Introduction
Welcome to Barnes & Noble’s Story Design: Innovative STEAM Projects!

This is an exciting student-driven, high-engagement interdisciplinary program that combines science, technology, engineering, arts, and math with English Language Arts. In a Story Design lesson, students ...

- read and understand grade-level literature.
- identify conflicts in a literary text.
- identify a specific problem in the text that could have a practical, physical, or technological solution.
- design and propose a solution that incorporates science, technology, engineering, math, and design.
- construct, test, and improve a prototype of the solution.
- communicate the solution to the classroom or school community.

The Story Design approach is an example of problem-based learning, or PBL, a student-focused approach in which students learn by solving an open-ended problem using procedures they devise. PBL reflects how real people encounter, identify, evaluate, investigate, refine, and solve problems.

Research has shown that interdisciplinary problem-based learning experiences like Story Design increase student engagement and participation, encourage higher-order thinking skills, improve knowledge retention, and translate to better performance on assessments. In addition, students work in teams and practice 21st-century skills such as collaboration, critical thinking, and creativity.

Advantages for students often become advantages for instructors. Greater engagement and enthusiasm can make classroom management easier. An interdisciplinary approach offers a springboard for deeper investigation into subject-specific topics. Practical projects help ground more abstract skills and ideas such as reading comprehension or nature-of-science skills.

This guide includes instructions on how to implement the Story Design approach in your classroom, including teaching tips, materials lists, information on technology tools like classroom robots, and guidance on how to create your own lessons.

With Story Design, you’ll be amazed at what your students come up with and what they learn along the way.
Story Design: Innovative STEAM Projects
Interdisciplinary Proficiencies

During a Story Design: Innovative STEAM Projects lesson, students can practice and apply any or all of the following critical skills:

English Language Arts:
- identifying narrative elements
- analyzing characters
- identifying conflicts
- understanding problem-and-solution and cause-and-effect relationships

Science:
- defining a problem
- creating a hypothesis
- designing an impartial test
- conducting multiple trials
- observing, measuring, and recording data
- researching existing knowledge and evaluating research resources
- understanding a range of science topics (forces, energy and motion, electricity, light and sound, the needs and life cycles of living things)

Technology:
- designing and programming robotics
- designing, writing, evaluating, testing, and improving computer programs
- working with social and collaborative media
- evaluating the impact of technology on individuals and society

Engineering:
- identifying solvable problems
- brainstorming, evaluating, and selecting solutions
- identifying, testing, and evaluating materials and their properties
- using materials and objects for new purposes
- incorporating material or cost parameters
- designing testable prototypes
- testing, evaluating, and revising solutions

Arts and Humanities:
- incorporating visual design into engineering
- identifying and evaluating how solutions affect individuals and society
- creating and presenting visual and multimedia displays
- communicating ideas to peers and the community
- evaluating the aesthetics of materials and products

Mathematics:
- measuring and working with measurements
- using mathematical models to test real-world situations
- identifying, applying, and solving mathematical formulas in science
- collecting, organizing, and displaying numerical data
- analyzing statistical data
Story Design: Innovative STEAM Projects and Problem-Based Learning

Story Design: Innovative STEAM Projects is an example of problem-based, or project-based, learning (PBL), also sometimes referred to as inquiry-based learning. During PBL, the instructor presents students with an open-ended situation or multi-solution challenge. (In Story Design, the “situation” is drawn from a narrative text.) Students are responsible for identifying a problem, brainstorming solutions, designing tests, evaluating their progress, and presenting their final product. They investigate the subject by following their own curiosity and solving smaller problems or challenges that arise from decisions they make in the course of their investigations. The instructor manages the classroom, acts as a facilitator, and supports student efforts, but does not offer or evaluate solutions.

Steps of Problem-Based Learning

1. The teacher presents a scenario, situation, or problem, and defines any restrictions or parameters. The teacher may also define a final deliverable, such as a presentation or demonstration.
2. Students brainstorm possible solutions and evaluate them based on prior knowledge, research, judgment, and project parameters.
3. Students select the best solution and create a plan for building a model or a prototype of the solution.
4. Students construct a physical model or prototype of the solution.
5. Students design and conduct fair tests of the model or prototype, and use the observations and data from the test as feedback to improve it. Then they determine whether to conduct further rounds of testing and revision.

