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| TIME TO INVENT |
| During this apprenticeship, students will learn about the Design Process. Each lesson will focus on a specific step in the Design Process and will provide students with an opportunity to implement that step. Throughout the apprenticeship, students will meet fictional clients who have hired them to solve various different problems using the Design Process. By the end of the apprenticeship, students will be able to independently use the Design Process to generate original ideas and build a product that suits a specific purpose. The apprenticeship will culminate with students working in pairs to independently implement the Design Process to solve a problem for a fictional WOW! client. Working with the Design Process will give students the tools to approach problems they encounter both in the classroom and in their daily lives. |

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| **Unit Standards and Objectives**  **21st Century Skill: Innovation** |
| **Innovation Standard #1: Citizen Schools students will generate an original idea or product that suits a practical or artistic purpose.**  Lesson Objectives:   * **Generate** original ideas * **Describe** the practical purpose for which the recess game is necessary or useful * **Use** a creative process such as brainstorming to generate an appropriate list of possible games for Mr. Johnson’s third graders * **State** the advantages, limitations, and feasibility of each game idea from a practical standpoint * **State** the advantages, limitations, and usability of each game idea from an end-user standpoint * **Use** the advantages, limitations, and feasibility of the game ideas as criteria for selecting the best one   **Innovation Standard #2: Citizen Schools students will use a design process to create ideas or products.**  Lesson Objectives:   * **Describe** a sound, multi-step process for realizing recess game for a third-grade class * **Identify** tools and materials needed to create a recess game for a third-grade class * **Use** an evaluative process such as reflection or data analysis to refine and revise the recess game * **Describe** a plan for a draft or for field testing the game   **Innovation Standard #3: Citizen Schools students will realize a product or idea that suits a given purpose.**  Lesson Objectives:   * **Create** a game for third-grade students that can be played at recess |

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| **Essential Questions** |
| * In what ways does the Design Process lead to solutions? * Is building the most important step in the Design Process? |

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| **Performance Task Assessment (WOW!)** |
| For the WOW! for this apprenticeship, students will work with a partner to use the Design Process to generate original ideas and products that will solve a problem for a fictional client. The client they will work with for their WOW! is Mr. Johnson’s third-grade class. Mr. Johnson’s third-grade class keeps complaining to Mr. Johnson that they are bored at recess. Their school does not have any games for them to play, and they have recess in their school’s parking lot so there is not even a playground for them to climb on. (There are no cars parked there.) Mr. Johnson gathered a bunch of materials, and his class has hired the students in this apprenticeship to turn these materials into games that they can play at recess. Each pair of students will be given specific materials to work with. There will be some variation in the materials amongst the groups.  **Goal:** Students create a low-cost game for third graders to play at recess.  **Role:** The students are the inventors implementing the Design Process for the client.  **Audience:** The main audience is a fictional client (Mr. Johnson’s third-grade class).  **Situation:** Mr. Johnson’s third-grade class has hired the students to solve a specific problem for them. Mr. Johnson’s third-grade class keeps complaining to Mr. Johnson that they are bored at recess. Their school does not have any games for them to play, and they have recess in their school’s parking lot so there is not even a playground for them to climb on. (There are no cars parked there.) Mr. Johnson gathered a bunch of materials, and his class has hired the students in this apprenticeship to turn these materials into games that they can play at recess.  **Product:** Students will use the Design Process to create a game Mr. Johnson’s students can play at recess.  **Standards:** Students will be evaluated based on the 21st Century Skills Innovation Rubric. |

