) Teaching practices are partially aligned to the school's STEM mission, vision, and expectations in selected STEM classrooms.	c) Teaching practices are aligned to the school's STEM mission, vision, and expectations in some STEM classrooms.	c) Teaching practices are aligned to the school's STEM mission, vision, and expectations in most STEM classrooms.	c) Teaching practices are purposefully and effectively aligned to the school's STEM mission, vision, and expectations in all STEM classrooms.

continued

Domain II: STEM Curriculum, Instruction, and Assessment

2.1
Academic Rigor and Instructional Quality
(continued)

Artifacts that demonstrate Academic Rigor and Instructional Quality

- Evidence of the integration and application of two or more STEM disciplines into curriculum maps, lessons, units, and/or syllabi
- Evidence of instructional strategies promoting critical thinking skills and real-world problem solving, active learning and/or the use of 21st-century skills (e.g., whole-group and small-group discussions, Socratic seminars, and project-based inquiry)
- Evidence of lesson plans, teaching practices, student work, student contracts and/or parent/teacher conferences that demonstrate alignment to school expectations in their STEM integrated mission and vision
- Academic Intervention Services (AIS) programs geared toward STEM enrichment through the use of research validated teaching practices

Domain II: STEM Curriculum, Instruction, and Assessment

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
2.2 STEM-centric Curriculum **A well-defined STEM education program establishes a culture of inquiry that promotes and supports the development of innovative thinking, engineering design, scientific and digital literacy, computational thinking, problem solving, and 21st-century skills, which align to State and Common Core Learning Standards.** **STEM programs provide opportunities for students to engage in extracurricular activities in school or after school with partner organizations where they are able to learn and apply STEM concepts in real-world situations.**	a) Discipline-specific content is rarely integrated across STEM disciplines or focuses on creativity, innovation and the explicit and meaningful integration of technology to find solutions to real-world problems.	a) Discipline-specific content is sometimes integrated across STEM disciplines and focuses on creativity, innovation and the explicit and meaningful integration of technology to find solutions to real-world problems.	a) Discipline-specific content is regularly integrated across STEM disciplines and focuses on creativity, innovation and the explicit and meaningful integration of technology to find solutions to real-world problems.	a) Discipline-specific content is purposefully and effectively integrated across STEM disciplines and focuses on creativity, innovation and the explicit and meaningful integration of technology to find solutions to real-world problems.
	b) Teachers sporadically differentiate STEM curricula to meet the needs of all students. Student-centered instruction is rare. The STEM curriculum sparks few students' interest and engages few students.	b) Teachers occasionally differentiate STEM curricula to meet the needs of all students. Student-centered instruction is limited. The STEM curriculum sparks some students' interest and engages some students.	b) Teachers consistently differentiate STEM curricula to meet the needs of all students. Instruction is often student-centered. The STEM curriculum sparks many students' interest and engages many students.	b) Teachers purposefully and effectively differentiate STEM curricula to meet the needs of all students. Instruction is mostly student-centered. The STEM curriculum sparks all students' interest and engages all students.
	c) Minimal time is allotted to support STEM education including the integration and application across two or more STEM disciplines.	c) Limited time is allotted to support STEM education including the integration and application across two or more STEM disciplines.	c) Adequate time is allotted during and/or after school to support STEM education including the integration and application across two or more STEM disciplines.	c) Significant time is allotted during and after school to support STEM education including the integration and application across two or more STEM disciplines.
	d) STEM teachers minimally provide access to ALL students to engage in authentic STEM education experiences including but not limited to the use of engineering design practices, the meaningful integration of technology, and project-based learning.	d) STEM teachers occasionally provide access to ALL students to engage in authentic STEM education experiences including but not limited to the use of engineering design practices, the meaningful integration of technology, and project-based learning.	d) STEM teachers regularly provide access to ALL students to engage in authentic STEM education experiences including but not limited to the use of engineering design practices, the meaningful integration of technology, and project-based learning.	d) STEM teachers purposefully and effectively provide access to ALL students to engage in authentic STEM education experiences including but not limited to the use of engineering design practices, the meaningful integration of technology, and project-based learning.