When applied to practical, physical problems in the real world, PBL mirrors the engineering design cycle, the process by which engineers apply curiosity, creativity, observation, collaboration, and experimentation to solve problems and improve lives.

Research has shown that PBL increases engagement and enthusiasm, and consequently knowledge retention, by giving students the freedom and responsibility to direct their own learning. PBL is a departure from traditional lecture-based education and works best with a specific approach to classroom planning, management, and assessment. This guide addresses these requirements with information and practical tips in the sections Tips for Planning and Management and Using the Rubrics for Student Assessment.
Story Design: Innovative STEAM Projects and Social-Emotional Learning

The Barnes & Noble Story Design: Innovative STEAM Projects program is uniquely suited to foster social-emotional learning (SEL). Story Design seamlessly integrates the engagement and empathy vivid literature inspires with the creative collaboration of engineering.

Social-emotional learning, defined by the Collaborative for Academic, Social, and Emotional Learning (CASEL), is “the process through which children and adults acquire and effectively apply the knowledge, attitudes, and skills necessary to understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships, and make responsible decisions.” Its core concepts include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making.

Self-Awareness

Story Design and other open-ended, creative problem-based learning approaches are a key builder of self-awareness. Story Design encourages students to observe and understand their own emotions and traits as they ...

- make personal connections and identify with story characters.
- identify and utilize their own strengths and talents when selecting a goal.
- contribute to group work according to their strengths.
- recognize difficulty and frustration as practical challenges.
- conduct frequent reflection activities.

Self-Management

The open-ended Story Design tasks build essential self-management skills; in fact, one of the major advantages of project-based learning is a powerful emphasis on self-motivation. During a Story Design project, students will ...

- set their own goals.
- make their own plan to achieve those goals.
- employ strategies to overcome frustration and difficulties using creativity and new choices.
- design a parameter by which they measure their own success.
- measure their own progress against that parameter.

Social Awareness

The unique combination of literature and group engineering encourages deep and meaningful social awareness. A Story Design project allows students to ...

- take the perspective of a fictional character who may be different from them.
- identify with both the practical and emotional challenges of a character.
- open themselves to the creative ideas of others.
- recognize and value the contributions of others during group work.
**Relationship Skills**

Story Design helps build relationship skills through group work with both a product and a process that are open-ended and student defined. In other words, students decide not only what the group will work toward, but also what roles and contributions each student will offer without the instructor defining specific roles. This helps students ...

- cooperate with others toward a shared goal.
- recognize and value the contributions of others.
- identify a neutral or fair metric by which to measure competing or conflicting ideas.

**Responsible Decision-Making**

Through literature and collaboration, Story Design provides students with models of positive decision-making. When they are asked to help others overcome a problem, students gain practice making positive choices and contributing to society. Students will ...

- learn the value of helping others.
- observe and evaluate the real-world consequences of choices and actions.
- make practical decisions about safety.
- identify the social and cultural parameters and limits of a situation.

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**Tips for Fostering SEL in Story Design: Innovative STEAM Projects**

- Return to the book often and ask students how characters feel and think, including how the characters might feel about student projects and actions.
- When possible, identify factors that influence a character’s perspective, such as his or her personality, life history, culture, and surroundings.
- Create and continually reinforce safe and non-judgmental spaces for brainstorming and generating ideas.
- Encourage students to evaluate ideas based on fair, measurable progress toward a defined goal, rather than judging based on who contributed them.
- Allow students to express frustration and identify frustration as a signal to make a different choice.
- Identify setbacks or challenges as examples of learning and guidelines for how to make new choices.
- Post and remind students of physical safety rules, and when possible, discuss the reasoning behind them.
- Define rules and reasons for respecting the space and work of others.
Integrating Literature and Engineering

STEM, or Science, Technology, Engineering, and Mathematics, has been one of the major focuses of 21st-century education, reflecting the ever-increasing prominence of technology and scientific thinking in the global economy. However, some researchers worry that the focus on STEM education may inadvertently rank academic subjects by their economic usefulness, further wealth and gender gaps in achievement, and neglect the critical social, emotional, and civic roles of the humanities. In the past several years, educational researchers have expanded STEM to STEAM, or Science, Technology, Engineering, Arts, and Mathematics.

Story Design: Innovative STEAM Projects adds an additional focus on language arts. Story Design takes into account that reading comprehension is the first step in learning any discipline, writing skills are critical for communicating new ideas, and that literature and the arts are critical for social and emotional health.

