

UNIT 9

New Game

UNIT OVERVIEW

UNIT NUMBER: 9

**DURATION: Up to 15 in-class hours
(depending on complexity of game and
means of implementation)**

SUMMARY

In this unit, students will think critically about their experience with previous units and apply the skills they've developed to create an original *FIRST*Tech Challenge Game. They will use a thematic scenario as the inspiration for original game design and incorporate elements from previous challenges into the game play, using commonly available materials from around the school or classroom. Skills developed in outreach efforts will be applied to teach another group of students or community members how to play their game.

INSTRUCTIONS

1. Divide the class into small groups and encourage students to brainstorm and list on chart paper three of their favorite elements of game play or strategy from their previous experience in *FIRST*Tech Challenge. They should briefly explain why they liked them so much. Have the groups share these ideas with the class and then complete the same activity with their least favorite elements of game play or strategy. Post these lists in the classroom to view throughout the design phase.
2. As a class, review and discuss the *Ship it! Warehouse Scenario* resource.
3. Divide the class into small groups again to brainstorm or incorporate ideas from previous brainstorming, into an initial idea for a new game that meets the scenario and criteria provided.
4. In groups, or as a class (depending on available resources), create a plan to develop and test the new game idea. Provide students with the *Game Design* resource to document their plan, ideas, and progress.
5. Complete and test the new game. This can be completed in small groups if resources allow, but may need to be completed as a class if materials or space is limited.

6. Have students share their game or teach it to new players. Teams may wish to exchange original game challenges and complete them individually, or gather together in a full-day scrimmage workshop to learn and adapt to the games on-the-fly.

Teachers may wish to have students complete formal or informal presentations about their games. Students should reflect on the game design experience and what they have learned from it.



ASSESSMENTS:

1. Weekly Engineering Notebook
2. Weekly Self & Peer Evaluation
3. Ship it! Warehouse Scenario resource
4. Game Design Process resource
5. Unit 9 Rubric

TOOLS & MATERIALS

1. Tetrax Kit of Parts or Rev Kit of Parts
2. Completed robot
3. Classroom materials or field kit
4. Art supplies (as needed)
5. Electrical tape in various colors
6. Found items such as:
 1. Cardboard boxes, boards, safety cones, benches turned on their sides to create barriers
 2. Balls of different sizes, plastic cups or lunch containers, stuffed toys, books, cans or boxes of non-perishable food as items to select
 3. Plastic storage bins of different sizes
 4. PVC or cardboard tubes to create "portals"

STANDARDS ADDRESSED:

Full course standards alignments can be found [here](#).

NEW GAME CHALLENGE

Ship it! Warehouse Game Scenario:

What would you do if you could design a FIRST Tech Challenge Game?

You and your teammates have been selected to develop a new game that can be created using the field kit and/or everyday classroom materials.

This game theme is set in a semi-automated warehouse where items are stored in one area of the playing field to be selected by a robot that is "shopping." The items must then be "shipped" to various locations via portals in another area of the playing field.

Robots will need to complete their shopping and shipping task without dropping their items and without colliding with obstacles or other robots completing the same task. The game you design must meet the criteria below.

Ship it! Warehouse Game Criteria:

1. The field must have at least two sections:
 1. Storage (where items are kept for selection and transportation)
 2. Shipping (the area on the field that contains the "portals" to different locations)
2. Part one of the game must be autonomously controlled.
 1. In this part of the game, the robot should drive to select one item out of three options located in the "Storage" section of the field.
 2. (Optional) Each item may be worth a different value.
 3. The item should be selected and transported to a transition point on the game field where the remote-controlled portion of the game will begin.
3. Part two of the game must be remote controlled.
 1. Once the items have been selected and transported to the transition point, the robot needs to drive and move them to one of three shipping portals located in the "Shipping" section of the field.
 2. (Optional) Each portal may be worth a different value.
4. Two robots must complete this task at the same time.
5. At least two obstacles must be present on the game field.

The rest, is up to you!



HINT:

Remember, someone else is going to have to play your game. Make sure to test it for difficulty, playability, and fun!

DRIVING QUESTION:



How can we, as a team of experienced *FIRST* Tech Challenge participants, use what we've learned about design, programming, building, and communication, to create a fun, challenging robotics game that other students can play?