continued

Domain II: STEM Curriculum, Instruction, and Assessment

2.2
STEM-centric Curriculum
(continued)

Artifacts that demonstrate a STEM-centric Curriculum

- Evidence of STEM-enriched curriculum maps, unit plans, and lessons illustrating opportunities for the student application of STEM content and 21st-century skills utilizing the engineering design process and/or inquiry and that are aligned to appropriate standards
- Evidence of a pacing calendar that explicitly indicates the amount of time that is devoted to STEM curricula and the integration of the four STEM disciplines
- Evidence of STEM curricula that is differentiated via content, product, and/or process to meet the needs of all learners
- Evidence of authentic learning experiences, such as project-based learning (PBL), for students to interact w/STEM professionals, universities, and/or partners in STEM

Domain II: STEM Curriculum, Instruction, and Assessment

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
2.3 Authentic Assessments **A well-defined STEM education program engages students in relevant and authentic STEM aligned assessments and consistently monitors student progress in order to guide and encourage student reflection and self-assessment.**	a) Teachers sporadically collaborate to identify or develop relevant, authentic, performance-based assessments.	a) Teachers occasionally collaborate to identify or develop relevant, authentic, performance-based assessments.	a) Teachers regularly collaborate to identify or develop relevant, authentic, performance-based assessments.	a) Teachers consistently and effectively collaborate to identify or develop relevant, authentic, performance-based assessments.
	b) Teachers sporadically use rubrics and authentic assessments (projects, portfolios, oral presentations, journals, etc.) to measure success. There are no opportunities for students to self-assess and to present their work to authentic audiences (their peers, families and other stakeholders), answer questions and receive feedback.	b) Teachers occasionally use rubrics and authentic assessments (projects, portfolios, oral presentations, journals, etc.) to measure success. There are infrequent opportunities for students to self-assess and to present their work to authentic audiences (their peers, families and other stakeholders), answer questions and receive feedback.	b) Teachers (and students) regularly use rubrics and authentic assessments (projects, portfolios, oral presentations, journals, etc.) to measure success. There are some opportunities for students to self-assess and to present their work to authentic audiences (their peers, families and other stakeholders), answer questions and receive feedback.	b) Teachers (and students) consistently and effectively use rubrics and authentic assessments (projects, portfolios, oral presentations, journals, etc.) to measure success. There are regular opportunities for students to reflect, self-assess and present their work to authentic audiences (their peers, families and other stakeholders).
	c) Teachers sporadically use authentic formative and culminating summative assessments to periodically check for understanding guide next-step decisions for instruction and make curricular adjustments.	c) Teachers occasionally use authentic periodic formative and culminating summative assessments to periodically check for understanding guide next-step decisions for instruction and make curricular adjustments.	c) Teachers regularly use authentic periodic formative and culminating summative assessments to check for understanding, provide feedback and guide next-step decisions for instruction and making curricular adjustments.	c) Teachers consistently and effectively use authentic periodic formative and culminating summative assessments to check for understanding, provide students with specific feedback and guide next-step decisions for instruction and making curricular adjustments.

continued

Domain II: STEM Curriculum, Instruction, and Assessment

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
2.3 Authentic Assessments (continued)	d) **Cycles of Learning** are rarely used by teachers and stakeholders to plan, implement, reflect, adjust and share lessons learned.	d) **Cycles of Learning** are occasionally used by teachers and stakeholders to plan, implement, reflect, adjust and share lessons learned.	d) **Cycles of Learning** are regularly used by teachers and stakeholders to plan, implement, reflect, adjust and share lessons learned.	d) **Cycles of Learning** are used effectively by teachers and stakeholders to plan, implement, reflect, adjust and share lessons learned.

Artifacts that demonstrate Authentic Assessments

- Evidence of opportunities within curricula that allow students to demonstrate understanding of STEM content through the development of innovative solutions to community-based projects
- Evidence of engaging STEM professionals in the evaluation of authentic performance-based assessments
- Evidence of the use of formative assessment to monitor student progress and benchmark (interim) assessments to enhance student understanding and curricula
- Evidence of a school schedule that provides time for teachers to regularly collaborate and develop authentic performance based assessments