To increase student engagement and fully integrate literature and engineering, Story Design: Innovative STEAM Projects emphasizes reading skills and identification with literary characters. This helps students model how real engineers function within the larger society.

To apply this fully interdisciplinary approach, help students link their practical engineering projects with the literature they are based on.

- **Return students to the text** as they identify the problem in the story. Follow each Story Design lesson plan for tips on identifying story problems.
- **Encourage students to identify with characters** as they help those characters solve problems. Reinforce that students are helping the character. Ask students to reflect on how the character might react to their projects.
- **Use the text as a guideline** for engineering. Look to text details for information about materials, spatial limitations, time limits, cause-and-effect relationships, and other parameters.
- **Use art and illustrations**, if applicable, for ideas on the appearance, size, materials, and other properties of a possible solution.
- **Keep copies of the book** near project stations and encourage students to return to it for reference and inspiration.
- **Use the book as a guideline for testing** whether students’ ideas solve the problem. Continue to verbally reinforce that their goal is to help the character solve his or her problem.
- **Discuss how students’ solutions might affect the story**, including how the character could execute the solution, how it might affect his or her feelings, and what events might follow.
- **Reflect on how participating in a project increased identification** with the story’s characters. Relate the challenges students faced in the project to the challenges faced by the characters as each attempted to solve the same or similar problems.
Using the Engineering Design Cycle

Story Design: Innovative STEAM Projects are structured around the engineering design cycle. The engineering design cycle is a set of flexible, repeatable steps that guide students through an open-ended problem-solving process. The Story Design program divides the engineering design cycle into five steps:

1. Ask: Identify and Define the Problem

In Story Design, students will identify a problem from a work of literature. Use each book’s lesson plan for specific guidance on how to help students analyze the text and identify a major practical problem they can solve using engineering. To help students identify problems, ask:

- What does the character want or need most?
- What is giving the character trouble or making him or her upset?
- What is standing in the character’s way?
- How do the surroundings affect the character and his or her goals?
- What objects and materials does the character have to work with?

2. Imagine: Brainstorm Ideas

Once students identify a problem, encourage them to brainstorm solutions. The goal is to generate and share as many ideas as possible, without rejecting, criticizing, or evaluating the ideas in any way, and to support all others’ contributions. (Students will evaluate and select a single idea in the next step.) Achieve this using brainstorming techniques like the following:

- freewriting (timed, continuous writing)
- mind maps and flowcharts
- word games (an idea for each letter, word association)
- mood board with sticky notes to arrange ideas
- starting with a material or object and eliciting every possible way to use it
- think-pair-share
- drawing/coloring or making audio/video recordings

3. Plan: Select and Develop an Idea

Students evaluate their brainstormed ideas, select the best solution, and come up with a plan for how to build it, including selecting materials and delegating any teamwork. Students can evaluate their ideas by asking themselves these questions:

- Does this idea help the character reach his or her goals?
- Does this idea work in the character’s surroundings?
- What size and shape will the idea be?
- How many parts does it have?
- Do any of the parts move, and how will they work?
• What qualities should its materials have (flexibility, strength, size, etc.)?
• Does my team need to research anything?
• Does anyone on my team have special skills or talents that will be helpful?

4. Create: Build a Model or Prototype
This is the construction phase in which students use materials to build a prototype, or testable model, of their idea. The following tips will facilitate students’ work:
• Post any safety rules.
• Allow free movement, conversation, and collaboration.
• Allow time for familiarization and experimentation with tech-enhanced materials before beginning official construction.
• Set aside a construction space with materials already provided.
• Categorize materials by properties (put all plastic together, all metal, etc.) or function (fasteners, connectors, movable parts, etc.) to help students understand their uses.
• Encourage students to identify and evaluate substitute materials with similar properties if their ideal material is not available or does not work.

5. Improve: Testing and Revising
Students will need to test how well their idea solves the problem from the book. Each Story Design lesson plan suggests a test or experiment for the problem identified in each book. While designing or conducting tests, guide students to identify what makes the experiment fair and accurate. Ask:
• How can we re-create the character’s problem in our classroom?
• How can we model the conditions from the book?
• What would it look like if your idea solved the problem?
Students will evaluate how well their idea performed, and then apply what they learned to revising or improving their prototype. Help students collect, understand, analyze, and apply data:
• How well did your idea solve the problem?
• Did you have trouble with the idea itself, or with your prototype and its materials?
• Do you know what caused it to break/stop/fail/not work?
• How can you change that part of your idea?
• What new idea can you add?