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| **Lesson Plans At-A-Glance** |
| Full Lesson Plans are available [here](https://drive.google.com/open?id=0B1Ac8nDh50UyfnoyT212Wk5MblhZNDBaX25BTkVuMDhqbUs3VUZYQlNuUU5WZXhxNUVIXzg).   |  |  |  |  | | --- | --- | --- | --- | | Week | Lesson Objectives | Agenda | Outcomes & Work Products | | 1 | * **Generate** original ideas * **Describe** a sound, multi-step process for realizing a product or idea (the Design Process) * **Create** a piece of work that is able to retrieve a fruit roll-up from the wall | * Hook: Treat on the Wall * Introduction to New Material: What is the Design Process? * Activity 1: Who is the Client and What is the Problem? * Activity 2: Client/ Problem Scenarios * Activity 3: Introduction of the Chair Project * Assessment: Exit Ticket | Students will meet each other and their CT and TL. They will be introduced to the Design Process and work specifically on identifying clients and problems within fictional scenarios. They will meet the client they will be working with on the project that will lead up to their WOW!. | | 2 | * **Generate** original ideas * **Brainstorm** to generate an appropriate list of possible innovations that suit a practical purpose (creating a wire out of paper clips, building a bridge out of paper, creating a portable chair using cardboard). | * Hook: Paper Clip Challenge * Introduction to New Material: Brainstorming as Part of the Design Process * Activity 1: Design Journals * Activity 2: Paper Bridge * Activity 3: Chair Project--Brainstorming * Assessment: Exit Ticket | Students will focus on the Brainstorming step of the Design Process and will brainstorm ideas for the Paper Clip Challenge, building a strong Paper Bridge. Students will continue working with their client, James, and will brainstorm ideas for a chair for him as part of the project that will lead up to their WOW!. | | 3 | * **Use** the advantages, limitations, and feasibility of the ideas for the rice cake mailer, the trophy tower, and the portable chair as criteria for selecting the best one * **Identify** tools and materials needed to realize the rice cake mailer, the trophy tower, and the portable chair | * Hook: Rice Cake Mailer * Introduction to New Material: Designing as part of the Design Process * Activity 1: Trophy Tower * Activity 2: Chair Project--Design * Assessment: Exit Ticket | Students will focus on the Design step of the Design Process and will work together to design a mailer that will protect a rice cake and a trophy tower for a tennis ball. Students will continue working with their client, James, and will design and build model chairs for him as part of the project that will lead up to their WOW! | | 4 | * **Identify** tools and materials needed to realize a cardboard chair * **Create** a portable chair that can fold up and be carried | * Hook: Rice Cake Mailer * Introduction to New Material: Building as part of the Design Process * Activity 1: Trophy Tower * Activity 2: Chair Project--Build * Assessment: Exit Ticket | Students will focus on the Build step of the Design Process and will work together to build a mailer that will protect a rice cake and a trophy tower for a tennis ball. Students will continue working with their client, James, and will build a chair for him as part of the project that will lead up to their WOW!. | | 5 | * **State** the advantages, limitations, and usability of your chair from an end-user standpoint * **Describe** a plan for field-testing your chair | * Hook: Hands on Ball Challenge * Introduction to New Material: Testing as Part of the Design Process * Activity 1: Down the Drain * Activity 2: Chair Project--Test * Assessment: Exit Ticket | Students will focus on the Test step of the Design Process and will work together to test ideas for having everyone touch a ball the fastest and test products built to get a ping pong ball out of a drain (toilet paper roll). Students will continue working with James and will test the chairs they built for him as part of the project that will lead up to their WOW!. | | 6 | * **State** the advantages, limitations, and usability of your cardboard chair from an end-user standpoint * **Use** an evaluative process such as reflection or data analysis to refine and revise your cardboard chair * **Create** a portable chair that can be folded and carried | * Hook: Rice Cake Mailers * Introduction to New Material: Redesigning as part of the Design Process * Activity 1: What would you redesign? How would you do it? * Activity 2: Chair Project: Redesign and Rebuild * Assessment: Exit Ticket | Students will focus on the Redesign and Rebuild step of the Design Process and will work together to redesign the mailers they build to protect rice cakes. Students will continue working with James and will redesign and rebuild the chairs they built for him based on the data they collected during the test step. This is part of the project that will lead up to their WOW!. | | 7 | * **Describe** the practical purpose for which the chair invention is necessary or useful * **State** the advantages, limitations, and usability of your chair from an end-user standpoint * **Describe** a sound, multi-step process for realizing your cardboard chair | * Hook: Bubble Challenge * Introduction to New Material: Sharing Solutions * Activity 1: Chair Project: Share * Activity 2: Introduce WOW! * Assessment: Exit Ticket | Students will focus on the Sharing Solutions step of the Design Process and will share ideas for keeping bubbles off the ground. Students will continue working with James and will share the final chairs they designed for him. This lesson will end with the introduction of their WOW! client. | | 8 | * **Generate** original ideas * **Use** a creative process such as brainstorming to generate an appropriate list of possible games for Mr. Johnson’s third graders * **State** the advantages, limitations, and usability of a game from an end-user and practical standpoint * **Use** the advantages, limitations, and feasibility of the game ideas as criteria for selecting the best one * **Create** a game for Mr. Johnson’s third graders to play at recess | * Hook: Handcuff Puzzle * Introduction to New Material: Using the Design Process * Activity 1: WOW! Brainstorm * Activity 2: WOW! Design * Activity 3: WOW! Build * Assessment: Exit Ticket | Students will focus on the entire Design Process and will use that process to generate original ideas and create a recess game for Mr. Johnson’s third grade class--their WOW! client. They will brainstorm, design, and build the game during this lesson. | | 9 | * **Describe** a plan for field testing the game * **Use** an evaluative process such as reflection or data analysis to refine and revise your game * **State** the advantages, limitations, and usability of your game from an end-user standpoint * **Create** a game for Mr. Johnson’s third graders to play at recess | * Hook: Hole in Paper Challenge * Introduction to New Material: Continuing the Design Process * Activity 1: WOW! Build Completion * Activity 2: WOW! Test * Activity 3: WOW! Redesign and Rebuild * Activity 4: Prep for WOW! Share * Assessment: Exit Ticket | Students will focus on the entire Design Process and will use that process to generate original ideas and create a recess game for Mr. Johnson’s third grade class- their WOW! client. They will finish building the games, test the games, and redesign and rebuild the games during this lesson. They will also prepare to share their WOW! project in the final class. | | 10 | * **Describe** the practical purpose for which the game you created is necessary or useful * **State** the advantages, limitations, and usability of your game from the perspective of a player * **Describe** a sound, multi-step process for realizing the game you created | * Hook: Welcome to our WOW! Rehearsal Day! * Activity 1: WOW!: Sharing Solutions * Assessment: Exit Ticket | Students will share their WOW! games with the class during this lesson. This is the rehearsal for the culmination of their WOW! projects. | |

