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Tech Museum of Innovation
New Lesson
Subject Area: 5th Grade
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Board Game Design Challenge

0. Abstract

The goal of this ETP is to introduce and practice the engineering design process in a fun and high interest manner: by designing a board game which will help reinforce previously taught content. Students will work in teams and follow the design process to develop a game that is connected to content of their choice (within certain parameters). Students will research existing games (as well as sharing ideas from their own experiences), brainstorm and develop ideas based on content, design a prototype based on a set of criteria, test their game with players, collect feedback, and redesign their game accordingly, based in part on that feedback.

I. Standards/Skills/Objectives/Assessment

1. Focal Standard or Skill:

Next Generation Science Standard: 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

2. Measurable Objective(s):

1. Students will use the engineering process to design their games.
 2. Students will design three prototypes. The first will be their original prototype, the second will be after testing their game once, then their third and final prototype after testing the game a second time.
 3. Students will reinforce chosen content standards accurately.
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3. Assessment:

Students must follow each step of the engineering process, and there will be formative assessments in place at each step. There will also be a summative assessment, in the form of a rubric, assessing different aspects of the game: how effectively it ties to content, the playability of the game (game board design, game card design, how understandable the rules are), and how well students collaborated as a team.

Students will also have the opportunity (requirement) of self-assessment/reflection. Does the game meet the required criteria? Why and how did the game change from one prototype to the next? (What evidence from the game testing phase led to these changes?) How were decisions made regarding what worked and what did not? What would be done differently next time?

4. Additional Standards

These standards will vary, depending on what content the game will be connected to. For example, if a student team is focusing on 5th grade Physical Sciences, then those standards will be tied to this ETP.

II. Fellowship Connections

1. 21st Century Skill(s):

Learning and Innovation Skills:

Creativity and Innovation

- Use a wide range of idea creation techniques
- Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts

Communication and Collaboration

- Demonstrate ability to work effectively and respectfully with diverse teams
 - Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal
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2. 21st Century Skill(s) Application:

These skills will be applied throughout the process of this ETP. Students will need to collaborate with each other to come up with creative and fun ways to design their games, demonstrate flexibility and respect as these ideas are narrowed down and put into practice, and improve and refine their games through a testing process.

3. Fellowship Description:

My fellowship is taking place at the Tech Museum of Innovation. This museum, open to the public, showcases some of the most innovative ideas coming out of Silicon Valley, through engaging hands-on type exhibits meant to inspire innovation in everyone who visits. Through experimentation and play, visitors connect excitement and enthusiasm to these activities, and learn about science and technology in the process. Careers at the Tech Museum are varied, but all with the same focus of supporting the goals and mission of the museum: education, learning, and innovation. These different roles, such as exhibit

designers, nonprofit administration, IT/tech, and general educators, use specific skills to reach that same goal.

During my fellowship, I have had two primary roles. One is to help develop field trip experiences for some of the exhibits here in the museum. Rather than an unstructured, unmeasurable interaction with an exhibit, students will get a guided, standards-based, “lab like” experience, which will engage them in the exhibit and connect to specific educational standards. My other role will be as a lesson coach for the Tech Museum’s summer Tech Academy. Teacher teams will be developing lessons connected to the museum’s “Tech Challenge” theme (this year being aeronautics), with a goal of building their capacity for engineering, design-challenge learning education. In this role, I will be using skills in curriculum development, collaboration, and teaching both children and adults.

4. Fellowship Connection to School/Classroom:

As mentioned above, through experimentation and play, visitors to the Tech Museum connect excitement and enthusiasm to these activities, and learn about science and technology in the process. This is precisely what I want to connect back to my classroom. My experiences at the Tech Museum have further inspired me to promote learning by accessing my students’ curiosity and sense of fun, as well as developing a classroom of collaborative learners. The design/engineering process is a big part of the Next Generation Science Standards, and although they will not “officially” be rolled out by my school district this year, I will still use them to guide my integration of this ETP.

III. Instruction

1. Instructional Plan:

Lesson Hook (approx. 60 min.)

