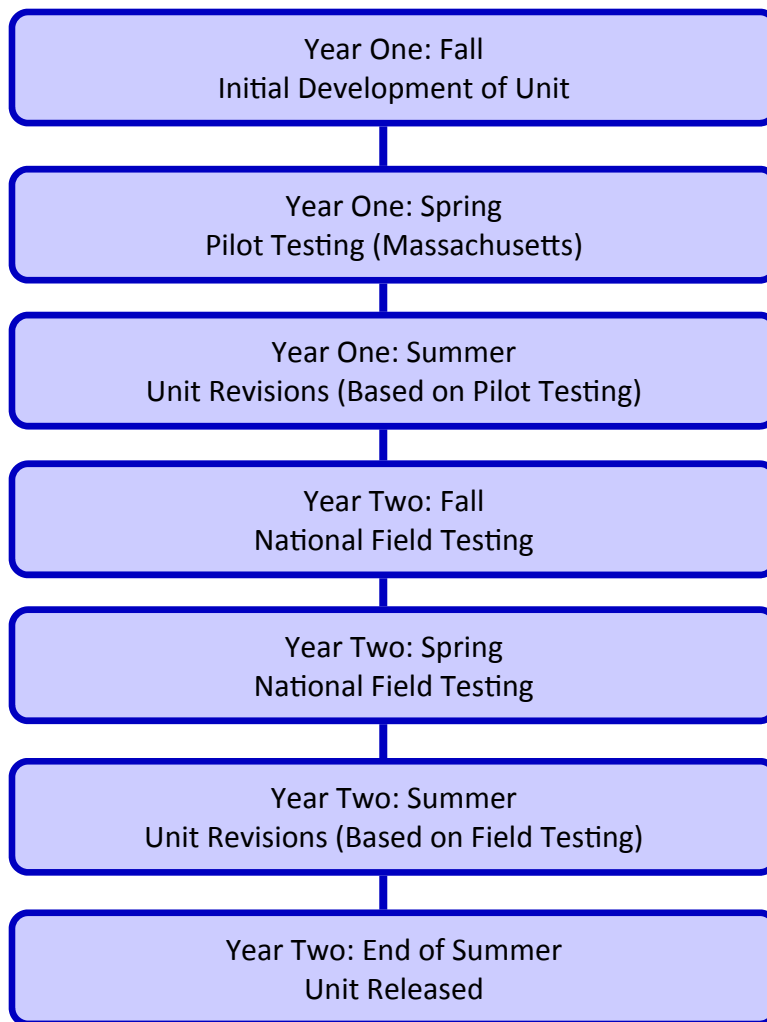




Curriculum Development Process

Each Engineering is Elementary curriculum includes over 3000 hours of development over the course of two years. In addition to this development time, units are pilot tested across Massachusetts and Field tested across the United States. Below is a typical unit development cycle beginning with background research and ending with unit release two years later.

Below is a summary of the development that each unit undergoes. Beyond that is a more detailed description of each step of the process.



CURRICULAR MAPPING

(Whole Curriculum):

1. Define Engineering Concepts / Essential Understandings
 - a. Review engineering and technology standards and science standards
 - b. Outline the "essential" list of concepts
 - c. Assure concepts are in accord with engineering and technology standards
 - d. Outline possible unit concepts & skills
2. Identify Core Content and Pedagogical Strategies
 - a. Review educational research about effective teaching strategies, cognitive development
 - b. Examine other high-quality curricular materials
 - c. Talk with other expert curricular materials developers
 - d. Identify a list of principles that guide content and pedagogy
 - e. Decide what types of materials and resources are needed in short and long-term
 - f. Identify an overarching format for the materials
3. Determine Curricular Materials and Format
4. Create Master List of Units to be Developed
 - a. Read FOSS, Gems, Insights and STC lessons to become familiar with lessons and objectives
 - b. Review FOSS/STC/etc. materials lists to create master lists of materials available
 - c. Try out some of the FOSS/STC/etc. experiments or schedule to observe in the classrooms
 - d. Identify corresponding field of engineering
 - e. Create a grid of FOSS/STC/etc. and correlate with potential design activities/ unit themes as well as standards
 - f. Research potential activities
 - g. Research potential resources
 - h. Revise grid of FOSS/STC/etc. and EiE while checking alignment with standards
 - i. Settle on unit concepts & skills