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| **Lesson Elements**   |  |  | | --- | --- | | **Hook**  Opening ritual used each week to build excitement | Each lesson will begin with a specific activity or challenge that will build student interest and participation as soon as they enter the classroom. The Hook activity will focus on the new material for that lesson or on general creative thinking. | | **Assessment**  How you will measure student learning (i.e., exit tickets, student writing, student presentations, etc.) | At the end of each lesson, students will complete an exit ticket to assess their grasp of the day’s objectives. This ticket will include questions and will be turned in before the students leave class each day. Additionally, they will be expected to learn and independently implement the Design Process for their WOW!. | | **Structures**  Learning structures, tools, or student grouping strategies | The apprenticeship includes both small group and partner work. Students will have frequent opportunities to work together in both teacher-led and independent activities as they master the Design Process. It is recommended that all groupings be assigned by the teachers. | | **Procedures**  Special procedures used each class (i.e. handing out folders, rearranging seating, etc.) | * This apprenticeship uses many materials. You will need to have procedures in place for how you will distribute and collect materials during each class. You will also need to have a procedure for how and where these materials will be stored between lessons. Having boxes for each group/ set of partners would be helpful in order to pass out and clean up supplies efficiently. * Design Journals will need to be handed out at the beginning of each class and collected at the end of class. One option is to have the journals already at their seats when the students enter the classroom. | |

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| **Implementation Notes**   |  |  | | --- | --- | | **Supplies**  Materials, tools, technology | This apprenticeship has an extensive supply list. Some supplies are used week to week, and others are only used in one class. All of the supplies are listed in the order they are introduced during the apprenticeship, but may also be used in subsequent lessons. This list includes enough supplies for 16 students (four groups of four, or eight groups of two), and 20 students (five groups of four, ten groups of two).   * 1 Design Process poster * 1 Roadmap to WOW! poster * 16 (20) Design Journals--*Copy and staple these in the CS office.* * 1 Fruit roll-up to hang on the wall (or any snack food that is light enough to tape to the wall)--*Bring from home or check with the CS office.* * 8 (10) Rolls of masking or clear tape--*$20* * 6 (8) full newspapers--*Bring from home or ask for donations.* * 70 (100) paper clips--*$2* * 1 pack Index Cards--*from the CS office.* * 1 pack 8.5x11 copy paper--*from the CS office.* * 200 pennies * Books to make two even stacks about 4 inches high--*Borrow from the CS office.* * 8 (10) rulers-*-from the CS office.* * 8 (10) pairs of scissors--*Borrow from the CS office.* * Cardboard (around 30 (35) boxes)-*-Donations from your local grocery or hardware store. Also check with the school recycling.* * 1 pack 200 ft. Clothesline--*$11* * 4 (6) packs of Markers--*Borrow from the CS office.* * 8 (10) rolls 10 yd. Duct tape--*$20* * 1 Tennis Ball--*Borrow from the CS office or the school where you are located.* * 16 (20) feet Thin string or thread--*Donations, any kind* * 120 (140) Straws--*$6* * 1-2 Utility Knives (for teachers only!)--*Borrow or bring in from home.* * Playground Ball (basketball size)--*Borrow from the school or CS office or use one of the Beach Balls from the WOW! supplies.* * 12 (15) ping pong balls--*$5* * 4 (5) toilet paper tubes--*Seek donations or bring from home.* * 24 (30) pipe cleaners--*$5* * 24 (30) popsicle/craft sticks-*-$5* * 1 1b bag of rubber bands--*$7* * 4 (5) small paper cup, 3.5 oz--*$5* * Bubbles (1 bottle)--*$1* * 16 (20) Handcuff Puzzle Supplies (string with a loop tied at each end to serve as handcuffs. The string should be long enough for the students to step over if they want to).--*Any kind available/ donated* * 80 (100) Paint Stirrers--*Hardware store donation* * 8 (10) Ball of String--*Any kind available/donated* * 80 (100) Paper Plates--G*et donations from local coffee shop/ grocery store/ caterer* * 80 (100) 12oz. Paper Cups--G*et donations from local coffee shop/ grocery store/ caterer* * 20 (25) Balloons 1 inch or longer--*$6* * 4 (5) Beach Balls--*$9* * 8 (10) Pool Noodles--*$16* | | **Budget** | Total cost of apprenticeship: $118 | | **Location**  Tables/desks, or classroom, gym, kitchen, outside, etc. | You will need space for students to sit at tables or desks grouped into tables (4 students per group). Ideally, there should be an ample amount of work space as there are many materials that are used in this apprenticeship. Additionally, you will need somewhere on-site to store projects and materials from week to week. See if there is space for this in the CS office. | | **Choice and Voice**  Key decisions students make | Because this apprenticeship focuses on innovation, students will be able to use their ideas to guide each of their inventions. They will be able to choose which of the designs they create will be built. Additionally, one lesson provides students with the opportunity to choose a scenario with which to work. | | **Modifications for Student Needs**  Supports and changes to help meet the needs of all learners | In order to meet the needs of all the learners in this apprenticeship, common modifications include:   * Adjust student groups * Provide additional time to complete tasks * Provide extra guidance as students work independently   This can be a great apprenticeship for English Language Learners, since it involves a lot of hands-on activities. Consider modifications for ELL students:   * Plan for extra time * Provide additional visual reinforcement when explaining and giving directions. * Make sure ELLs have a clear line of sight to all of the demonstrations. * Modified visual references | | **Student Background Knowledge and Skills Needed**  Academic skills, social emotional skills or developmental milestones needed | Students of varying levels of development, background, etc. are well suited to participate in this apprenticeship. Instead of background knowledge and skills, ideally, students will bring the following to the apprenticeship:   * Interest in innovation and coming up with new ideas to solve problems * Interest in working together as part of a team to come up with solutions | | **College and Career Readiness**  Connections to college and career | College Connection: Students who are interested in innovation, the Design Process, and creating products might be interested in college courses that focus on design, engineering, architecture, and technology development.  Career Connections: Students who are interested in innovation, design, and creating new products might be interested in careers in engineering, architecture, and technology development. People who work in these fields are often tasked with coming up with solutions to unique and challenging problems. | | **Co-Teaching Roles**  Recommendations for co-teaching and planning | It is recommended to use Team Teach or One Teach, One Assist and tradeoff who is the lead for the majority of this apprenticeship. This will allow students to get to know both the CT(s) and the TL and allow for a shared teaching experience throughout the apprenticeship. Plan ahead which teacher will lead which activity. While students are working collaboratively (whether in groups or in pairs) both teachers should circulate the room to provide guidance and answer questions as needed. | | **Special Resources**  Field trips, excursions, guest speakers | There are suggestions for guests in Lesson 9. Lesson 9 involves testing the product for the WOW! project. Because the client is a third grade class, it is suggested that at least some third grade (or similar-aged) students attend as guests to test the games created for the WOW! assignment--and even perhaps their parents/ families if they can attend.  Although there are no activities planned for guests, it would be very helpful to have guests during any lessons from week 7 onward to help with design/ building and feedback on projects. If these guests join, introduce them to students and be sure to briefly connect the Design Process and innovation to their interests and profession,, if applicable. | | **Road Map to WOW!**  Visual overview for students of their 10 week apprenticeship | Note to CT/ TL: Create a poster-sized visual of the information listed below, display and reference weekly in your classroom.  Visual overview for students of their 10 week apprenticeship:  Week 1: Beginning the Design Process  Week 2: Time to Brainstorm  Week 3: Creating a Design  Week 4: Building the Design  Week 5: Time to Test  Week 6: Redesigning the Design  Week 7: Sharing Solutions  Week 8: Working on our WOW!  Week 9: Finalizing our WOW!  Week 10: WOW! Rehearsal  WOW! | |

