Design Thinking Lesson Plan

Objectives:

To familiarize students with the steps of the “Design Thinking” process, and then use those steps to identify an issue, an audience, and a solution, in the form of a game.

Concept:

“Design Thinking” is a series of questions that are useful to ask before embarking on any project. The most important part of “Design Thinking” is to remember that *no solution exists in a vacuum;* in other words, always keep in mind who your solution is for. Lots of different people can have the same problem, but the same solution won’t always work for all of them. Sometimes, having a solution that doesn’t work for you can be worse than no solution at all.

Skills:

Students will learn to go through the *define, research,* and *ideate* stages of the design process. They will identify a problem, research exactly what the problem is and who is having it, and then brainstorm some possible solutions. With what they know, they should then be able to narrow down their solutions based on exactly who is having the problem, to determine what kind of solution might work best for that person or group of people.

Set:

I like to open discussions of design by showing the work of Katerina Kamprani, whose project “The Uncomfortable,” demonstrates objects with negative design qualities.

http://www.kkstudio.gr/projects/the-uncomfortable

This gets students thinking about the ways that things we take for granted (handles on mugs) are actually design solutions to problems (hot mugs, burnt fingers.) This can transition nicely into a discussion of what kinds of problems people have that the class might tackle, which is where we get to the first step of the design process.

Materials:

None needed.

Instructional Steps:

Direct Instruction:

Start by defining the first three steps of the design process:

1. “Define.” In this step, we identify the problem we’re trying to solve. We need to be as specific as possible. Crucially, at this point, we need to identify the person or group who is having the problem.
2. “Research.” In this step, we must try to gather as much information about the problem as possible. This step ABSOLUTELY must include an interview with the person who is having the problem. If the problem is being experienced by a group of people, interviewing several people is required.
3. “Ideate.” In this step, we propose possible solutions to the problem. We want to propose many different possible solutions, so that we can test them and see which ones work the best. Problems rarely have one perfect solution, and solutions can sometimes cause problems of their own, so having a big menu to choose from is essential.

Have the class identify an example problem that you can model together.

One thing that’s specifically important when we’re talking about the Ideation stage in game design is that, unlike a movie or a book, in a game, players should actually be addressing the thing they’re having problems with. In other words, as much as possible, the act of winning the game should be synonymous with the change in behavior that you want to encourage in your player.

Modeling:

With the class, try to run quickly through the first three steps of the design process. Think about a problem that someone in the class is having, something that they don’t mind sharing. (Obviously, steer the class away from topics that are going to make any student feel isolated or uncomfortable.) Have that student describe their problem, and then help the class go through those first three steps.

1. “Define” might be a restatement of the original issue, but sometimes the “Research” step can identify an underlying cause that means restating the definition of the problem.
2. “Research” should always be a series of questions. Encourage students to ask “Why” and “How” questions, but also “When” and “Where” questions. “What” and “Who” should pretty much already be covered. It’s especially important to emphasize that students reflect on what they LEARN about the problem during this phase. What new thing do

they understand about the problem that they didn't know before? How is that going to shape their suggestions for solutions?

3. "Ideate" Brainstorm some possible solutions to the problem. Encourage students to come up with solutions that span a range of possibilities from the practical to the silly. Sometimes concrete ideas come out of whimsical ones.

Check for Understanding:

This should be pretty clear from the Modeling section, but you can have students get together in groups, choose one person to offer up a problem, and have the rest of the group go through the steps together, and then present to the class.

Guided/Independent Practice:

Once kids have a pretty good handle on the process, they should be able to turn to their game ideas. Again, these will reflect a real-world need, so students should go through the design process with their chosen audience, potentially including doing interviews outside of class time. It might be important to talk a bit about interview etiquette, depending on your class. Once students have done their interviews, get them back together to do some brainstorming around solutions. The "classic" brainstorm can be a little bit nerve wracking, so feel free to do something more structured. Maybe make each person on the team responsible for a solution with a specific restriction ("cheapest possible solution," "least disruptive on the life of the audience," "most likely to work," "digital solution," "analog solution,") to guide thinking.

Assessments:

Students should present their audience, problem, research, and ideation to the rest of the class. What is the problem and who is having it? What do we know about it and how might we fix it?

Are the problem definitions concise and thorough?

Is the research sufficient? Did students think through the problem deeply?

Do the students have multiple suggestions on how to solve the problem?

Engaging Classroom Assessments Planner
(Adapted from The Leadership and Learning Center)

Subject	Game Design
Grade/Course	Game Design Academy I
Unit of Study	Design Thinking
Duration of Unit	1-2 weeks

Power/Priority Standards (Grade or Course Specific Indicators Beneath the General Standard)
CTE ICT/AME Foundational Standards http://www.cde.ca.gov/ci/ct/sf/documents/ctestandards.pdf ICT 2.4.1.1 Formulate judgments about the ideas under discussion and support those judgments with convincing evidence. ICT 2.4.2.3 Apply appropriate interviewing techniques: a. Prepare and ask relevant questions. b. Make notes of responses. c. Use language that conveys maturity, sensitivity, and respect. d. Respond correctly and effectively to questions. e. Demonstrate knowledge of the subject or organization. f. Compile and report responses. g. Evaluate the effectiveness of the interview ICT 5.1 Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks. ICT 5.2 Understand the systematic problem-solving models that incorporate input, process, outcome, and feedback components. ICT 5.3 Use critical thinking skills to make informed decisions and solve problems.

"Unwrapped" Concepts (Students need to know)	**"Unwrapped" Skills (Students need to be able to do)**	**Bloom's Taxonomy Levels**
The steps of the "design thinking" process (define, research, ideate, prototype, test, iterate)	Recognize a problem that is shared among several different people or groups of people	Understand
The relationship between a population and a problem	Create interview questions that deepen student understanding of the problem.	Analyze

Research interview protocols	Invent solutions for the problems that students have researched, using the information they've identified.	Create

Essential Questions	Big Ideas
How do you identify a population that shares a problem? How do you differentiate how members of that population might experience that problem differently? How do you make questions that will let you learn more about the problem? How do you come up with solutions that might address the problem?	The Design Thinking process allows students to approach a problem from the point of view of the population that is experiencing that problem. It's very important that students develop empathy and try to put themselves in the shoes of their audience. No problem has only one solution. Every potential solution has upsides and downsides, students need to be able to identify those.

Supporting Standards

AME Media and Design Arts Pathway Standards
A 1.2.1 Solve a visual arts problem that involves the effective use of the elements of art and the principles of design.

ICT Information and Support Services Pathway
A8.1 Develop the purpose and scope of a project.

Key Concepts and Skills from Supporting Standards	Other Unit Vocabulary Terms
Developing familiarity with the principles of design, as exemplified in the design thinking process. Developing solid outcomes as the first	

step of scoping a software project.	

Performance Task Synopses
Directions: 1) Brainstorm two to five possible performance tasks 2) Write a synopsis for each selected task and list the tasks in a "learning progressions" sequence.
Performance Task 1: Name: Identify a problem Synopsis: Students should work together to identify a problem they want to solve, or an issue they want to educate people about. Performance Task 2: Name: Develop Research Questions Synopsis: Students develop a list of questions that will help them deepen their understanding of the issue that they're trying to approach. Performance Task 3: Name: Research Interviews Synopsis: Students will reach out to members of the community and conduct interviews, trying to deepen their understanding of the issue they're tackling.

Performance Task #1 **In Detail**
Directions: 1) Refer to/Review your "unwrapped" Priority Standards skills, related concepts, and matching Bloom levels specific to this task. 2) Refer to/Review any additional concepts and skills from supporting standards and unit vocabulary terms specific to this task. 3) Describe the task in full detail. Check that the task directly reflects the level of rigor for each targeted skill and related concept(s).
There are three steps to this: 1) Brainstorming: As a class, students should brainstorm broad issues they want to investigate. These should be quite broad, like "The Environment," etc.

2) Refinement: Student groups should form around broad issues, and then identify a single issue within the broad context that they're interested in. Encourage students to think about things that directly affect them.
3) Audience: Students should identify a group of people that they have direct access to and try to explain exactly how their chosen issue affects that audience. That audience will be the group of people they interview in the second task.

Performance Task #1 Scoring Guide

Advanced:
☐ All "Goal" criteria plus:
☐ Audience suggested has a clear, direct need for the problem to be solved.
☐ Problem is clearly stated, with a well defined need and at least some possibility for a solution.

Goal:
☐ Student takes part in the classroom wide brainstorming session.
☐ Student contributes to refinement process, focusing the broad brainstorming concepts into more specific, actionable problems.
☐ Student identifies an attainable audience that experiences the problem in question.

Progressing:
☐ Meets _____3____ of the "Goal" criteria

Beginning:
☐ Meets fewer than _____3____ of the "Goal" criteria
☐ Task to be repeated after re-teaching
☐ Comments:

Interdisciplinary Connections and Related Priority Standards Specific to this Task	**21st Century Learning Skills Specific to this Task**
Is there specific terminology you might want to add here, ie: industry terminology	✓ Check all those that apply for each task: ✓ Teamwork and Collaboration ☐ Initiative and Leadership ✓ Curiosity and Imagination

	☐ Innovation and Creativity ✓ Critical Thinking and Problem Solving ✓ Flexibility and Adaptability ☐ Effective Oral and Written Communication ☐ Accessing and Analyzing Information

Performance Task #2 **In Detail**
Directions: 1) Refer to/Review your "unwrapped" Priority Standards skills, related concepts, and matching Bloom levels specific to this task. 2) Refer to/Review any additional concepts and skills from supporting standards and unit vocabulary terms specific to this task. 3) Describe the task in full detail. Check that the task directly reflects the level of rigor for each targeted skill and related concept(s).
Students should think about what they DON'T know about the problem. The kinds of questions students want to ask involve how the problem affects their interviewee specifically. Students should build a list of five to ten questions, as well as a list of three to five interviewees.
Performance Task #2 Scoring Guide
Advanced: ☐ All "Goal" criteria plus: ☐ Questions engage student empathy and understanding of their audience. ☐ Interviewees are chosen well, with a clear connection to the problem students have identified. ☐ Questions clearly focus on issues like "How does this affect you?" and "When do you experience this problem?" Goal: ☐ Student Group develops five to ten questions. ☐ Questions are clearly related to the problem at hand, and will potentially deepen understanding of the problem

☐ Student Group identifies three to five interviewees who can shed light/deepen understanding of the problem. Progressing: ☐ Meets ____3____ of the "Goal" criteria Beginning: ☐ Meets fewer than _____3___ of the "Goal" criteria ☐ Task to be repeated after re-teaching ☐ Comments:

Interdisciplinary Connections and Related Priority Standards Specific to this Task	**21st Century Learning Skills Specific to this Task**
Is there specific terminology you might want to add here, ie: industry terminology	✓ Check all those that apply for each task: ☐ Teamwork and Collaboration ☐ Initiative and Leadership ✓ Curiosity and Imagination ✓ Innovation and Creativity ☐ Critical Thinking and Problem Solving ✓ Flexibility and Adaptability ✓ Effective Oral and Written Communication ✓ Accessing and Analyzing Information
Performance Task #3 **In Detail**	
Directions: 1) Refer to/Review your "unwrapped" Priority Standards skills, related concepts, and matching Bloom levels specific to this task. 2) Refer to/Review any additional concepts and skills from supporting standards and unit vocabulary terms specific to this task.	

3) Describe the task in full detail. Check that the task directly reflects the level of rigor for each targeted skill and related concept(s).

Students conduct interviews, asking each of their interviewees the same set of questions they've developed. Students can ask clarifying questions if they need to, but as much as possible, students must try to stick to their script. Students must record their answers and, if possible, record their interviews. Students should abide by good interview guidelines, such as explaining to their subjects that they are being recorded.

Students then take their answers and collate them into a set of "learnings" about the problem at hand. What things did they discover? How was their understanding of the problem changed?

Performance Task #3 Scoring Guide

Advanced:
☐ All "Goal" criteria plus:
☐ Students develop a deeper understanding of their problem as a result of interviews
☐

Goal:
☐ Students conduct interviews appropriately
☐ Interviewees are treated with care and respect
☐ "Learnings" document is clear and complete
☐

Progressing:
☐ Meets ____all____ of the "Goal" criteria

Beginning:
☐ Meets fewer than ___all_____ of the "Goal" criteria
☐ Task to be repeated after re-teaching
☐ Comments:

Interdisciplinary Connections and	**21st Century Learning Skills Specific**

Related Priority Standards Specific to this Task	**to this Task**
Is there specific terminology you might want to add here, ie: industry terminology	✓ Check all those that apply for each task: ✓ Teamwork and Collaboration ✓ Initiative and Leadership ☐ Curiosity and Imagination ☐ Innovation and Creativity ☐ Critical Thinking and Problem Solving ✓ Flexibility and Adaptability ✓ Effective Oral and Written Communication ✓ Accessing and Analyzing Information

Paper Prototype Lesson Plan

Objectives:

To get students familiar with the steps that lead up to the creation of a paper prototype, and give them some experiences with making and iterating the prototype.

Concept:

Students should learn that paper prototyping is a form of *modeling,* where we try to build a version of our final product in a physical form. The important thing is to make the model fairly quickly, even if that doesn't capture the whole idea. Having something to test and iterate on is much more important than getting lost in the weeds of trying to make the PERFECT model. Models are, by their nature, imperfect. So it's fine if your prototype doesn't work the first time, or the fifth time, or even the tenth. As long as it's getting better, getting more refined, that's the important thing.

