



INTRO TO GAME DESIGN

Museum Educator Guide

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Welcome and Introduction

Welcome to the Games for Change Student Challenge Curriculum Museum Educator's Guide, a comprehensive handbook that will help you organize and teach the basic concepts of game design in your formal or informal learning setting. This guide provides both big picture information about teaching game design as well as many practical tools, tips and lessons to ensure the success of your learners as they embark on game design.

This guide has five sections: the first section provides an overview of teaching game design; the second focuses on the lessons that will move your learners through the game design process, step by step; the third section contains details about participating in the Games for Change Student Challenge; the fourth section provides resources that align to the lessons but can also be used on their own as you see fit, as well as information about the alignment of game design to computer science standards; and the final section gives tips for virtual instruction and resources and appendices for further reading and research.

We hope you find this guide helpful as you embark on guiding your learners through this exciting process!

Why Game Design

Games, game design and the principles that underlie them can help build critical 21st Century skills like systems thinking, creative problem solving, collaboration, empathy and innovation, which have a unique relevance as social tools to rebuild the foundations of citizenship.

By facilitating game design in the classroom, we allow learners to develop strong system thinking and design skills. Learners have a chance to develop theories, test them and get immediate feedback from other players.

Let's unpack three core reasons why games and game design are worth integrating into your curriculum:

- 1. Games and Systems Thinking**
- 2. Games and Learning**
- 3. Games and Design Thinking**

"[Systems thinking] is understanding a world of interdependence and things continually changing. How do you see a system and not just a bunch of isolated things? —Peter Senge, 2013

1. Games and Systems Thinking

A system, human-made or natural, exists and functions as a whole through the dynamic interaction of its independent parts. When one part of a system changes, it affects other parts of the system, and ultimately affects the stability and sustainability of the system.

Games do a great job of modeling complex systems because they are complex systems.

They are made of components, organized by rules, and provide players with challenges to overcome on the way to meeting a goal. When we design games, we are involved in the design of systems.

We believe it is essential to help young people understand how systems work, how they are represented, how they change. Game design can help learners become systems thinkers. Systems thinkers learn to reason systemically, honing an ability to understand components, see interconnections, and ask “what if” questions about possible future behaviors and outcomes.

Playing, modding, and designing games support the development of systems thinking, because learners consider interactions among components and how they affect game play. They begin to recognize that sometimes a small change to a component can make a significant impact on the overall behavior of the system.

Systems thinking means understanding a system by examining the linkages and interactions between the elements that compose the entirety of the system. That is the core of systems thinking. And with this type of thinking, learners and educators can learn to make positive changes in systems.

2. Games and Learning

Games provide engaging contexts for players to build content knowledge along with 21st century skills (Gee, 2003). Numerous research reports suggest that games are powerful student engagement and learning tools in classrooms (Hines, Jasny & Mervis, 2009; NRC,

2010). Additionally, several studies focused on studying game play and 21st Century skills indicate that playing games (both analog and digital) helps young people identify patterns, think about future moves, predict outcomes of possible moves, and learn from experience (Dewar, 2012).

Games as a tool for learning in museums is nothing new. Dave Patten, Head of New Media at UK’s Science Museum, said ““In the museum, games are a great way of allowing visitors to have agency over often quite complex areas of content, allowing visitors to explore ideas and content in a very interactive way.”

3. Game Design

Game design activates an iterative design process that is, by nature, collaborative and active.

Design broadly describes a creative process by which an idea is realized through observing, defining, ideating, prototyping, playtesting, and refining. The process is cyclical and along the way the designer likely produces many versions of his or her idea, not all of which make it into the final product. In one sense, design is all about organizing a set of parts into a whole in ways that the whole becomes greater than the sum of its parts. Design combines empathy for the context of a problem, creativity in the generation of insights and solutions, and rationality to analyze and fit solutions to the context.

Game Design thinking is learning to see all dynamic systems as being made up of rules, components, core mechanics, space, challenge, goal, and conflict. To think like a game designer is to ask, “How might I change this system to transform the experience it creates?”

We have adapted the term “design thinking” from the worlds of engineering, technology, and business for use in the education realm. For us, design thinking is a mindset relating to the process that designers use when conceiving, planning, and producing an object or system. Young people become highly familiar with design thinking as they design and mod

games. Our design thinking process is a highly iterative and collaborative methodology that consists of 5 steps. with design thinking as they design and mod games. Our design thinking process is a highly iterative and collaborative methodology that consists of 5 steps.

Setting the Stage

Things to Remember

As you embark on this journey with your learners, it's important to remember a few key ideas that will help you and your learners experience success.

First, your role as an educator is to facilitate. Learning Game Design is a process and it is important that your learners are able to experience every step of it along the way. There may be times that you aren't sure of the answer or you don't know exactly how to help your learners. Trust the process! Designing anything can be a frustrating, but ultimately fulfilling, process. If you are witnessing your learners experience frustration, remind yourself that they are exactly where they are meant to be. Give them tools, tips and resources (many of which can be found in this guide) but let them be the ones to figure it all out.

As you try to help guide your learners through the design process, remember that games are systems and everything is interconnected. Sometimes when something isn't working it's important to look at all the parts of a game and how they are working together. Help learners understand how the parts depend on each other for success and prompt them to think about what will happen if they make small changes to different parts. Help them find leverage points or points in their games where small changes can have a big impact.

This curriculum is meant to be hands on. At Games for Change we believe that learning happens by doing therefore we designed this guide to help you get your learners doing as soon as possible. Resist the urge to talk to your learners about concepts or ideas for too long. We strongly recommend getting them doing and designing as soon as possible.

Games are perfect spaces for failure. In fact, when you play a game the only way to improve is to mess up and learn from it. This curriculum and game design is also meant to help learners reframe their failure as iteration. As mentioned above, it's important you let your learners struggle and it's equally important you let them fail. Design is a cycle and iteration is an important piece of that cycle. Remind your learners over and over that game designers never get it right straight out the gate. Just like when they play a new game, failing and trying again is all part of the process.

And finally, this curriculum is meant to be fun and should feel like play. Encourage your learners to play and be playful. The only way to design play is to understand play and the only way to understand play is to experience it deeply. The more playful you can make this curriculum the more your learners will get out of it!

Game Design Process

Throughout this curriculum, we'll make reference to different stages in the Game Design Process. There are many variations in the language that people use when they talk about the game design process, but for the sake of this curriculum, we will use the following terms:



STEP 1- BRAINSTORM

Brainstorming is all about coming up with many different ways of approaching a provided design constraint or challenge. During this phase, it is important to encourage learners to not edit themselves or write off any ideas. No idea is a bad idea at this stage! That being said, after coming up with several different possible directions, you might consider asking your learners to pitch their ideas to you or to peers for feedback to help them narrow down and improve their ideas.



STEP 2- PROTOTYPE

Once they've selected their top ideas, they can begin to prototype in order to create something playable to elicit more feedback. Post-it notes, index cards, paper and pen make great prototyping materials. Make sure to encourage learners to try out their game as they build it, so they can refine as they go. It's okay if their game totally changes at this point! The point is to go back and forth between prototyping and testing in order to get to a game that is super fun.



STEP 3 - PLAYTEST

Playtesting is a crucial part of the design process. It's impossible to know how a game will work without having other people play it and provide feedback. At this stage, learners should be paired up to play each other's games and give feedback to one another. Allow time for both play and feedback. Encourage learners to ask for both verbal and written feedback from their peers. More guidance on playtesting will be provided throughout the lessons.



STEP 4 - ITERATE

After playtesting, allow time for learners to make changes to their game based on feedback. Encourage learners to select just one or two ideas from the playtest to implement. Time permitting, you may build in another playtest after learners have iterated their games.



STEP 5 - REFLECT

Reflection is a key part of the game design process and for student learning. Build in structures for learners to reflect on what they learned during the process and from collaborating with their peers. It's important for learners to think about what went well, but also, what was challenging for them. You might consider doing a think-pair-share in order to get the conversation going.

Tips for Virtual Instruction

The lessons in this guide are designed for in-person learning, however if you are teaching in a virtual environment, you can modify them for learners who are learning from home.

