The Design Process

The Design Process unit transitions students from thinking about computer science as a tool to solve their own problems towards considering the broader social impacts of computing. Through a series of design challenges, students are asked to consider and understand the needs of others while developing a solution to a problem. The second half of the unit consists of an iterative team project, during which students have the opportunity to identify a need that they care about, prototype solutions both on paper and in App Lab, and test their solutions with real users to get feedback and drive further iteration.

Chapter 1: User Centered Design

Big Questions

- How do designers identify the needs of their user?
- How can we ensure that a user's needs are met by our designs?
- What processes will best allow us to efficiently create, test, and iterate upon our designs?

Week 1

Lesson 1: Designing With Empathy

Unplugged

The class explores a variety of different shoe designs to consider design choices. Building on this, you will explore the relationship between users, their needs, and the design of objects they use.

Lesson 2: Understanding Your User

Unplugged

Using user profiles, you will explore how different users might react to a variety of products. Role playing as a different person, each member of the class will get to experience designs through someone else's eyes.

Lesson 3: User-Centered Design - Define and Prepare

Unplugged

In small groups, you will use the design process to come up with ideas for smart clothing. From brainstorming, to identifying users, to finally proposing a design - this activity serves as the first of several opportunities for you to practice designing a solution for the needs of others. Today's lesson focuses on brainstorming users and ideas that will meet their needs.

Lesson 4: User-Centered Design - Try and Reflect

Unplugged

In small groups, you will use the design process to come up with ideas for smart clothing. From brainstorming, to identifying users, to finally proposing a design - this activity serves as the first of several opportunities for you to practice designing a solution for the needs of others. Today's lesson focuses on creating your design and reflecting on how well it meets the needs of your users.

Lesson 5: User Interfaces

Unplugged

In this lesson, you get to see how a paper prototype can be used to test and get feedback before writing any code. To help out a developer with their idea, the class tests and provides feedback on an app prototype made of paper.

Week 2

Lesson 6: Feedback and Testing

Unplugged

Users have been testing an app, and they have lots of feedback for the developer. The class needs to sort through all of this feedback, identify the common themes and needs, and start revising the prototype to make it better meet the users' needs.

Lesson 7: Identifying User Needs

Unplugged

In this lesson, we begin thinking about designing our own paper prototype for an app that can solve a problem in our community. Using interviews from different users, you will identify needs and interests that you can use to design an app for these people in your community.

Lesson 8: Project - Paper Prototype

Unplugged | Project

Using the interview information from the previous lesson, you will come up with app ideas to address the needs of your users. To express those ideas, and test out their effectiveness, you will create and tests paper prototypes.

Chapter Commentary

This chapter introduces the design process as a specific version of the problem solving process in which empathy for a user's needs is consistently integrated. Students learn strategies for identifying user needs and assessing how well different designs address them. In particular they learn how to develop a paper prototype, how to gather and respond to feedback about a prototype, and consider ways different user interfaces do or do not affect the usability of their apps.

Chapter 2: App Prototyping

Big Questions

- How do teams effectively work together to develop software?
- What roles beyond programming are necessary to design and develop software?
- How do designers incorporate feedback into multiple iterations of a product?

Lesson 9: Designing Apps for Good

Unplugged

To kick off the app design project, the class organizes into teams and starts exploring app topics. Several examples of socially impactful apps serve as inspiration for the project.

Week 3

Lesson 10: Market Research

In this lesson, we dive into app development by exploring existing apps that may serve similar users. In groups, you will identify a handful of apps that address the same topic you are working on, and use those apps to help refine the app idea you will pursue.

Lesson 11: Exploring UI Elements

Paper prototypes allow developers to quickly test ideas before investing a lot of time writing code. In this lesson, teams explore some example apps created in App Lab and use these examples to help inform the first paper prototypes of your apps.

Lesson 12: Build a Paper Prototype

Unplugged

In your teams, you will create your paper prototype for the app you've been developing. Each team member will create a different screen and design how the user will navigate between each screen.

Lesson 13: Prototype Testing

Unplugged

In this lesson, teams test out their paper prototypes with other members of the class. As one student role plays as the computer, one narrates, and the rest observe, teams will get immediate feedback on their app designs, which will inform the next version of your app prototypes.

Lesson 14: Design Mode in App Lab

App Lab

Teams now move to App Lab to build the next iteration of your apps. This lesson focuses on how to use Design Mode in App Lab to create digital prototypes for your apps.

Week 4

Lesson 15: Build a Digital Prototype

App Lab

Using the drag-and-drop Design Mode, each team member builds out at least one page of their team's app, responding to the feedback you received in the previous round of testing.

Lesson 16: Events in App Lab

App Lab

Building on the previous lesson, we learn how to import new screens into our apps and link them together using buttons and events to complete the Recycle Finder app we started in an earlier lesson.

Lesson 17: Linking Prototype Screens

App Lab

Building on the screens that they designed in the previous lesson, teams combine screens into a single app. Simple code can then be added to make button clicks change to the appropriate screen.

Lesson 18: Testing the App

In this lesson, teams run another round of user testing with their interactive prototype. Feedback gathered from this round of testing will inform the final iteration of the digital prototype.

Lesson 19: Bugs and Features

Teams analyze the feedback they received from the last round of testing and make a plan for how they would like to address it. You will categorize feedback as either a bug or a feature and decide which items are most important for improving your app.

Week 5

Lesson 20: Updating Your Prototype

Using the feedback from the last round of testing, teams implement changes that address the needs of their users. Each team tracks and prioritizes the features they want to add and the bugs they need to fix.

Lesson 21: Project - App Presentation

Project

Each team prepares a presentation to "pitch" the app they've developed. This is the time you can share the struggles, triumphs, and plans for the future.

Chapter Commentary

This chapter is focused on a long running group project that allows students to apply all they've learned about User-Centered Design to develop an app prototype. Working in teams, students identify a social issue that they care about and design and prototype an app to address that issue. This is an opportunity for students to explore other roles in software development, such as product management, marketing, design, and testing.

English

Lesson 1: Designing With Empathy

Overview

Question of the Day: How can we choose products based on the needs of a user?

To kick off a unit devoted to group problem solving and developing products for other users, students begin by investigating the design of various shoes. Students look at a variety of shoes and attempt to match each shoe with a potential user. Students also provide feedback on these designs, using an “I Like...” / “I Wish...” / “I Wonder...” structure that will be repeated throughout the unit. To conclude the activity, students are asked to propose some changes to one of the teapots that would make it more useful or usable.

Purpose

Students will enter this unit with an understanding of the problem solving process from prior units.

The problem solving process used throughout CS Discoveries is:

- Define
- Prepare
- Try
- Reflect

In this lesson, students look at real world objects to understand how the problem solving process can be applied to help others. Starting with this lesson, we will be reframing this process to include a layer of empathy, encouraging students to consider how others will experience and use the things they create.

We are purposefully starting out by looking at non-technical objects to encourage students to think more broadly about what it means to consider the end user of a product before honing in on how it specifically applies to software design

Assessment Opportunities

1. **Critically evaluate an object for how well its design meets a given set of needs**

   In the discussion at the end of the activity, ensure that students are connecting specifics of the user descriptions to the features of the shoes that they have chosen for those respective users.

2. **Identify empathy for the user as an important component of the design process**

View on Code Studio

Objectives

Students will be able to:

- Critically evaluate an object for how well its design meets a given set of needs
- Identify empathy for the user as an important component of the design process

Preparation

- [ ] Print a copy of the activity guide for each student (or prepare to distribute the document digitally).

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides
- **Determine the User** - Exemplar

For the Students

- **Designing With Empathy 2021** - Activity Guide Make a Copy
- **Problem Solving Process with Empathy** - Image

Vocabulary

- **Empathy** - In design, paying attention to a user's feelings and needs when designing a product.
- **User** - Someone who uses an object, including software and hardware.

In the discussion at the end of the activity, check that students are referencing the user descriptions for their explanations, rather than general advantages and disadvantages of each shoe.

Agenda

Warm Up (5 min)

- **Journal**

Activity (35 min)

- **Determine the User**
- **Design Feedback**

Wrap Up (5 min)

- **Journal**

Teaching Guide

Warm Up (5 min)

Display: Show the Problem Solving Process graphic, which now includes an *Empathize* section in the background of the entire process.

Journal

Prompt: We've used this Problem Solving Process several times throughout this course. In this unit, we're adding a new element: **Empathize**. What does it mean to empathize? Where else have you heard this term before?

Discuss: Students should write their responses in their journal first, then share their ideas with a partner before discussing as a full class. Eventually direct conversation towards the fact that to empathize with other people means to consider their wants, needs, or concerns.

Discussion Goal

Goal: This discussion can be fairly free-flowing and open ended. While you want to eventually arrive at a shared understanding of what it means to empathize, students will be working on their understanding of the word over the entire unit. There's no need to settle on a single fixed definition, so treat this discussion as an introduction to a theme of the unit.

Vocabulary: Display the following vocabulary as a transition to the main activity:

- Empathy - In design, paying attention to a user's feelings and needs when designing a product.
- User - Someone who uses an object, including software and hardware.

Remarks

> This unit we are going to start thinking a lot more about designing for other people. This is still largely a problem solving process, but we will now need to think a lot more closely about the needs of our users. In other words, empathy will be an important theme as we learn more about design.

Question of the Day: How can we choose products based on the needs of a user?

Activity (35 min)

Distribute: Hand out copies of the Determine the User Activity Guide.

Designing With Empathy

Determine the User

Overview: Have students read through the Determine the User section of the activity guide. The first part of this activity asks students to match different shoes with the most likely user. Have students work through this activity in pairs, encouraging discussion about why exactly they are choosing to make each connection. This is a great place to discuss the design of shoes and the needs of users.

Circulate: Monitor students as they complete the first page of the activity guide, asking students to justify some of the decisions that they made. It's okay if students disagree about a particular shoe choice. There are no right or wrong answers here - the discussion and ability to reasonably justify a decision are what matter.

Share Out: Have students discuss the following questions in small groups before bringing to a full class discussion:

- Which users were the easiest to find matches for?
- Which users were the hardest to find matches for?

Based on your observations while circulating, you should also identify a few specific users to ask the class to discuss, especially users where multiple students chose different shoes. Encourage students to hear different justifications for their choices, emphasizing that the rationale is more important than the choice itself.

Design Feedback

Remarks

> We're now going to learn how to give feedback on a design. We're going to give our opinion about the good and bad parts of these shoes. It's important to give feedback that acts as a positive step towards improvement, rather than feedback that is negative and judgemental that doesn't help make the product better.

Design Feedback: Have students read the Design Feedback section of the activity guide on the second page. This second activity gives students an opportunity to provide feedback on four of the shoes. The structure of this page reflects the general approach we will be using for feedback, using the three statements:

- I Like... (a strength)
- I Wish... (a weakness)
- What if... (a suggestion)

Circulate: Monitor students as they complete this activity, ensuring that students are giving actionable feedback that can lead to improvements rather than generic or unhelpful feedback that feels more like a judgement than a suggestion.

Share Out: Have students discuss the following questions in small groups before bringing to a full class discussion:

- Which shoe was your favorite? Why?
- Which of these shoes do you think would be the favorite for someone in your family? Why?

Encourage students to think about both themselves and other people in their lives, such as a family member. This helps emphasize that designing means thinking about more than just your own needs and desires, but considering how other people will react to a product as well.

Teaching Tip

Reducing Printed Materials

Unit 4 contains a lot of printed materials. Classrooms with limited ability to print can choose one of the following options instead.

Option 1: Online Activity Guides

All of our activity guides are available in editable Google Doc and Microsoft Doc formats. Classrooms using Google or Microsoft products can distribute digital copies to students, who can complete most of the activity guides entirely online.