FOR EACH UNIT:

I. DEVELOPMENT

1. Identify Desired Understandings
 - a. Which engineering concepts will be particular to the unit?
 - b. Which science concepts?
 - c. What skills will be taught/reviewed?
 - d. Which enduring understandings will be emphasized?
2. Research Students' Conceptions
 - a. What prior research has been conducted about students' understanding of the science topic?
 - b. Conduct research, including interviews of students, to determine what students think about the engineering field for the unit as well as their understanding of key science and engineering concepts
 - c. Talk with teachers about what they understand and what resources they will need
 - d. Revise desired understandings if necessary
3. Plan for Assessment
 - a. Determine: What kinds of evidence are suitable to demonstrate desired understandings?
 - b. Develop rubrics
 - c. Develop open-ended and multiple-choice assessment questions
 - d. Plan outline of design challenge/what students need to demonstrate
 - e. Worksheets for gathering observation evidence
 - f. Plan for journal/student feedback/self-assessment
4. Plan Lessons & Activities
 - a. What kinds of activities will support learning of desired understandings?
 - b. What kinds of activities will prepare students for assessments?
 - c. Sequence & emphasis
 - d. Test main activity ideas for feasibility & develop
 - e. Cognitive interviews of students to test assessment items
5. Select Storyline Character, Setting, & Technology
 - a. What story line/technology/country & situation will best showcase & support the desired design activity and science learning?
 - b. Develop list of key ideas & understandings to focus on
 - c. Select a character: balance gender, ethnic cultures, and disabilities

6. Develop Preliminary Story Outline
 - a. Research technology & real-life engineering/setting for storyline
 - b. Research setting for historical, geographical and community project background
 - c. Develop a preliminary storyline/outline: Obstacles, problems? Dramatic tension? Surprises? Resolution?
 - d. Research name, customs, clothing and other factors important to the setting
7. Develop a Solid Draft of the Story
 - a. Share drafts in-house, collect feedback
 - b. Check against list of key ideas & understandings: sufficient emphasis?
 - c. Check against other key factors list: community emphasis, lesson activity, etc.
 - d. Plan for key factors & activities to be in illustrations
 - e. Editing (grammatical, text layout, etc.)
 - f. Revisions to near-final draft
8. Illustration
 - a. Meet with illustrator: share story, work on illustration ideas
 - b. Be sure key factors & activities will be represented in story
 - c. Review draft illustrations as they arrive & note problems to be fixed
 - d. Add final illustrations to story
9. Develop the First Draft of Lessons (simultaneous with 4, 5, 6 & 7)
 - a. Write up planned activities & lessons
 - b. Continue testing activities in-house; revisions
 - c. Write up duplication masters
 - d. What misunderstandings are likely? Difficulty with skills?
 - e. Edit /revise assessments to reflect findings from cognitive interviews as well as changes in lesson drafts
10. Lead Teacher First Review
 - a. Introduce unit materials to lead teachers in a workshop, review with them
 - b. Revise materials according to lead teacher feedback

II. PILOT TESTING

1. Pilot Testing, Feedback
 - a. Observe pilot lessons, take notes
 - b. Revise activities, lessons as needed and retest
 - c. Discuss with teachers. Feedback on usability, skill level, sophistication required, etc. Ideas for improvements
 - d. Have teachers complete Pilot Testing Feedback form
 - e. Have students from pilot classrooms and other classrooms complete the pilot version of written summative assessment
2. Lesson Review & Revision
 - a. Does the unit meet design criteria? Does it work towards desired understandings?
 - b. Statistical analysis of written assessment for reliability
 - c. Editing of all elements (story, lessons, assessments, etc.)
 - d. Revisions
3. Review by Experts
 - a. Review by experts in engineering, cognitive psychology, curriculum development, disabilities

III. FIELD TESTING

1. Field Testing, Feedback
 - a. Teachers use lessons
 - b. Observation of some lessons by field staff
 - c. Teachers complete Field Testing form. Feedback on usability, skill level, sophistication required, etc. Ideas for improvements
 - d. Interviews with a subset of teachers
 - e. Students complete field test version of written summative assessment
 - f. Statistical analysis of field test summative assessment to examine student learning overall, across learning objectives tested, and across demographic groups
2. Repeat Field Testing (If Necessary)
3. Final Revision of Unit