# Overview

The vision of the 2016 MA STE standards is to engage students in the core ideas (content) through the integration of the science and engineering practices, while making connections to what they know and the world they live in. ESE has identified five components districts should attend to when designing a rigorous, coherent and relevant pre-K-12 STE education program. Educators, administrators and curriculum designers can refer to this guide for brief descriptions and resources for each component.



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| Step 1: Setting a Shared Vision and Goals |
| Developing an STE vision and goals requires coherent district wide prek-12 planning and ongoing support for implementation that addresses both student learning and engagement.**Action Steps**:* Refer to the “STE Education for All Students” vision statement in the MA STE Curriculum Framework.
* Use the “Guiding Principles” from the Framework to inform your vision.
* Convene a team of PreK-12 educators, instructional leaders and administrators to develop and articulate goals, create a coherent plan that is vertically aligned and integrated with mathematics and literacy.
* Communicate and disseminate the vision and plan to families and other stakeholders.

**RESOURCES:** [STE Education for All Students Vision](http://www.doe.mass.edu/frameworks/scitech/2016-04/Vision.pdf), [Guiding Principles](http://www.doe.mass.edu/frameworks/scitech/2016-04/GuidingPrinciples.pdf), [A Framework K-12 Science Education](https://www.nap.edu/read/13165/chapter/4)  |

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| Step 2: Administrative, Instructional Leadership and Partner Support |
| Strong leadership is essential in promoting a vision for STE education for students and educators. Understanding the components of an effective STE program and how best to communicate and disseminate the vision and plan to all stakeholders is vital for success. Instructional leaders provide time for science instruction in every grade, as well as time for teacher learning and collaboration. In addition, an effective science program requires appropriate learning environments and the necessary resources for teachers and students to engage with the disciplinary core ideas and the science and engineering practices. It is also important to cultivate partners that have the resources, motivation, capacity and expertise to be supportive of implementation.**Action Steps:*** Instructional leaders and administrators should educate themselves about the 2016 STE Framework, especially the Guiding Principles, to understand the shifts and implications for curriculum and instruction.
* Administrators and science leaders should assist educators in adopting the STE vision and goals through incremental and ongoing change.
* Create opportunities for collaboration between educators, STE experts and community partners within and across districts and schools.
* Identify and establish networks that build capacity and teacher leadership opportunities and support educators to share and address problems of practice.

**RESOURCES:** [What to Look for Guides](https://www.doe.mass.edu/frameworks/observation/), [Guiding Principles](http://www.doe.mass.edu/frameworks/scitech/2016-04/GuidingPrinciples.pdf), [Guide to Implementing NGSS](https://www.nap.edu/catalog/18802/guide-to-implementing-the-next-generation-science-standards) |

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| Step 3: Curriculum Materials and Resources  |
| The STE standards are intended to drive engaging, relevant, rigorous and coherent instruction that emphasize student mastery of both disciplinary core ideas (concepts) and application of science and engineering practices (skills) to support readiness for citizenship, college and careers. The standards articulate a coherent progression of learning to develop student’s ability to apply their knowledge and skills to analyze and investigate the world around them. Districts should choose engaging, challenging, and accurate curriculum materials that are based on research on how children learn STE, as well as research about how to address student preconceptions.**Action Steps:*** Educators and leadership teams should complete an inventory of existing units and materials to determine whether these materials need to be supplemented or replaced to support and align to the 2016 STE Framework.
* Include key curriculum implementation components such as rigorous scope and sequence, professional development, classroom assessments and materials management.
* Consider critical resources; time, space, scientific tools and materials that provide equitable access for investigation and design projects.

**RESOURCES:**  [Crosswalks](http://www.doe.mass.edu/stem/resources/Crosswalk-revised.pdf), [Strand Maps](http://www.doe.mass.edu/stem/standards/StrandMaps.html), [Disciplinary Core Idea Matrix](http://www.doe.mass.edu/frameworks/scitech/2016-04/AppendixIII.pdf), [Science & Engineering Practices Matrix](http://www.doe.mass.edu/frameworks/scitech/2016-04/AppendixI.pdf), [STE Quality Review Rubric](https://www.doe.mass.edu/stem/ste/ste-rubric.docx), [Contexts for teaching STE](http://www.doe.mass.edu/frameworks/scitech/2016-04/AppendixIX.pdf), [STE labs](http://www.doe.mass.edu/frameworks/scitech/2016-04/AppendixVII.pdf), [Model STE Curriculum Units](https://www.doe.mass.edu/frameworks/mcu/) |

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| Step 4: Professional Learning Opportunities  |
| Develop learning experiences that support the STE vision and goals while addressing the needs of students, teachers, and administrators. These active learning experiences need to focus on specific STE content, connection to classroom practice, collaboration, equity and must be ongoing and sustainable. Learning opportunities should be differentiated to address the needs of individual teachers (i.e., moving from novice to competent and from competent to expert). **Action Steps:*** Design STE learning opportunities that identify and prioritize needs and examine values and beliefs of educators and administrators.
* STE learning opportunities may take place on or offsite and can include multi-day trainings, one-on-one instruction, coaching/mentoring, professional learning communities and cross district and community collaborations.

**RESOURCES­:** [High Quality Professional Development Planning and Assessing Resources](http://www.doe.mass.edu/pd/PlanAssess/default.html)  |

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| Step 5: Instruction and Assessment |
| Research on learning shows that to develop a coherent understanding of scientific explanations of the world, students need sustained opportunities to engage in the practices, work with the underlying science ideas and appreciate the interconnections among these practices and ideas over a period of years, not weeks or months. STE instructional approaches must engage all students and offer opportunities for them to collaborate and communicate their scientific ideas. Assessment assists teachers in improving classroom practice, planning curricula, developing self directed learners, reporting student progress, and evaluating programs. A strong system of STE assessment includes formative and summative classroom assessments and statewide summative assessments and reinforces consistent science instruction and learning for students to achieve the rigorous performance expectations set forth in the standards.**Action Steps:*** Develop a classroom culture that supports the vision for STE education by aligning teaching approaches, curricular resources and student tasks with the vision.
* Ensure that assessment is ongoing and an integral part of instruction. Collect assessment data for a variety of purposes; diagnose student needs, monitor progress, elicit preconceptions and misconceptions, and evaluate both student progress and teacher instruction.
* Be clear from the start how the data will be used so the right data can be collected and analyzed.

**Resources:** [2016STE standards](http://www.doe.mass.edu/frameworks/scitech/2016-04.pdf), [Developing Assessments for the NGSS](https://www.nap.edu/catalog/18409/developing-assessments-for-the-next-generation-science-standards) , [Instructional Leadership for Science Practices](http://www.sciencepracticesleadership.com/), [STEM Teaching Tools Practice Briefs](http://stemteachingtools.org/tools), [Statewide Science Assessments (MCAS)](http://www.doe.mass.edu/mcas/tdd/sci.html), [National Science Teachers Association (NSTA) Classroom Resources](http://ngss.nsta.org/Classroom-Resources.aspx)**RESOURCES- Guiding principles** |

**References:**

LASER model; Smithsonian Science Education Center: <https://ssec.si.edu/stemvisions-blog/professional-services-discusses-laser>

LASER Model: A Systemic and Sustainable Approach for Achieving High Standards in Science Education Summative Report Section 2: Overview (2015)<https://ssec.si.edu/sites/default/files/SSEC%20Summative%20Report%20Section%202%20Overview.pdf>

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National Research Council. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* <https://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts>