



TOTAL INSTRUCTIONAL FOCUS: RIGOROUS AND ENGAGING CURRICULUM

A rigorous and engaging STEM curriculum aligns with state standards and integrates disciplines. By incorporating 21st century skills and technology, the curriculum affords opportunities for real-world experiences and promotes civic responsibility.

Standards-based

A viable STEM curriculum is based on state-adopted content standards. It is guided by research on how students learn, and what they are able to learn at different levels of their cognitive development. Currently in the US, 45 states have adopted the [Common Core State Standards](#) (CCSS) for math and ELA. According to the CCSS developers, the standards “are designed to ensure that students graduating from high school are prepared to go to college or enter the workforce and that parents, teachers and students have a clear understanding of what is expected of them. The standards are benchmarked to international standards to guarantee that our students are competitive in the emerging global marketplace.” A viable STEM curriculum reflects the goals of the CCSS and is based on these and other rigorous, state-adopted content standards.

Aligns K-12

Standards-based STEM curriculum is comprehensive, cohesive and connected across and within subjects and grade levels. Instruction and assessment practices support the content standards. Vertical alignment across grade levels identifies and eliminates gaps and overlaps in the curriculum. For example, within a district, all teachers of science K-12 may collaborate to see that all standards and concepts are taught and assessed at the appropriate level of rigor, ensuring prerequisite skills are addressed. This vertical process encourages learning that builds from grade to grade.

On the other hand, horizontal alignment occurs when teachers within the same subject have a clear understanding of what they must teach at their grade level and what students need to know and be able to do for that subject. Horizontal alignment ensures consistency of the knowledge and skills students possess as they move from one grade to the next. The implementation of a viable, aligned curriculum is essential to acquiring the knowledge and skills students need to experience success in STEM at each subsequent grade level.

Integrated, Real World

Teaching and learning with an integrated perspective mirrors the world of work where solutions require skills and knowledge from multiple disciplines. In their book, *Meeting Standards through Integrated Curriculum*, Susan Drake and Rebecca C. Burns have defined three categories of curriculum integration: multidisciplinary, interdisciplinary and trans-disciplinary. While there are multiple approaches within these categories, curriculum integration in a STEM school moves beyond integration of subjects in thematic units. It is the artful interweaving of rigorous academic standards to create meaningful learning experiences focused on innovation and solutions to current, real-world problems.

Categories of Curriculum Integration

Multidisciplinary	Interdisciplinary	Trans-disciplinary
<ul style="list-style-type: none"> • Disciplines are taught separately, but a common theme, skill or practice is infused into each. • Examples: Literacy across the curriculum; 21st century skills integrated across the curriculum; technology across the curriculum. 	<ul style="list-style-type: none"> • Processes, methods and language from more than one discipline are integrated to examine a topic or solve a problem. • Example: Students apply mathematical practices, writing processes and the scientific method to report on their analysis of water quality in their town. 	<ul style="list-style-type: none"> • All knowledge is interconnected and interdependent. • Example: Students design a school system for a poverty stricken country and engage knowledge from applicable disciplines as needed.

21st Century Skills and Technology

In STEM schools, 21st century practices are embedded in the curriculum to promote content mastery and facilitate real world investigations, applications and innovations. These practices include 21st Century skills and technology proficiencies that enable students to:

- Communicate ideas clearly, verbally and in writing for multiple purposes and audiences, locally and globally.
- Collaborate with classmates and other stakeholders to make decisions, solve problems and advance common goals.
- Create and innovate using a design process.
- Think critically, assimilating core knowledge and key ideas to address complex topics.
- Understand and use the most appropriate technology for a given task.

These practices are an integral part of teaching and learning in the STEM classroom, as teachers provide opportunities for students to apply important academic concepts in real world contexts.

Promotes Civic Responsibility

STEM-minded schools equip learners with skills and confidence to think and act in STEM-relevant aspects of civic life. Students learn the value of being informed, financially literate and productive citizens of their communities, state, nation and globe. A learning opportunity in a STEM classroom might require students to construct evidence-based arguments for or against a given candidate, based on the candidate's tax policy proposals for small businesses or farmers in their state. Another assignment might have students use data to analyze the impact of a proposed business on the local natural habitat vs. its effect on the local economy in their town, or in a village in a foreign land. A viable STEM curriculum provides students with experiences that focus on their civic rights and responsibilities as well as how their actions affect the rights of others.

A viable STEM curriculum is the result of a rigorous developmental cycle including expert review, field-testing and revision based on data about student learning. STEM schools systematically review their curriculum for effectiveness. All stakeholders have input into this process to ensure the curriculum remains challenging and current in its application, preparing students to flourish in an ever-evolving and demanding world.

Bibliography

Burns, Rebecca, and Drake, Susan. Meeting Standards through Integrated Curriculum. Alexandria, VA: ASCD. 2004. Print.

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Success at the Core. Four Questions About Curriculum Alignment. Vulcan Productions. 2010.
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Guiding Questions

Use the reflection questions below to guide discussions. We recommend documenting evidence to support each question. Doing so will assist you in setting action plans, goals, and progress monitoring.

Standards-Based

- What processes are in place to ensure that your school's STEM curriculum is based on the Common Core State Standards and other state-adopted content standards?

Aligns K-12

- What are some things you are doing to identify and eliminate gaps and overlaps in the curriculum?
- What are some things you are doing to ensure that all teachers at the same grade level have clarity as to what they must teach?

Integrated, Real World

- What are some ways you are approaching teaching and learning from an integrated perspective?

21st Century Practices

- What are some examples of 21st century skills embedded in all curriculum at your school?
- What are some opportunities teachers provide students to apply important academic concepts in real world contexts?

Promotes Civic Responsibility

- How are you equipping students with the skills and confidence to think and act in STEM relevant aspects of civic life?