Below are some general tips for adjusting activities for virtual instruction to get you started:

- **Breakout rooms** - With breakout rooms you can pair learners up together or in small groups to discuss or do an activity together, and then come back to the larger group.
- **A short poll or survey** - These are useful to check in on learning for larger classes. You can also do a discussion activity after you learn the poll results.
- **Screen sharing** - Share your screen to share a slide deck with learners that goes through a list of steps for activities.
- **Video recording** - Record a video of you demoing something with other kids or adults for them to watch in advance, or during the class time. This is really helpful when you need to demo the game design process, modding, or any hands on activity
- **Materials** - Tell learners in advance what materials they will need. It's much better to have them come to class with what they need with them. Most of the materials here are simple (coins, cups, paper, pen, etc), but you can always have them make substitutions.
- **White board** - Learners can use the whiteboard feature for the games like tic tac toe, or when brainstorming ideas to share.
- **Tools for collaborative writing** - Use Google docs, Padlet, or a digital whiteboard like Mural or Miro.
- **Modify so design time is asynchronous** - Because game design is a collaborative process, it may be helpful to use live sessions to introduce design challenges, show them videos and examples, then have them work on things on their own and upload a photo, video, or description. If they have siblings or family members at home, they can always involve them in design and playtesting. Because most people enjoy game design, it may be easier for them to work on with people at home.

If you are teaching virtually, think about modifications that you can make as you read the lessons. There are so many substitutions you can make for materials or games - the most important thing is for learners to learn the core skills and concepts. It matters much less if you play a specific game or use a specific material.

Lessons

In this section you will find lessons that you can use to teach Game Design to your learners. These lessons will help them understand the parts of a game, how the parts of the game work together to create play and how to design a game from scratch. Once the learners complete these lessons they will be ready to begin to design their impact games.

Note: We will use the word “students” within each lesson plan, though we realize that many museum educators will not use that terminology for the learners they are working with. Whatever your context, the activities in these plans will work, and they are not designed to be used in only teacher-student settings.

LESSON 1 Play vs. Game

WHAT'S THIS ABOUT?

In this lesson, learners explore the differences between play and game and discuss what makes a game a game.

LEARNING GOALS

Students will be able to differentiate between what makes something a game vs just a playful experience

MATERIALS

Games vs. Play worksheet - see resources section

PREPARATION

Print the worksheet or make available digitally.

TIME

20+ mins

STEPS

1. Warm up (5 mins): Ask learners to share their ideas on what makes something a game.
2. Small groups (10-15 mins) Hand out the worksheet and ask learners to work on their own or in small groups to complete.
3. Group discussion: (10 mins) Bring class back together and discuss - what makes something a game? What makes it play? What from our original brainstorm list might we need to adjust or add?

EXTENSIONS

Give learners an example of something that is playful and ask them to suggest ways it could turn into a game.

LESSON 1 Play vs Game (CONTINUED)

CHECK FOR UNDERSTANDING

Have learners come up with their own examples of games and play. Can they correctly create each? If so, they understand the difference between what makes something a game and what makes something just a playful experience.



LESSON 2 Parts of a Game

WHAT'S THIS ABOUT?

What is a game? It's often hard to define. A good way to examine what is a game is to look at parts of a game. Throughout time and across cultures, most games have the same six parts – a goal, a challenge, core mechanics, components, rules, and space. Understanding parts of a game opens up the world of game design because with this knowledge, you can change one part of a game to create a new game (called modding) or design your own unique game by taking all six parts of a game into account.

LEARNING GOALS

1. Students will be able to identify the parts of a game.
2. Students will reflect on why people play games.

MATERIALS

1. Parts of a Game Vocabulary sheet
2. Parts of a Game Worksheet
3. Chart paper / board
4. A game you want to play: Select any simple game that learners can play easily together based on your context, such as Tic Tac Toe, Simon Says, or Musical Chairs

PREPARATION

Print all worksheets or make available digitally.

TIME

30+ mins, depending on what game you choose to play and how many rounds

STEPS

1. Parts of a Game introduction (5-10 mins) Introduce parts of a game using the Parts of a Game Vocabulary Sheet and write the parts of a game on a chart paper, wall, or screen. If you want to do some scaffolding, go through an example together, such as basketball or tag, or have them give general examples, such as below:
 - **Goal** - What does a player or team have to do to win? Cross the finish line first, collect the most marbles, be the last one standing, etc.
 - **Challenge** - What obstacles might you put in the player's way to make reaching the goal fun and interesting? How is she being kept from reaching a goal? Her leg is tied to a teammate's, the marbles are hidden, getting hit with a ball ends game play.
 - **Core Mechanics** - What core actions or moves does the player do to power the play of the game? Jumping, wiggling, searching, solving clues, ducking, bobbing, weaving, dodging.
 - **Components** - What parts make up the materials of play? Bandanas? A grassy field, marbles, red rubber balls and a court? (Note: Players are components of a game)
 - **Rules** - What relationships define what a player can and cannot do in the game? Players' legs are tied together, they must start on the same line, all marbles must be gathered within 3 minutes, balls can only be thrown outside the line towards the midsection.
 - **Space** - Where does the game take place and how does that space affect the game? Basketball court? A circle? Classroom? The park?

LESSON 2 Parts of a Game (CONTINUED)

2. Review the rules of the game you selected and have the learners PLAY (15 min) Explain the rules of the game to the class, then lead a few rounds of the game. If remote, consider picking a game that can be played remotely or ask students to choose a game they have played often and are able to imagine the game play well enough to break the game down into its parts.
3. Practice Parts of a Game (5 min) After a brief introduction to the parts of a game, give the learners the opportunity to define on their own (or in small groups) the parts of the game they have just played by completing the Parts of a Game Worksheet.
4. Share-out: Parts of a Game (5 min) Once the learners have analyzed the parts of the game, have learners share out. Keep track of their answers to parts of the game by writing (on board, chart paper, etc)
5. Discuss why people play games (5 min) Once the game and its parts have been collaboratively analyzed, ask:
 - Why do you play games?
 - Why do other people play games?
 - Are games useful in ways other than just “having fun”?

Keep track of learners’ responses on a board for easy discussion/reference.

TIPS

Remember the difference between components and core mechanics— components are nouns and core mechanics are verbs.

Sometimes parts can overlap, so don’t get stuck if something is confusing. Let the learners talk it through with you together and decide, is this really a rule, or an obstacle? Or both?

EXTENSIONS

Have learners pick another game they enjoy and break it into parts. You can also have them play another game and do this, or teach the class a game. Think about games that are perhaps quite similar, and have them figure out what really makes them different - eg, soccer on a field vs. a foosball table. They can even debate about what would happen if you changed something big - when does the game become a new game, and not just a version of the same game..

CHECK FOR UNDERSTANDING

Give students an exit ticket with an example of a game and ask them to break it into parts. Are learners able to correctly identify each part?

LESSON 3 Core Mechanics and Components: Coin and Cup Challenge

WHAT'S THIS ABOUT?

In this lesson, learners will explore core mechanics of a game. They will use everyday objects to play with the different actions. They will design a game using coins and paper or plastic cups, and explore all the things they can do with coins and cups (eg, spin coins, hide in cups, stack cups, etc). Then, they will design a game using only coins and cups. You will introduce the design process to learners and they will learn the basics about how to brainstorm and test a game. (You will delve deeper into the design process in the next lesson, so keep it simple for today).

LEARNING GOALS

1. Students will know that a core mechanic is the main action of the game: the one that occurs most frequently.
2. Students will understand that physical properties of components give rise to certain actions (mechanics).
3. Students will know that the design process is a set of steps designers use to come up with an idea, test it, and then make it better.

MATERIALS

1. Ball, paper clip, or some other objects for the warm up.
2. Different coins and plastic or paper cups - enough so each group gets a handful.
3. Coin and Cup Challenge Worksheet

PREPARATION

1. Put Students in groups of 2-4.
2. Gather coins and cups and distribute them equally for each group that will be participating.
3. Print the worksheet or make available digitally.

TIME

45 mins or more, depending on how many games you want to have learners demo

STEPS

1. Introduction/Warm up (5 mins): Take out a few objects, like a ball and a paperclip. Either do a fishbowl, a teacher demo, or pass them out to learners. Explore what each object can do. Ask learners:
 - What kinds of actions can they give rise to? For example, play with a ball - what are all the things you can do with it? Throw it, bounce it, roll it - what else? What can a ball do that a paperclip cannot?

For remote, break out course into rooms organized around each object. Each group has 3 minutes to list as many things one can do with that object. Bring them back and share how many they figured out, and then share 1 obvious one and 2 unexpected.

2. Debrief and Review the definition of Core Mechanics (5 mins): Remind learners that the core mechanics are the actions or moves that the player does during gameplay. They should think of

LESSON 3 Core Mechanics and Components: Coin and Cup Challenge (CONTINUED)

them as the verbs you use to talk about your game. A game can consist of many mechanics. The core mechanic is the main action of the game: the one that occurs most frequently. A game's core mechanics can really make or break gameplay. Mechanics have to be fun and rewarding in order for a game to be enjoyable.