**HINT:**

When students are considering the challenge and what they will incorporate into their own game, they should be encouraged to “keep it simple” and add complexity as ideas are developed and tested. They will ultimately need to teach other students about their game, so the tasks, rules, and scoring they incorporate should be both attainable and reasonably easy to understand.

Guiding Questions:

- What questions do we have about the challenge?
- Are there clear answers to all of these questions or is there “wiggle room” to innovate and make up our own answers?
- What does this challenge make us think of?
 - Real world situations or examples
- Are there other challenges we’ve completed that might contain useful game elements or ideas for game play?
- Where can we find information about old games or look for inspiration?
- What have we learned in previous units that will help us complete this challenge?
 - Generating ideas
 - Design skills, tasks, or ideas
 - Programming skills, tasks, or ideas
 - Building skills, tasks, or ideas
 - Communication and presentation skills or tools

Facilitator’s Tips:

Q: Where can students find archived game material for inspiration?

A: A playlist of previous *FIRST*Tech Challenge game animations can be found [here](#).

Q: How can this game scenario be adjusted for greater or less complexity?

A: Additional and optional challenge ideas have been included in the Facilitator’s Tips in the Design and Complete the Game phase of this unit.

DESIGN AND COMPLETE THE GAME

Provide students with the *Game Design Process* resource. Divide the class into small groups and have them work through the process, using the resource to document their ideas and progress.

Use the *DESIGN THE GAME* and *MAKE A PLAN* sections of the resource to document ideas and progress.

The final game may be completed by small groups if resources allow, or groups may come together and share ideas to create a single collaborative game. If a collaborative game is the goal, it’s a good

idea to use a fresh copy of the Game Design Process resource to document the final product after groups have used individual copies for brainstorming and idea development.

To encourage critical thinking about game design, encourage students to brainstorm their own questions that will need to be asked to design an engaging, playable game. To support students and teachers in this process, a list of guiding questions has been provided below to be used as needed.

Guiding Questions:

- What resources do we have to build the game field and elements on the game field?
- How big should the “warehouse” be? How much space do we have to set up and play the game as it is developed?
- Will we need to take apart or store the game during the development process? Will it need to be easy to disassemble and store?
- What are the basic criteria?
- What additional criteria will we add?
- How will the game be scored or won?
 - Will each item have a different value based on size, color, placement, or how easily it can be picked up or transported?
 - Will each portal have a different value based on size in relation to the items, placement, or level of difficulty in navigation towards it?
- Will the game or parts of the game be timed or will there be time limits?
- Will the Pushbot or another robot made for this year’s *FIRST* Tech Challenge be an appropriate size or include appropriate components for this game?
 - Will modifications need to be made to the robot to complete it?
 - How extensive or complicated will those modifications be and will players be able to make them?
- What programming elements can we use that we gained in the skill development unit? (e.g., Include a Path to portals that robots can be programmed to follow autonomously.)
- What building elements can we use that were in skill development? (e.g., Incorporate the transportation of a container that can spill among the items to be “shipped.”)
- What tools do we have to plan and test our game? (e.g., Use CAD to design the field.)
- Could we explain this to someone? Who will be playing and how can we effectively explain the game to them? (e.g., Create a video demo of the game to post online so a team in another part of the country or world can learn to play it.)
- Would another team in another location be able to set this up based on our instructions and play this? (e.g., Use the communication strategies from the Problem Solving and Communication challenge in Unit 7 to break down and represent the information.)
- Do we have enough time to create this game?
- How will we test the game?
 - How will you determine if it’s too easy, too hard, or just hard enough?
- How will we teach people to play it?
- How much time will players need to understand the game and to develop a robot and program that works to complete it?

Additional (Optional) Challenges:

- Create two or three different versions of the same game to accommodate skill level or experience of players (e.g., Beginner, Intermediate and Advanced Levels of game play).
- Design the game field in CAD or using open-source software.
- Design a game where three items must be selected and transported to specified portals. Items may need to be collected at once and stored, or the remote and autonomous portions of the game may need to be repeated for each item to be selected and then “shipped” individually.
- Design a game that can be completed entirely using a remote control to practice driving skills.
- Design a game to be completed autonomously to practice more advanced programming skills.
- Use the new game for a community outreach effort.
- Incorporate the new game into local scrimmages with other *FIRST* Tech Challenge teams.
- Use open source video editing, graphic design, or animation software to create a professional-looking instructional video about the game so other teams in the *FIRST* community can view and play it.