Using the Rubrics for Student Assessment
One of the most important things to remember about a Story Design project is that project outcome does not always correlate with project achievement. Suppose a character in a book needs to cross a steep ravine. One student might successfully build a simple bridge, while another fails to complete a much more ambitious zipline. The student who attempted the zipline may have still learned a great deal, even if he or she was unable to execute the project in the allotted time.
Project-based learning such as Story Design does not usually generate traditional deliverables such as worksheets, essays, or standardized answers that can be discretely assessed. Rather, instructors must assess performance and understanding. To accurately assess student learning in this type of project,

- use standards-based assessment, or measuring against a specific learning goal, over comparative assessment, or measuring against other students.
- use performance assessment, or evaluating student participation, process, thinking, and communication.
- Use project assessment, or evaluating student deliverables, as a means of assessing performance and understanding, rather than “success” at a discrete task.

Your main tool for student assessment in Story Design: Innovative STEAM Projects is the Rubric for Student Assessment. The Rubric identifies specific standards of achievement at three levels in each area of the project:

- reading comprehension:
  - identifying major literary elements and/or correctly summarizing the literature
  - identifying the major problem in the book
- the steps of the engineering design cycle:
  - identifying a problem
  - brainstorming possible solutions
  - selecting the best solution
  - building a prototype
  - testing and improving the prototype
- student reflection and self-evaluation

Give students an opportunity to understand the tasks you will evaluate by sharing each goal and its evaluation criteria from the rubric during each stage of the lesson. Emphasize the performance-based nature of your assessment. Reassure students that during brainstorming, you are looking for their creativity, not their correctness. During testing, you will evaluate how fairly and accurately students conduct a test, not whether their prototype succeeds or fails.

As the project progresses, use these tips to elicit and evaluate student learning:

- **Elicit individual student goals** for the project to help you assess their reading comprehension, problem identification, creativity, and understanding of the task. This also acts as a formative assessment, allowing you to measure each student’s progress against his or her own goals.
- **Elicit thinking and understanding** during conversations with students by having them explain why they made a specific choice or why they are pursuing a specific goal. This can reveal underlying conceptual understanding.
- **Use frequent student self-assessment and summaries** by utilizing the Student Reflection Worksheet and formal or informal conversations and deliverables.
- **Formalize revision** by offering students the opportunity to revise after a round of targeted teacher feedback. Revision allows students to correct mistakes or difficulties and allows you to assess skills such as flexibility and the ability to incorporate new information into existing understanding.
Using the Reflection Worksheets

Reflection is an essential element of performance assessment. It allows students to articulate the thought process and understanding behind their actions, and allows you to gauge whether students grasped the concepts that underlie your project goals.

The Story Design: Innovative STEAM Projects reflection worksheets offer prompts for student reflection. You can use the reflection worksheets throughout the course of the project for formative assessment. Ask students to answer questions during each phase of the project: identifying the story problem, brainstorming a solution, building the prototype, testing the prototype, and improving the model. You can also use them for summative assessment by asking students to reflect on their work at the end of the project. The worksheets can serve as prompts for either group or one-on-one discussion, or as a private or shared writing assignment.

When assessing student reflection, look for …

• an accurate retelling of the main problem in the story.
• a clear and accurate description of their initial idea.
• details about how the student modified the idea during planning, prototype building, testing, or after testing.
  • Look for instances where students are able to identify a problem with their model and correct it.
  • Look for students’ ability to recognize and incorporate feedback in the form of data or difficulties.
• an honest evaluation of their idea’s ability to solve the problem in the book.
  • Look for students’ ability to relate their project to the specific book problem.
  • Look for students’ ability to identify successes and failures of the idea, the prototype, or the test.
• the ability to identify errors and acknowledge what they learned from them.
• the ability to identify successes and acknowledge what they learned from them.
• an understanding that engineering is an ongoing cycle, and that identifying improvements is an essential part of the process.

The student reflection worksheet can also help you assess how well you, the instructor, helped engage students and facilitate the project. The instructor reflection worksheet includes prompts to help you in this goal. Use the student and instructor reflections to assess how the class as a whole performed, and how instruction might be improved.