3. Design Challenge Overview + Design Time (20 mins): Explain to learners that they will be using the DESIGN PROCESS to design a game today using only coins and cups. The design process is a set of steps designers use to come up with an idea, test it, and then make it better. Today we will begin to use this process, and we will learn more about it in the next lesson. Explain the first step today is to brainstorm all the things they can do with these materials. Then they will create their game and test it. Hand out the worksheet and explain the steps. Give learners at least 15 mins to design the game in small groups (2-4 learners each). Summarize steps or write on board or chart paper:
 - Explore the components and make a list of all the actions they give rise to. Have one person in the group be a recorder for this on their worksheet.
 - Brainstorm ideas for games by moving the materials around and trying things out.
 - Pick an idea to build your game around. This should be a simple, fast game. Record on the worksheet name of the game, rules of the game, goal of the game, and any and all mechanics used in the game.
 - Pick someone to explain/demo your game to the class.
4. Bring students back together and test at least 2 of the games (20 mins+): Explain to learners that this is the playtesting process - when someone else tries your game to give you feedback. Today, we just want to try a few of the games and guess the core mechanics. We aren't going to give feedback about what we liked or think could be improved about the game.
5. Have learners present their games in front of the entire class, one group at a time, with volunteers playing the games. After each gameplay, ask if the class can guess what mechanics were used. Ask that playtesters provide one Glow (something they liked about the game) and one Grow (an area for improvement).
6. Wrap up by asking the students to think about how many different actions they were able to create using just coins and cups.

TIPS

- Don't give too much time for learners to design their game! This should be a simple game that focuses on the mechanics.
- Students may want extra materials, like tape. We strongly suggest you keep it to coins and cups for design materials, but if they want to label objects with markers (such as putting point values on the cups) that is ok.
- Keep the feedback during testing positive. The next lesson will focus more explicitly on playtesting and how to give proper feedback to improve a game. The main goal of today is to

LESSON 3 Core Mechanics and Components: Coin and Cup Challenge (CONTINUED)

focus on core mechanics and components.

EXTENSIONS

- Dig deeper into the connection between components and actions in a game. Ask learners to think about two different sports you might play, for example, hockey and soccer. What are the actions in those games? What are the objects in those games? How would soccer be different if you used a hockey stick?
- For homework, have students pick 5 objects - any 5 will do, but here are some ideas: rubber bands, paperclips, cotton balls, index cards, a straw. List each object and come up with at least 5 different things you can make each object do. Tell them don't be afraid to bend them and move them around! Share out what is the most interesting thing they found at the next lesson.

CHECK FOR UNDERSTANDING

As individuals or in small groups, Ask learners to come up with an example of a game (or list some options on the board) and name at least 2 core mechanics. Are learners able to correctly identify the major mechanics?



LESSON 4 Space, Rules and Challenge: Tic, Tac, Toe Mod

WHAT'S THIS ABOUT?

In this lesson, learners will focus specifically on how the Space, Rules, and Challenge of a game affect the experience of gameplay. After playing Tic Tac Toe together, learners will analyze the parts of Tic Tac Toe and then work in small groups to modify, or “mod,” the Space, Rules, or challenge of the game.

LEARNING GOALS

1. Students will be able to identify the Space, Rules, and Challenge within a game.
2. Students will be able go through the game design process to modify a game.

MATERIALS

1. Chart paper / Board
2. Writing Utensil
3. Design process handout
4. Prototyping materials (paper, index cards, post-its)
5. Parts of Game Modding Worksheet
6. Tic Tac Toe Matching Worksheet
7. Role Cards (optional)

PREPARATION

1. Put learners in groups of 2-4.
2. Gather coins and cups and distribute them equally for each group that will be participating.
3. Print the worksheet or make available digitally.

TIME

45 mins or more, depending on how many games you want to have learners demo

STEPS

1. Introduction (5 min): Inform students that they will do a design challenge where they will have to design a game from scratch.
2. Model and Practice (5 min): Ask for 2 volunteers to come up and play the game Tic Tac Toe (TTT) so that everyone can agree on the rules together. Ask the learners to recall the parts of Tic Tac Toe again. In groups of 3, have learners play a few rounds of regular tic tac toe, taking turns with each other so that all 3 players get a chance to play another person in their group. Stop play and ask how that felt. Questions to ask:
 - What do you like about Tic Tac Toe?
 - What do you NOT like?
 - How'd it feel to play like this in a group? How did the 3rd person not playing feel?

LESSON 4 Space, Rules and Challenge: Tic, Tac, Toe Mod (CONTINUED)

3. Introduce the Struggle (e.g. the need to modify Tic Tac Toe) (5 min): Tell the class that they will now play a version of Tic Tac Toe for ALL THREE players in the group. The only change they can make is that instead of 2 players assigned "X" and "O," players will now be assigned "X," "O," and "Δ." After a few minutes of play, check in with each group to see how it is going.

- What works and doesn't work with this new RULE of three players?
- How does it affect the CHALLENGE of the game?

4. Mini-Design Challenge (10 min): Explain to students that by introducing a third player but not making any other changes to the game breaks the game. Once we added a new rule of adding a third player, it threw the rest of Tic Tac Toe off-balance. As a result, they must fix the broken game with a design challenge. In teams of 3, learners will mod the game to accommodate a third player AND make sure the game stays fun and challenging! They should think specifically how they can mod the SPACE, RULES, or CHALLENGE to make it more fun for 3 players.

Learners will go through the following steps together:

- **Brainstorm** ways to make the game more fun.
- **Prototype** and Test their ideas together by trying them out as a group as they design.
- **Iterate** by making changes based on testing the game.
- **Reflect** and Share: Be prepared to share out what you created and have another group potentially play the game.

Before sending the learners off in groups, inform learners that when they work in groups they will each have a different role. If using the role cards, pass them out to groups and either let them self assign roles or assign them yourself. The roles are:

- **Play Provoker:** This student's job is to provoke the group to jump in and test ideas.
- **Fun Critic:** This student's job is to monitor the fun levels of what they are creating.
- **Includer:** This student's job is to make sure everyone's voice is being heard.
- **Playtest Faciliator:** When the group is ready to playtest, this student's job is to make sure the play testers know how to play the game and how to give feedback.

Tip: Strongly encourage the participants to think outside the box, create very DIFFERENT versions of Tic, Tac, Toe that don't just involve adjusting the grid size.

5. Challenge Reflection (10 min): Come back together to share out. Ask questions to debrief the experience:
 - What did you change?
 - What did you notice about the process you went through?
 - What did you notice about the process of modding and how the game was affected by changing the RULES, SPACE, and/or CHALLENGE?
6. Return to the design process visual and reiterate the steps that they went through. Ask them questions about the design process as needed.

LESSON 4 Space, Rules and Challenge: **Tic, Tac, Toe Mod** (CONTINUED)

TIPS

Make sure to actively introduce and reiterate the design language--brainstorming, prototyping, playtesting, reflecting, iterating--during this process in a way that feels authentic and reminds learners of the language and where they are in the process.

EXTENSIONS

Task learners with a Design Modding Challenge for a more complicated game, such as Musical Chairs or Simon Says.

CHECK FOR UNDERSTANDING

As an exit ticket, have students complete the Tic, Tac, Toe matching sheet, found in resources and/or have them reflect on what they believe to be the most important step in the design process and explain why.

LESSON 5 Designing from Scratch: Found Object Challenge

WHAT'S THIS ABOUT?

Now that your learners have learned all about the parts of a game and modding a game, it's time for them to design a game from scratch. In this challenge, your learners will start a game design from a particular set of components, mostly available around the house or in a classroom. During this lesson, your learners will be provided with this set of materials as well as a 1 game quality card. This lesson will guide learners through the full game design and playtesting cycle.

LEARNING GOALS

1. Students will be able to use a variety of objects to design a game from scratch
2. Students will understand how the parts of a game work together to create a game.
3. Students will practice giving and receiving constructive feedback and use the feedback to iterate their designs.
4. Students will understand the importance of playtesting and iteration in the game design process.

MATERIALS

1. Design a Game Worksheet
2. Game Quality Cards (optional)
3. Writing Utensils
4. Variety of found objects (coins, rubber bands, paper clips, paper cups, legos, blocks, etc).
If teaching this remotely, consider giving students a list of objects to gather so all students have the same set of objects to work with.
5. Playtesting reflection worksheet (see resources)
6. Role cards (optional)

TIME

1 - 1.5 hours

PREPARATION

1. Put students in groups of 3 or 4.
2. Gather found objects and distribute them equally for each group that will be participating.
3. Print all worksheets, print and cut role cards and quality cards

STEPS

1. Introduction (5 min): Review the 5 parts of a game by asking the learners to recall them each and remind each other what each part is. If time permits, you could choose a common game to breakdown as has been done in previous lessons. Tell learners that they will be designing their own games from scratch today using everyday materials with the goal of evoking an assigned state of being for players.
2. Explore components and mechanics (5 mins): Model for student how to play with materials

LESSON 5 Designing from Scratch: Found Object Challenge (CONTINUED)

in order to come up with as many mechanics as possible. (i.e. you can throw a ball, roll, toss, bounce, balance on your head, etc — get them to think of actions that are not immediately obvious) Hand out 1-2 materials to each group and ask groups to think about what the materials can do and record on the worksheet.

3. Brainstorm (20 mins): Using their assigned game quality, have learners brainstorm times they have felt this way. You could choose to have learners interview each other or just discuss together by thinking about what makes them feel....(For example, I feel silly when I'm laughing, I feel silly when I make funny faces, etc) Once the learners have explored their assigned game quality, have them begin brainstorming ideas for game actions/game structures that could elicit the game quality in their players. Have learners use the worksheet to develop 2-3 ideas and be ready to pitch to a teacher. When the group is ready they can pitch. Groups should receive feedback and then decide which idea they want to move forward with.
4. Prototype and Iteration (20 mins): Have learners prototype their game together, and start to test it out as they design it. Remind learners about the importance of testing early and often! They can make changes to their designs as they test it out. Make sure they play it as a group together before they move on to external play testing next.
5. Playtesting (25 mins): Now that students have prototyped their games and playtested within their groups, they're ready to have another team play their game and provide feedback.
 - A. Model Playtesting: Ask for one team to volunteer to test their game with the whole class. Have one student from the team present their game and ask for volunteers to play the game. Provide this playtest feedback matrix as a guide to help learners provide constructive feedback. Model asking the following questions:
 - + What is a Glow, or one thing you liked about the game?
 - + What is a Grow, or an area of improvement for the game?
 - + What questions do you have?
 - + What ideas do you have to help us improve the game?
 - B. Playtest: Pair the remaining teams up, dividing up the team that already playtested into each small group. Explain that each group will have 1 minute to explain their game, and then 5 minutes for the other group to play their game and give them feedback using the form as a guide.
6. Reflection (10 min): Use the "think-pair-share" protocol to reflect on their experience. Have learners take a minute to write individually in response to reflection questions. Then have them pair up to discuss, followed by a group share out. Any of the following questions can be used provoke discussion:
 - What was different about designing from scratch vs. modding?
 - When was the design process most engaging? What challenges did you face?
 - How did you collaborate? What was challenging?
 - How did it feel to develop a game around a specific game quality for the player?

LESSON 5 Designing from Scratch: Found Object Challenge (CONTINUED)

- What role did empathy play in your design process? Playtesting?

TIPS

Encourage learners to keep their games simple. Have learners playtest early and playtest often, there is nothing more frustrating than spending a long time designing something only to try it and find it doesn't work!

EXTENSIONS

Have students "package" their game for the classroom by writing up the rules, gathering the materials and customizing any pieces with the game's name.

CHECK FOR UNDERSTANDING

If you were able to observe students designing, testing, and reflecting on their games and this process, that in itself can be your assessment. If you want something more formal, you could ask students to write a reflection on the experience.

Playtest Tips

There are two types of important feedback that learners can glean from playtesting:

- **Implicit Feedback:** The feedback that we learn by observing people interact with our game; and
- **Explicit Feedback:** the feedback that playtesters communicate after playing the game.

Encourage students to observe and take notes during the playtest so they can jot down what they notice. Explain that it is important that they let the playtesters play the game, without them intervening, so they can learn what works and does not work within the game as well as what might be unclear or confusing.

Feedback approaches

Heat checks: Playtesters raise their hands. A student from the design team poses a scaled question to their playtesters and then counts to 5, asking their playtesters to lower their hands at the number that corresponds to how they feel. Questions might include: How fun was the game on a scale of 1-5? How challenging? How clear were the directions/how easy was it to understand?

Use the **playtest reflection form** found in the resource section. Have all play testers reflect after game play and fill out the form. Forms can be collected by the game designers and reviewed.

Use the **feedback matrix** from the resource section. Designers ask their playtesters for:

- **Glow:** Something that worked well;
- **Grow:** Something that did not work so well

LESSON 6 Designing for Impact

WHAT'S THIS ABOUT?

Designing around impact, or a theme, provides important creative restraints and also gives learners a sense of direction as they begin developing content. It is important to allow time for learners to grapple with the theme, make sense of the key issues involved, and brainstorm relevant ideas before beginning the design process. In this lesson, students will understand what it means to design around a given theme and will have time to wrap their minds around the key ideas.

LEARNING GOALS

1. Students will understand the theme and key issues involved.
2. Students will be able to design a game around a provided theme.

TIME

30 - 60 min

MATERIALS

1. Theme materials from G4C Student Challenge Website (LINK)
2. Post-it notes and markers OR google doc

PREPARATION

1. Put students in groups of 3-4
2. Curate theme materials.
3. Gather post-its and distribute for each group that will be participating.

STEPS

1. Introduction (10-20 min): Ask learners to consider how a theme might show up in a game. Ask for a few examples. Based on what the group has learned so far, explain that the theme can show up in various ways, through each component of the game.

Pose the following question to the group:

Imagine you are designing a game around kindness. What might it look like for kindness to be incorporated into a game through:

- + Core Mechanics? (e.g. listening and taking turns is a key action in the game.)
- + Space? (e.g. circle formation so everyone always feels included.)
- + Rules? (e.g. each player has to say 'Please', and 'Thank you' throughout their turn.)
- + Components? (e.g. all materials used are plush and colorful.)
- + Challenge? (e.g. it is a collaborative game.)

Introduce the theme to learners. Provide content related to the theme so learners can begin to grapple with key ideas. This could be something they play, watch, read, or listen to.

2. Discussion (5-10 min): Pose 2-3 reflection questions and divide learners into groups of 3-4 to share and discuss their ideas and thoughts related to the content they consumed. You might consider doing a think-pair-share to aid in student discussion.

LESSON 6 Designing for a Theme (CONTINUED)

3. Share Out (5-10 min): Facilitate a full class share out and discussion on the reflection questions.
4. Brainstorm (10 min): Allow time for learners to begin brainstorming game ideas in relation to the theme, based on the group discussion. Keeping learners in their same groups, ask them to brainstorm ideas of how the theme could be incorporated into each component of the game. You can try using Collect and Cluster as a brainstorming tool by following these steps:
 - Students have 2-4 minutes to brainstorm individually, writing down ideas on post-it notes or in a google doc (1 idea per post it or line in the doc).
 - As a team, learners review all of the ideas together, and group them into common or connected ideas.
5. Share Out (5-10 min): Have each team share out some of their ideas with the whole class.

TIPS

If students have trouble understanding what “theme” means, explain that it is the central idea or message that underlies something - themes are present in movies, books, and games. A good way to help them understand themes is pick a popular movie, such as one with superheroes, and have them identify the how the theme of good vs. evil appears in the movie.

Participating in the Competition

The Games for Change Student challenge is a game design program and national competition that invites middle and high school youth to create digital games about real-world issues. Every year, youth are challenged to create an original digital game about a social impact theme. To learn more about this year's themes and explore the topics, visit the program website at www.gamesforchange.org/studentchallenge

STUDENT ELIGIBILITY

Any young person enrolled in middle or high school in the U.S is eligible for the national competition. Youth can submit a game as an individual or in a team of up to 4 participants. Youth under 18 must have parent, teacher or guardian consent to enter the competition.

HOW TO SUBMIT

To enter a game into the competition, youth must complete the following steps:

- Visit bit.ly/g4c_challenge
- Read the Rules & Guidelines to verify you are eligible to submit a game.
- Create a user account and sign in
- Complete a submission form (answer all required questions and hit "submit")

AWARDS

Games for Change will recognize finalists and national winners in various award categories. Finalist games will be showcased in a special online arcade and winners will be announced during a culminating awards ceremony.

PRIZES

Competition winners receive prizes that include trophies, games, technology, theme and industry prizes and more! Each student on the Grand Prize winning team will receive a cash scholarship!

JURY PROCESS

Games are evaluated by expert judges in three phases. Judges will evaluate the submission forms, play the games and provide numerical scores and written feedback based on the evaluation criteria.

QUESTIONS

Send Games for Change an email at studentchallenge@gamesforchange.org. Check out prior competition finalists and winners from the G4C Student Challenge here: bit.ly/g4c-student-arcade.

Resources

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Play vs Game Worksheet

Can you tell the difference between what is a **GAME** and what is **PLAY**?
Examine the following scenarios. What do you notice?

You are sitting in your chair in class. There is a rubber band around your pencil. You start stretching the rubber band and moving it around your pencil. You start to spin the pencil around, holding the rubber band around your fingers. Is this a game, or just play?

GAME or **PLAY?** (CIRCLE ONE)

How do you know?

Your little sister starts kicking a ball around the hallways of your house. Sometimes she kicks it at a wall, other times she picks it up and throws it to your mother, and eventually, she just sits down and balances the ball on her feet. Is this a game, or just play?

GAME or **PLAY?** (CIRCLE ONE)

How do you know?

You're challenged to explore a museum searching for objects and hidden clues in the works of art. Is this a game, or just play?

GAME or **PLAY?** (CIRCLE ONE)

How do you know?

What are the Game Parts of _____ ?

Before designing games, it is important to practice identifying parts of familiar games. In the example below, the parts of Rock, Paper, Scissors are identified. After you read the example, pick a game you like to play and try to break it down into its six parts.

Rock, Paper, Scissors

GOAL

The goal is to choose the winning object.

CHALLENGE

Three different objects exist - rock, paper, scissors - and players do not know what the other player is going to choose as their object.

CORE MECHANICS

Players "throw" an object meaning they make the shape of an object with their hand and extend their arm to "throw" it.

COMPONENTS

The components are one hand from each player.

RULES

Each person throws an object with one hand. Rock (a fist) beats scissors (a v-shape made with index finger and second finger). Scissors beats paper (flat hand). Paper beats rock. Whoever wins gets a point.

SPACE

The space is anywhere enough space exists for two people to stand facing each other and extend one arm.

Name of your game:

GOAL:

CHALLENGE:

CORE MECHANICS:

COMPONENTS:

RULES:

SPACE:



Parts of a Game

The best way to examine what is a game is to look at the parts of a game. Throughout time and across cultures, most games have the same six parts - **a goal, a challenge, core mechanics, components, rules** and **space**. The table below explains each part in more detail.

Understanding the parts of a game opens up the world of game design because with this knowledge, you can change one part of a game to create a new game (called modding) or design your own unique game by taking all six parts of a game into account.

Parts of a Game Vocabulary

Goal

What does a player or team have to do to win?

Cross the finish line first, collect the most marbles, be the last standing, etc

Challenge

What obstacles might you put in the player's way to make reaching the goal fun and interesting?

How is she being kept from doing it? Her leg is tied to her teammate's, the marble is hidden, getting hit with a ball ends game play, etc

Core Mechanics

What core actions or moves does the player do to power the play of the game?

Jumping, wiggling, searching, solving clues, ducking, bobbing, weaving, dodging

Components

What parts make up the materials of play?

Bandanas? A grassy field, red rubber balls and a court? Art?

Rules

What relationships define what a player can and cannot do in the game?

Players' legs are tied together, they must start on the same line, all marbles must be gathered waiting 3 minutes, balls can only be thrown outside the line towards the midsection.

Space

Where does the game take place and how does the space affect the game?

Basketball court? A circle? Museum? The park?

Coin and Cup Game Design Challenge

Your challenge is to design a game using only coins and paper or plastic cups!

STEP ONE: Explore the core mechanics

Explore all the things you can do with coins. How can they move? Can you stack them, spin them? What else can you do with them?

RECORD YOUR IDEAS:

Explore all the things you can do with cups. How can they move? Can you flip them, stack them? What else can you do with them?

RECORD YOUR IDEAS:

Now explore how you can use these two components (coins and cups) together. Can you toss and catch? Can you hide? What else can they do together?

RECORD YOUR IDEAS:

STEP TWO: Game design time!

Using what you learned about what your components can do and what their core mechanics are, design a game using only coins and cups.

Describe your game below.

Name of the game:

Rules of the game:

Goal of the game:

Any and all mechanics used in the game:

STEP THREE: Playtest

Together, we will playtest your game. Decide now who on your team will explain the rules and quickly demo your game to the class. Do not tell us your core mechanics! We will try to guess after we try your game.

Design Process



STEP 1- BRAINSTORM

Brainstorming is the first step in the design process. During this phase, game designers ask themselves what kind of game they can make with the materials at hand to meet their design constraints and goals. Often, you might just come up with a few kernels that can be developed into a game and by testing it out, running it by other people, and pushing your creativity, you can come up with something great! It's important to come up with many ideas during the brainstorming phase - don't edit yourself and certainly don't write anything off just yet!



STEP 2- PROTOTYPE

Once you've brainstormed a number of ideas, it's time to select one or two favorites to push forward and start building. Prototyping is all about trying to get your idea on paper in order to create something playable so that you can test out your idea and get feedback. You want to think about which ideas seem the most possible, given the time you want to spend, the materials you have, and the design challenge at hand. Create a sketch of your idea if you'd like, then start to use the materials to build your game. Index cards and post-its are great prototyping tools! It's ok to change your idea once you start to build it - that's part of the process.



STEP 3 - PLAYTEST

Once you've built a playable prototype and tested it and refined it yourself or with your team members, you're ready to have someone else play to help you determine how to make it the best possible game. Find one or more people to play your game and ask them what they think. It helps if you ask them specific questions about their experience such as:

- + How fun was this game? What did you like about it? What didn't you like?
- + What suggestions do you have for improving it?

Record some notes so that you can use them later to improve your design. Also - you'll be able to learn a lot just by watching them play the game. Did they understand the rules? Did they interact with the game in the way you intended? Was anything confusing or overly challenging? What were you surprised by?



STEP 4 - ITERATE

Iteration is a fancy word for making changes to your game in order to make it better and more fun. What changes need to be made to your game based on the playtest? How can you improve your game? Using playtester feedback, pick one or two ideas that you think are best for making a change to your game to improve it, then put those changes into action by redesigning your game. You can playtest it again and get more feedback if you want until you feel you are done with it.



STEP 5 - REFLECT

Reflection is a key part of the game design process. As game designers, we are constantly evaluating our work and processes and getting feedback from others in order to improve and grow. Think about what you learned during your game design process. It's helpful to think about what you liked about the process and your game, but more importantly, consider what didn't go so well and what you would change if you were going to do this again. The game design process is about reframing failure or mistakes as an opportunity to improve

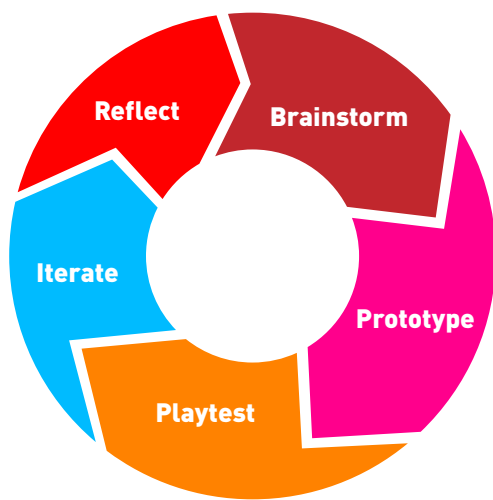
Parts of a Game Modding Worksheet

Tic, Tac, Toe Mod

Now it's time to modify or as real game designers say, "mod" a game. During this activity you will focus on how the Space, Rules and Challenge of a game affect gameplay. Your challenge is to make a new version of Tic, Tac, Toe that is playable for three players! Ready, set, design!

STEP ONE: Gather your materials

Now it's time to modify or as real game designers say, "mod" a game. During this activity you will focus on how the Space, Rules and Challenge of a game affect gameplay. Your challenge is to make a new version of Tic, Tac, Toe that is playable for three players! Ready, set, design!



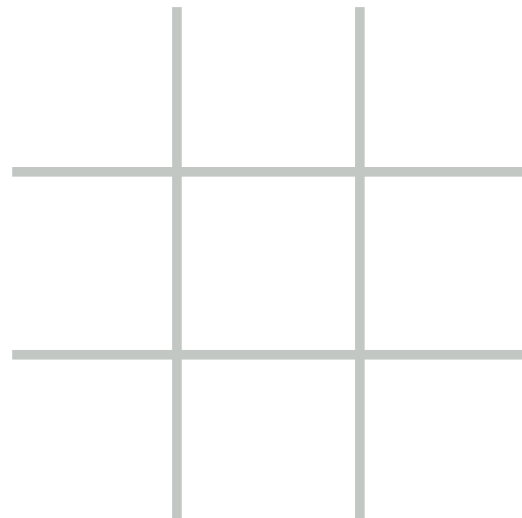
STEP TWO: Remember the design process

At the beginning of your journey to becoming a game designer you learned about the design process. Now you are going to put it to use. In order to modify Tic, Tac, Toe, you will move through each step of the design process. Take a look at the process and go back to the first section to read about any step that you have questions about. Once you remember the process, it's time to get started.