Option 2: Student Journals

Many of the activity guides can be converted into journal activities. Teachers can project the instructions and prompts or allow students to view them online, then complete the activity itself in a journal.

Look for teaching tips on relevant lessons to indicate when you may avoid printing by using one of these options.

Assessment Opportunity

As students discuss their reasoning for their choices, check to ensure that they are identifying the particular user's needs and characteristics, rather than general reasons to prefer a certain teapot. You may want to challenge students to distinguish their own needs and preferences from those of the described users.

Teaching Tip

The first step towards creating a design that can be effectively used by many people is to understand that not everyone thinks the same, or looks at an object or design in the same way. This is the first exercise in the students thinking outside of themselves and at how others may perceive items in the world

Remarks

> An important part of this activity is thinking about how different products are made for different people, and how there's always room to improve a product so it is helpful to more users. Throughout this unit, we'll continue to think about how different people use objects for different reasons so that we can design apps for as many users as possible!

Wrap Up (5 min)

Journal

Prompt: Pick one or two of the objects you analyzed today. What could you change to make this object more usable for you? Feel free to use words, pictures, or a combination of both.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **CS** - Computing Systems

Lesson 2: Understanding Your User

Overview

Question of the Day: How can we make sure a product is meeting the needs of a user?

Designers need to understand their users' needs in order to create useful products. This lesson encourages students to think about how to design for another person by role-playing as someone else using a user profile and reacting as that user to a series of products. Each student is assigned a user profile describing a person, which they then use to choose appropriate products, critique product design, and suggest improvements to design.

Purpose

This lesson builds on the previous by asking students to not only consider that there *is* a user that products are designed for, but also empathize with those potential users. Throughout this unit, students will work to apply the problem solving process from Unit 1 to problems for other people. Empathy is a key element of this kind of user-centered design and a difficult skill for students at this age to master.

Assessment Opportunities

1. **Critique a design through the perspective of a user profile.**

   Activity Guide, page 1: Students should connect the information in the user profile to their predictions about the user's preferences.

2. **Design improvements to a product based on a user profile.**

   Activity Guide, page 2: In the first discussion question, students should make explicit connections between the user profile and their added features.

Agenda

Warm Up (5 min)
- **Journal**

Activity (35 min)
- **Think Like a User**

Wrap Up (5 min)
- **Journal**

View on Code Studio

Objectives

Students will be able to:

- Critique a design through the perspective of a user profile.
- Design improvements to a product based on a user profile.

Preparation

- [ ] Print out enough user profiles for all students, ensuring as much variety as possible
- [ ] Print an activity guide for each user
- [ ] Prepare prompt questions for warm up exercise
- [ ] Label four corners of the room as A, B, C, and D
- [ ] Arrange room in table groups of 4, and place a number on each table group (1, 2, 3,...)

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides
- **Reacting as Your User** - Exemplar

For the Students

- **Reacting as your User** - Activity Guide Make a Copy
- **Profile 1** - User Profile Make a Copy
- **Profile 2** - User Profile Make a Copy
- **Profile 3** - User Profile Make a Copy
- **Profile 4** - User Profile Make a Copy

Teaching Guide

Warm Up (5 min)

Journal

Prompt: Let's think about products that look good vs products that are easy to use.

- Can you think of any examples of a product that looked good but was hard to use?
- What about something that was easy to use, but you didn't like how it looked.

> Discussion Goal
>
> **Goal:** Highlight that there are many kinds of user needs that we need to empathize with as designers. In particular call out that usability of a product is an important and separate consideration from whether it is merely aesthetically pleasing.

Discuss: Have students journal their thoughts. As they share with their neighbors what they wrote, ask them to also discuss whether they care about a product being usable or looking good. After a couple of minutes allow a couple of partners to bubble up what they discussed.

Remarks

> Clearly we have a lot of needs when using products. The *usability* of our designs will affect whether a user can use the product in the first place. However, If a product isn't attractive, it may never be used at all. As we think more about designing for other people, we'll want to have many different kinds of needs in mind.

Question of the Day: How can we make sure a product is meeting the needs of a user?

Activity (35 min)

Distribute: a User Profile handout to each student. Try to vary the user profiles within student groups so they are not all the same.

Remarks

> Take a few minutes to read over your assigned user profile - you'll need to "get in the head" of your user for our activity today. In fact, for the rest of the day you will be learning to empathize with you users, and respond to situations as your users might.

> Teaching Tip
>
> **Reducing Printed Materials**
>
> The User Profiles are used for reference only. Students can look at digital versions during this activity. Assign each student a link, rather than handing out the actual profiles.
>
> If you choose to print out the user profiles, they can be reused, as long as the students are told not to write on them.

Circulate: Give students a few minutes to read over their profiles, encouraging them to think like their assigned user, almost like they are playing a role in a movie or play. For the rest of the day students will be attempting to empathize with their users and respond to situations as their users should

Think Like a User

Display: The next three slides contain different choices for the same product - a pet, a backpack, and a car. For each slide, ask students to choose a corner based on which picture *their user* would be drawn to. Then have students walk to the corner (A, B, C, or D) that they have chosen to discuss with other students.

Share: Have the groups in each corner briefly discuss (1-2 minutes) why they think their user is drawn to this version of the product. Have one or two students or groups share what they discussed with the whole class. Repeat this for each of the slides.

Group: After repeating this activity for all the objects in the slides, place students in groups of 3-5 based on their assigned user profile - students with the same profile will be working together through the next activity.

Distribute: Hand out copies of the activity guide to each student.

Reacting as Your User

Display: The next three slides contain different products for each user group to react to - waterproof boots, a bicycle, and chocolate cupcakes. Students will react to each product as their user by filling out a row in the activity guide. The guide asks students to make a distinction between the *usability* of an item for their user and whether a user likes or dislikes it. You may want to go through the first one as a group so you can model that a product may be aesthetically appealing, but not very usable, or usable but not aesthetically appealing.

Circulate: Monitor students as they complete the activity guide, ensuring that they are taking on the role of their user rather than reacting to the product as themselves. Remind students that this is an intentional part of the activity - to see the world through the eyes of another person rather than just themselves.

Share: Have a few groups share out their reactions to each product.

Display: The final slide contains a table with several chairs, which is used for the second page of the activity guide. Students can work individually on the second page, which asks them to consider which of the chairs displayed best fits their user. After reflecting on the features that lead them to choose a specific chair, students have a space to design an even more appropriate chair for their user. This is a creative activity, and students can choose to approach it in whatever way is most expressive for them, including drawing their design.

Share: Circle around the room to share some of the chair designs, prompting students to define what specifically makes their design a better choice for their user.

Teaching Tip

Reducing Printed Materials

Online Option: The Activity Guide can be completed online. Students can "circle" their chosen ratings by putting a border around them, or by typing the rating in the box. For the chair design, students can either draw their design online or submit a paper version of their design separately.

Journal Option: This activity can be completed as a journal entry. Students can use a digital version of the Activity Guide as a prompt, copying the charts and questions into their journals.

Tip: Multiple windows or tabs open on the same computer can be confusing. Have groups work together with one computer displaying the User Profile while another displays the Activity Guide.

Teaching Tip

Adapting the Activity: The provided slides include several products already, but you could add some additional products and images that you think will resonate with your students.

Assessment Opportunity

On the first page, check that students' reasoning includes references to the user profile and reasonably connects the description of the user to the preference that the student has chosen.

On the bottom of the second page, check that students have made explicit connections between the user profile and the features that they have added to their chair.

Wrap Up (5 min)

Journal

Prompt:

- What were 3 things about your user that were different from you personally?
- What were 2 times that you found it hard to empathize with your user?
- What was 1 thing you think your user would really like about the chair you designed?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▶ **CS** - Computing Systems

English

Lesson 3: User-Centered Design - Define and Prepare

Overview

Question of the Day: How can we design for people other than ourselves?

This is the first part of a two-day lesson where students are guided through an abbreviated version of the design process they will be seeing throughout this unit. This lesson focuses on the Define and Prepare steps of the process. Students first brainstorm a list of potential users of smart clothing. As a class, they then group these ideas into broad categories and each group will choose one category of user. Groups repeat this process to brainstorm needs or concerns of their user, eventually categorizing these needs and choosing one to focus on. In the next lesson, students will complete the Try and Reflect steps of the design process.

Purpose

This micro activity is the first of three design projects in this unit. It is a fast-paced introduction to the user-centered design process, intended to give students an experience with user-centered design that they can build on in later projects. In this lesson the primary goal is to establish that design decisions will be made with the user's needs in mind. The practice of categorizing lots of disparate ideas to help make decisions will also reappear later in the unit.

The activity in this lesson is an adaptation of the **Design Charrette from the University of Washington**.

Assessment Opportunities

1. **Generate multiple strategies for meeting user needs.**

   Activity Guide, Page 2: At the top of the page, students should have have generated multiple relevant ideas for meeting the user's needs.

2. **Organize ideas and strategies into meaningful categories.**

   Circulate the room as students group their ideas into categories. There should be multiple related ideas in each category, with multiple categories for each group.

Agenda

Warm Up (5 min)

Journal

Activity (35 min)

View on Code Studio

Objectives

Students will be able to:

- Generate multiple strategies for meeting user needs.
- Organize ideas and strategies into meaningful categories.

Preparation

- [ ] Ensure you have plenty of sticky notes, pens and large poster paper for students to work on
- [ ] Set up groups with preferably 3 students each

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides
- **User Centered Design** - Exemplar

For the Students

- **User Centered Design (Define & Prepare) 2021** - Activity Guide Make a Copy
- **The Design Thinking Process** - Video

- Introduce Design Thinking
- Introduce the Activity
- Define
- Prepare

Wrap Up (5 mins)

- Journal

Teaching Guide

Warm Up (5 min)

Journal

Prompt: In the last two lessons we've seen that products are designed with a purpose and that different designs are more useful or pleasing to different people. Since different people have different needs or interests, what might be some of the challenges if you're trying to design a product for someone else?

Discussion Goal

Goal: This should be a very quick introduction to the lesson. You are looking to call out that designing for other people requires you to consider their needs instead of your own, which can often be challenging. This discussion will lead into the video introduced just after the warm up.

Discuss: Have students think silently before having them share with their tables and then the class as a whole.

Remarks

> Designing for other people can be challenging for a lot of reasons, but one of the most important is that it challenges us to consider what another person values, likes, or is concerned about. In other words we need to have empathy for someone else. Today we're going to do a mini design activity to help us practice the entire process ourselves.

Question of the Day: How can we design for people other than ourselves?

Activity (35 min)

Introduce Design Thinking

Video: Watch the Design Thinking Process video with students. Stop the video after Step 5 (around 3:10).

Display: Display the steps from the Design Thinking Process. As you talk about this process, click the animation on the slide to have these steps fade out and the Problem Solving Process fade in.

Remarks

> The Design Thinking Process is very similar to our Problem Solving Process - both are centered around empathy, and both have a similar cycle for defining, preparing, trying, and reflecting. Over the next few weeks, we're going to practice this process so we can design products and apps for people in our communities and around the world. Today and tomorrow, we're going to practice a shorter version of this process by brainstorming different groups of people and their needs, then designing smart clothing products to meet those needs.

Teaching Tip

Design Thinking: Today's activity, as well as this entire unit, are heavily influenced by Design Thinking. This is a very open-ended, creative process that may be hard to visualize if you've never participated in a design thinking activity yourself. The resources below can help you imagine what your classroom will look like during these design thinking activities.