Domain II: STEM Curriculum, Instruction, and Assessment

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
2.4 **Staff Capacity** **A well-defined STEM education program builds teacher content and pedagogical knowledge in order to support the successful implementation of STEM learning experiences.**	a) A plan is being developed by the school leadership team to build teacher content and pedagogical knowledge throughout the school year to support the school's capacity to implement STEM education.	a) A collaborative plan is being developed by the school leadership team and a group of interested teachers to build teacher content and pedagogical knowledge throughout the school year to support the school's capacity to implement STEM education.	a) A collaborative plan has been developed by the school leadership team and lead teachers to build teacher content and pedagogical knowledge throughout the school year and enhance the school's capacity to implement STEM education.	a) A high-quality and effective collaborative plan has been developed by the school leadership team and all STEM teachers to build teacher content and pedagogical knowledge throughout the school year and enhance the school's capacity to implement STEM education.
	b) School stakeholders sporadically share research and best practices but have no plans to participate in learning experiences (on- or off-site) to increase STEM content and pedagogical knowledge.	b) School stakeholders occasionally share research and best practices and participate in at least one learning experience (on- or off-site) to increase STEM content and pedagogical knowledge.	b) School stakeholders consistently share research and best practices and participate in twice yearly learning experiences (on- or off-site) to increase STEM content and pedagogical knowledge.	b) School stakeholders purposefully and effectively share research and best practices and participate in multiple learning experiences (on- or off-site) to increase STEM content and pedagogical knowledge.
	c) Information about STEM programs and/or STEM opportunities are shared sporadically with school stakeholders and with educators from partner organizations.	c) Information about STEM programs and/or STEM opportunities are shared occasionally among school stakeholders and with educators from partner organizations.	c) Information about STEM programs and/or STEM opportunities are consistently shared among all school stakeholders and with educators from partner organizations.	c) Information about STEM programs and/or STEM opportunities are shared purposefully and effectively among all school stakeholders and with educators from partner organizations.

Artifacts that demonstrate Staff Capacity

- Evidence of opportunities (on- and off-site) that support professional learning in STEM content and pedagogy
- Evidence of collaborative professional learning communities that support the implementation and refinement of best practices through the use of inter-visitation
- Evidence of digital (such as social media) or print media that inform all stakeholders of STEM programs and opportunities

Domain III: Strategic Partnerships

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
3.1 **STEM Partnerships** **A well-defined STEM education program identifies and secures key partnerships with families, local community-based organizations (CBOs), businesses, informal institutions of learning, and schools of higher education (two- and four-year programs) to enhance students' learning experiences in STEM Education.** **See Conversation Tools for Building and Sustaining Partnerships.*	a) The STEM leadership team, including families and school administration, are formulating a strategy to develop partnerships with local community-based organizations (CBOs), informal institutions of learning , and schools of higher education (two- and four-year programs) to enhance students' learning experiences in STEM education.	a) The STEM leadership team, including families and school administration, are developing a process to establish partnerships with local community-based organizations (CBOs), informal institutions of learning , and schools of higher education (two- and four-year programs) to enhance students' learning experiences in STEM education.	a) The STEM leadership team, including families and school administration, have established partnerships with local community-based organizations (CBOs), informal institutions of learning , and schools of higher education (two- and four-year programs) to enhance students' learning experiences in STEM education.	a) The STEM leadership team, including families and school administration, have established purposeful and effective partnerships with local community-based organizations (CBOs), informal institutions of learning , and schools of higher education (two- and four-year programs) to enhance students' learning experiences in STEM education.
	b) Family members and other mentors working in STEM career fields are minimally engaged in supporting a school's approach to STEM education.	b) Family members and other mentors working in STEM career fields are encouraged to support a school's approach to STEM education.	b) Family members and other mentors working in STEM career fields are engaged as partners in supporting a school's approach to STEM education. Opportunities for them to speak to students about their careers happen yearly on Career Day.	b) Family members and other mentors working in STEM career fields are engaged as partners and key stakeholders in supporting a school's approach to STEM education. Opportunities for them to speak to students about their careers happen regularly.
	c) There are limited opportunities for the development of partnerships with other pre-K–12 local schools that demonstrate similar interests in STEM education.	c) There are some opportunities for the development of partnerships with other schools pre-K–12 that demonstrate similar interests in STEM education.	c) There are regular opportunities to foster the development of partnerships with other schools pre-K–12 that demonstrate similar interests in STEM education.	c) There are purposeful and effective partnerships with other schools pre-K–12 that demonstrate similar interests in STEM education.