Skills:

The skills this lesson focuses on have to do with conceptualizing an idea and then making a model of it.

A good paper prototype should have the following qualities.

1. Focused. A prototype should focus on the most central, important aspects of our eventual game.
2. Clear. A prototype should clearly lay out which actions are being taken by players, and which are taken by the system, or the computer.
3. Mutable. A prototype is meant to change from iteration to iteration. Playing it once isn't enough, you have to play it, change it, and play again. So it needs to be easy to change.

Set:

I've tried this a couple of different ways and haven't really settled on the exact right thing. Here are a couple of suggestions:

1. Talk about modeling as a concept, using examples of games like Battleship, or economic simulators like Agricola. Even Monopoly might be a good example of a game that models something.

2. Play an initial round of BattleBattle, Eric Zimmerman's dice game. Talk about what that game is modeling.

Materials:

- Colored Pencils/Crayons/Markers/Pens
- Paper for everyone, both unlined construction paper and larger sheets of paper for game boards, etc.
- Tokens, beads, poker chips, dice, counters, cards, etc.

Instructional Steps:

Direct Instruction:

Introduce the concept of *abstraction,* where a simpler model is used to stand in for something more complex. Give some examples of systems, like "A farm," or "A store," and talk about how you might abstract those. (i.e. "A farmer does a lot of work, and he or she takes care of a lot of animals. But if we wanted to boil a farm down to its bare essentials, we might talk about how much grain it uses, and how much food it produces.") Finding the right level of abstraction is important for a good model, and as students start to think about their games, they can also be thinking about what kinds of abstractions they're going to use. Another really important consideration is what the model is meant to communicate. Lead the class in a discussion about possible end-states do we anticipate for the model and which ones do we want to encourage or discourage.

Another important concept in any model are *resources.* Resources are the various external and internal things that make the model work. Resources are often gained, expended, exchanged, or transformed during the process described by a model. Sticking with the farm example, what kinds of resources might be useful to think about? At one level of abstraction, we might talk about all of the money that the farmer spends on grain. At another level, we might just think about grain, maybe if we want to know how much grain each animal on the farm is getting fed. Or each type of animal. At a very high level of abstraction, we might even say that the farm simply produces a certain number of resources over time.

Hand in hand with resources, though, comes *scarcity.* Games rarely offer every player everything they need every turn. Instead, games use scarcity to force players to make choices; players who are thoughtful about how their resources are used are rewarded by getting closer to the goal.

Finally, it might be worth talking quickly about the materials you have on hand. Paper, pens and pencils, tokens and cards, just do a quick run through of your inventory so that students know what they have on hand.

Modeling:

As a class, chose a system that you can model. Talk about the system's *inputs* and *outputs.* What resources does it need? What resources does it produce? What resources are scarce? What kinds of choices might players make to get more resources? (We'll dig deeper into this topic in the lesson on *Game Balance.)*

Give a second example, from a different order of things. If you worked on a commercial example, try one from nature. Think about a tree, how would you model a tree? Again, what resources does a tree need? What does it produce? What is scarce?

Many models also work in terms of talking about *actions.* A farm takes in grain, and transforms it into a certain amount of different other types of food (eggs, meat, milk, etc.,) These foods can further be acted upon by someone to change them. (milk → cheese.) Each of these actions winds up costing the farmer something, but producing something that is (hopefully) more valuable than the cost it took to make. These actions are also an important part of the model.

Now that you have your model, think about how you would prototype it in paper form. Maybe the grain is represented by cards, or dice, or chips. Maybe you can draw the farm on a big piece of paper, and talk about how different areas in the farm produce different things. Come up with rules about the farm. E.g. "It costs three grain tokens to make one token of milk." Time is often a very important resource, and you should consider it. What other elements do you have to think about? What about the time those take? Do farms make milk as fast as they make everything else? What about eggs? What about apples?

Step through an entire cycle with your model. Grain comes into the farm, gets used by animals, who produce products, which are sold, which make money, which buys grain, thus starting the whole model over again.

Check for Understanding:

Make a list of seven or eight things, and ask students to give an example of a quick model for each of those. What are the things *inputs* and *outputs?* What kinds of actions does the thing take? What do those actions cost? Who can take them?

Guided/Independent Practice:

By now, your students should have a fairly clear idea of the kind of game they want to make. (See lesson on *Design Thinking.*) Have them step through the process of abstraction*,* talking about the possible inputs, outputs, and actions that their game might have. They should have some fairly obvious next-steps when it comes to making models, but if you see students struggling, definitely encourage them to take a step back and think about it another way. Often, a problem that seems very complicated at one level of abstraction can be very simple at another. Remember, these prototypes should be focused, clear, and changeable, so anything that's too complicated or too slow can probably be made simpler and faster.

One thing that's very important is that, once students square away their models, they need to test and iterate on them. Give students time to play through their prototypes a couple of times. Each time they finish, have them write down what DIDN'T work about that playthough, and how they're going to change it next time. Sometimes changes will help, sometimes they won't. If a change makes the game worse, more boring, less interesting, less fun, then just roll back to the last version and change something else.

Assessments:

Have each team come up to the front of the class and run the class through their model, what the player actions are, and then what changes they made from version to version.

Is the central model of the prototype clear?

Do the model's inputs and outputs make sense?

Are the player actions clear and appropriate?

Were the playtests conducted successfully?

Did students write down their changes?

Can they describe how a change made their prototype better or worse?

- Construction clearly represents game concepts
- Construction clearly identifies game elements and states

Engaging Classroom Assessments Planner
(Adapted from The Leadership and Learning Center)

Subject	Game Design
Grade/Course	Game Design Academy I
Unit of Study	Paper Prototyping
Duration of Unit	1-2 weeks

Power/Priority Standards (Grade or Course Specific Indicators Beneath the General Standard)
CTE ICT/AME Foundational Standards http://www.cde.ca.gov/ci/ct/sf/documents/ctestandards.pdf ICT 2.2.5 Extend ideas presented in primary or secondary sources through original analysis, evaluation, and elaboration. AME 1.2.4 Demonstrate in their own works of art a personal style and an advanced proficiency in communicating an idea, theme, or emotion. AME 4.3 Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources. AME 5.3 Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment. AME 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions

"Unwrapped" Concepts (Students need to know)	**"Unwrapped" Skills (Students need to be able to do)**	**Bloom's Taxonomy Levels**
Models use abstraction to make simple versions of complex systems. Models are made up of inputs and outputs, with some kind of constraint on turning the former into the latter. Making a model lets us quickly build an understanding of a complex system.	Take a complex system and make a simple model of it. Be able to describe a system in terms of its inputs and outputs, and in terms of the player actions and system actions that go into the system. Use iteration to refine a model to make it more and more reflective of the	Create Identify Analyze

	system that you want to model.	

Essential Questions	Big Ideas
How do you make a simple model of a complex system? What can a model teach us about the system that it's modeling? How do you use iteration to refine a model?	Models are simple versions of complex systems. Models can work at a variety of levels of abstraction. Iteration is the process of playing and changing a model in order to reach a desired effect.
Supporting Standards	
AME Media and Design Arts Pathway Standards A 1.2.1 Solve a visual arts problem that involves the effective use of the elements of art and the principles of design. ICT Information and Support Services Pathway A 8.4 Analyze business problems by using functional and cost-benefit perspectives.	

Key Concepts and Skills from Supporting Standards	Other Unit Vocabulary Terms
Using models to create a visual language that lets students explore a system in a simple way. Use iteration to test a system and refine it over multiple playthroughs.	

Performance Task Synopses
Directions: 1) Brainstorm two to five possible performance tasks 2) Write a synopsis for each selected task and list the tasks in a "learning progressions" sequence.

Performance Task 1:

Name: Scaffold a Model

Synopsis: Students should identify a system they want to model, and its components.

Performance Task 2:

Name: Iterate a Model

Synopsis: Students should play through their model (maybe in groups) until they get to an outcome and then decide what to change about their model to make it more accurate to the outcome they want.

Performance Task #1
In Detail

Directions:

1) Refer to/Review your "unwrapped" Priority Standards skills, related concepts, and matching Bloom levels specific to this task.
2) Refer to/Review any additional concepts and skills from supporting standards and unit vocabulary terms specific to this task.
3) Describe the task in full detail. Check that the task directly reflects the level of rigor for each targeted skill and related concept(s).

Ask students to think of a system they want to model. This system could be commercial, natural, social, any complex thing they want to understand better.

They should name the model, and make a list of the following:

1) Inputs
    a) This describes what kinds of resources come into the system
2) Outputs
    a) This describes what resources come out of the system
3) Cycle
    a) This actually describes the relationship between the last two elements. How do outputs become inputs? How do inputs become outputs?
4) Player action
    a) This describes the decisions that the player makes while running the model.
    b) "Spend grain on cows instead of chickens" is a player action.
5) System action
    a) This describes the reactions that the systems have to player actions.

b) "If the player spends two grain on cows, they make one milk" is a system action.

6) Outcomes
   a) Student must describe the possible outcomes of a system. Systems should, best case scenario, have a positive and a negative outcome.

Performance Task #1 Scoring Guide	
Advanced: ☐ All "Goal" criteria plus: ☐ Model is clearly unified in terms of its cycles and outcomes. ☐ Goal: ☐ Students describe thoroughly each aspect of their model (each element counts as 1 goal) Progressing: ☐ Meets _____4____ of the "Goal" criteria Beginning: ☐ Meets fewer than _____4____ of the "Goal" criteria ☐ Task to be repeated after re-teaching ☐ Comments:	
Interdisciplinary Connections and Related Priority Standards Specific to this Task	**21st Century Learning Skills Specific to this Task**
Is there specific terminology you might want to add here, ie: industry terminology	✓ Check all those that apply for each task: ☐ Teamwork and Collaboration ☐ Initiative and Leadership ✓ Curiosity and Imagination ✓ Innovation and Creativity ✓ Critical Thinking and Problem Solving ✓ Flexibility and Adaptability

	☐ Effective Oral and Written Communication ☐ Accessing and Analyzing Information

Performance Task #2 **In Detail**
Directions: 1) Refer to/Review your "unwrapped" Priority Standards skills, related concepts, and matching Bloom levels specific to this task. 2) Refer to/Review any additional concepts and skills from supporting standards and unit vocabulary terms specific to this task. 3) Describe the task in full detail. Check that the task directly reflects the level of rigor for each targeted skill and related concept(s).
Ask students to get into groups of two or three. Students should step through each others' models, allowing them to both see someone run their model andhelp that student run their playthrough. After each time stepping through a model, students should take a minute and decide what they want to change about their model. What do they want to balance? What values need to get bigger, what values need to get smaller? Are they getting the outcomes they want? If not, how do they change it so that they're getting the ones they want?
Performance Task #2 Scoring Guide
Advanced: ☐ All "Goal" criteria plus: ☐ Student models are clear and can be played by other students with minimal intervention from the student ☐ Goal: ☐ Students can move through their models entirely to one outcome or another. ☐ Player actions are well described ☐ System actions are well described Progressing: ☐ Meets ____3____ of the "Goal" criteria Beginning:

☐ Meets fewer than _____3____ of the “Goal” criteria
☐ Task to be repeated after re-teaching
☐ Comments:

Game Balancing Lesson Plan

Objectives:

To introduce the concept of game balance as it relates to player and system actions in both digital and analogue games. To ensure that students can apply those concepts to their own games to incentivize certain player behaviors and ultimately build games that encourage players to solve the problems identified in the Design Thinking lesson.

Concept:

As game designers, students need to understand both *how* to balance a game, as well as *why* games should be balanced. Balanced games are more interesting to play, and game balance is an important tool to drive player behavior. Especially in the context of a game meant to teach/solve a real-world issue, game balance is the lever which will help the students encourage the desired behavior in their players.

Skills:

Students will be able to identify the costs and rewards of player actions and tell whether or not those actions are balanced against one another. Students will have a sense of how to apply that same skill to their own games in order to drive player behavior.

Set:

Play multiple rounds of BattleBattle, asking students to keep tallies of their win-loss ratios. Tell students NOT to make alterations to their characters after each match, but they should change to new characters. After each student has played five matches, and thus five different characters, have them line up according to most wins. Make sure that some students have the “Vanilla” card. Find the highest win-group of characters and the lowest win-group of characters and talk about what students observed. Were they having fun playing against the high-winners? Did they want to keep playing?

Materials:

- BattleBattle cards (http://www.stonetronix.com/gdc-2013/battlebattle.pdf) (Rules are at the bottom of the .pdf) (Copyright Eric Zimmerman, used by permission for educational purposes)
- 2 6 sided dice per student

- Many Tokens

Instructional Steps:

Direct Instruction:

BattleBattle is a great example of game balance. Each “character” in BattleBattle has a variety of characteristics, some of which are unbalancing for the game. Some characters rely mostly on chance, other characters demand more strategic thinking. Ultimately, some of the characters are unbalanced, either too powerful or too weak for the game. As players play, they’ll start to notice that those characters make the game less fun. The process of identifying these imbalances and correcting them is one of the central elements of game design.

Stepping out of BattleBattle for a moment, students should recall their discussion of models (from the lesson *Paper Prototyping.)* Students should already have some sense of how well or poorly balanced their games are from playing them, but they might not be able to tell exactly how to fix them.

One important skill in game design is being able to identify the *economy* of any particular system. In our farm system, we might describe the economy as

- How much grain does it cost for the farm to produce a certain amount of dairy?
- How much can the farm sell that dairy for?
- How much grain can the farm then buy with the dairy?

These three questions form a cycle which allows us to do a simple analysis of the economy of the farm. We can think about the *minimal case,* which is if the farm has only a single unit of grain, or the *maximal case,* where the farm has as much grain as it could ever want. These give us the *bounds* of the farm economy. Within this, whatever the “player” of the farm wants to do is described as a *player choice.*

Good games give players LOTS of meaningful choices. A meaningful choice is one where the result of the choice changes the player’s situation in the game. A choice between a red door and an identical blue door is not meaningful. A choice between giving one unit of grain to one cow or another identical cow is not meaningful.

Sometimes, things might seem meaningful, but they aren’t. If I have a choice between giving my unit of grain to a cow and getting one unit of milk, or giving that same unit of milk to a Golden Cow and getting FIVE units of milk with no drawbacks, there’s no meaningful choice there. We say that the Golden Cow *strictly dominates* the “normal” cow.

Game balance is the process of asking “On a turn, what can a player do? What happens when they do it? And how do I make that choice meaningful?”

Modeling:

Have students think about BattleBattle.

What are the resources in BattleBattle? (tokens, health)
What is the “minimal case?” (player spends 1 token to get +1 to their die roll)
What is the “maximal case?” (various, but for example, the Ruler can potentially spend one token to get up to +6 to their die roll)

How do we make sure that a character in BattleBattle is balanced against other characters?

Finally, students can look at their own games, and begin asking themselves similar questions. Are player actions balanced? What is the “minimal case” in their game? What about the “maximal case?” How can they change their own game?

Check for Understanding:

You can check for understanding either by having players play BattleBattle again, this time making some changes to their characters, or by having them talk about the changes they’re making to their own games now that they’re thinking about it.

Guided/Independent Practice:

Either way, give students time to do another round or two of iteration, refinement, and re-testing on their projects. By this time, student understanding should be deep enough that they can identify what kinds of player actions players have access to, and how that changes the distribution of resources in their game. As they’re testing, they should also start to see ways to use the balance of elements in the game to actually affect how players play the game. Rewarding certain actions and disincentivizing others is an important tool in the game designers’ arsenal, especially if the intent is to create a real change in the behavior of your players.

Assessments:

Students should re-present their (now, hopefully more polished) final prototypes. The real-world assessment here is to have the students’ chosen audience play the game, and report whether or not the game has helped them solve their problem or at least understand it better. The closer you can get to that, the better.

Engaging Classroom Assessments Planner
(Adapted from The Leadership and Learning Center)

Subject	Game Design
Grade/Course	Game Design Academy I
Unit of Study	Game Balance
Duration of Unit	1-2 weeks

Power/Priority Standards (Grade or Course Specific Indicators Beneath the General Standard)
CTE ICT/AME Foundational Standards http://www.cde.ca.gov/ci/ct/sf/documents/ctestandards.pdf ICT 2.2.5 Extend ideas presented in primary or secondary sources through original analysis, evaluation, and elaboration. AME 1.2.4 Demonstrate in their own works of art a personal style and an advanced proficiency in communicating an idea, theme, or emotion. AME 4.3 Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources. AME 5.3 Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment. AME 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions

"Unwrapped" Concepts (Students need to know)	**"Unwrapped" Skills (Students need to be able to do)**	**Bloom's Taxonomy Levels**
Game Balance is a critical part of game design, both because unbalanced games aren't fun AND because balance lets the designer incentivize certain player actions.	Critique a system to identify which elements need balance. Iterate to balance a system. Iterate to focus player incentives on specific actions/outcomes	Evaluate Apply Apply

Essential Questions	**Big Ideas**
Why is game balance important?	Game Balance allows designers to

How do we use game balance to incentivize specific player actions or outcomes?	identify flaws in their own design. Game Balance allows designers to use a system of rewards or punishments to incentivize certain player actions. Designers must understand the economy of a system in order to balance that system.

Supporting Standards

AME Media and Design Arts Pathway Standards
A 1.2.1 Solve a visual arts problem that involves the effective use of the elements of art and the principles of design.

ICT Information and Support Services Pathway
A 8.4 Analyze business problems by using functional and cost-benefit perspectives.

Key Concepts and Skills from Supporting Standards	Other Unit Vocabulary Terms
Balance a model to drive interesting game play. Balance a model to identify cost-benefit structures that drive the model's economy, in terms of inputs and outputs.	

Performance Task Synopses

Directions:
1) Brainstorm two to five possible performance tasks
2) Write a synopsis for each selected task and list the tasks in a "learning progressions" sequence.