HINT:

Encourage students to build and test their games several times throughout the development process, documenting problems encountered and solutions discovered on their Game Design resource.

Facilitator’s Tips:

Q: What materials or resources should students incorporate into their game?

A: The list of available materials and resources may vary from school to school or classroom to classroom. Students should be encouraged to think critically and resourcefully about what is available to them to use without purchasing additional materials. It may be a good idea to provide time for students to investigate their school, home, or community for opportunities to reclaim, reuse, or repurpose found or scrap materials.

Below is a list of suggested materials to use as a starting point.

Suggested Resources to Build the Game and Field:

- Tetrix Kit of Parts or Rev Kit of Parts
- *FIRST* Tech Challenge field kit
- Art supplies (as needed)
- Electrical tape in various colors
- Found items such as:
 - Cardboard boxes, boards, safety cones, benches turned on their sides to create barriers
 - Balls of different sizes, plastic cups or lunch containers, stuffed toys, books, cans or boxes of non-perishable food as items to select
 - Plastic storage bins of different sizes
 - PVC piping or cardboard tubes to create “portals”

Q: How can games and student participation be assessed?

A: Teachers may wish to have their students complete formal presentations of their game design, using the Game Design Process resource as a template for the elements that should be represented in final project documentation.

This may take the form of:

- A formal proposal developed to present to a fictional committee of *FIRST* game designers as a potential scenario for next year's *FIRST* Tech Challenge
- An Elevator Pitch (see Unit 8) and face-to-face interview about the game and how it was developed and tested

A general rubric has been provided with this unit for teachers to adapt to their needs and their students' levels.

REFLECT ON GAMEPLAY

Encourage students to create instructional material to demonstrate or teach a new group of players about their game. This may be in the form of instructional print outs, posters, video tutorials, or in-person demonstrations and coaching.

Students should share their game with another team and gather feedback and questions, or if possible, observe as another team completes the game challenge they've created.

Depending on the complexity of the game and the kinds of programming or robot modifications required, this may be possible in a one-day workshop, or may require a few weeks between presenting the game and observing the game so that the teams playing it have time to consider and prepare to complete the game challenge.

Alternatively, students can complete their game and play it themselves, following the iterative engineering design process they've learned throughout the *FIRST* Tech Challenge.

When students have completed this experience, return to the Game Design Process resource and encourage them to complete the TEST THE GAME and REFLECT ON THE GAME DESIGN EXPERIENCE sections.

Facilitator's Tip:

Q: How can this Unit be used to build stronger *FIRST* teams?

A: In the off-season, new games that have been generated can be exchanged between teams to support innovative problem solving and skill development without the risk or pressure of competition. Teams can get together and play each other's games in scrimmages and novel solutions to problems that the game presents can be shared. Networking and sharing can be done face-to-face, or online via the exchange of demo videos and video documentation or live streaming as the student-generated challenges are completed.



Ship it! Warehouse Scenario

SCENARIO:

What would you do if you could design a *FIRST* Tech Challenge Game?

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 - *(Optional)* Each item may be worth a different value.
 - The item should be selected and transported to a transition point on the game field where the remote controlled portion of the game will begin.
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4. Two robots must complete this task at the same time.
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The rest, is up to you!

HINT: Remember, someone else is going to have to play your game. Make sure to test it for difficulty, playability, and fun!