<table>
<thead>
<tr>
<th>Student Difficulty</th>
<th>Instructor Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Few students can identify the problem in the text.</td>
<td>Refocus on the book and conduct more close-reading lessons.</td>
</tr>
<tr>
<td>Few students are able to come up with viable ideas.</td>
<td>Clarify the story problem using a prompt students can understand. Revisit brainstorming techniques.</td>
</tr>
<tr>
<td>Few students are able to build a functional prototype.</td>
<td>Offer a wider range of materials.</td>
</tr>
</tbody>
</table>
Tips for Planning and Management

Barnes & Noble Story Design: Innovative STEAM Projects lessons provide guidance and materials that can help you identify, plan, carry out, and assess projects in a productive and timely way. As you implement the lessons, use these tips to ensure a successful project.

Set up the classroom in a way that directs the project.

- Consult the Barnes & Noble Lesson Plans and Materials List to identify and collect materials beforehand. Gather substitutes and extras for unforeseen challenges.
- Create work stations with materials and storage and define these spaces for students before the project begins.

Define learning goals and deliverables for the whole classroom.

- Use the Barnes & Noble Story Design Lesson Plans to identify and define specific, measurable learning goals for the project.
- Define the deliverables, parameters, and other limitations (such as time limits) for students before they begin their work.
- Hand out or prominently display notes about deliverables, benchmarks, and other targets to keep students focused. Consider assigning timekeepers to assist with time management.

Ensure reading comprehension before assigning projects.

- Conduct discussion and, if necessary, provide remediation to help students identify the problems they will tackle during the project.
- Use the literature selection to refocus students’ attention during the project.
  What does [character] need from this solution? How will it help her?

Assign groups.

- Story Design lessons are best carried out by small groups of three or more. For this type of open-ended PBL, groups that are heterogeneous with respect to abilities are recommended. Follow best practices and your students’ needs when assigning groups for each project.
- Intersperse group work, such as problem-solving and building, with solo tasks such as research and reflection.
- Within groups, students may benefit from having assigned roles such as “researcher,” “data recorder,” “materials manager,” etc.

Monitor progress.

- Circulate and inquire frequently about student activities.
  How’s it going so far? What are you trying to do now?
- Intervene and redirect when students go off topic. When redirecting, offer process suggestions rather than answers.
  Have you tried testing other materials? Do you need to go back and remember the problem from the book?
- Ask students to document their procedures to help ensure focus, purpose, and deliberate transitions.
• Collect research resources, questions, brainstorming activities, or small side projects you can offer if students get stuck or distracted.

**Allow for student-directed activity and communication.**

• Recall that the PBL approach allows students to freely converse, move around, switch topics or activities, or use materials in unconventional ways.

• Allow students to pursue a related inquiry if it furthers the lesson goals. For example, while students are building a physical object, they may become curious about the physical properties of materials, and want to conduct independent experiments on (for example) the strength versus flexibility of different solids.

**Manage transitions and conclusions.**

• Offer alerts before transitioning from or concluding project time.

• Set aside secure spaces for partially finished work. Include individual or group name labels to ensure security and ease when restarting.

• Set aside time for group or individual reflection or self-assessment.