- **What is Design Thinking? A Handy Guide for Educators**.
- **Design Thinking: Lessons for the Classroom**
- **Design Thinking Teacher Training (Video)**

Some of these resources are framed around science classrooms or physical prototypes, which is different from this unit which ultimately focuses on creating apps. Regardless, they should offer some clarity on what the entire process looks like from start-to-finish and what your classroom may look-and-sound like during these activities.

Introduce the Activity

Group: Students should be in teams of 3 to 5.

Distribute: Hand out the activity guide to each student, as well as markers, sticky notes, and poster paper for each group.

User-Centered Design

Overview: As a class read through the "Overview" section to make sure groups understand the goal of the activity.

Define

Brainstorm User Groups: Ask students to list on their activity guides as many different potential user groups of smart clothing as they can think of. The video gave an example of elderly people, but students can come up with different groups of people. Give students a couple of minutes to brainstorm independently. Once they're done, ask each student to create a post-it for the two or three user groups they think are most interesting.

Categorize Users: Have students group together post-its of their users into similar categories on their poster board, such as by age or occupation. It is okay if some post-its don't fit into any similar groups and are left by themselves.

Choose Specific User: Ask groups to pick one of the user categories they've created. Do your best to ensure a good mix of categories in the classroom but it's not a problem if some groups choose similar user categories.

Brainstorm & Categorize Needs: Students will repeat the brainstorming process to identify a list of potential concerns, interests, and needs of the user they picked. Begin by brainstorming on the activity guide, then creating post-its for two or three of their ideas to share on the poster board. Encourage students to think carefully about what might be important to those people.

Circulate: Students should repeat the same process of creating scraps of paper for each need, interest, or concern of their user and then grouping them. Students can use the markers and poster paper to do this step if you have provided those materials.

Choose Specific Need: Ask groups to pick the specific need for their user that they want to address. They should try to pick a need they think could be addressed by smart clothing so in some cases they may need to be a little creative in thinking about these needs.

Share Out: By this point, each group should have settled on a specific user group and a need or interest that group has. Ask groups to share their user group and need with the rest of the class.

Teaching Tip

Reducing Printed Materials

Online Option: The Activity Guide can be completed online. For the drawing, students can either draw their product online or submit a paper version of their product separately.

Journal Option: This activity can be completed as a journal entry. Students can use a digital version of the Activity Guide as a prompt, copying the headers or prompts into their journals.

Teaching Tip

Why Smart Clothes?: This type of product was chosen because there are broad applications for combining computing technology with clothing that could benefit many types of users. An additional benefit is that the field is not yet well-defined and so it provides students more leeway to develop ideas for how to solve people's problems rather than rely on more established solutions.

Teaching Tip

Brainstorming User Groups: In this first brainstorming activity, try to model this process carefully. Encourage students to consider different identifying factors when brainstorming users - for example, identifying users by age or occupation or living situation. These should be broad, one or two word responses that identify large groups of people in the population. Some examples may include: young students, military, doctors, pet owners, live on a farm, etc.

Encourage students to draw from people they know in their lives to help generalize to a certain type of user. Emphasize the fact that there are no right or wrong ideas, and students will have a chance to narrow down their choices later.

Teaching Tip

Categorizing Users: The larger goal is for students to notice any patterns or similarities between the groups that each person brainstormed independently. The categories may continue to generalize user groups - for example, post-its like "police" and "firefighter" and "EMTs" might get grouped together because they are all "first responders".

When creating categories, emphasize that again there are no "right" categories - instead, remind students that the goal here is to Define the problem they will try to solve and this process is a useful way to begin focusing on a specific problem.

Prepare

Brainstorm Solutions: Ask students to brainstorm potential ways smart clothing could be used to address the problem they've decided to solve. Record their thoughts on the second page of their activity guide.

Discuss Pros and Cons: Once students have brainstormed solutions individually, have students share their ideas with their group and discuss the pros and cons of each solution. Encourage students to use the discussion to build on each other's ideas, possibly generating even more potential solutions.

Choose Specific Solution: Have the group choose a specific solution they will focus on. They may decide to combine solutions from their discussion, or use a brand new solution that developed during the discussion. This decision will guide the product they create in tomorrow's activity.

Remarks

Today we've completed the Define and Prepare stages of our design process - we've determined our users and brainstormed their needs, and are now ready to design a solution using smart clothing. Tomorrow we'll complete the Try and Reflect stages, where you'll create your own smart clothing design and share your ideas with the class.

Assessment Opportunity

As you circulate the room, check that students are grouping ideas into meaningful categories. Categories should be broad enough that several related ideas fall into them, but not so broad that there are only one or two categories for the entire group.

Teaching Tip

Discussing Pros and Cons: Students should speak from the standpoint of their user, imagining any intended or unintended benefits and harms for each proposed solution. They are not judging ideas as "good" or "bad", but instead discussing whether or not the solution addresses the needs & interests of their user. Some useful phrases during the discussion are saying "Yes, and..." when they hear a pro, and saying "No, but..." when they hear a con.

Collect: Either collect the activity guides from each student or ask them to store them in a safe place - they will be used in tomorrow's activity.

Wrap Up (5 mins)

Journal

Prompt: Today's activity involved a lot of brainstorming with your group. What is one example from today where a group member had an idea that you hadn't considered before? How did that idea affect some of the decisions you made?

Discuss: Allow students a minute to think silently before having them share with their tables and then the class as a whole.

Discussion Goal

Goal: Students should reflect on how different voices helped elevate the ideas the group had and may have contributed to the product they will begin designing tomorrow. This attention to teamwork and valuing others ideas will be important throughout the unit as students work together to develop apps for others.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **CS** - Computing Systems
- **IC** - Impacts of Computing

Lesson 4: User-Centered Design - Try and Reflect

Overview

Question of the Day: How can we design a product to meet a user's needs?

This is the second part of a two-day lesson where students are guided through an abbreviated version of the design process they will be seeing throughout this unit. Yesterday students completed the Define and Prepare steps of the design process. Today, they complete the Try and Reflect portions. Students continue their work from yesterday by designing a piece of smart clothing, using the specific needs and concerns they brainstormed to guide their decision making. Students have a chance to share their decision-making process and get feedback on how well their product addresses the user needs they selected.

Purpose

This micro activity is the first of three design projects in this unit. It is a fast-paced introduction to the user-centered design process, intended to give students an experience with user-centered design that they can build on in later projects. In this lesson the primary goal is to align the design of a product to the needs of the user, sometimes setting aside personal beliefs or preferences. The act of basing decisions around a user rather than yourself is a key mindset that appears throughout the unit.

The activity in this lesson is an adaptation of the **Design Charrette from the University of Washington**.

Assessment Opportunities

1. **Analyze and select the most appropriate strategies to meet user needs.**

   Activity: Students should present justification for how their chosen strategy meets the user need.

Agenda

Warm Up (5 mins)

- **Journal**

Activity (35 mins)

- **Try**
- **Reflect**

Wrap Up

- **Journal**

View on Code Studio

Objectives

Students will be able to:

- Analyze and select the most appropriate strategies to meet user needs.

Preparation

- [ ] Return the activity guide from yesterday to students
- [ ] Make copies of the Try & Reflect activity guide - one for each group

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides
- **User Centered Design** - Exemplar

For the Students

- **User Centered Design (Try & Reflect) 2021** - Activity Guide Make a Copy

Teaching Guide

Warm Up (5 mins)

Distribute: As students enter the classroom, redistribute the activity guides from yesterday. If a student was absent, have them join an existing group and use the same user, needs, and solutions as that group.

Journal

Prompt: Look at your activity guide from yesterday and list out:

- The user you are designing for
- Their specific need or interest
- Your chosen solution to their need

Then write down an idea for a specific type of smart clothing you could design based on your solution.

Discuss: Allow students a minute to remind themselves of their work yesterday. Once they've written these notes in their journal, ask them to take turns sharing this information with their groups from yesterday.

Discussion Goal

Goal: This is a quick refresher of the work that students did yesterday and an opportunity to share different product ideas before making a decision as a group in the first part of the activity.

Remarks

> There are a lot of different users and needs that we're designing for. Today, we'll complete the Try and Reflect stages of this activity. Your group will have a chance to design your own smart clothing product for your user, and share your ideas with the class.

Question of the Day: How can we design a product to meet a user's needs?

Activity (35 mins)

Distribute: The User Centered Design (Try & Reflect) Activity Guide to each group. If available, also distribute poster paper to each group.

User Centered Design (Try & Reflect)

Try

Overview: Read the overview as a class to ensure students understand the activity. Lean into the role-playing aspect of this project, encouraging students to imagine they have all the resources they need to complete this task.

Assign Roles: Have students assign roles - a scribe, an artist, a timekeeper, and a presenter. Ensure students are clear on their roles and assignments during this task.

Do This: Students should work together to design a smart clothing product to meet the needs of their user. They can use their discussion during the warm up to help guide this process. They should also create a sketch of how the design could look, with arrows and labels to help communicate how the product functions. The artist can draw their product either on the activity guide or the poster paper provided. See the included Exemplar for an example of what students may end up creating. Give students a time limit and ensure the timekeeper in each group is aware of it.

Circulate: Monitor students as they work through the Try stage, checking in that the user needs are guiding the decisions for their product. If needed, remind students to "get in the head" of their user similar to the Understanding Your User lesson.

Teaching Tip

Smart Clothing Research: If students are unfamiliar with smart clothing, encourage them to use the internet to do some initial research first on how smart clothing works or has been used to solve problems. They should steer away from trying to find an existing smart clothing product that meets their user's needs, but they can still investigate common uses for smart clothing if they're unfamiliar.

Remarks

> I've seen some really creative products while checking in with you all, and I'm excited for you to share your ideas with each other! This is the final step of the design process - sharing your ideas, getting feedback, and reflecting on what your next steps are.

Reflect

Do This: Have students answer the questions on the second page of the activity guide and be prepared to share the results with their peers.

Circulate: Check in with students as they summarize their thoughts on this reflection guide. As students answer these questions, they may decide to make last-minute changes to their product.

Share Out: Have groups take turns sharing out the products they designed. They should be sure to share their intended user and their needs, and how the product addresses those needs. When they finish, encourage other groups to give feedback in the form of "I like..." and "I wish... statements.

Wrap Up

Journal

Prompt: What was one challenge in designing a product for someone other than yourself? What was one activity from today or yesterday that made this challenge easier?

Discussion Goal

Goal: Answers will vary, especially if students are still learning to empathize with users other than themselves. Encourage students to see how brainstorming and collaborating with their peers can be helpful in generating ideas and thinking outside of their own experiences.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **CS** - Computing Systems
- **IC** - Impacts of Computing

Lesson 5: User Interfaces

Overview

Question of the Day: How can we test an app to make sure it meets a user's needs?

Following the mini design project, students look towards the next phase of design - prototyping a product that attempts to address user needs. In teams, students examine a paper prototype for a chat app called "Txt Ur Grndkdz". Through using this paper prototype, students get a chance to see how a simple paper prototype can be used to quickly test ideas and assumptions before we ever get to the computer. After "using" the provided prototype students begin to identify ways to improve the next iteration.

Purpose

This lesson introduces students to the concept of a paper prototype as a quick and dirty tool to kick off the development of an app. Paper prototypes will return in both the next few lessons and the chapter two project as well. This prototype will also serve as the context around which students will start to parse and organize feedback from a wide variety of users. While this lesson asks students to work with an existing prototype, they will soon be developing prototypes of their own design.

Assessment Opportunities

1. **Use a paper prototype to test the design of an app.**

   Activity & Discussion: Circulate the room as students are using the paper prototype. Ensure that "computers" are following the diagram and not giving hints to the "users" and that "users" are trying to accomplish their given tasks and writing down relevant information in the chart. Use the discussion to check students' understanding of how the activity allows them to test the design of the app.

2. **Collect and analyze feedback from user testing with a paper prototype.**

   Journal: Students should share feedback and improvements related to the users' experiences as shared in the class discussion or indicated in the chart filled out in the activity.

Agenda

Warm Up (5 min)

Journal

Activity (35 min)

Paper Prototypes

View on Code Studio

Objectives

Students will be able to:

- Use a paper prototype to test the design of an app.
- Collect and analyze feedback from user testing with a paper prototype.

Preparation

- [ ] Print one copy of the User Interface Screens activity guide for each pair of students
- [ ] Print one copy of the User Experience (computer) activity guide for each pair of students
- [ ] Print one copy of the User Experience (user) activity guide for each pair of students
- [ ] Cut out the UI Screens or provide scissors for students to do so themselves

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

For the Students

- **User Interface Screens** - Resource
  Make a Copy
- **User Testing (Computer)** - Activity Guide
  Make a Copy
- **User Testing (User)** - Activity Guide
  Make a Copy

Vocabulary

- **Prototype** - A first or early model of a product that allows you to test assumptions before developing a final version.
- **User Interface** - The visual elements of a program through which a user controls or

Debriefing

Wrap Up (5 min)

Journal

communicates with the application. Often abbreviated UI.

Teaching Guide

Warm Up (5 min)

Journal

Prompt: What is an app? What apps do you or other people you know use?

Discuss: Have students write down their responses in a journal, then ask students to share with the class. Keep a running list of responses on the board. Once everyone has had an opportunity to share, write down a proposed shared definition of an app as "a piece of software designed for a purpose".

Discussion Goal

Goal: This discussion aims to introduce the definition of an app. Most suggestions students provide should be able to be tied to this definition. Apps can provide services, organize or provide information, or might just be a game or other form of entertainment. In all cases, you just want to establish an app as a piece of software built for a purpose.

Vocab:

- **App:** A piece of software designed for a purpose

Remarks

> When you think of an app, you probably imagine the finished product. In the last lesson you got a chance to experience the earliest phase of development, when we were brainstorming ideas and coming up with potential users and needs. In our next few lessons, we'll see how we can use this same design process to develop an app for a specific user based on their needs and interests.

Question of the Day: How can we test an app to make sure it meets a user's needs?

Activity (35 min)

Paper Prototypes

Group: Place students into pairs.

Distribute: Hand out a copy of the User Interface Screens activity guide to each pair of students. If you haven't already cut the screens apart, give students a few minutes to do so.

Teaching Tip

Reducing Printed Materials

These manipulatives can be reused if students do not write on them. You will need them for the next lesson's activity, too.

Display the following definitions while addressing the class

- **Prototype** - A first or early model of a product that allows you to test assumptions before developing a final version.
- **User Interface** - The visual elements of a program that a user controls and interacts with. Often abbreviated UI.

Remarks

> The set of screens I just handed you is called a paper prototype. A prototype is an early model of a product that lets you test your assumptions before developing a final version. This is one of the first steps in designing an app, and it allows a developer to test out their idea before investing a lot of time programming.
>
> Paper prototypes are a quick and easy way to share the user interface of your app with potential users. The user interface is the visual elements of a program that a user controls and interacts with the application. This is often abbreviated as UI.

Prompt: Based solely on the screens, who do you think is the main user of this app? What do you think this app was designed to do?

Discuss: Have students discuss with their partner, then share ideas with the class.

Remarks

> For today's activity, we're going to use this paper prototype to test out our app. One person will be the user, who will try to use the paper prototype. Another person will be the computer, who is in charge of changing the screens and reacting to what the user does. Our goal is to collect feedback so we can make recommendations and improve it.

Discussion Goal

Goal: Encourage students to identify specific elements of the prototype that support their arguments, and to consider the user needs that this prototype might have been designed to address

Taking Roles: For each pair of students, assign each student a role of *Computer* and *User*. Once the roles have been assigned, have pairs move so that they are sitting across from each other.

Distribute: Give each of the *Computers* a copy of User Experience (computer) activity guide and each of the *Users* a copy of User Experience (user) activity guide. The computer activity guide should only be seen by the computer and not the user.

Teaching Tip

Reducing Printed Materials

Computer Activity Guide The computer's Activity Guides are used for reference only. Students can look at digital versions during this activity. If you choose to print out the guide, they can be reused, as long as the students are told not to write on them.

User Activity Guide: The user's Activity Guide can be completed online or as a journal activity. Students can use a digital version of the Activity Guide as a prompt, copying the charts and questions into their journals.

User Testing

> **Display**: Read through the opening paragraph on Test Cases with the class. Emphasize that users have a set list of tasks to complete, and both people should give reactions on ways to improve the experience. Some of these tasks may not even be possible, which means we can make suggestions for how to improve the app and complete the task.
>
> **Model:** This activity has pairs of students testing the paper prototype, with one acting as the *User* and one as the *Computer*. The basic process is as follows, and should be modeled for students before working independently in their pairs:
>
> 1. The *Computer* places the home screen (the one titled "Txt Ur Grndkds") in front of the *User*.
> 2. The *User* selects a task from the table on their activity guide.
> 3. The *User* attempts to complete the tasking by "clicking" on the paper prototype screen in front of them.
> 4. Every time the *User* clicks on the screen, the *Computer* consults the Navigation Diagram on their activity guide.
>   - If the Navigation Diagram shows a line connected to the element that was clicked, find the screen at the other end of the line and place it in front of the user.
>   - If the Navigation Diagram doesn't show a line connected to the element that was clicked, do nothing.
> 5. When the *User* completes a task (or decides it is impossible in the current prototype), they fill out the "What I Tried" and "My Reaction" columns and the computer resets the app back to the home screen.
>
> **Prototype Testing:** Have students Test out each of the tasks in the table on the User Testing Activity Guide. After each test, students should "reset" the app by having the computer place the home screen in front of the user.
>
> **Circulate**: Monitor students as they work in pairs to complete this task. Ensure computers are using the guided arrows to navigate the screens, and ensure users are completing each row of tasks in the table. Have students swap halfway through the task, trading who is the user and who is the computer.

Debriefing

Prompt: What was a problem that a *User* ran into while using the app? What is a potential improvement you would make to the prototype based on your experience?

Discuss: Have students discuss in their pairs, then invite each pair to share their feedback with the class. Keep a list of potential improvements in the front of the classroom.

Assessment Opportunity

Students should connect specific user experiences to problems with the app and brainstorm how those problems could be addressed. If necessary, ask students to recount specific incidents during the test that revealed problems with the design.

Remarks

> Creating and testing a prototype is an important part of the design process - look at all the feedback we received and the changes we need to make! When we start designing our own apps, one of our first steps will be to make a paper prototype so we can test and get feedback early to make sure we're meeting our users needs.

Wrap Up (5 min)

Journal

Prompt: Earlier in the lesson we guessed the user needs that this prototype addresses. Now that you experienced the app first hand, jot down the following:

- What user need does this app address well?
- What user need could this app could do a better job of addressing?
- What is a user need that isn't addressed at all, but that you think would make a good addition?

Assessment Opportunity

Students should synthesize the earlier discussion to key, actionable points for a revision of the design. These should be clearly related to the earlier discussion, and check that students are connecting the user needs, user experience in the test, and the specific features of the app.

Share: If there's time, have students share out their needs. Consider writing this up on the board or on poster paper where they can be referred to in the next lesson.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming
- **CS** - Computing Systems

Lesson 6: Feedback and Testing

Overview

Question of the Day: How can we use feedback to improve an app?

In this lesson students use feedback from "users" of the paper-prototyped app from the previous lesson in order to develop improvements to the user interface of that paper prototype. The lesson begins with a reflection on the fact that designers need to translate human needs with technology into changes to the user interface or experience. Students are then given a collection of feedback and requests from users of the app from the previous lesson. In groups students categorize the feedback and identify ways the needs expressed in the feedback could be met by changes to the interface of the app. Then in groups students will implement some of these changes to meet one of the needs they identified.

Purpose

This lesson introduces several skills that students will need to use later in the unit. They will learn to categorize feedback in order to organize and prioritize their response. They learn to interpret human needs with a piece of technology in terms of the changes to the user interface. They have their first opportunity to create a paper prototype of their own by designing a new screen of an app. As students move towards designing apps of their own from scratch these will be important skills that students use repeatedly.

Assessment Opportunities

1. **Categorize and prioritize user feedback for an app**
2. **Use feedback to create a plan for further development of an app**

   Activity Guide, page 1: The table should have several suggestions for improvement to the app that clearly relate to the feedback categories the students have identified.
3. **Create a paper prototype for the screens of an app**

   Activity Guide: The screen sketches should reflect the app improvements identified on the first page of the guide.

Agenda

Warm Up (5 mins)

Journal

Activity (35 mins)

Categorizing Feedback

View on Code Studio

Objectives

Students will be able to:

- Use feedback to create a plan for further development of an app
- Categorize and prioritize user feedback for an app
- Improve a screen design based on user feedback.

Preparation

- [ ] Either print one copy of the User Interface Screens resource for each group, or be prepared to display the screens at the front of the classroom
- [ ] Print one copy of the Prototype Feedback resource for each group. If possible, cut into strips ahead of time
- [ ] Print one copy of Improve a Screen for each group. If possible, print single-sided so students can divy up the activity guide.
- [ ] Colored pencils or markers for the paper prototypes

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides
- **Improve a Screen** - Exemplar

For the Students

- **Prototype Feedback** - Resource
  Make a Copy
- **Improve a Screen** - Activity Guide
  Make a Copy
- **User Interface Screens** - Resource
  Make a Copy

Teaching Guide

Warm Up (5 mins)

Journal

Prompt: Think about a piece of software (like an app) that was hard to use. Maybe you couldn't find something you needed, it was poorly organized, or just difficult to use. What specifically didn't you like about it? How could it have been improved?

Discuss: Students should silently write down their ideas. Then move to a full class discussion of the types of issues students have had with apps in the past. Direct conversation towards what specifically about the user interface or user experience of the app was lacking, and follow up by asking how those aspects of the app could be improved.

Discussion Goal

Goal: Explore how many of the issues we have when using an app can be solved with changes to the user interface. This is primarily a brainstorm and a way for students to make personal connections between the apps they use every day and the activity we'll complete in class to help improve an app's design and user interface.

Remarks

> I heard lots of good examples of how apps could be improved to be more accessible and meet our needs. This type of feedback would be incredibly valuable to the makers of these apps so they could improve them. In today's activity, we're going to take a look at some feedback from the app we explored yesterday and see how we can improve the user interface based on this feedback.

Question of the Day: How can we use feedback to improve an app?

Activity (35 mins)

Categorizing Feedback

Group: Place students in groups of 2 or 3

Distribute: Give each group of students a copy of the Prototype Feedback slips of paper. If possible, try to have these cut out ahead of time - otherwise, give students time to cut these out in class. You should also either distribute copies of the User Interface Screens resource or display them on the screen.

Teaching Tip

Reducing Printed Materials

The Prototype Feedback and User Interface screens can be reused, as long as students don't write on them. The User Interface Screens should already be printed from the previous lesson.

The Activity Guide can be completed online or as a journal activity. Students who complete the activity online may choose to use an online drawing tool to sketch the improved user interface or submit the sketch separately on paper.

Do This: Students should work in groups to create piles of slips of paper so that each pile is a category of feedback. Categories should correspond with similar needs or problems that the feedback is addressing. For example, several pieces of feedback might all be about the fact that the font is too small to read. As they categorize the feedback, they should also discuss which categories they would like to focus on and why.

Circulate: Monitor student progress, asking groups to explain how they are forming their categories. There's no correct grouping of feedback here, but students should be prepared to justify their categories. Prompt students to explain which categories they have chosen as most important to address and why.

Share: Once all groups have categorized their feedback ask for a few suggestions of the types of categories they created.

Responding to Feedback

Distribute: A copy of the Improve a Screen Activity Guide to each group. Each group only needs one copy to share between students.

Improve a Screen

Potential Improvements

Do This: As a group, students take the feedback that they categorized and propose some potential improvements to the app. Each proposed improvement should be clearly connected to one of the feedback categories that were created in the last activity.

Circulate: Monitor students as they work in their groups, ensuring that all voices are heard within the groups and clarifying any questions.

Screen Redesign

Do This: Each student will draw an improved version of one of the screens in the paper prototype app. The activity guide contains one page for each screen of the app for the group to divvy up. If possible, print the activity guide single-sided so it is easier for students to divide up the screens.

Teaching Tip

Choosing Improvements: Students may need help brainstorming good improvements to their apps. For example, if multiple users are complaining about small text then they could try to increase the size of the font on the screen they are improving. They might also choose to add a "text size" setting in their "Settings" page. There are always many improvements to an app that might have the desired effect. For this lesson it is more important that the change reasonably addresses the need they chose. There will be more opportunities to investigate what is realistic to change in an app's UI later in the unit.

Share: Ask one student from each group briefly present the screen that they have updated. Ask them to describe specifically

- The category of needs they chose to address
- Different ways they considered to address those needs
- The changes to the user interface they designed to address those needs

Wrap Up

Journal

Prompt: Display the Problem Solving Process. Where do you think User Feedback fits in the problem solving process? What do you think is a next-step after gathering user feedback?

Discuss: Have students write a response in their journal, then discuss with their neighbors. If time, have a full group discussion relating user feedback to the problem solving process.

Discussion Goal

Goal: Students should gravitate towards placing user feedback in the Reflect or Try stages of the problem solving process. Try to guide the conversation towards what next-steps could be, emphasizing that the diagram has arrows going in both directions. Being flexible with this process is important when developing an app to meet user's needs.

For example, if user feedback is in the Reflect stage, then you can move backwards to the Try stage to make quick changes and test again, or the feedback may cause you to move forward to the Define stage where you discovered a whole new user need that you've decided to address.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- ▶ **AP** - Algorithms & Programming
- ▶ **IC** - Impacts of Computing

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Lesson 7: Identifying User Needs

Overview

Question of the Day: How can user interviews help us create apps to meet the needs of a user?

In this lesson students interpret user interviews to determine the needs & interests of a user. They then speculate on the barriers these users are facing or the opportunities that are available for each user. In a group, they share these barriers & opportunities and brainstorm different apps that could be used to address these issues. By the end of the lesson, students will have decided on an app idea that addresses a barrier or opportunity for a user.

Purpose

In previous lessons, needs & interests have been presented more explicitly to students. In this lesson, they have the task of extracting that information from a user interview, which motivates the app they will create. Even though example user interviews are provided, this lesson can be more impactful if real user interviews are used from people in the community. This lesson also bridges to the project in the next lesson, which uses the app brainstorm as the starting point for creating a paper prototype.

Assessment Opportunities

1. **Analyze interview notes to identify specific user needs**

   Activity Guide: There should be multiple barriers identified on the bottom of the last page of the activity guide, which connect to the notes from the interview.

Agenda

Warm Up (5 min)

Journal

Activity (35 min)

Listening to Users
App Brainstorm

Wrap Up (5 mins)

Journal

View on Code Studio

Objectives

Students will be able to:

- Analyze interview notes to identify specific user needs

Preparation

- [ ] Print one copy of User Interview activity guide for each student
- [ ] Print a copy of the Example User Interviews for each group
- [ ] Gather poster paper and brainstorming materials (pens, sticky notes, etc)

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

For the Students

- **User Interviews** - Activity Guide
  Make a Copy
- **Example User Interviews** - Resource
  Make a Copy

Teaching Guide

Warm Up (5 min)

Journal

Prompt: What do you think should be some of the first steps when designing an app for a specific group of people, especially if you want to make sure people will actually use it?

Discuss: Have students brainstorm in their journal, then discuss with a partner, then invite students to share out as a full group.

Discussion Goal

Goal: There are many possible answers here, but it's important to steer the class conversation towards the idea of a user interview. If we want to make an app for a certain group of people, we need to talk to them and make sure we understand their needs and interests when designing the app. If students don't make this point explicitly, that's okay - you should still mention it in the remarks that transition to the next activity.

Remarks

> An important part of the design process is the user interview - this is how we first begin to identify the needs and interests of the users who may ultimately use our apps. Today you will read several user interviews and pick a user to focus on. This is an important decision, because we will spend the next few days developing a paper prototype of an app that meets the needs of this user!

Question of the Day: How can user interviews help us create apps to meet the needs of a user?

Activity (35 min)

Listening to Users

Group: Have students work in groups of 3-4.

Distribute: Give each student one copy of the **User Interview Activity Guide**. Give each group of students one copy of each of the **Example User Interviews**, which contains four user interviews

Teaching Tip

Reducing Printed Materials: This Activity Guide can be completed online or as a journal activity.

Connections to the Community: Rather than using the example user interviews, you may want to collect real user interviews from people in your community. Consider asking people in your school, or in small businesses, or parents & family members of your students to answer similar questions. As a result, students can prototype apps that serve the needs of real people and can directly impact their community.

User Interview

> **User Interviews:** Have students read each of the user interviews in their groups. Individually, they will select a user that they would like to design an app for. It is okay for multiple students to choose the same user, and it's also okay for every student to choose a different user.
>
> **Needs & Interests:** After students identify their user, they should begin filling out the User Interview activity guide to identify needs and interests based on the interviews. They can continue in the activity guide to identify barriers and opportunities as well.
>
> **Circulate:** Monitor groups as they complete this task. The room may start off quiet as students read the user interviews. Once finished, encourage students to discuss their choices with their group and brainstorm ideas together, even if others in the group aren't working with the same user. Encourage groups to use each other as "thought partners" during this brainstorming stage.

App Brainstorm

Remarks

> Now that we've identified our user and their needs and interests, it's time to brainstorm app ideas that could meet these needs! We're going to decide on a particular barrier or opportunity that we want to focus on, then form new groups to help brainstorm different apps that can meet these needs.

Do This: Have students choose one of the barriers or opportunities they identified and circle it on their paper.

Group: Have students move to different areas of the room based on which user they are designing for (for example: each corner of the room is a different user). If one group has more than 4 students, ask them to split into smaller groups of no more than 4. Give each group a piece of poster paper, markers, and some post-its.

Do This: Have each student write the barrier or opportunity that they circled on the poster paper. As a group, discuss each item on the poster paper and brainstorm potential apps that could address that barrier or opportunity. Students should write each app idea down on a post-it and place it on the poster around the barrier or opportunity. Empathize that there are no wrong-answers when brainstorming - every idea should get written on a post-it.

Teaching Tip

Needs & Interests: The example interviews are designed for students to pick up on different facets of each user, with some needs and interests being more explicit than others. However, students can also "read between the lines" and make additional connections to the user, especially taking into account a user's age and location. In a real-world scenario, students might wish to ask follow-up questions to get more clarity from a user.

Barriers & Opportunities: This section requires more speculation from students as they try to imagine barriers to users meeting their needs, or opportunities for users to explore their interests. It's okay if these are less connected to the user interview, but they should be strongly tied to a specific need or interest that they've identified.

Circulate: Monitor groups as they complete this task, ensuring that app ideas are written down on post-its and placed on the board. The room may start to sound loud and energetic as students get excited by their ideas and write them on post-its. Make sure groups are building each other up and staying positive, and not devaluing any ideas from their peers.

Remarks

> I see some really amazing ideas on your boards! Using all of these ideas as inspiration, write down your own app idea on the bottom of your activity guide. This is an important decision, since we will use this app idea for the next few lessons.

Do This: Have students record their app idea on the bottom of their activity guide

Wrap Up (5 mins)

Journal

Prompt: Now that we've brainstormed our app ideas, what do you think will be the next steps in designing our app for our users?

Discuss: Have students journal, then share in their groups, then ask a few students to share with the class.

Discussion Goal

Goal: Students are essentially predicting what they will do in the next few days. Answers will probably reflect activities from the last few lessons, such as developing a paper prototype, doing user testing, and responding to feedback.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming
- **IC** - Impacts of Computing

Lesson 8: Project - Paper Prototype

Overview

Question of the Day: How can I develop an app prototype for a user?

Based on user interview from the previous lesson, each student comes up with an idea for an app that will address their user's problem. Students then get to create their own paper prototype of their app ideas by drawing "screens" on individual notecards. A project guide directs students through the process including building the paper prototype and testing it with their user to see if their assumptions about the user interfaces they created are accurate.

This is a two-day lesson, with specific timings outlined in the lesson plan below

Purpose

This lesson concludes the first chapter of Unit 4 and is another opportunity to practice the problem solving process for designing an app. The focus in this project is on the design process, especially empathizing with their user and the testing & feedback steps of the app design process. In the next chapter students will continue using this process to design apps and learn how to program their prototypes in App Lab.

Assessment Opportunities

Use the project rubric attached to this lesson to assess student mastery of learning goals of this chapter.

Agenda

Warm Up (5 mins)
- **Journal**

Day 1 (40 mins)
- **Getting Started**
- **Paper Prototyping**
- **Wrap Up**

Day 2 (40 mins)
- **Warm Up**
- **Prototype Testing**
- **Reflect**

Wrap Up (5 mins)
- **Journal**

View on Code Studio

Objectives

Students will be able to:

- Design a paper prototype of an app to address the specific needs of a user
- Identify improvements to an app based on user testing
- Design the user interface of an app

Preparation

- [ ] Print one copy of the project guide for each student
- [ ] Print one copy of the rubric for each student
- [ ] 6 notecards for each student
- [ ] Drawing supplies (colored pencils, markers, rulers, etc.)
- [ ] Poster paper for each student

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides
- **Paper Prototypes** - Exemplars

For the Students

- **Paper Prototype 2021** - Project Guide Make a Copy
- **Paper Prototypes** - Rubric Make a Copy
- **Computer Science Practices** - Reflection Make a Copy

Teaching Guide

Warm Up (5 mins)

Journal

Prompt: Today we will start making the interfaces of our paper prototypes. Before we get started reflect on the "Txt Ur Grndkdz" app we improved or other apps you've used in the past. What features make a good user interface? How can we make sure apps are easy to use and address our user's needs?

Discuss: Have students share their ideas. You can record them on the board for reference throughout the class.

Discussion Goal

Goal: Before sending students off to design their paper prototypes give them an opportunity to brainstorm attributes of effective designs. For example they may bring up

- Simple interfaces
- Reusing design elements
- Placing common elements in the same place on each screen
- Draw attention to what's important

Remarks

> Yesterday we used user interviews to identify a user's needs and interests, and brainstormed different apps that can address these items. That was just the first part of the design process - empathizing with a user. Today we'll continue that process and begin making a paper prototype for the app we brainstormed yesterday!

Question of the Day: How can I develop an app prototype for a user?

Day 1 (40 mins)

Getting Started

Distribute: Give each student a copy of the Paper Prototype Project Guide. If you collected the User Interview Activity guide from yesterday, re-distribute this to students as well so they can use it as a reference for today's activity.

Paper Prototype Project

Overview: As a class read through the overview of the project reviewing what they will need to produce and how it will be assessed.

Define: Have students complete the Define section of the project guide. They should reference their User Interview Activity Guide from the previous lesson.

Prepare: Students should brainstorm the minimum set of features their app would need in order to address their user's needs. This can be completed as a bulleted list on the activity guide.

Navigation Diagram: Students are provided space on their activity guide to sketch out their ideas for the screens of their app and create a navigation diagram. This is an opportunity to make a quick first draft of their app. This should take about 10 minutes and focus primarily on

- How many screens they'll need
- What information or functionality appears on each screen
- How screens will be connected to one another

Teaching Tip

Scoping Projects: Encourage students at this point to scope the functionality of their app to the minimum amount necessary to address their user's needs. As they work they'll likely discover new components they need to add so it's best to start with a small set early on.

Teaching Tip

Why Six Screens?: There's nothing magical about the number six. It's a rough estimate of the number of screens most students should be able to work within for their ideas and is a concrete way to help scope students' apps. It also just fits nicely on one piece of paper. Feel free, however, to impose any other limit you like.

Paper Prototyping

Distribute: Give each student up to six note cards for creating their screens as well as drawing supplies.

Do This: Have students create their paper prototype screens based on their navigation diagram. Leave enough time for students to begin filling in the table for User Testing before Day 1 ends.

Circulate: Monitor student progress as they create their screens, keeping an eye on time management. If possible, have a timer available for students to see so they know how much time they have remaining. Encourage students to start with the basics on their screens so they are usable, then add more details once all the screens have the basics and are usable.

Remarks

> I'm really excited by the prototypes we're developing! Tomorrow, you'll get a chance to see what each other have made because we'll be testing our prototypes, just like we did with the Text Your Grandkids app. Before we leave, we're going to do one last step to prepare for our user testing tomorrow.

Wrap Up

Display: Have students turn to page 4 of their Project Guide, which focuses on User Testing. Have students fill in the left-most column of the table with the main tasks they would like to test with a user. This will be the first activity students start with the next day.

Collect: Decide how you would like to collect or store the notecards for students who have finished their paper prototype. You may decide to collect and redistribute them, or you may have students keep their materials in a specific location.

Day 2 (40 mins)

Warm Up

Distribute: As students enter, have them gather their paper prototype notecards and **Paper Prototype Project Guide**. Instruct them to test the app themselves and practice "navigating" the app as if they were a user by pressing buttons and switching screens. Once all students are ready, jump right into the next activity.

Remarks

> Now that our paper prototypes are prepared, we need to test them! Today we'll spend time testing our prototypes and getting feedback, making a plan for improvements, and making a poster to showcase our app prototype and share our results.

Prototype Testing

Group: Group students into pairs. Have students decide who will test their app first and who will test their app second.

Test Your App: Using the same structure as an earlier lesson with one person as the user and another person as the computer, have students take turns testing their app with each other. One person acts as the user and navigates the paper prototype, the other person acts as the computer and changes the screens. The user should try and complete each of the tasks outlined on the User Testing section of the activity guide. Further instructions exist inside the project guide.

Circulate: Monitor students as they complete this task, making sure users are able to explore the app from their own perspective.

Reflect

Display: Have students turn to page 5 of the activity guide for the Reflect prompt. Students have a T chart on the project guide to interpret their user feedback and identify potential changes or improvements. On the left side of the T chart, students list all of the interesting observations they made during testing (such as assumptions the user had, ways they tried to interact with the app, or statements they made while using the app). The right side

of the chart is an area to interpret what each of those observations might mean. This process will help students identify what changes they should consider for their app.

Circulate: Monitor students as they reflect on their feedback from user testing. If students appear discouraged because the app didn't work as intended, encourage them to see this as a good thing because it means the feedback was valuable and will lead to real improvements.

Remarks

> Congratulations - we've completed the full steps of the design cycle! We started by empathizing with our users through user interviews. We defined our problem based on their needs and interests. We prepared to make the app by brainstorming with a team. We developed our paper prototypes so we could try and test the app. And, based on our feedback, we reflected on the improvements we could make. To close out this project, we're going to create a poster to represent our app prototype. However, the larger goal is to showcase the whole process we went through - empathize, define, prepare, try, and reflect.

Teaching Tip

Timing: Students should spend no more than five minutes each testing each other's paper prototypes. This ensures there is enough time for the remaining activities in this lesson.

Challenges: Students may struggle to empathize with their users while they are testing the app. Decisions that may seem "obvious" to the creator of the app are not always so clear for the user, which may be frustrating. App designers may try to clarify their app or interject and say "you're supposed to..." as the user navigates the app. Encourage students to avoid these instincts and instead let the user explore the app in whatever way seems intuitive to them.

This is exactly what is supposed to happen with user testing - it challenges our assumptions and helps us see from another person's perspective, uncovering problems we may not have even known existed. This will enrich the Reflect stage of the process, since there will be many places that the app can be improved

Display: Have students read the Create a Poster section of the activity guide. This step requires students to cut out pieces of their activity guide and paste them on a poster. Additionally, they will write a small summary of their app based on the questions on the bottom of the activity guide. An example poster is included in the unit slides.

Display: Show students a copy of the rubric for this project, which will be distributed to students in a moment. All the criteria from this rubric should be evident in the activity guide and on the poster when it is finished.

Distribute: Each student needs a piece of poster paper and a copy of the rubric. Groups of students can share tape or glue-sticks, scissors, and markers or colored pencils.

Circulate: Monitor students as they create their posters, clarifying any questions. Emphasize that the goal is for the poster to describe the entire design process, not just showcase the app idea and paper prototype. Encourage students to use the rubric to help guide what information they include on their poster.

Teaching Tip

Displaying the Posters: As students finish their posters, encourage them to hang them around the classroom. If there is time in class, students can also participate in a gallery walk and give positive feedback and "shoutouts" to other student posters via post-it notes. Even if the posters are not discussed at the end of the lesson, they can remain prominently displayed throughout the rest of the unit as a reminder of the successful design process.

Wrap Up (5 mins)

Journal

Prompt: Think about the entire development process for your paper prototype, from the initial interview to designing the prototype, to testing, to brainstorming further improvements.

- What were the biggest challenges involved in designing a piece of software for a different user?
- What skills from this project do you think will be useful when programming app prototypes later in this unit?

Discussion Goal

Goal: Highlight the difficulty in viewing projects from another person's perspective, especially when you are the one doing the creating. This is a skill students will need to continue to use in this unit. Call out skills like interpreting user needs from interviews and live tests, scoping large projects, designing user interfaces, and general organization that students will continue to use in the second chapter of the unit.

Discuss: Ask students to share their reflections with the class.

Survey: Send students to Code Studio to complete their reflection on their attitudes toward computer science. Although their answers are anonymous, the aggregated data will be available to you once at least five students have completed the survey.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- ▶ **AP** - Algorithms & Programming

Lesson 9: Designing Apps for Good

Overview

Question of the Day: What is an App for Good we want to create?

This lesson starts an app design project that lasts through the end of the unit. Students first explore a number of apps designed for social impact that have been created by other students. Students form project teams and lay out a contract for how the team will function throughout the development of their app. Finally, they brainstorm a team name, a topic for their app, and potential users.

Purpose

This lesson lays the foundation for the project that will last the remainder of the unit. Students are introduced to apps where people their age have used technology to address issues they care about. The resources provided are a great starting place, but you can make this lesson pack a bigger punch if you find examples (even those from your own previous classes) that demonstrate local examples of students designing apps for social good. Students also complete a teamwork contract, which will anchor how they collaborate for the remainder of the unit.

Assessment Opportunities

1. **Develop a plan for collaborating with others to design a computational artifact**

   Activity Guide, page 1: There should be a reasonable plan for managing disagreement under "Decision Making".

2. **Describe the target users for a computational artifact**

   As students share their user groups at the end of the main activity, the descriptions should include enough specificity and detail to later identity a common set of needs among the group members.

Agenda

Warm Up (5 min)

Journal

Activity (35 min)

Team Contract
Brainstorming

Wrap Up (5 min)

Journal

View on Code Studio

Objectives

Students will be able to:

- Develop a plan for collaborating with others to design a computational artifact
- Describe the target users for a computational artifact

Preparation

- [ ] Assign teams of 3-4, ideally based on similar interest in an app topic
- [ ] Print one copy per team of the activity guide
- [ ] Choose 1-3 of the apps from the example apps to share with the class
- [ ] Arrange classroom seating for pre-selected teams of 3-4 students
- [ ] Put out sticky notes for each team

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides
- **Example Apps for Good** - Teacher Resource
  Make a Copy

For the Students

- **App Design Kickoff** - Activity Guide
  Make a Copy

Teaching Guide

Warm Up (5 min)

Journal

Prompt: What are other apps or pieces of technology that work do address a social issue or solve a problem for a community?

Discuss: Have students share their answers with a partner before sharing out as a full group. Keep a list of apps in the front of the room for the class to see.

Discussion Goal

Goal: This is a brainstorming prompt, where students are encouraged to come up with a wide variety of responses. They may think of apps or pieces of technology that address accessibility issues, such as captioning apps for the deaf and hard of hearing. They may also think of apps that connect groups of people together, such as apps that help distribute food from a food bank, or give medical updates from a doctor's office.

Remarks

> I can tell many of you are already familiar with apps that address an issue or solve a problem. That's important because today we're going to start a project that will last for the remainder of this unit - we'll be working as a team to design an app that solves a problem in our community. To start, we're going to look at a few example apps developed by students just like you that also solve problems in society. Each of these apps used the same problem solving process that we've seen over the last few weeks.

Question of the Day: What is an App for Good we want to create?

Activity (35 min)

Display: Have 2-3 example apps prepared to display to students. Several are provided in the slides, but you can also use apps from the Example Apps For Good resource or other student apps from your school or community. For each app:

Discuss: What do you think is the social issue that this app was designed to address? How does it accomplish this?

Display: Show the Problem Solving Process graphic to review the Define, Prepare, Try, and Reflect steps

Teaching Tip

Timing: There's a lot happening in this lesson, so be mindful of timing when looking at these apps. You don't need to explore each app in-depth - a broad overview is fine for now. The goal is to present some initial sample apps to set student expectations before jumping into the main activity.

Remarks

> Each of these apps were created using the Problem Solving Process. We've practiced many of these steps in our previous lessons, but not always in the same order and sometimes with "shortcuts" to help develop the app faster. For this project, we will spend several days completing this entire process.

Group: Have students move into their teams that they will work with for the remainder of this project. For future lessons, students can start class sitting with their teams.

Teaching Tip

Forming Teams: The remainder of this unit has students completing a project in teams of 3-4. They will work together to choose a topic, develop an app, refine the app through testing and feedback, and present their work at the end of the unit. Consider how you would like to group together students to form teams, since this is a decision that will impact the rest of the unit. Also consider whether any of your class norms can be used in this unit to help reinforce teamwork & collaborative behavior.

Distribute: One copy per team of the activity guide.

Teaching Tip

Reducing Printed Materials This guide can be completed online or as a journal activity.

App Design Kickoff

Let students know that they are currently seated with the team that they will be working with throughout this app design project.

Team Contract

Display: Have students read through the top section of the activity guide. In order to support a positive and productive team work environment, each team will start by developing and signing an agreement. You can use this agreement throughout the course of the project to address and mediate issues among team members. Go through each section of the agreement with the whole class.

Communication: The communication section covers basic respectful communication guidelines. There are two open spaces for groups to add rules of their own. Ask groups to consider the modes of communication that they'd like to use and what the expectations should be. For example, *we will use email to communicate outside of the classroom*

Decision Making: While other sections are just bullet pointed lists, the decision making section includes a space for students to think of ways to manage disagreement. Encourage them to find a plan that will seem fair to everyone, even those with a minority point of view. You may want to have a small class brainstorm and modeling rules that encourage respectful conversations before having students return to their groups and make their own rules.

Participation: The participation section is meant to prevent students from getting stuck in situations where they are unsure how to proceed. Consider adding rules to this section as a whole class.

Signing the Contract: Once you've confirmed that all students understand and agree to the terms of the contract, have team members sign their names at the bottom.

Teaching Tip

Customizing Rules: The rules in the team contract are general enough to work for most classrooms, but to make it more impactful you should consider customizing the contract to include wording from your classroom or school rules.

Teamwork Videos: Consider reminding your students of the Teamwork videos they watched in Unit 2 when building a website together - or, if you and your students didn't complete Unit 2, consider watching those videos at this point in the lesson.

- **How Teamwork Works**
- **Dealing with Disagreements**

Assessment Opportunity

This part of the guide may prompt a class discussion. Check that students are finding ways that respect everyone on the team. Although the simplest solution may be "majority wins", you may want to challenge the students with scenarios in which the majority is unfair to the minority, such as three members voting that the fourth must do most of the work. Although there is no one right way to handle disagreement, students' plans should find ways to incorporate every team member's perspectives.

Remarks

> Great job everyone! Now that we've all agreed on how we'll work as a team, it's time to start brainstorming our app! Turn to the next page of the activity guide and get ready to start thinking of a name for your team!

Transition: If space allows, give each team some space to work on the next activity where they can spread out.

Distribute: Pass out sticky notes to each group.

Brainstorming

Display: Remind students of the brainstorming activity they did in the User-Centered Design Activity where they used post-it notes to generate as many users as they possibly could. We will be doing the same exercise for our team name, our topic, and our potential users. Remind them of some of the norms for this activity:

- One idea per sticky note
- No bad answers
- Build on others' suggestions with "Yes, and..."
- Every idea is appreciated, no matter how wild!

Team Name: To warm up and practice brainstorming, give teams a few minutes to come up with a team name and record it on the activity guide. Encourage students to complete this in three steps:

- Write down any team name ideas on a post-it and place it in the center of your group
- As a team, categorize and group post-its
- As a team, discuss the options you like the most and decide on a team name.

Circulate: Monitor students as they complete this process, making sure students are following the brainstorming process. They will repeat this process many times throughout the unit, and developing a team name is a low-stakes way to practice the process itself.

Topic: Give teams roughly five minutes to choose a general topic for their app. It's important to remind them that they aren't trying to come up with what the app will do or any specifics at this point, but just agreeing on a general topic that it should address. They should use the same brainstorming process as above - ideas on stickies, grouping & categorizing ideas, then discussing and coming to a decision.

Circulate: Monitor students as they complete this process, focusing on whether or not students are sticking to communication, participation, and decision-making norms they decided earlier in the lesson. As you interact with groups, it may be helpful to model inclusive sentence starters that teams can use when brainstorming.

User Groups: Give students some time to generate ideas for different users who might use their app. They will have 5 minutes to generate their post-its and group them, but they don't need to make a decision about specific users yet. Once teams have groups of possible users for their topic, they should discuss one or two potential categories they would like to focus on. They will have time during the next two lessons to further research and refine their target user group, but they want to have a clear starting point to guide that research.

Circulate: Monitor groups as they complete this process, focusing on their choice of user groups. Check that the groups are specific enough that students will be able to identify a set of needs common to the group's members. For example, "students" is probably too broad, since it could include a wide variety of ages and goals. For these examples, encourage students to get more specific, such as narrowing in on students by age or location or mode of transportation.

Teaching Tip

Managing Papers: The Team Contract is the first of many activity guides and paper prototypes that students will use throughout this unit as they build their app. Consider creating a folder for each team where they can store all of their materials, or creating a designated project area for each team. This makes it easier to refer back to previous resources, and helps students stay organized and manage their materials.

Share: Ask each team to briefly share their name, topic, and a description of one of their target user groups.

Collect: Either collect the materials from each team, or have students store their team contract in a safe place that can be accessed later.

Wrap Up (5 min)

Journal

Prompt: Now that we've identified a topic and some potential users, what are some strategies for how we can learn more about our users before developing our app?

Discuss: Have students write in their journals first, then share with their team and then as a full class.

Discussion Goal

Goal: Hopefully students will recall steps we've taken in previous lessons, specifically talking to our users and interviewing them to better understand their needs and interests. Students may also come up with ideas centered around independent research, such as looking up information online or researching similar apps. If this comes up, tell students that this is exactly what we will be doing in the next lesson - performing research to better understand our users and any existing apps on our topic.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **IC** - Impacts of Computing

Lesson 10: Market Research

Overview

Question of the Day: How can we use existing apps as inspiration for our own apps?

In this lesson students research apps similar to the one they intend on creating to better understand the needs of their users. Students work within their teams to search the Internet for other apps, then evaluate the ones they find interesting. By the end of the lesson, each team will have a clearer idea about the type of app they want to create and further refine who their target users are. Each team will maintain a list of citations for all the apps they examined for use in their final presentation.

Purpose

This lesson is the primary opportunity students have to get user input into the original conception of their app. By looking at apps similar to the ones they have proposed needing they may be inspired to change the structure of their app or may even identify an aspect of their problem they had previously ignored. In later lessons students will test out prototypes of their app to perform further refinements.

Assessment Opportunities

1. **Evaluate a design based its ability to meet target user's needs**

   Activity Guide: The "liked" and "didn't like" columns of the chart should clearly relate back to the user needs as described in the "Who is the target user" column.

2. **Evaluate the purpose and impact of a computational artifact**

   Activity Guide: The apps and descriptions identified in the first column of the chart should show a relationship to the team's original app topic from the previous lesson, and the second column should identify how the apps meet the target group's needs.

Agenda

Warm Up (5 min)

Getting Prepared
Journal

Activity (35 min)

Finding Similar Apps
Brainstorming App Ideas

Wrap Up (5 min)

Journal

View on Code Studio

Objectives

Students will be able to:

- Evaluate a design based its ability to meet target user's needs
- Evaluate the purpose and impact of a computational artifact

Preparation

- [ ] Arrange classroom seating for teams of 4-5 students
- [ ] Print one copy per team of the activity guide

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

For the Students

- **Market Research** - Activity Guide
  Make a Copy

Teaching Guide

Warm Up (5 min)

Getting Prepared

Distribute: Make sure each team has their materials available, especially the Team Contract they created yesterday.

Group: Have the students sit at their team tables. This will be the default seating arrangement for the rest of the unit.

Discussion Goal

Goal: This is a quick, low-stakes brainstorm that asks students to bring in their own experiences with apps and imagine what apps might already exist for their same topic and user. Ideally, as groups share out, heading from other groups will inspire new ideas their group hadn't considered.

Journal

Prompt: Today we will be looking at similar apps that might already exist for the topic and users we brainstormed yesterday. Before we go look online, what type of apps do you predict you'll find when we do our research?

Discuss: Give groups a minute to journal individually, then brainstorm in their groups. Ask someone from each group to share with the class.

Remarks

> Today you will work in your teams to research any similar apps that might already exist for your topic as a form of inspiration. This will also help narrow-in on the type of user you would like to design your app for, and the type of app you will be making. It's okay to get inspired by the apps you see and borrow some of their ideas for your app, but we are not yet planning out the individual screens of what the app will look like - that happens in a later lesson.

Question of the Day: How can we use existing apps as inspiration for our own apps?

Activity (35 min)

Distribute: Hand out one copy of the activity guide to each team.

Market Research Activity Guide

Finding Similar Apps

Display: Read through the instructions on the Market Research activity guide. Every student is expected to find at least one app for the team to analyze. Give students time to research individually first, then time to share the apps they found in their teams. They should make special note if there are any features of the apps they found that they might "borrow" for their own app.

Researching Apps: Here are a few places for students to search:

- **Code.org Public Gallery**
- Mobile app classes or competitions such as:
  - **Apps for Good**
  - **Technovation**
- Mobile app stores like Apple App Store or Google Play

Teaching Tip

Reducing Printed Materials: This Activity Guide can be completed online or as a journal activity.

Assessment Opportunity

As students fill out the chart, circulate to ask them questions about why they chose those particular apps, and how they identified the app's target users. Make sure students are thinking about the target users as well as the general app topic. As they fill out the "liked" and "didn't like" columns, ensure that they are doing so from the perspective of their identified user group's needs, rather than their own personal preferences.

- General web search using Google or Bing
  - Try phrases like “app competition” or “apps for social good”
  - Include your state name for local ideas or competitions

Circulate: Monitor teams as they look for apps and complete the first page of the activity guide. This activity may start off quietly as students research on their own, but will gradually build to team conversations as they share the apps with their teams. Make sure teams are recording the name and location of the app they research, so they can later create a citation in their final presentation.

Brainstorming App Ideas

Teaching Tip

Brainstorming: This brainstorming activity can also be done with Post It notes similar to yesterday’s activity. Students can write down their ideas like they have done in previous grouping exercises, then as a team select the top 3-6 ideas and record them on their activity guide.

Display: Have teams transition to the second page of the activity guide and read the instructions. Inspired by their research, teams should have roughly 10 minutes to share specific ideas for the apps they want to make and the features the app should have. There is space for them to write down these ideas as team members propose them. As they generate ideas, they should also record the apps they discovered that inspired their ideas.

Circulate: Monitor students as they complete their brainstorm, ensuring all voices are heard in their discussions. Their goal today is to start getting more specific with the app the team wants to design, including the features the app should have. Emphasize that they will have time in the next lesson to make a final choice, plus time in future lessons to design the app.

Collect: Either collect the materials from each team, or have students store their market research activity guide in the same place as their team contract so they can be accessed later.

Wrap Up (5 min)

Journal

Prompt: What is one feature you are excited for your app to have?

Discuss: Have students journal individually, then share in their groups. Ask one person from each group to share with the class.

Discussion Goal

Goal: This prompt is meant to generate shared excitement for the ideas they’ve generated so far, and build momentum for the next few lessons as they begin designing their user interface for their app. There are no right or wrong answers - it’s more important for each student’s voice to be heard within their group as they share the features they’re excited for.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **IC** - Impacts of Computing

Lesson 11: Exploring UI Elements

Overview

Question of the Day: What user interface elements will be useful for our app?

Before starting to design apps, we need to help students scope their expectations. Because students will eventually be prototyping these apps in App Lab, they will be in better shape if their ideas align with the kinds of apps that can be made using AppLab's tools. Today focuses on having teams look at several example apps made in AppLab and identifying the components of the user interface. They then make a plan for which features could use which components in their app.

Purpose

This lesson helps narrow the scope of the types of design elements students can include in their apps. Up until now, students have explored and brainstormed apps with a variety of functionality - they may have discovered apps that use maps, or connect to social media, or access data on your phone. In this lesson, they explore only apps built with AppLab tools so they have more realistic expectations for the apps they can create by the end of the unit.

Assessment Opportunities

1. **Explain the purpose of individual UI elements when developing an app**

   Activity Guide: Students will list the intended use of each UI element, and brainstorm how these elements connect to the features they're planning for their apps.

Agenda

Warm Up (5 mins)

- **Getting Prepared**
- **Journal**

Activity (35 mins)

- **Explore App Lab Apps**

Wrap Up

- **Journal**

View on Code Studio

Objectives

Students will be able to:

- Explain the purpose of individual UI elements when developing an app

Preparation

- [ ] Print a copy of the activity guide for each team
- [ ] (Optional) Preview Lesson 14 - Design Mode in AppLab to help answer questions from students about UI elements in AppLab.

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

For the Students

- **Explore UI Elements** - Activity Guide
  Make a Copy

Teaching Guide

Warm Up (5 mins)

Getting Prepared

Distribute: Make sure each team has their materials from previous lessons available.

Group: Have the students sit at their team tables.

Discussion Goal

Goal: This is a brainstorm discussion that helps connect their prior experiences to today's lesson. Other examples may include checkboxes or dropdown menus or sliders, or even more complicated components like an interactive map or a social media feed. Use the ideas generated by the class to connect with today's activity.

