

Figure 6.1: Engineering a Board Game Project Plan

<p>Project Title: Engineering a Board Game Topic: Designing an educational board game that engages players as they learn about a topic</p>	
<p>Grade Level: 6-12 Varying levels of game difficulty, prototyping requirements, and topic or subject content including requiring more content inclusion, adding electronic effects, and more complex rules and including instructions will scale this project from the middle to high school level.</p>	<p>Estimated Class Time: Ten to fifteen classes, depending on the grade level</p>
<p>Challenge: Create a board game to help students and others learn about a subject or topic. Note: Teachers should specify age level of players and required content. Project content includes visual layout and appeal, technical writing for instructions, and the value of consumer feedback. You can also use this project to focus on planning and collaboration skills due to its multifaceted nature.</p>	
Curricular Connections	Skills Focus
<p>Mathematics—measurement; 2-D to 3-D planning; analysis of Likert scale feedback data Art—aesthetics of packaging and board design ELA—technical writing of instructions; any trivia-type questions part of the actual game All others—Topic or subject focus of the game connects to any chosen discipline</p>	<p>Critical Thinking—choosing materials; identifying key needs; analyzing effective designs Creativity—deciding design aesthetics Spatial Reasoning—going from 2-D planning to 3-D models; human interaction with designed environments and objects Collaboration—working as a team; recognizing common human factors; managing a project with many aspects (board design, packaging design, strategy, and marketing) Communication—listening to and acting on consumer feedback; presenting the final game; creating clear instructions and questions</p>

Overall Plan	
Hook	<p>There are a number of short videos and articles about the game Monopoly’s educational nature. Search <i>story behind Monopoly</i> to find one at an appropriate level for your class.</p> <ul style="list-style-type: none"> • Watch “The Surprising History Behind the Board Game ‘Monopoly’” (www.youtube.com/watch?v=mz5H0cg2uXs). • Watch “This Woman Invented Monopoly to Combat Greed” video about the history of Monopoly (https://bit.ly/2XBQQzL).
Engagement Activity or Quick Build	<ul style="list-style-type: none"> • Each student interviews five people about their favorite board game. • Develop questions (similar to pain-point interviewing) with the entire class; have students focus on what they think they need to know to make the game fun and engaging. Create a graphic organizer to record interviewee responses. • Allow class time for group members to compare and analyze responses.
Background Instruction	<ul style="list-style-type: none"> • Use any content-related (theme) information students need to understand and include in the game. • Consider including an activity where students write simple step-by-step instructions for an everyday activity (brushing your teeth or making a sandwich, for example) as preparation for writing the game instructions.
Background Research	<ul style="list-style-type: none"> • Use additional content background, particularly connections and trivia-type information. • Research different game designs and strategies. • Investigate best ways to build a box. <p>Note: Some of the ideas and resources from the Building a Better Box project might be helpful.</p>
Engineering Design Process	
<p>Know Your Problem</p> <ul style="list-style-type: none"> • Know your end user • Identify constraints • Define criteria 	<ul style="list-style-type: none"> • Think about the given age group; survey the types of games they play; how well they can read; and explain concepts clearly for a particular age group. • Teacher-supplied constraints include board size and number of players. • Use research about the end user to develop a list of features players like; discuss color and packaging specifics as possible criteria.
<p>Know Your Options</p> <ul style="list-style-type: none"> • Research • Brainstorm 	<ul style="list-style-type: none"> • Remind students they need to know concepts well to explain them to younger students via the game; encourage students to investigate strategies in some classic games. • Use a variety of techniques to get students to consider innovative designs; remind them to consider layout, color themes, design and packaging, name, player pieces, and so on.

Engineering Design Process

Develop a Solution—Part One

- Choose a design
- Identify needed materials

- Students settle on the best design and discuss how it meets constraints and criteria.
- Encourage students to keep it simple; see the suggested materials. Reusing and repurposing materials such as old games and toys from home is fine with teacher approval. Students need to create and build their own board and packaging.
- The following common materials work for this project.
 - + Chart or craft paper (for planning)
 - + Foam core (for game pieces)
 - + Cardboard (recycled, for boxes and boards)
 - + Card stock (various colors, for any cards students may wish to create)
 - + Buttons, pom-poms, pipe cleaners, and so on (for making and decorating game pieces)
 - + Scissors
 - + Transparent adhesive tape
 - + Duct tape (various colors)
 - + White or craft glue
 - + Hot glue guns and glue (optional)
 - + Student-supplied materials (recycled, not new; with teacher approval)

Develop a Solution—Part Two

- Create a plan; make a sketch

- Students need to plan the following before building anything for this project.
 - + Game components
 - + Game concepts based on your requirements. It is critical for students to list these; some teachers also request information about where each appears in the game.
 - + Game packaging
 - + Instructions (can be done concurrently with building but a general plan should be in place beforehand). Encourage students to look at actual game instructions. They need to think about how pieces move, penalties, rewards, initial set-up, what determines winning, and so on.
- Obtain materials and build the game, pieces, and box; keep material choice simple.
- Work on detailing instructions.

Engineering Design Process

<p>Develop a Solution—Part Three</p> <ul style="list-style-type: none"> • Get feedback • Plan modifications to make it better 	<ul style="list-style-type: none"> • Test using consumer feedback. <ul style="list-style-type: none"> + Find a good audience. + Consider having test groups rotate through two or three games to get enough feedback (you may need to limit play time to ten to twenty minutes). + Work with students before testing to develop Likert scale (1-5) surveys for testers. Five questions and a comment space work well. Encourage students to consider their criteria when they develop questions. + Have testers set up and play the game without input from the student engineers. If necessary, students can provide a prompt and should note what was unclear. + Encourage your students to take notes as they observe how testers play the game. + Allow one or two minutes at the end for testers to complete the survey. • Try modifications. <ul style="list-style-type: none"> + Students must connect their modifications to their testing information (observations or survey data). Create a very simple modification form for this task. The form needs to ask what the modification is and why it is being done. + Limit modifications or any need to plan and follow a design process will be lost. Two or three modifications are generally enough.
<p>Develop a Solution—Part Four</p> <ul style="list-style-type: none"> • Communicate your results 	<ul style="list-style-type: none"> • Since this is a consumer product, a marketing pitch or ad campaign works well and eliminates the opportunity for a rote and boring presentation. • Limit time and give students a list of a few things that should be in their pitch. • Have the students in the audience rate or rank the pitches, just for fun.

Group Size

Four or five students should begin to function effectively in teams; jobs are a must because of the number of planning and building steps. Indicate some suggested jobs in the project planning discussion. Alter the jobs as needed, but look for a diverse and equitable distribution of responsibilities.

Assessment

Follow the general assessment guidelines in chapter 3. Key considerations specific to this project follow.

- Although it is a group project, many tasks are done individually and concurrently. The individual component of the grade can be a bit higher (30 to 40 percent) than I normally suggest, and it can focus on jobs.
- Other useful tools include a simple teacher checklist indicating who is on task every day with an opportunity for peer assessment.
- Some teachers opt to include a short quiz about the concepts and focus of the game, which becomes part of the individual assessment.

Resources

- “Toying With Education” (<https://bit.ly/2JarulD>)
- “Board Game Helps Mexican Coffee Farmers Grasp Complex Ecological Interactions” (<https://bit.ly/2WyC1tW>)
- “Playing to Learn: Panelists at Stanford Discussion Say Using Games as an Educational Tool Provides Opportunities for Deeper Learning” (<https://stanford.io/2VU9Vw4>)