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| **Co-Teaching Structures Guide** |
| |  |  |  |  | | --- | --- | --- | --- | | **Teaching Model** | **Description** | **Why should we use it?** | **When should we use it?** | | **Parallel Teaching** | Class is split into two (or more) small teams. Same content is taught to each team. | ·Low student-teacher ratio  ·Greater proximity to high-risk students  ·Co-teachers have equal presence and responsibility in the classroom | ·We can plan effectively together to ensure we teach the same content to each group well.  ·Classroom’s physical structure permits it.  ·Lessons with heavy independent work  ·Need to provide a lot of individual attention | | **Station Teaching** | Class is split into two (or more) small teams. Different material taught to each group simultaneously and then teams switch or teachers switch. | ·Low student-teacher ratio  ·Co-teachers have equal presence and responsibility in the classroom.  ·More variety in teaching methods for teachers and students | ·When a lesson can be split into two mutually exclusive and equally timed parts (e.g. using a camera/critiquing a photo, chopping vegetables/measuring ingredients)  ·Classroom’s physical structure permits it  ·Lessons with a lot of knowledge or skill-building | | **Team Teaching** | Both teachers actively teach the material taking turns during the lesson to lead teach. While one teacher is lead teaching the other goes around to groups or individual students. | ·One teacher can pay attention to high-risks students while one teacher leads the full class.  ·Co-teachers have equal presence and responsibility in the classroom. | ·When it’s difficult to effectively split a lesson into two stations  ·When a lesson has lectures and independent practice time  ·If most SPED students can follow whole-group instruction  ·Best with well-developed co-teaching relationship  ·Lessons with a lot of group work | | **Alternative Teaching** | One teacher remediates a small group of students (pre-teach, re-teach, supplement, or enrich) and catches them up for the main lesson being taught by the other teacher. | ·Low student-teacher ratio.  ·To remediate in class for a small group of students.  ·To catch students up who may not have understood/missed previous lesson | ·When the benefits from a few minutes of remediation/ pre-teaching will pre-empt greater misunderstandings for the lesson.  ·Classroom’s physical structure permits small group in one part of the room. (CTs should not be left alone in the classroom with students.) | | **One Teach, One Assist** | One teacher lead teaches the whole lesson and the other teacher works with individual students. | To redirect behavior from an especially low functioning student.  To pay greater attention to a student who needs one-on-one interaction in order to keep up | ·If there is a particularly high-needs student(s) in the classroom that need specific support.  ·During direct-teach sections of the lesson | |