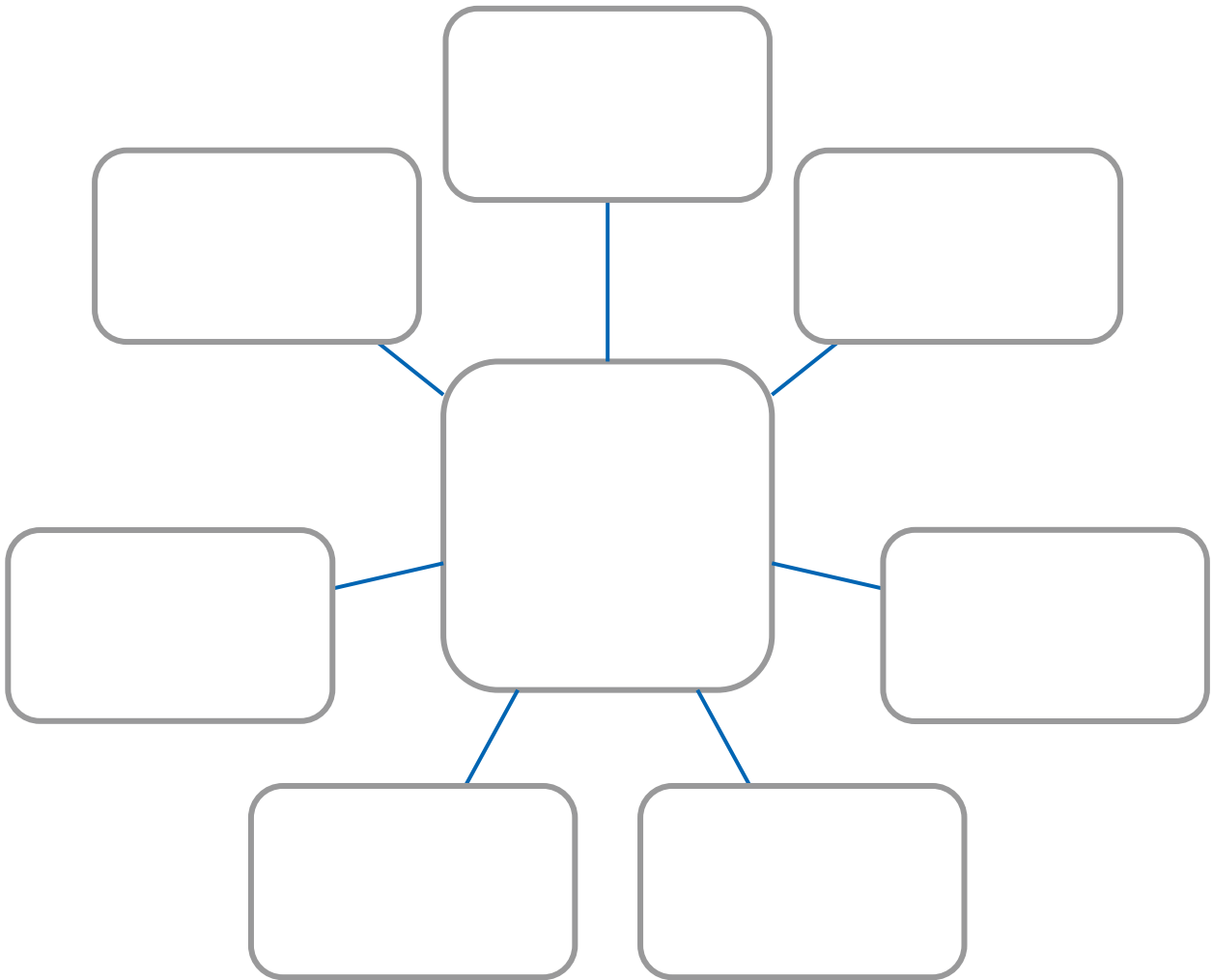


Game Design Process

Unit 9: New Game Challenge

DESIGN THE GAME:

Use the template below or create your own mind map to brainstorm the questions you will need to ask yourself or others to develop your game.



Make a list of resources and materials that can be used to make your game field and elements.

Available Resources for
Game Field:

Available Resources for
Game Elements:

Resources We Need to Find:

Check resources off the lists as they are assembled or found.

Create a rough sketch of the game field you would like to create.

Make sure to label components and materials used so that you can ensure you have everything you need and identify items that might need to be found to complete your game.

Double check the game criteria to make sure you've included all the requirements elements of the game.