STEP THREE: Game design time!

BRAINSTORM: Part of the first step of the design process is to really understand what you are designing and who you are designing for. In order to really understand your design challenge you need to play a lot of Tic, Tac, Toe and since you are being challenged to redesign for three people, you need to play with three people! Follow the steps below to begin your brainstorming.

- 1 Find two other people to play Tic, Tac, Toe with you. Make sure they understand how to play regular Tic, Tac, Toe. Now explain that they are going to help you understand how to play Tic, Tac, Toe with three players. The only change will be that you will play with an X, an O and a Y.



Tic, Tac, Toe Mod *(CONTINUED)*

2 After a few minutes of playing check in with your players and see how it is going. Here are some questions you might ask:

- a) What works and doesn't work with this new Rule of 3 players in the game?
- b) How does the new rule affect the challenge of the game?
- c) How does the new rule affect how fun the game is?

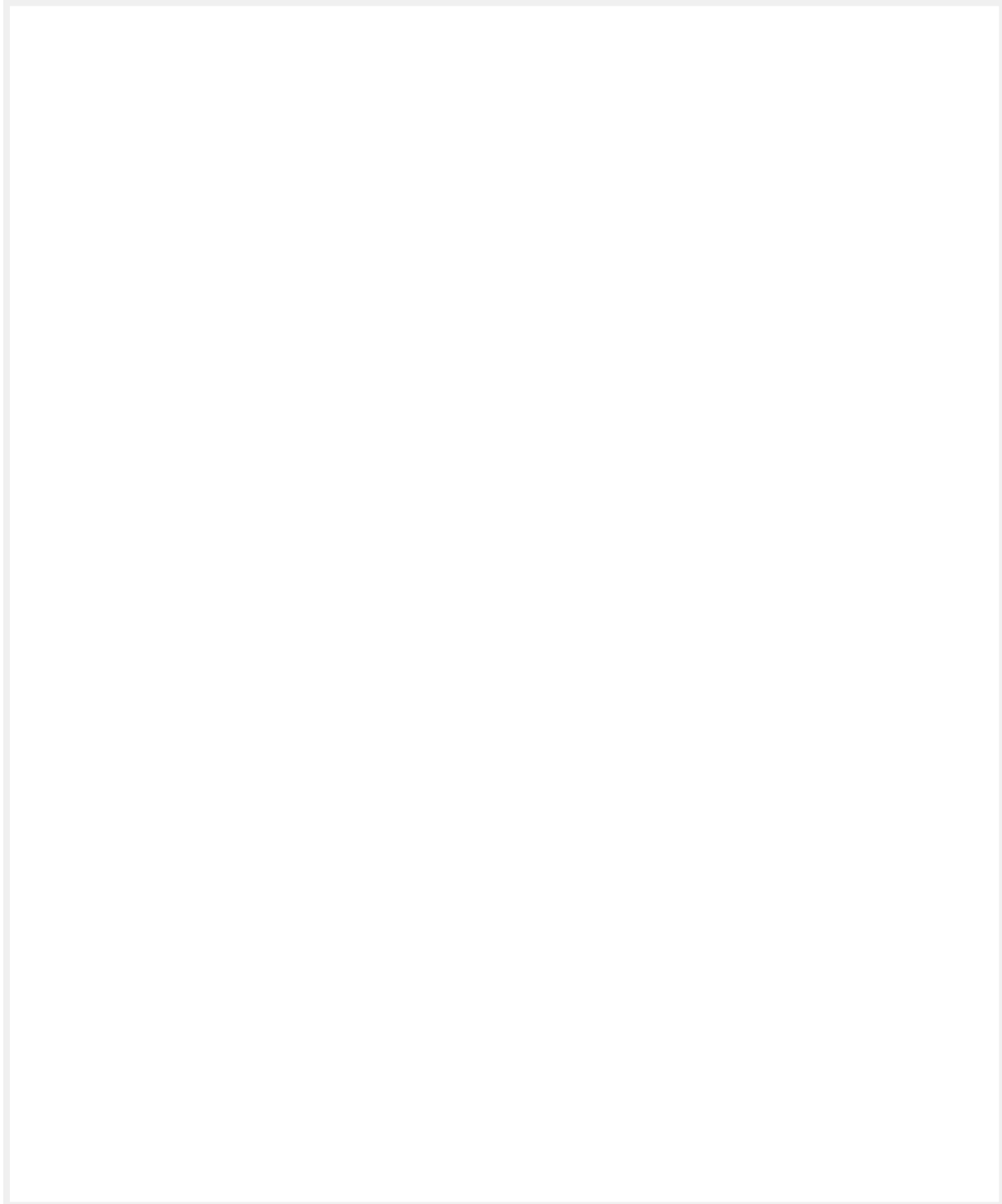
Record the information you gather:

3 You probably observed that when you add an additional player to Tic, Tac, Toe but keep other parts of the game the same, it's not that fun and doesn't really work. In fact, it breaks the game! Once you added a new rule of adding a third player, it threw the rest of Tic, Tac, Toe off balance. **A good game is a balanced game!** As a game designer, your job is to fix the broken game. How can you mod the game for a third player AND make sure the game stays fun and challenging? Think about how you can mod the SPACE, RULES and/or CHALLENGE to make it more fun for 3 players? Brainstorm some ideas below!

Tic, Tac, Toe Mod *(CONTINUED)*

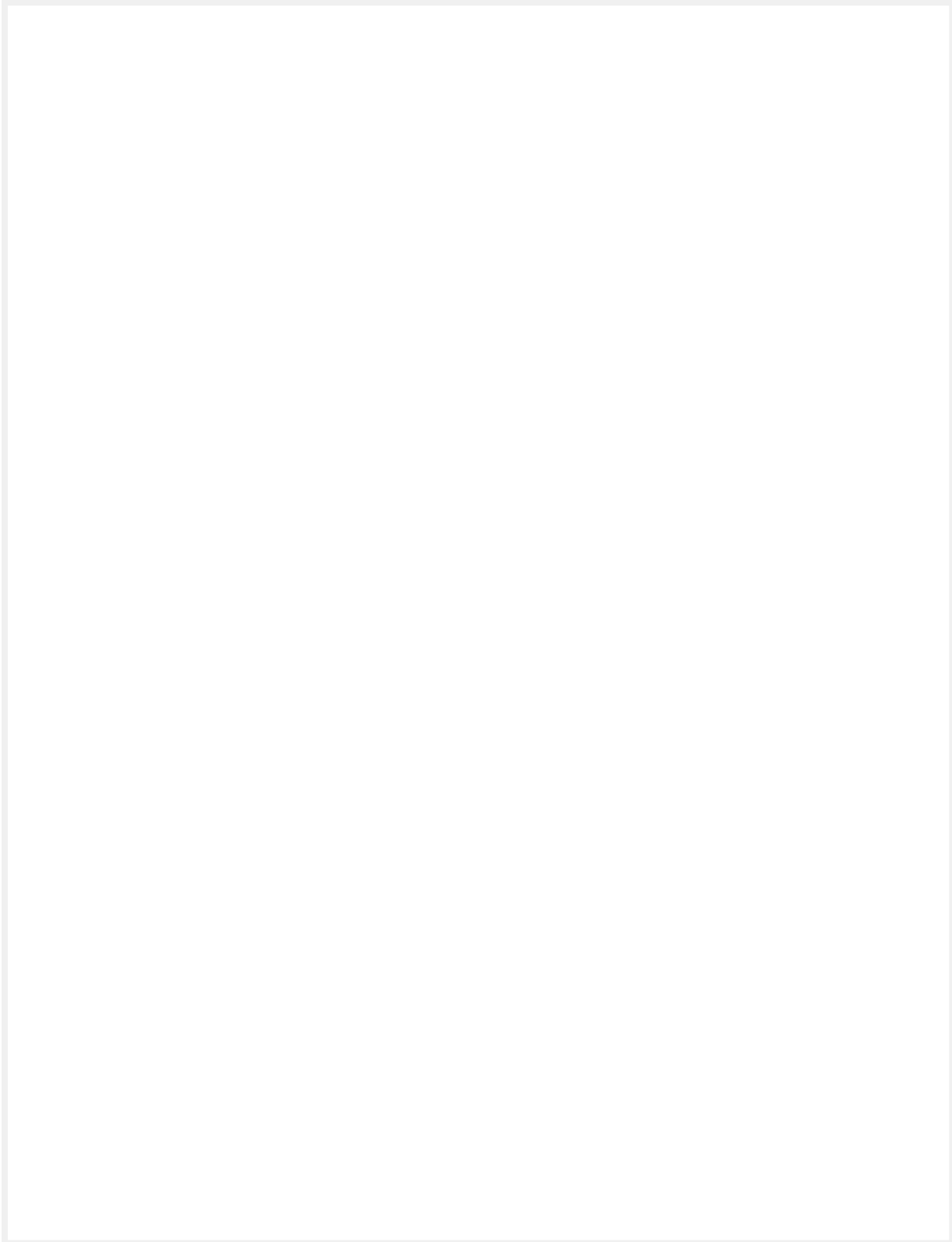
PROTOTYPE:

Once you have a few ideas, try them out! Use next couple of pages to design a couple different versions of Tic, Tac, Toe. Remember, you can use other materials that you gathered, you could change the look of the Tic, Tac, Toe board, change the rules, etc



Tic, Tac, Toe Mod *(CONTINUED)*

More space for prototyping and writing new rules:

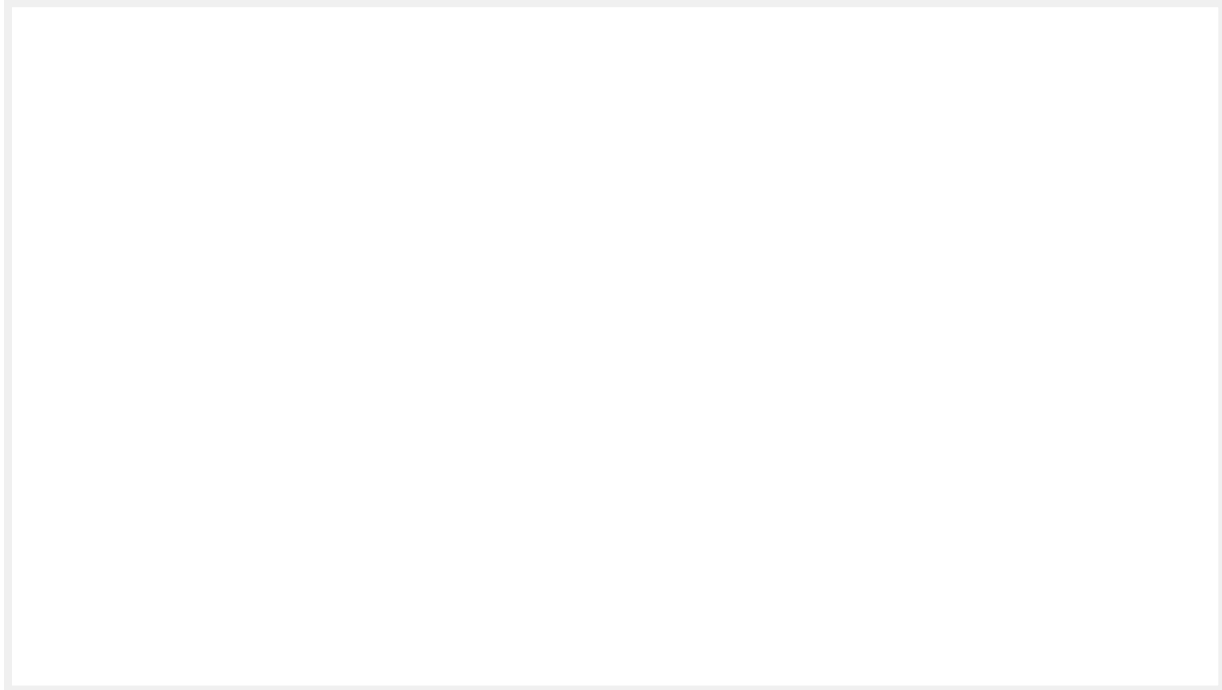


Tic, Tac, Toe Mod *(CONTINUED)*

PLAYTEST:

Now gather some family, friends, or classmates and ask them to playtest. Explain the new rules to them and ask them to play. As they are playing watch them play. Does it seem like the game is fun? Do your new rules make sense? Is there anything that needs to be changed to make it more fun or more playable?

Record your ideas here:



ITERATE:

Use your playtest feedback to make any changes to your game to make it better and more fun.

Share your game!
You did it, you modded a game!



Tic Tac Toe Matching Worksheet

One entry point to becoming a game designer is to mod a game - change one part - to create a new game. Before you change one part you have to understand all the parts and how they work together. Look at the parts of a game chart one more time, below. After reviewing the definitions, match the words below (on the right) to the correct part(s) of Tic Tac Toe.

Parts of a Game

GOAL

What does a player or team have to do to win?
Cross the finish line first, collect the most marbles, be the last standing, etc

CHALLENGE

What obstacles might you put in the player's way to make reaching the goal fun and interesting?
How is she being kept from doing it? Her leg is tied to her teammate's, the marble is hidden, getting hit with a ball ends game play, etc

CORE MECHANICS

What core actions or moves does the player do to power the play of the game?
Jumping, wiggling, searching, solving clues, ducking, bobbing, weaving, dodging

COMPONENTS

What parts make up the materials of play?
Bandanas? A grassy field, red rubber balls and a court?

RULES

What relationships define what a player can and cannot do in the game?
Players' legs are tied together, they must start on the same line, all marbles must be gathered waiting 3 minutes, balls can only be thrown outside the line towards the midsection.

SPACE

Where does the game take place and how does the space affect the game?
Basketball court? A circle? Classroom? The park?

Parts of Tic Tac Toe:

Match the items below to the appropriate part(s) of Tic Tac Toe.

- WRITING UTENSILS
- WHITE BOARD
- BLOCKING
- BE THE FIRST TO GET THREE IN A ROW
- 3X3 GRID
- PLAYERS TAKE TURNS WRITING THEIR SYMBOL
- CHALKBOARD
- 2 PLAYERS
- X AND O
- PAPER
- WRITING
- YOU DON'T KNOW WHERE YOUR OPPONENT WILL PLACE THEIR SYMBOL



Playtest Reflection Form

GAME: _____

DATE: _____

NAME: _____

GRADE: _____

Fun

How fun was the game?
(Please circle a face)



SO fun!



Fun!



I'm not sure



Not so fun



Epic fail

Difficulty Level

How difficult was the game?
(Please circle one)

Too Easy

Nicely
Challenging

Too
Challenging

Clarity of Rules

How clear were the rules?
(Please circle a face)



Perfectly clear!



A little clear



I'm not sure



Not so clear



Not clear at all

What can you and other players learn from playing this game?

What would you change about the game? What would you add or take out?

What was your favorite thing about the game?

What was your least favorite thing about the game?



Glows and Grows Worksheet

GAME: _____

DATE: _____

REVIEWER: _____

GLOWS

Positive Feedback; what works well

GROWS

Constructive feedback; areas for improvement



RESOURCES

SILLY

SERIOUS

COLLABORATIVE

COMPETITIVE

RELAXED

ANXIOUS

TRUSTING

PARANOID





Play Provoker

Your job is to provoke the group to jump in and test ideas.

Try saying "Let's jump in and try this out!" or "Let's play this and see how it works."



Play Provoker

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Fun Critic

Your job is to monitor the fun levels of what you're creating.

Don't be afraid to say "This isn't fun," or to ask "Would the people we're making this for get excited by this?"



Playtest Facilitator

When your team is ready to playtest, you've created the facilitation plan.

Who's explaining the rules, who's taking notes, what you're testing for, i.e. Learning goal, Fun.

Role Cards



Fun Critic

Your job is to monitor the fun levels of what you're creating.

Don't be afraid to say "This isn't fun," or to ask "Would the people we're making this for get excited by this?"



Playtest Facilitator

When your team is ready to playtest, you've created the facilitation plan.

Who's explaining the rules, who's taking notes, what you're testing for, i.e. Learning goal, Fun.



Includer

Your job is to make sure every voice is heard.

Try saying "Could we hear from everybody before we move on?" or asking folks who haven't spoken for their opinion.



Includer

Your job is to make sure every voice is heard.

Try saying "Could we hear from everybody before we move on?" or asking folks who haven't spoken for their opinion.

Design a Game Worksheet

For this challenge, you will be designing a game around a **Game Quality**. Follow the steps below to design your f game from scratch!

STEP ONE: Explore Components + Mechanics

What are your game materials?

Get your materials and think about what the materials can do.

Material

For example: Tennis ball

Actions

Throw, roll, pass, tag, bounce, squeeze
Remember: these actions can turn into core mechanics for your game!

STEP TWO: Brainstorm

Using your assigned game quality, interview your teammate or discuss as a group times when they have felt this way. Take notes on rules/goals/mechanics etc that could support gameplay and create the state of being for the player.