1. Let students know ahead of time that, as part of research for an upcoming engineering design project, you will be holding a "Board Game Day." Invite students to bring some of their favorite board games to class that day. (Remind them that this does not include computer games.) Also, use whatever board games you might happen to have in the classroom. Consider connecting this to a classroom reward/party that the class has earned (using whatever reward system the teacher has set up).
2. Set up games around the classroom. Have students help set up their own games.
3. Organize game play in whichever way seems most appropriate for the class. This could be very structured, organizing students into small groups of 3-4, have them start at a game, play for a specific amount of time (10-15 min.), then rotate to another game. Or, this could be done with more freedom, where students play whichever game they want. In this case, parameters should be set, such as: "every student must play at least three games." Or, give a signal every 10-15 minutes to have students switch to a new game.
4. Let students know that this process will not only be for fun, but will also serve an important purpose. They will be conducting research on board games, with the ultimate goal of creating one of their own. As they play the games, they should use the "[Board Game Research Notes](#)" handout to note some of the important aspects of three different games. Again, this could be very structured: give a certain amount of time for groups to play a game (10-15 min), then ask students to complete their research notes silently for that game. Or, this could be done with more freedom, where students can complete their notes as they play. Or, students can be provided with silent writing time following all the game play, where they can complete their research notes for three of the games they played. As long as students are given time to reflect on the different aspects of the games they played.
5. Give students a 2-minute warning before game play time will end, followed by time to clean up, put all game pieces back in boxes, get games put away, etc. Have students return to their seats.

Lesson Introduction (approx. 30 min.)

1. At this point, I will discuss my summer fellowship at the Tech Museum of Innovation, and connect it to the project that I will subsequently introduce. I will let my students know that, like the games we just finished playing, I was able to spend my entire summer playing "games" at the Tech Museum! (I will be continuing with most of the same 5th graders this year, who I had in 4th grade last year. We went on a field trip to the Tech Museum, so most students will be able to make that connection. We will also be going again this year.) I will remind them that the Tech showcases some of the most innovative ideas coming out of Silicon Valley, through engaging hands-on type exhibits meant to inspire innovation in everyone who visits. Through experimentation and play, visitors connect excitement and enthusiasm to these activities, and learn about science, technology, and engineering/design in the process. This is exactly what we will be doing, by designing, testing, and making improvements on, our own board games! I will let students know that one of the main things I did at the Tech was to help develop field trip experiences for some of the exhibits in

the museum. Rather than an unstructured, unmeasurable interaction with an exhibit, the idea is that students will get a guided, standards-based, "lab like" experience, which will engage them in the exhibit and connect to specific educational standards. I will let students know that my experiences at the Tech were super fun, and inspired me to think of a way that we could practice using the engineering design process in class. Then, once we are finished, we will end up a bunch of games that: 1) we can have fun playing, and 2) will actually be useful by helping to reinforce things we have already learned about in 5th grade!

2. Let students know that they will now be using their research to create a similar product using the Engineering Design Process. Hand out "[Board Game Design Challenge: Project Guidelines](#)," and go over the expectations of the project. Make sure students know and understand the design criteria, what materials they can and should use, what kinds of questions and considerations they should think about when designing their game, and a general overview and timeline of the project.

3. Hand out and review the "[Board Game Design Challenge Rubric](#)" as well, so that students are aware of how they will be graded.

Form Design Teams / Begin Brainstorming and Research (2-3 sessions, 45-60 min. each)

1. Teacher can form teams in one of a few different ways: 1) Assign students to be in teams of 2-3 students, using whatever criteria is normally used for group activities (good balance of academic ability, design skills, personality types, which content area they would like to focus on, etc.), or 2) Let students choose for themselves who they will work with. With this approach, limitations could still be given ("make sure you choose team members you haven't worked with before;" "choose others who are interested in the same content area;" "choose others who sit at a different table;" and so on.)

2. Once teams have been formed, have them begin the research and brainstorming process:

- Have students start by sharing their own "[Board Game Research Notes](#)" from the Board Game Day.
- Have students go online to look for other examples of games, rules, etc. [BoardGameCapital.com](#) is a good place to start: <http://www.boardgamecapital.com/board-game-rules.html>.
- Have students go online to look for examples of game boards. [Microsoft Word Games & Game Templates](#) is a good place to start: http://people.uncw.edu/ertzbergerj/word_games.html.

3. Depending on the team's progress, the research/brainstorming process may need to be carried over into 2 or 3 different sessions. Make sure teams have a good basis of research from which to begin designing their own game.

4. Make sure teams discuss which content area they plan to focus on.

5. Once teams have completed the research and brainstorming process, and have some good initial ideas about what kind of game they would like to create, have them complete the "Board Game Design Proposal" handout. Remind them that this is only their initial proposal. They do not have to have every single detail worked out, and their actual game will not have to follow every aspect of this proposal exactly. Students will be learning what works and what does not, and changing their game design along the way.