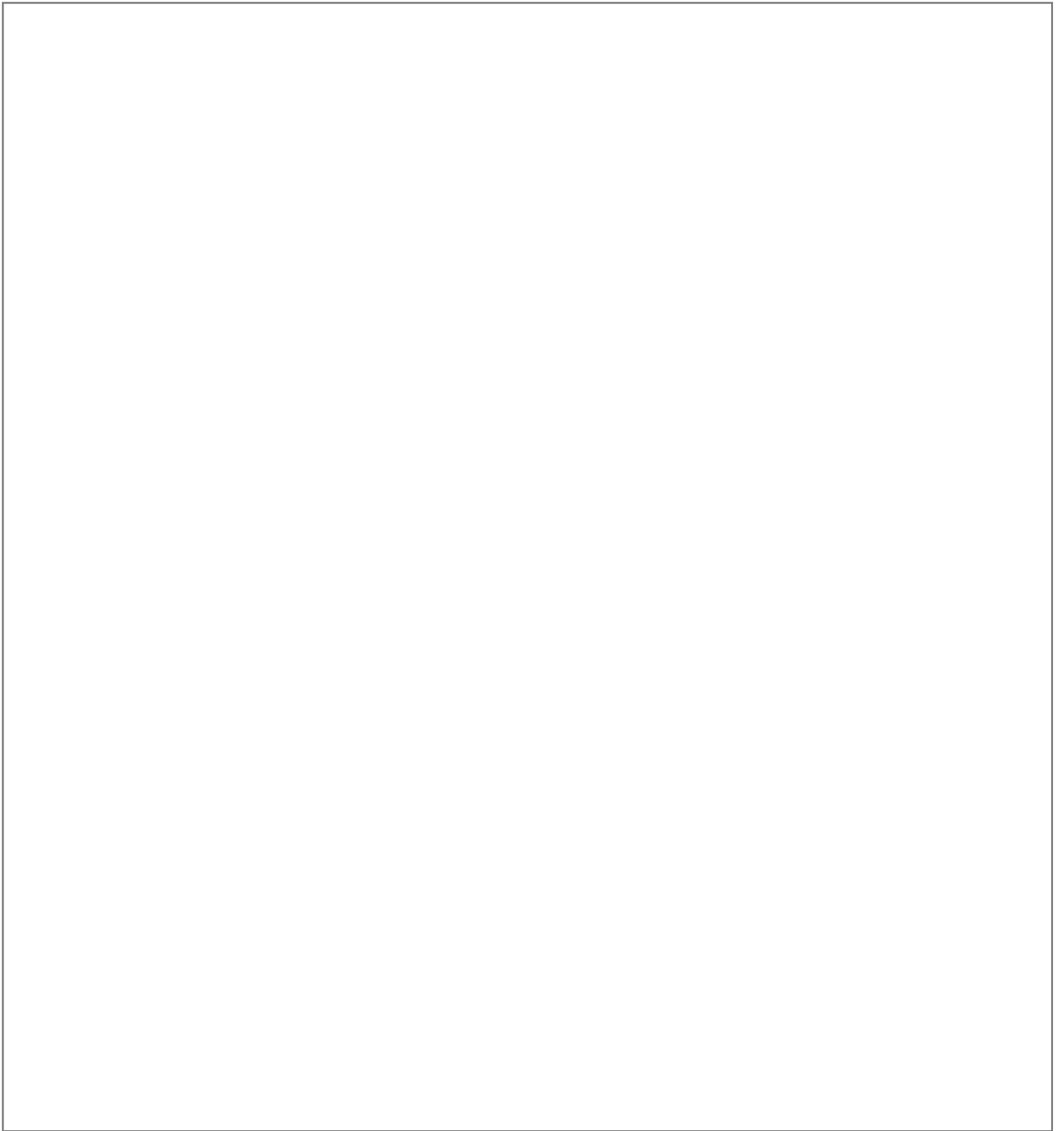


Notes about the sketch or design:



Now think about how players will play the game and how they will win.

Describe the game's goal, rules, scoring and any additional details that will affect how the players play the game.



What will be the most challenging aspects of game play?

What will be the least challenging aspects of game play?

What problems do you expect to encounter when playing the game?

Propose a solution for each challenge you anticipate.

Expected Problem:	Proposed solution:

MAKE A PLAN:

Use the template below or make your own timeline or checklist to complete the new game you have designed.

Task	Resources Needed	Estimated Completion Date	Team Members Responsible

TEST THE GAME:

Make a list of things that work well in the game:

Make a list of things that need improvement in the game

As problems with the game are solved, cross them off the list.

REFLECT ON THE GAME DESIGN EXPERIENCE:

How well does the game meet the criteria outlined in the challenge?

The game meets some of the criteria in a limited way.	The game meets at least half of the criteria.	The game meets all required criteria.	The game meets all required criteria and includes additional innovative elements.
Comments:			

How effective were the instructions for the game?