Design a Game Worksheet (CONTINUED)

STEP TWO (Continued): Brainstorm

As a group, brainstorm what games structures could be useful to help you meet your constraint. Develop 2-3 ideas, which you will pitch to a teacher!

IDEA # 1

Brief description:

Core Mechanics:

Game goal:

IDEA # 2

Brief description:

Core Mechanics:

Game goal:

IDEA # 2

Brief description:

Core Mechanics:

Game goal:



Design a Game Worksheet (CONTINUED)

STEP FOUR: Pitch

Present your 2-3 pitches to a teacher! You'll receive feedback (which you should record below), and then you can go ahead and start to prototype your game!

STEP FIVE: Prototype + Iterate

Start to prototype your game, as you make decisions about parts that work, record them here:

Goal:

Space:

Core Mechanics:

Components:

Rules:

Challenge:

STEP SIX: Playtest

Your teacher will coordinate playtesting for you and another group. Make sure you know what questions you want to ask and strategies you want to use to collect feedback.

STEP SEVEN: Iterate

What's one small change you can make to improve your game? List below. Change something, then try it together. Time permitting, you might playtest again with another group.



Standards Alignment

The information below is a comprehensive guide to mapping Computer Science standards to Game Design. For more information on Computer Science standards visit <https://k12cs.org/>

Concepts

ABSTRACTION

Abstraction allows game designers to build models of a player's interaction with the game and its overall system in order to solve more complex problems. For example, the popular game Pong is an abstraction of ping pong or table tennis - it uses only two rectangles and a circle instead of building out a more detailed environment.

Decomposition. Games are systems can be broken down into different parts (goal, challenge, rules, components, space, core mechanics, players).

Pattern Recognition. In Tetris, players identify different blocks and determine what spaces they can fit into.

Interfaces. Game interfaces allow the player to interact with the game (e.g. buttons on the screen or physical controllers) and give feedback on their position in the game (e.g. a life status bar).

ALGORITHMS

Algorithms are the instructions the game designer writes to form the relationship between player, components, and space of the game based on the rules, goal, challenge, and core mechanics of the game.

Algorithm Design. Writing the rule set for the game Pong, then comparing it with the game play experience.

Control Flow. Creating a decision tree that outlines different outcomes based on player input in Pong.

Inputs, Variables and Outputs. In Pong, when a player moves the paddle, the location of the paddle is stored in a variable, then the game uses that information to determine whether or not it intersects with the ball.

PROGRAMMING

Game designers use different programming languages and environments to create digital games. Programming a game means translating the parts of a game (rules, core mechanics, goal, challenge, components, and space) into instructions the computer can understand.

Development Environments. There are many different tools and platforms you can use to design a game. Some of them use a visual programming language, some are text-based, and others are a combination of the both.

Collaboration. Designing a game involves many different skill sets including art direction, narrative design, project management, playtesting, and programming. A successful game design team requires each of these roles to work together to achieve their goal.

Standards Alignment (CONTINUED)

DATA

Games collect data from the player's actions and analyze it to determine how that action impacts the overall game system. Game designers program automated tasks that give to respond to the player and give them feedback about their status in the game.

Sensors and Datasets. Game controllers take data from the player and turn it into meaningful information that allows them to interact with the game.

Transformation and Visualization. Digital games take data from many different places (player input, etc). The interface of your game allows players to understand the relationship between their actions (data) and how different components interact together.

NETWORKS

Some digital games operate over networks. For example, online multiplayer games allow players to play together on a shared server.

Trust. When creating a game, designers should consider what type of personal information or data they ask of their players, if any. When playing a game, players should be aware of any personal information the game captures about you or your device.

PRACTICES

SKILL	DEFINITION	GAME DESIGN EXAMPLE
DESCRIBE	Describe an application of computing by detailing who, what, where, when. In this first step, focus on things that can be observed.	Pong is a game in which two players use a paddle and send the ball back and forth to each other. Players control the paddle using keys on a keyboard.
ANALYZE	Analyze the description for patterns, general characteristics, or anomalies. How do the parts of the whole relate to each other and the user?	Both paddles can only move up and down at the same speed. If the ball collides with the paddles, it bounces off the paddle in the opposite direction. If it does not collide with the paddle, it disappears off the screen. Players need to know when to move the paddle to intersect with the ball. Changing the speed of the ball will increase the difficulty of the game.
INTERPRET	Interpret your analysis by looking for evidence to support an explanation. Test the evidence by researching similar cases, running experiments, or creating models (relates to prototype).	By playtesting this game with others and playing it myself, I can determine if changing the behavior (e.g. speed) of one or more components (ball or paddles) effects the difficulty and fun of the game.

Standards Alignment (CONTINUED)

SKILL	DEFINITION	GAME DESIGN EXAMPLE
EVALUATE	Evaluate the application of computing, based on your investigation. What are its benefits and evils; and to whom, how much, when and how? What are potential modifications and the arguments for and against?	Pong is a fun and challenging game if the speed of the ball does not move too quickly. Greatly increasing the speed of the ball at the beginning may frustrate players who cannot react as quickly. Increasing the speed over different rounds of the game allows players to practice, then level up as they get better.
ASK	Identify a problem that can be solved, break it down into smaller parts, and set constraints that limit its goal, features, or complexity.	Young people today may not understand the repercussions of actions they take online. How can we encourage our peers to be more critical of what they share and how they construct their digital identities?
RESEARCH	Read about the problem, look into how others solve it, find projects you can repurpose / remix, interview people such as experts, or people that might use your prototype.	We develop a survey to gather information about how and why young people in our school community share personal information online. We research and play games that have tackled similar issues.
IMAGINE	Collaborate to imagine how to solve the problem. Use problem definition, constraints, and research to help you imagine new ideas.	Based on our research, we redefine the problem to something more specific. We use post-it notes to collect ideas, then cluster them into categories. From those categories, we decide on the goal for our game.
PLAN	Select a promising solution, build a team, and set roles. Identify materials, break down your project into smaller parts, and set a timeline.	We paper prototype two versions of the game and choose the one we like best. Then we set our timeline and pick roles for the tasks we want to do.
CREATE	Work with your team to build enough of the project in order to test it out and get feedback. Be creative about your materials: paper, drawing apps and code. Take pictures or video, and comment on your work or code.	First iteration: We build a simple prototype to test the core mechanics and characters we created, then playtest it on ourselves. Second iteration: We add more visual elements and refine the rule set.
TEST OR CRITIQUE	Allow different people to test your prototype without telling them how it works. Take detailed notes and ask questions. When critiquing or giving feedback, use the Analyze/ Practice to structure feedback.	First iteration: We thought the game was too boring with only one player, so we adapted it to include two players.

Standards Alignment (CONTINUED)

SKILL	DEFINITION	GAME DESIGN EXAMPLE
IMPROVE	Repeat the process using the information from testing as a new starting point. Repeat the process multiple times!	Second iteration: We decided to add more of a realistic background and change the rules to make it a little easier based on feedback from our external playtesters.
WHAT	What did you learn about computing? Make a statement about how a computing concept was used while prototyping or analyzing.	While designing the game, we mapped different control flows to know how a player progressed in the game and what feedback they should receive.
WHO	Consider presenting ideas to broader audiences: the entire class, all the teachers in school, the community, etc. Empathize with the backgrounds, knowledge and values of the audience.	Understanding online privacy can be complex and troublesome, so we will focus on presenting concrete tips and actions they can take to become more knowledgeable consumers and producers of what they read and share on social media.
HOW	Select the media that works best for the intended audience, be it interactive programs, video, audio, slide decks, blog posts, papers, or instructional activities.	Games are a good way to demonstrate more complex systems in action. They allow the player to test out different roles and receive feedback about their actions. After playing the game, we will ask players why they decided to take a particular action and how they felt about the outcome.
WHY	Explicitly show and explain the application of a computing concept. Why was it significant to your thinking? Why should others care about it? How did it help you? Why was it easy or hard to use? How do you plan to learn more?	Collaboration was critical to the development of our game. Each team member had different skills and perspectives that made our game stronger and develop in ways I didn't expect.
FEEDBACK	Present or publish your work and ask for formative feedback in the form of questions and answers, comments, or user testing. Publishing work and capturing feedback as part of digital portfolios helps work continue after the unit or class ends. When critiquing, or giving feedback, use the analyze practice to structure feedback.	Our final playtest went well, but we're not sure how successful we were in making the connection to playtesters real lives. We posted our game online for others to play with a set of reflection questions for them to think about at the end of the game, followed by a set of tips for them to use regarding digital privacy.