continued

Domain III: Strategic Partnerships

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
3.1 STEM Partnerships (continued)	d) There are limited opportunities leading to student and family participation in off-site learning opportunities with STEM-centric organizations.	d) There are some opportunities leading to student and family participation in off-site learning opportunities with STEM-centric organizations.	d) There are regular opportunities for student and family participation in off-site learning opportunities with STEM-centric organizations and higher education institutions.	d) There are purposeful and effective opportunities for student and family participation in off-site learning opportunities with STEM-centric organizations and higher education institutions.
	e) The school is developing a plan that maps out a communication process with some stakeholders focused on supporting STEM education.	e) The school has developed a plan that maps out a process of communication with stakeholders focused on supporting STEM educations but communication is irregular.	e) The school regularly communicates with all stakeholders, including families, about the school's STEM education initiatives. Tools such as emails, websites, and newsletters, are used to share information.	e) The school purposefully and effectively communicates information with all stakeholders, including families, about the school's STEM education initiatives. Tools such as emails, websites, newsletters and social media platforms are used to share information.
	f) The school does not use information from local community-based organizations (CBOs), science-rich institutions, and schools of higher education (two- and four-year programs) to assess students' progress about student's experiences in STEM education.	f) The school has a plan to use information from local community-based organizations (CBOs), science-rich institutions, and schools of higher education (two- and four-year programs) to assess students' progress about student's experiences in STEM education.	f) The school occasionally uses information from local community-based organizations (CBOs), science-rich institutions, and schools of higher education (two- and four-year programs) to assess students' progress about student's experiences in STEM education.	f) The school regularly uses information from local community-based organizations (CBOs), science-rich institutions, and schools of higher education (two- and four-year programs) to assess students' progress about student's experiences in STEM education.

continued

Domain III: Strategic Partnerships

3.1
STEM Partnerships
(continued)

Artifacts that demonstrate STEM Partnerships

- Evidence of off-site learning for students and families at STEM institutions and/or university partners
- Evidence of collaboration, communication, and implementation between educators and STEM partners
- Evidence of family engagement including but not limited to STEM family outreach surveys, STEM family events, STEM maker fairs, and family communications
- Attending ongoing professional learning experiences such as the DOE STEM Institute, which fosters forming new partnerships and collaborations
- Ongoing collaboration and inter-visitation among schools with similar interests in STEM education

Domain IV: STEM College and Career Readiness

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
4.1 **STEM Pathway Preparation for Elementary School** **A well-defined STEM education program provides early college awareness to all students, introducing them to the preparation required to pursue a STEM degree (two- or four-year) and/or STEM career and includes learning experiences outside the school.**	a) A process is being developed to provide opportunities for teachers and students to visit middle and high school STEM education programs and interact with middle and high school teachers and students.	a) There are limited opportunities for teachers and students to visit middle and high school STEM education programs and interact with middle and high school teachers and students.	a) There are regular opportunities for teachers and students to visit middle and high school STEM education programs and interact with middle and high school teachers and students.	a) There are ongoing opportunities for teachers and students to visit middle and high school STEM education programs and interact with middle and high school teachers and students.
	b) There are few opportunities in and out of school time that support families in helping their children develop positive growth mind-sets and aspirations.	b) There are limited opportunities in and out of school time that support families in helping their children develop positive growth mind-sets and aspirations.	b) There are regular opportunities in and out of school time that support families in helping their children develop positive growth mind-sets and aspirations.	b) There are ongoing opportunities in and out of school time that support families in helping their children develop positive growth mind-sets and aspirations.
	c) The school, staff, and stakeholders provide limited guidance to families to raise awareness about the importance of learning opportunities in museums, parks, gardens, etc.	c) The school, staff, and stakeholders provide some guidance to families to raise awareness about the importance of learning opportunities in museums, parks, gardens, etc.	c) The school, staff, and stakeholders provide regular guidance to families to raise awareness about the importance of learning opportunities in museums, parks, gardens, etc.	c) The school, staff, and stakeholders provide ongoing guidance to families to raise awareness about the importance of learning opportunities in museums, parks, gardens, etc.

continued

Domain IV: STEM College and Career Readiness

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
4.1 **STEM Pathway Preparation for Elementary School** **(continued)**	d) There are limited or no opportunities for the administration and staff, including guidance counselors, to talk to students and families about the important roles attendance, punctuality, homework, collaboration, effort, self-discipline, persistence, resilience, promotion, and self-management play in college and career readiness.	d) There are some opportunities for the administration and staff, including guidance counselors, to talk to students and families about the important roles attendance, punctuality, homework, collaboration, effort, self-discipline, persistence, resilience, promotion, and self-management play in college and career readiness.	d) There are regular opportunities for the administration and staff, including guidance counselors, to talk to students and families about the important roles attendance, punctuality, homework, collaboration, effort, self-discipline, persistence, resilience, promotion and self-management play in college and career readiness.	d) There are ongoing on going opportunities for the administration and staff including guidance counselors to talk to students and families about the important roles attendance, punctuality, homework, collaboration, effort, self-discipline, persistence, resilience, promotion and self-management play in college and career readiness.