They did not work well.	They worked ok. There were some problems with them.	They worked well.	They worked better than we expected.
Comments:			

How successful was the game play?

The game too difficult (or too easy) to play or there were too many problems. It did not go well.	Some aspects of game play went well but there were many problems.	Overall the game play went well.	Game play went better than expected.
Comments:			

How would you describe your participation in the game design?

I did not contribute very many ideas and did not really participate in the construction of the game.	I contributed a few ideas to game design or I helped to construct the game.	I contributed both ideas and construction effort to game design.	I took a leadership role or contributed innovative ideas to game design and construction efforts.
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Comments:

What would you incorporate into future game design?

What wouldn't you incorporate into future game design?

Describe one important lesson you have learned from this experience.

Describe next steps you would like to explore because of this experience.



Game Design - Rubric

Unit 9: New Game

	Emerging	Developing	Proficient	Advanced
Makes connections between available resources and potential game play.	Identifies some available resources to incorporate into game design.	Identifies some available resources and makes comments about how they can be incorporated into game design.	Creates a detailed list of available resources and clearly describes how they can be incorporated into game design.	Demonstrates an innovative approach to resource acquisition or use in a detailed list of available resources, and clearly describes how they can be incorporated into game design.
Asks and answers questions about game scenario and criteria.	Asks superficial or irrelevant questions about the game scenario and criteria.	Asks meaningful questions about the game scenario and criteria.	Asks meaningful questions about the game scenario and criteria and makes an effort to answer them.	Asks meaningful questions about the game scenario and criteria and uses innovative resources and approaches to answer them.
Describes and represents ideas for game design.	Provides minimal documentation of ideas for game design.	Provides general description and some visual representation of ideas for game design.	Provides a detailed description and visual representation of ideas for game design.	Uses novel tools or an innovative process to describe and visually represent ideas for game design.
Integrates concepts and ideas from previous units into game design or presentation.	Does not mention or refer to concepts or ideas from previous units.	Refers to general concepts or ideas from previous units.	Identifies ways in which concepts or ideas from previous units have influenced game design.	Identifies ways in which concepts or ideas from previous units have influenced specific aspects of game design.



Planning and Documentation - Rubric

Unit 9: New Game

	Emerging	Developing	Proficient	Advanced
Effectively identifies tasks and subtasks required to complete game design.	Identifies general tasks required to complete game design.	Identifies specific tasks required to complete game design.	Identifies specific tasks and subtasks required to complete game design.	Identifies specific tasks and subtasks required to complete game design and effectively communicates the relationship between them.
Prioritizes tasks and subtasks and manages work flow to complete the final game.	Demonstrates an effort to prioritize tasks or estimate completion time to complete the final game.	Prioritizes some tasks effectively and provides an estimate of completion time for some of them.	Prioritizes most tasks effectively and provides an estimate of completion time for all of them.	Prioritizes tasks effectively and provides substantiated estimates of completion time.
Documents key questions, notes, and observations throughout the game development process.	Makes minimal notes or observations throughout the game development process.	Documents key questions, notes, or observations sporadically throughout the game development process.	Consistently documents key questions, notes, and observations throughout the game development process.	Asks insightful questions and consistently makes detailed notes and observations throughout the game development process.



Implementation and Reflection - Rubric

Unit 9: New Game

	Emerging	Developing	Proficient	Advanced
Provides detailed and effective instructions for game play.	Provides incomplete or unclear instructions for game play.	Provides complete instructions for game play that are at times difficult to follow	Provides complete instructions for game play that are generally easy to follow	Provides detailed, complete instructions for game play that demonstrate anticipation of challenges or questions players might have.
Identifies strengths and challenges of the game designed.	Identifies some strengths or challenges of the game designed.	Identifies some strengths and challenges of the game designed.	Identifies and describes both strengths and challenges of the game designed.	Identifies and describes both strengths and challenges of the game designed, and provides solutions or next steps where appropriate.
Draws conclusions about the overall game design experience and identifies personally relevant actions or next steps for the future.	Makes general comments about the overall game design experience.	Makes general comments about the overall game design experience and how it relates to them personally.	Identifies key lessons learned throughout the game design experience and relates these experiences to personal actions or next steps.	Identifies key lessons learned throughout the game design experience, relates these experiences to personal actions, and describes detailed next steps.