**Troubleshooting Tips**

<table>
<thead>
<tr>
<th>When students ...</th>
<th>Try ...</th>
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</thead>
<tbody>
<tr>
<td>have trouble brainstorming ideas</td>
<td>• reading on to find out how the character tries to solve the problem.</td>
</tr>
<tr>
<td></td>
<td>• posing a similar, but simplified problem.</td>
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<tr>
<td></td>
<td>• starting with a concrete object.</td>
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<td></td>
<td>• sharing a story or media with a similar problem.</td>
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<tr>
<td></td>
<td>• playing a brainstorming game.</td>
</tr>
<tr>
<td>cannot select a single best idea</td>
<td>• offering the opportunity to plan or build more than one solution.</td>
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<tr>
<td></td>
<td>• asking which idea the character would like best.</td>
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<tr>
<td></td>
<td>• taking a class poll.</td>
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<tr>
<td>do not know how to start or plan their prototype</td>
<td>• researching real-world examples as models.</td>
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<tr>
<td></td>
<td>• starting with an existing classroom object.</td>
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<tr>
<td></td>
<td>• drawing the object.</td>
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<td></td>
<td>• listing the object’s properties (size, shape, color, motion, etc.).</td>
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<tr>
<td></td>
<td>• leading a visualization exercise (students close their eyes and imagine the object along with teacher prompts).</td>
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<tr>
<td>are collaborating poorly</td>
<td>• setting specific student expectations for interaction and group cooperation.</td>
</tr>
<tr>
<td></td>
<td>• assigning specific group roles or tasks.</td>
</tr>
<tr>
<td></td>
<td>• asking students to identify group members’ positive contributions.</td>
</tr>
<tr>
<td>have practical trouble with materials and building</td>
<td>• reducing frustration with a reading break.</td>
</tr>
<tr>
<td></td>
<td>• having students conduct controlled tests of the performances of different shapes, materials, or construction.</td>
</tr>
<tr>
<td>get frustrated with a failed test or project</td>
<td>• asking students to list what they learned.</td>
</tr>
<tr>
<td></td>
<td>• asking students to draw or write about what they hoped the solution would do, and compare it to the results of the test.</td>
</tr>
<tr>
<td></td>
<td>• setting aside time for a full revision of the prototype.</td>
</tr>
</tbody>
</table>
Materials List

General Arts and Crafts Materials
These materials will be useful for any of the projects in Story Design: Innovative STEAM Projects.

- paper of different weights (tissue, construction, printer, poster board, cardboard, flat foam, paper bags)
- tape (masking, transparent, duct, electrical)
- string, yarn, craft wire, twine, unflavored dental floss
- modeling clay, moldable plastic, modeling dough
- non-toxic glue, glue sticks, paste, rubber cement
- cardboard (boxes, sheets, tubes, rolls)
- paper clips, binder clips, chip or bag clips, hair clips, fasteners, zip ties
- rubber bands, hair elastics, small bungees,
  - twist ties
  - wooden blocks, dowels, wooden shapes, toothpicks
  - aluminum foil, plastic wrap, wax paper
  - pipe cleaners, craft sticks, wax paper
  - fabric scraps, rags, felt
  - foam balls or bricks
  - scissors

Toys and Kits
These toys have broad uses for Story Design: Innovative STEAM Projects.

- LEGO classic bricks
- Magna-Tiles
- classic wooden blocks
- Gears! Gears! Gears!

Lesson-Specific Materials
These materials will be specifically helpful for the projects defined in each Story Design: Innovative STEAM Projects lesson:

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grades K–3</strong></td>
<td></td>
</tr>
<tr>
<td>The Most Magnificent Thing by Ashley Spires</td>
<td>sticky notes; a large sheet of paper; containers (buckets, plastic containers, cardboard boxes, bags); toys or materials students can use to create wheels and axles; a scooter, skateboard or simple wheeled vehicle; weight that represents a small dog (5 lb bag of flour, shopping bag filled with bean bags, etc.)</td>
</tr>
<tr>
<td>Chicka Chicka Boom Boom by Bill Martin, Jr. and John Archambault</td>
<td>six index cards per student; model “coconut tree” made of flexible material (wrapping-paper tube, pool noodle, flexible tubing); paper of different weights; different types of fabrics; plastic wrap or aluminum foil; objects to use as weights (paper clips, other objects of same size and standard weight)</td>
</tr>
<tr>
<td>Ada Twist, Scientist by Andrea Beaty</td>
<td>tall object (shelf, cabinet, etc.), model “baby” (5 lb bag of flour), string, soft materials (foam, feathers, cardboard, etc.), containers (buckets, plastic containers, cardboard boxes, etc.)</td>
</tr>
<tr>
<td>After the Fall: How Humpty Dumpty Got Back Up Again by Dan Santat</td>
<td>hard-boiled egg, water balloon, or similar model of a fragile object; soft materials (foam, feathers, packing peanuts, cardboard, bagged air, sponge, tissue, etc.); string, rope, wheels, other building materials; a drop cloth or newspapers</td>
</tr>
<tr>
<td>Flat Stanley by Jeff Brown</td>
<td>large pieces of paper, corrugated poster board, foam, or cardboard; measuring tools (ruler, tape measure)</td>
</tr>
<tr>
<td>Rosie Revere, Engineer by Andrea Beaty</td>
<td>flat materials (paper, plastic, cardboard, fabric); spinning toys (tops, yo-yos, fidget spinners); timer or stopwatch (optional); electric motors (optional); gear toys and building kits (optional)</td>
</tr>
<tr>
<td>Title</td>
<td>Design a Project</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
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<tr>
<td><strong>The Empty Pot</strong> by Demi</td>
<td>research resources; seeds that sprout quickly (sunflower, marigold, cabbage family); water; containers with lids; paper towels or other media that absorb water and stay moist; lights, cardboard box or dark fabric; plant food (optional); pots and potting soil for transplanting seedlings (optional)</td>
</tr>
<tr>
<td><strong>The Tale of Despereaux</strong> by Kate DiCamillo</td>
<td>flashlight or small light source; large cardboard box; dark closet or other dark, enclosed space; mirrors; aluminum foil; lenses; materials with different optical qualities (opaque, transparent, translucent); circuit toy kits (optional); programmable classroom robots (optional); smartphone or tablet with programming apps (optional)</td>
</tr>
<tr>
<td><strong>The Lemonade War</strong> by Jacqueline Davies</td>
<td>lemons, water, sugar, or powdered lemonade mix (or unsweetened drink mix); small cups (optional); measuring tools (measuring cups and spoons, graduated cylinders, scales); calculators (optional)</td>
</tr>
<tr>
<td><strong>Holes</strong> by Louis Sachar</td>
<td>measuring tools (for length, weight, and volume); programmable classroom robots (optional); smartphone or tablet with programming apps (optional); circuit toys (optional); digital cameras (optional); microphones and sound recording devices (optional)</td>
</tr>
<tr>
<td><strong>From the Mixed-Up Files of Mrs. Basil E. Frankweiler</strong> by E.L. Konigsburg</td>
<td>building toys (optional); programmable classroom robots (optional); smartphone or tablet with programming apps (optional); circuit toys (optional); digital cameras (optional); microphones or sound recording devices (optional)</td>
</tr>
<tr>
<td><strong>The Wild Robot</strong> by Peter Brown</td>
<td>model robot (can, canister, toy robot, etc.); natural materials (leaves, twigs, bark, grass, soil, rocks); research materials</td>
</tr>
<tr>
<td><strong>Hoot</strong> by Carl Hiaasen</td>
<td>bells or noise-makers; wind-up or other moving toy (optional); digital or smartphone camera (optional); motion-detector kits (optional); classroom robots (optional); smartphone or tablet with programming apps (optional)</td>
</tr>
<tr>
<td><strong>Mrs. Frisby and the Rats of NIMH</strong> by Robert C. O’Brien</td>
<td>large cardboard box; large sheet of paper or room divider; length-measuring tools; building toys, such as LEGO® bricks, Magna-Tiles®, or blocks; programmable classroom robots (optional); smartphone or tablet with programming apps (optional)</td>
</tr>
<tr>
<td><strong>Among the Hidden</strong> by Margaret Peterson Haddix</td>
<td>lights; mirrors; sound-recording devices (optional); programmable classroom robots (optional); smartphone or tablet with programming apps (optional); circuit toys (optional)</td>
</tr>
<tr>
<td><strong>Charlie and the Chocolate Factory</strong> by Roald Dahl</td>
<td>wrapped chocolate bars, bars of soap, or other similar objects; scales or balances (digital, if available); beakers or measuring cups marked with metric units; water; calculators (optional)</td>
</tr>
<tr>
<td><strong>Falling Over Sideways</strong> by Jordan Sonnenblick</td>
<td>household tools or utensils; classroom furniture; construction scraps and tools (optional)</td>
</tr>
<tr>
<td><strong>James and the Giant Peach</strong> by Roald Dahl</td>
<td>water tank, dishpan, or wading pool with water (optional); small toy cars, small balls, or pencils; weights; balloons and balloon pump (or other models of a peach)</td>
</tr>
<tr>
<td><strong>Stuart Little</strong> by E.B. White</td>
<td>gear toys; objects that can be used to make simple machines, including building toys, wheels, and gears; toy mouse or other small object to represent a mouse</td>
</tr>
<tr>
<td><strong>The Phantom Tollbooth</strong> by Norton Juster</td>
<td>building toys, such as building bricks, magnetic tiles, or blocks; classroom robots; smartphone or tablet with programming apps</td>
</tr>
<tr>
<td><strong>Hatchet</strong> by Gary Paulsen</td>
<td>different types of paper, fabric, and cardboard; string, rope or cord; natural materials; model “food” (a weight such as a bag of flour or bean bags)</td>
</tr>
</tbody>
</table>
Story Design: Innovative STEAM Projects offers technology-enhanced lessons that introduce students to essential 21st-century applications such as electronics, robotics, and computer programming. They take advantage of educational toys and tools that help students develop the skills used by real engineers, designers, inventors, and programmers.