Artifacts that demonstrate student access to STEM Pathway Preparation for Elementary School

- Evidence of student voices during the preparation and facilitation of STEM-centric events (e.g., STEM career expo)
- Evidence of middle and high school students tutoring and/or mentoring elementary students in STEM disciplines
- “College Knowledge” and “College Talk” assemblies in which students gather to learn information about preparation for college and STEM careers

Domain IV: STEM College and Career Readiness

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
4.2 **Access to STEM college and career opportunities for middle and high school students** **A well-defined STEM education program provides all students with opportunities to broaden their understanding of the requirements of pursuing and obtaining degrees and/or careers in STEM and includes learning experiences outside the school and engagement with external partners.** **The STEM program provides opportunities for students to engage in extracurricular activities, mentorships, and internships where they are able to apply STEM concepts in real-world situations.**	a) The school prepares a minimal amount of students for post-secondary STEM education and/or STEM career tracks by providing limited access to electives, extracurricular activities, and STEM courses. Few STEM mentorships and internship opportunities are identified. Only high-achieving students are placed. Most families are unaware of the value of the internships.	a) The school prepares Some students for post-secondary STEM education and/ or STEM career tracks by providing Some access to electives, extracurricular activities, and STEM courses (on and off campus). Some STEM mentorships and internship opportunities are identified. High-achieving students are placed. Other students need to apply to be considered. Many families are unaware of the value of the internships.	a) The school sufficiently prepares all students for post-secondary STEM education and/or STEM career tracks by providing all students access to electives, extracurricular and enrichment activities, STEM courses (on and off campus); face-to-face and virtually. STEM mentorship and internship opportunities (with stipends or incentives if possible) are identified and are available to most students. Most families are aware of and know the value of internships.	a) The school fully prepares all students for post-secondary STEM education and STEM career tracks by providing all students access to purposeful electives, extracurricular and enrichment activities, STEM courses (on- and off-campus); face-to-face and virtually. STEM mentoring and internship opportunities (with stipends or incentives) are identified and matched with all students Who apply. All families are made aware of and know the value of internships.
	b) There are limited opportunities for the administration and staff including guidance counselors to talk to students and families about the importance of attendance, punctuality, homework, collaboration, effort, self-discipline, persistence, resilience, promotion, GPA and self-management that play a critical role in college and career readiness.	b) There are some opportunities for the administration and staff including guidance counselors to talk to students and families about the importance of attendance, punctuality, homework, collaboration, effort, self-discipline, persistence, resilience, promotion, GPA and self-management that play a critical role in college and career readiness.	b) There are regular opportunities for the administration and staff including guidance counselors to talk to students and families about the importance of attendance, punctuality, homework, collaboration, effort, self-discipline, persistence, resilience, promotion, GPA and self-management that play a critical role in college and career readiness.	b) There are ongoing opportunities for the administration and staff including guidance counselors to talk to students and families about the importance of attendance, punctuality, homework, collaboration, effort, self-discipline, persistence, resilience, promotion, GPA and self-management that play a critical role in college and career readiness.

continued

Domain IV: STEM College and Career Readiness

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
4.2 **Access to STEM college and career opportunities for middle and high school students** **(continued)**	c) MIDDLE SCHOOL: Opportunities for students and families to learn about the importance of taking STEM courses are limited.	c) MIDDLE SCHOOL: The administration and staff including guidance counselors talk to students and families at least twice yearly about the importance of taking STEM courses beginning in grade six.	c) MIDDLE SCHOOL: The administration and staff including guidance counselors regularly talk to students and families about the importance of taking STEM courses beginning in grade six.	c) MIDDLE SCHOOL: The administration and staff including guidance counselors talk to students and families often about the importance of taking STEM courses beginning in grade six.
	c) HIGH SCHOOL: Opportunities for students and families to learn about the importance of taking STEM courses are limited.	c) HIGH SCHOOL: The administration and staff including guidance counselors talk to students and families at least twice yearly about the importance of taking STEM courses, including computer science, AP courses, and four years of math and science beginning in freshman year.	c) HIGH SCHOOL: The administration and staff including guidance counselors talk to students and families regularly about the importance of taking STEM courses, including computer science, AP courses, and four years of math and science beginning in freshman year.	c) HIGH SCHOOL: The administration and staff including guidance counselors talk to students and families often about the importance of taking STEM courses, including computer science, AP courses, and four years of math and science beginning in freshman year.
	d) Opportunities for students and families to learn about scholarships, grants, financial aid and information about attending colleges; and, pursuing STEM careers are limited.	d) The school provides all students and families at least once a year with opportunities to learn about scholarships, grants, financial aid and information about attending 2- and 4- year colleges (private and public)on campuses and online; and, pursuing STEM careers.	d) The school provides all students and families with regularly opportunities to learn about scholarships, grants, financial aid and information about attending 2- and 4- year colleges (private and public) on campuses and online; and, pursuing STEM careers.	d) The school provides all students and families with ongoing opportunities to learn about scholarships, grants, financial aid and information about attending 2- and 4- year colleges (private and public) on campuses and online; and, pursuing STEM careers.