Performance Task 1:

Name: BattleBattle

Synopsis: Students should play several rounds of BattleBattle in order to get a sense of the balance of that game.

Performance Task 2:

Name: Balance Student Work

Synopsis: Students should do a balancing pass on their own game designs for their projects. Students should keep a change-log so that they can see how their various elements work together.

Performance Task #1
In Detail

Directions:

1) Refer to/Review your "unwrapped" Priority Standards skills, related concepts, and matching Bloom levels specific to this task.
2) Refer to/Review any additional concepts and skills from supporting standards and unit vocabulary terms specific to this task.
3) Describe the task in full detail. Check that the task directly reflects the level of rigor for each targeted skill and related concept(s).

Play multiple rounds of BattleBattle, asking students to keep tallies of their win-loss ratios. Tell students NOT to make alterations to their characters after each match, but they should change to new characters. After each student has played five matches, and thus five different characters, have them line up according to most wins. Make sure that some students have the "Vanilla" card. Find the highest win-group of characters and the lowest win-group of characters and talk about what students observed. Were they having fun playing against the high-winners? Did they want to keep playing?

Performance Task #1 Scoring Guide

Advanced:

☐ All "Goal" criteria plus:
☐ Students have coherent ideas for how to change their character.
☐ Students develop a sense of which characters are over and underpowered.

Goal:

☐ Students play several rounds of BattleBattle
☐ Students can explain their characters' abilities
☐ Students can see how their characters stack up against other characters
☐ Students can see how multiple trials are needed to accurately judge

their characters' relative strengths. Progressing: ☐ Meets _____4____ of the "Goal" criteria Beginning: ☐ Meets fewer than _____4____ of the "Goal" criteria ☐ Task to be repeated after re-teaching ☐ Comments:

Interdisciplinary Connections and Related Priority Standards Specific to this Task	**21st Century Learning Skills Specific to this Task**
Is there specific terminology you might want to add here, ie: industry terminology	✓ Check all those that apply for each task: ✓ Teamwork and Collaboration ✓ Initiative and Leadership ✓ Curiosity and Imagination ✓ Innovation and Creativity ✓ Critical Thinking and Problem Solving ✓ Flexibility and Adaptability ✓ Effective Oral and Written Communication ✓ Accessing and Analyzing Information

Performance Task #2 **In Detail**
Directions: 1) Refer to/Review your "unwrapped" Priority Standards skills, related concepts, and matching Bloom levels specific to this task. 2) Refer to/Review any additional concepts and skills from supporting standards and unit vocabulary terms specific to this task. 3) Describe the task in full detail. Check that the task directly reflects the level of rigor for each targeted skill and related concept(s).

Students get into groups and address the games they've developed on their own.

Students should use what they learned about building models to model their games, and then use what they know about balance to begin balancing.

Performance Task #2 Scoring Guide

Advanced:
☐ All "Goal" criteria plus:
☐ Student have a deep understanding of game balance, with a nuanced understanding of the connections between their various game elements.
☐ Students are balancing for player experience and outcomes.

Goal:
☐ Students clearly transfer their ideas into a model that they can play through.
☐ Students play through their model and identify elements that need to be balanced.
☐ Students use iterative design to balance those elements.

Progressing:
☐ Meets ____3____ of the "Goal" criteria

Beginning:
☐ Meets fewer than _____3___ of the "Goal" criteria
☐ Task to be repeated after re-teaching
☐ Comments:

Rubric for Paper Prototype Activity	Below Expectations	Meets Expectations	Exceeds Expectations
Protoype Construction	Construction is flawed, unclear, or incomplete Construction does not reflect prototype design Game elements are not reflected in prototype construction	Construction clearly represents game concepts Construction clearly identifies game elements and states	Construction thoughtfully engages player actions, helping players to understand how they're meant to interact with the prototype.
Protoype Conceptualization	Prototype Concept is muddled, unclear, or does not identify different game states	Prototype clearly models a well-defined system, with clear inputs, outputs, and an end state	Prototype allows players to explore the system they're modeling in a sophisticated way, making connections between player actions and model states that are not immediately obvious.
Protoype Iteration	Prototype was not iterated, student failed to play the prototype multiple times and change it.	Prototype was iterated at least a couple of times, with thoughtful changes made each time.	Prototype was iterated several times (4-5) and the student took careful notes of player actions, and made focused changes to the prototype to address player confusion or model inadequecies.
Prototype Playability	Prototype is not playable, does not have clear player and system actions defined.	Prototype has clear player and system actions defined, and is playable to an outcome.	Prototype has thoughtfully connected player actions and system reactions to inform the model that's being expored.