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| **The Pitch** |
| * **Teacher’s Note:** *Have a table set up where you are presenting that includes a sample “Trophy Tower” and Box of WOW! supplies. You will need to build a sample Trophy Tower holding a tennis ball using straws and tape (Lessons 3 & 4) ahead of time to have on display. You also need to gather some of the WOW! supplies and place them in a box so that students cannot see them until you show them (Pool Noodle, String, Beach Ball, Rubber Bands, Duct Tape). Have the Design Process poster hanging if there is a place for it. If not, you can hold it up when you reference it.* * **Say**: Good Afternoon! My name is <insert name> and I am a <insert job>. The apprenticeship I will be teaching is Time to Invent. We come across inventions everyday even if we don’t think about it! Someone invented the light in this room (point to the light). Someone invented the car I drove here in (point towards outside). In fact, someone invented the chair you are sitting on! We don’t always think about how things got invented, but at some point- someone encountered a problem and someone invented a solution!   + If your career is connected to innovation or the Design Process, make that connection here. Students will be interested to learn how what they will do in the apprenticeship is tied to what you do at work. * **Say:** In this apprenticeship, different clients will come to us with problems, and we will invent the solutions!   + **Show:** For example, one of the clients we’ll meet is a coach who needs a stand to display the tennis ball his team won in the championship (hold up the tennis ball). I built this Trophy Tower for the coach using straws and tape (show the sample tower). It works pretty well. However, I bet one of you could invent an even better Trophy Tower! * **Explain:** In order to help us invent the best solutions for our clients, this apprenticeship will focus on innovation and the steps in the Design Process (point to the poster or hold it up for students to see). We use innovation when we come up with new and creative ideas to solve problems. The Design Process gives us a map to follow to get to these solutions. * **Say:** At the end of our apprenticeship, for our WOW! we will meet a client who needs our help. He is a third grade teacher and his students do not have any games to play at recess. He brought us a box of materials he has in his classroom (walk around carrying the box and show it to each student, so they can get a good look at what is inside). He has hired us to use these materials to create games for his third graders to play at recess. It will be up to us to use the materials he gives us to invent games that his students will understand and have fun playing! * **Say:** If you like working with other students and inventing new things, and you think you might be able to help Mr. Johnson’s class, Time to Invent might be the apprenticeship for you! I hope you’ll join us as we learn about the Design Process and use that process to come up with new and interesting solutions to the problems our clients bring to us! |

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| **Materials Needed for Pitch Day** |
| 1. Design Process Poster 2. Sample Trophy Tower (straws, masking tape, tennis ball) 3. Box 4. Pool Noodle 5. String 6. Beach Ball 7. Rubber Bands 8. Duct Tape |

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| **Apprenticeship in Action** |
| Time to Invent at the Edwards Middle School  Comments and Tips from CTs coming in 2016! |

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| **Apprenticeship Description for WOW! Communications** |
| The Time to Invent Apprenticeship focuses on innovation and the Design Process. Students will learn the specific steps in the Design Process and will have opportunities to implement the Design Process. Throughout the apprenticeship, students will meet fictional clients who have hired them to solve various different problems using the Design Process. By the end of the apprenticeship, students will be able to independently use the Design Process to generate original ideas and build a product that suits a specific purpose. The apprenticeship will culminate with students working in pairs to independently implement the Design Process to solve a problem for a fictional WOW! client. Working with the Design Process will give students the tools to approach problems they encounter both in the classroom and in their daily lives. |

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| **Apprenticeship Acknowledgements** |
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