6. Design teams should turn in their "Board Game Design Proposal" to the teacher for any feedback and approval. Help guide students if they are having difficulty, but do not tell them what to do. Remember, the design process is equally, if not more, important than the final product. Remind students that this is what the design process is all about, they are encouraged (required, actually) to make changes as they go from one prototype to the next, and that these changes will be based on testing and feedback from neutral game players.

Game Design (multiple sessions, 45-60 min. each):

1. This will be the longest and most unpredictable portion of the Board Game Design Challenge. There will likely be varying amounts of progress from the different design teams. Allow for teams to work on their game designs for a portion of time each day, and monitor their progress along the way.

2. When it seems like many teams are getting close to being finished with their first prototype, explain how they will test their game, get feedback, and make changes to their game. All teams do not necessarily have to be done with their prototype before beginning the testing phase. Once all teams have made some good progress, let students know that whenever they feel they are finished with their first prototype, they should get with another team (who is also finished) to begin the testing/redesign process:

- The first team explains to the second team how to play their game: rules, game cards, how to make progress and move their pieces, etc.
- The second team plays the game, with guidance from the first team.
- After the game has ended (or after a specific period of time), the first team asks the second team for feedback, which the first team should record on the "[Board Game Feedback and Design Changes](#)" handout.
- The teams should then switch roles.
- After getting feedback, the team should decide what changes they would like to make to their game, and record these changes on the handout, making sure they note why they are making the change, and what effects they expect this to have on their game. This will serve as a Formative Assessment, showing how well students are engaging in the engineering design process.
- After implementing these changes and making a second prototype, design teams will repeat the above process with a different team (not the same one they tested with before), ultimately ending up with a final prototype.

3. Lastly, have students reflect back on their board game design process by completing the "[Board Game Design Process Analysis](#)" handout. This will serve as one form of Summative Assessment.

Wrap-Up/Celebration/Board Game Day Round #2 (approx. 60 min.)

1. After all design teams have finished their final prototypes, celebrate their hard work by letting everyone play all of the games.
2. Conduct this just like you did for the original Board Game Day.

Assessment:

FORMATIVE: Students will be assessed as they are working on this design project by having them create, test, and make changes to their Board Game prototypes. After each prototype, students will use game player feedback to complete the "[Board Game Feedback and Design Changes](#)" handout, where they will note what changes they made to their game, why they made those changes, and what effect those changes will have on their game.

SUMMATIVE: Students will be assessed on multiple aspects of this design project, as shown on the "Board Game Design Challenge Rubric," including: Game Board Design, Rules Development, Effectiveness, Game Card Design, Engineering Design Process, Playability, Teamwork/Participation. They will also complete a "[Board Game Design Process Analysis](#)" at the end of the project.

2. Additional Instructional Context:

This lesson can be implemented at any point in any curriculum. If you would like it to focus on specific subjects/topics, introduce it at the beginning of the unit so that students can be thinking about it during the unit. The design process process itself should begin towards the end of the unit. Then, use the games to help students review the content. Otherwise, you can introduce this lesson at any point, and ask students to decide what subject/topic they would like to focus on.

3. Supply List:**STUDENT HANDOUTS:**

Board Game Design Challenge Project Guidelines
Board Game Research Notes
Board Game Design Proposal
Board Game Feedback and Design Changes
Board Game Design Process Analysis
Board Game Design Challenge Rubric
Game Card Template

SUPPLIES:

board games
sample game board templates
poster board
construction paper
laptops
markers
colored pencils
misc. art/craft supplies

4. Bibliography:

"Board Game Rules and Instructions." - *Board Game Capital*. Web. 1 July 2015.

"How to Make Your Own Board Game." *WikiHow*. Web. 1 July 2015.

"Microsoft Word Games & Game Templates." *Microsoft Word Games*. Web. 1 July 2015.

5. Keywords:

design, board game, engineering, collaboration, upper elementary, middle school

IV. Attachments

[Board Game Design Challenge_Project Guidelines](#)

[Board Game Research Notes](#)

[Board Game Design Proposal](#)

[Game Card Template](#)

[Game Card Template](#) (editable Google Doc)

[Board Game Feedback and Design Changes](#) (Formative Assessment)

[Board Game Design Process Analysis](#)

[Board Game Design Challenge Rubric](#) (Summative Assessment)