Artifacts that demonstrate Middle and High School Student access to STEM College and Career Opportunities

- Evidence of providing students and families with information (e.g., using social media or school website) about the processes of obtaining internships, mentoring, and off-site learning experiences
- "College Knowledge" and "College Talk" assemblies in which students gather to learn information about preparation (academic and financial) for STEM college and careers
- Evidence of student voice during the preparation and facilitation of STEM-centric events (e.g., STEM fairs and competitions)

Domain IV: STEM College and Career Readiness

INDICATORS	EARLY	EMERGING	INTEGRATED	FULLY INTEGRATED
4.3 **Planning Student Outreach and Support for Pre-K–12 STEM Initiatives** **A well-defined STEM education program provides students with many pathways in which to build their capacity in STEM-centric content, abilities and professions.**	a) The school offers limited guidance to elementary, middle and high school students to support their application to and selection of schools and colleges that match their interests, experiences, background and abilities in STEM.	a) The school (guidance counselor)offers some guidance to elementary, middle and high school students and their families to support their application to and selection of schools and colleges that match their interests, experiences, background and abilities in STEM.	a) The school (guidance counselor)offers regular guidance to elementary, middle and high school students and their families to support their application to and selection of schools and colleges that match their interests, experiences, background and abilities in STEM.	a) The school (guidance counselor)offers effective and ongoing guidance to elementary, middle and high school students and their families to support their application to and selection of schools and colleges that match their interests, experiences, background and abilities in STEM.
	b) There are few opportunities for STEM professionals to interact with students and families that provide genuine exposure and experiences in STEM careers.	b) There are limited opportunities for STEM professionals to interact with students and families that provide genuine exposure and experiences in STEM careers.	b) The school coordinates regular visits and opportunities for STEM professionals to interact with students and families to provide genuine exposure and experiences in STEM careers.	b) The school coordinates ongoing visits and opportunities for STEM professionals to interact with students and families to provide genuine exposure and experiences in STEM careers.
	c) The school provides purposeful and ongoing opportunities for student to develop agency, advocacy and voice in pursuing STEM-related pathways.	c) The school limited opportunities for student to develop agency, advocacy and voice in pursuing STEM-related pathways.	c) The school provides regular opportunities for student to develop agency, advocacy and voice in pursuing STEM-related pathways.	c) The school provides purposeful and ongoing opportunities for student to develop agency, advocacy and voice in pursuing STEM-related pathways.
	d) The school provides infrequent opportunities for student to develop agency, advocacy and voice in pursuing STEM-related pathways.	d) Provide limited support toward helping students to complete STEM-related pathways.	d) Provide regular support toward helping students to complete STEM-related pathways.	d) Provide purposeful and ongoing support toward helping students to complete STEM-related pathways.

continued

Domain IV: STEM College and Career Readiness

4.3
Planning Student Outreach and Support for Pre-K–12 STEM Initiatives
(continued)

Artifacts that demonstrate Planning Student Outreach and Support for STEM Initiatives

- Evidence of student participation in STEM leadership team meetings
- Student-generated proposals demonstrating interest in developing a particular program or initiative
- Student surveys that access their interest in and knowledge of STEM-related pathways
- Logs of internship hours and artifacts related to internship experiences
- Evidence of peer mentoring and tutoring in support of completing STEM pathways

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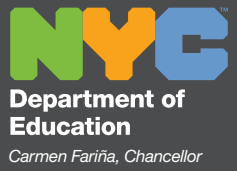
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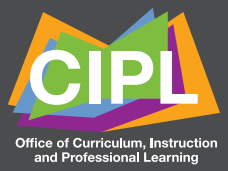
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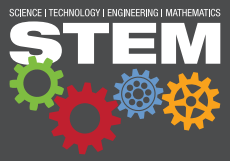
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STEM