Many of these toys and kits have instructional websites and videos. Users have also uploaded videos showing the toys, how they work, and what real students have built with them. Use this guide along with these resources to familiarize yourself with these high-tech learning tools.

<table>
<thead>
<tr>
<th>Toy or Tool</th>
<th>Functions and Capabilities</th>
<th>Tips for Use</th>
</tr>
</thead>
</table>
| Wonder Workshop Dot and Dash | • move in any direction  
• sense and avoid obstacles  
• record and play sounds  
• record and play photos and video  
• programmable lights  
• can add arm/manipulator for grabbing | • best for working on programming, rather than building  
• differentiate instruction by using different apps, which offer simple or more complex programming “languages” or interfaces  
• good for solving mazes, navigation, or sending messages |
| LEGO Mindstorms | • full LEGO kit with blocks, wheels, gears, connectors, and features  
• programmable electric motors  
• sensors, including infrared, motion detecting, sound detecting, and touch  
• computer app for programming  
• remote control | • a complex toy for advanced students  
• combines building, engineering, and design with computer programming  
• complex, realistic programming “language”  
• good for executing complex or multi-stage tasks, such as fetching an object |
| Snap Circuits and Snap Circuits Motion Detectors | • connectable “wires” or conductors  
• splitters and splicers  
• switches  
• lights and sounds  
• simple motors  
• motion-detector, infrared sensors/triggers | • helps students understand how electricity powers different objects  
• good for sending signals, activating lights, sound, or motion |
| Strawbees Coding and Robotics Kit | • beam-and-joint construction kits  
• small motors  
• robotic movable joints  
• connectable wires  
• lights | • advanced toy with small parts, some of which may require modification during building  
• entirely open-ended  
• smaller range of programmable behaviors; best for creating simple motions or repeated tasks, such as moving in a straight line or spinning |
Make Your Own Story Design Lesson: Innovative STEAM Projects

Barnes & Noble Story Design: Innovative STEAM Projects provides lessons and suggested materials for popular titles in children’s literature. You can also adapt the Story Design approach to a book or short story of your choice and use the Barnes & Noble Story Design materials, assessments, and guides to help you plan and carry out a successful project.

Included in this guide is a Make Your Own Story Design Lesson worksheet to use as a framework to create your own custom lesson. The tips below will help you get started.

**Select a Suitable Book**

Stories in which characters face practical (i.e., physical) challenges lend themselves best to the Story Design approach. Survival and adventure stories are good choices, as are books for younger students that describe the practical challenges of day-to-day life. Stories that incorporate magic, or technology that functions as magic, may be less appropriate, as the characters do not need practical solutions. Stories that focus on relationships and emotions are better suited to ELA lessons.

**Identify Possible Project Problems**

Read the book thoroughly and identify any applicable plot problems. Note them in the table on the worksheet. You can either select and assign students a single problem, or allow students to choose one of the problems you identified.

**Define Project Goals and Objectives**

Once you have specified a problem, consider and define the goals of the project, including the specific deliverables, and note them in the second column of the table. Consider what STEM topics the selected problem addresses, and what specific ideas or areas of knowledge students will learn about. You can note these in the third column of the table.

**Correlate to Your Curriculum**

Use the ideas you developed in the previous two steps to correlate the project to specific learning objectives and to target standards using the second table on the worksheet.

**Materials, Preparation, and Extension**

Specify any materials you need to acquire or set aside to complete the project, and any pre-project classroom preparation. It is also a good idea to brainstorm differentiated instruction activities that allow all your students to participate, or that will help students if they get stuck during the project.

**Assessment**

Follow the Barnes & Noble Story Design: Innovative STEAM Projects Rubric for Student Assessment, Reflection Worksheets, and the assessment tips in this guide to evaluate student progress. Use the template to specify the achievements you will evaluate in this project.
Resources and Bibliography