Journal

Prompt: Apps are made up of lots of individual components - things like buttons or text boxes. Write down as many components that you can think of from apps you've used in the past or seen in this class.

Discuss: Have students journal individually, then invite a few students to share their ideas with the class. Keep a running list in the front of the room.

Remarks

> This is a great brainstorm of different components used in apps! When apps are created, they can use whatever components are available in the tool they use to make the app. When we create our own apps, we'll use a tool called AppLab. Today we're going to explore apps made in AppLab and see which of these components we can use when designing our own apps!

Question of the Day: What user interface elements will be useful for our app?

Activity (35 mins)

Explore App Lab Apps

Transition: Have students go to Code Studio. Each code studio level is a different app that addresses a need in a community. Have students spend 5-10 minutes on the next task.

Do This: Explore each of the apps in whatever order you would like. Keep a list of the different components you see in these apps. Make note of any interesting features in these apps that you can share with your team

Circulate: Monitor students as they explore the apps. You may want to ask follow-up questions to help teams see the connections between their ideas and the apps they're exploring, especially if you know some apps will be relevant to the topics some of your teams have chosen.

Distribute: the Explore UI Elements Activity Guide.

Teaching Tip

Reducing Printed Materials: The Activity Guide can be completed online or as a journal activity. The 3x5 notecards can be substituted with paper that has been cut into 4-6 rectangles.

Explore UI Elements

> **Do This:** As a team, discuss each element in the table - what they think it does and how it could be used in their app. Teams don't need to (and likely won't) incorporate all of the elements in their app, but they should consider how each could be used in the context of their app.
>
> **Circulate:** Monitor teams as they complete this task, ensuring all voices within a team are heard and have a chance to share their observations about these elements.

Share: After giving teams time to fill out the table, go through the list asking different groups to share out how they might use each of the elements. Use this as an opportunity to ensure that the class has a clear understanding of what each element is and does.

Remarks

Tomorrow we will begin making a paper prototype for our app. Now that you've explored these apps and seen the UI elements that are available to you, this may have sparked some new ideas for the features of your app. Take some time to discuss with your group any new features you might want to add to your app. Or, discuss how you might want to change some of the features now that you've seen the UI elements that are available to you.

Teaching Tip

Design Mode: Each of the elements on this activity guide are from the Design Mode interface of AppLab, introduced in Lesson 14. To help answer questions for this activity, you may want to preview that lesson so you are familiar with how these elements will work in AppLab.

What Is A Label? In general, any static text students see on the screen is a Label element. Most screens of an app have at least one label, and they are heavily used on screens with instructions or explanations. Students may initially struggle to define and identify "labels" in the apps they see - it is okay to explicitly tell them about this component so they don't become frustrated or make incorrect guesses.

Discussion: Now that they've seen more examples of apps, teams should discuss any new ideas that they have for the app, or things that they might change based on what they saw. They can take notes on yesterday's activity guide, or they can take notes on the back of today's activity guide.

Circulate: Monitor students as they complete this task, looking out for groups that may have to make adjustments now that they see the features available to them in AppLab. You may need to support some additional brainstorming as groups discuss new ways to accomplish their goals without access to some of the elements that may have expected to use.

Collect: Either collect the materials from each team, or have students store their market research activity guide in the same place as their team contract so they can be accessed later.

Wrap Up

Journal

Prompt: What is one UI element you already know you will use in your app? Describe how you plan to use it in your app.

Discuss: Have students journal individually, then invite students to share their ideas with their teams.

Discussion Goal

Goal: This discussion helps team members share ideas for how they plan to use UI elements when creating their paper prototypes tomorrow, and continues to build excitement and momentum towards developing their app.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming

Lesson 12: Build a Paper Prototype

Overview

Question of the Day: How can we build a paper prototype for our app?

Students work in their teams to create paper prototypes for the apps they've been developing. They begin by making a plan for each screen, then assigning different team members to work on each screen so the task can be completed in time. They can use 3x5 index cards to develop their paper prototypes, or the Paper Prototype template.

Purpose

This lesson kicks off the actual design phase of this project. Students last created paper prototypes in Lesson 7, but at that point very few constraints were placed on the prototype user interface. Because these prototypes will eventually be converted into App Lab apps, it's important to better scope the types of apps teams design and the interface elements they use. Teams will use their paper prototypes tomorrow to test their apps and get feedback.

Assessment Opportunities

1. **Explain the role of paper prototypes in app development.**

   Activity discussion: Students should identify several key ways that paper prototypes contribute to app development, and these reasons should highlight the advantages over both a full product and digital prototypes.

2. **Create a paper prototype that incorporates the user flow for a computational artifact.**

   Students' prototypes are collected at the end of the lesson, but there are also opportunities in the second activity to circulate, assess, and give feedback to students as they work. Each notecard should be drawn with enough detail to identify the functionality of each element on the screen.

Agenda

Warm Up (5 mins)

- **Getting Prepared**
- **Journal**

Activity (35 mins)

- **Review Paper Prototypes**
- **Paper Prototyping**

Wrap Up (5 mins)

- **Collect Prototypes**

View on Code Studio

Objectives

Students will be able to:

- Explain the role of paper prototypes in app development.
- Create a paper prototype that incorporates the user flow for a computational artifact.

Preparation

- [ ] Prepare 3x5 index cards (or copies of the prototype template), sticky notes, colored pens and pencils, scissors for each team
- [ ] Print a copy of the activity guide for each team

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

For the Students

- **Paper Prototype Planning** - Activity Guide Make a Copy
- **Phone Paper Prototype** - Template

Vocabulary

- **Prototype** - A first or early model of a product that allows you to test assumptions before developing a final version.

Teaching Guide

Warm Up (5 mins)

Getting Prepared

Distribute: Make sure each team has their materials from previous lessons available.

Group: Have the students sit at their team tables.

Discussion Goal

Goal: This is a check-in point for teams to make sure they all have a shared understanding of the app they are making. It's okay for teams to be unsure about some of these points - time is given at the start of the activity for teams to discuss and come to agreements.

Journal

Prompt: Based on what you and your team know so far:

- Who is the target user for your app?
- What will your app look like?
- How will the user interact with it?

Discuss: Have students share out in their teams. It is important for teams to make sure everyone has the same understanding before beginning the activity.

Remarks

> Today we will create a paper prototype for our app and a basic navigation diagram. As with the prototypes you created earlier in this unit, this will allow for quick exploration and testing of your app. Throughout this unit, we will build different prototypes as a way to quickly test our ideas and get feedback - no one is expecting perfection, especially today.

Question of the Day: How can we build a paper prototype for our app?

Activity (35 mins)

Review Paper Prototypes

Prompt: Display the definition for **Prototype**. Why is it a good idea to build a prototype before jumping straight into making the final app?

Prompt: Show the What's For Lunch paper prototype. This is an example of a paper prototype you might create during class today. In what ways does this match the definition of prototype?

Distribute: Give each group a copy of the Paper Prototype Planning Activity Guide

Assessment Opportunity

Students may come up with any number of valid reasons, but you'll want to make sure to highlight at least the following:

- It's easier and faster to sketch out an idea
- Testing ideas on paper lets you find problems in your assumptions *before* you spend time programming
- Users are more likely to give feedback on something that looks less polished / finished

Paper Prototype Planning

> **Display:** Read through the directions on both pages of the activity guide as a class. This first page provides a table for teams to list all of the screens they'll need, and the second page is mostly blank for teams to sketch their navigation diagram. Let students know that this is a "first draft" of their screens that should cover all of their planned features, and they may end up changing these screens after testing. These two pages can be completed in any order, and teams may find it easier to go back and forth between sketching the diagrams and writing the descriptions
>
> **Circulate:** Monitor students as they plan their screens and create their navigation diagram. As students finish, you can check their work to make sure they have a solid plan moving forward. When they do, you can distribute the 3x5 index cards to each team as part of the next step.

Paper Prototyping

Distribute: 3x5 index cards (or copies of the prototype template), sticky notes, colored pens and pencils, scissors for each team.

Do This: Using this activity guide as a guideline, sketch out each of your apps screens on a separate index card. Each member of your team can work on a different screen.

Circulate: During this extended work period, teams will need to divide and conquer while still ensuring that they're working towards a common goal. Watch to make sure that teams continue communicating as they develop their screens, and encourage groups to frequently see how their screens are working together.

Initial Testing: As teams finish creating their paper prototype, have them test the app within their team to make sure they understand the navigation and didn't miss any key navigation elements.

Discussion Goal

Encourage connections to the definition of prototype, especially "first or early model" and "test assumptions before developing a final version". Students might bring up the following features as evidence:

- The screens are neat enough to read the next and have enough detail to understand what they will do, but are still not very polished.
- Some areas are "placeholders", such as the scribbled lines for text or a bubble that says "picture"
- You can identify the UI features on each screen (buttons, text, images, etc)
- The flow of the app is clear from the navigation arrows
- Enough of the app is ready so a user could test the app and give comments on how it functions

Teaching Tip

AppLab Elements: We introduced the App Lab elements yesterday so that students would have an understanding of the tools they'll have available. Students can stray from these elements, but when it comes time to develop their digital prototype, they'll need to either switch to one of the supported elements or use an image as a stand-in.

Wrap Up (5 mins)

Collect Prototypes

Collect: Gather the paper prototypes so they can be used for testing in the next lesson. Access to these prototypes will be essential for the next few lessons, so consider making a dedicated location in the classroom for teams to store them.

Assessment Opportunity

There should be a notecard for each screen described on the activity guide. The notecards should be composed of the AppLab UI elements from yesterday's activity, and it should be clear from the drawing the type of each element on the screen.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming

Lesson 13: Prototype Testing

Overview

Question of the Day: What can we learn by testing our prototype with real users?

The primary purpose of developing paper prototypes is that they allow for quick testing and iteration before any code is written. This lesson is focused on giving teams a chance to test their prototypes before moving to App Lab. Teams develop a plan to test with users before running prototype tests with multiple other students in the class (and potentially outside the class). In order to test the prototype with the users, the students will have to assign roles in the testing (the “narrator”, the “computer” and the “observers”) as well as have some questions prepared for the user to answer after the test is complete.

Purpose

The goal of this lesson is to give students a clear format for testing and iteration of their apps. This will be the first of multiple opportunities teams have to test various stages of their prototypes, and each stage will serve a different purpose. At this point the primary purpose is to gut check assumptions about how the app should be laid out and navigated - this is *not* the time for students to be overly concerned about fine details.

Assessment Opportunities

1. **Design and run test that use paper prototypes to gather feedback on a design**

   Activity Guide: Several relevant tasks should be identified in the chart, along with notes describing the user testing around those tasks.

2. **Analyze user tests to identify features that should be removed, added, or improved**

   Activity Guide: The left side of the T-chart should include at least four descriptions of things that happened in the test, and the right side should list respective proposed improvements to the app.

Agenda

Warm Up (5 min)

- **Getting Prepared Journal**

Activity (35 min)

- **Preparing for Testing**

Wrap Up (5 min)

View on Code Studio

Objectives

Students will be able to:

- Design and run test that use paper prototypes to gather feedback on a design
- Analyze user tests to identify features that should be removed, added, or improved

Preparation

- [ ] Either have other people lined up to test each team’s paper prototypes, or schedule enough time for teams to test each other's prototypes
- [ ] Print a copy of the Paper Prototype User Testing activity guide for each team
- [ ] Print a copy of the User Test Cases activity guide for each team

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

For the Students

- **User Test Cases** - Activity Guide Make a Copy
- **Paper Prototype User Testing** - Activity Guide Make a Copy
- **What's For Lunch Testing** - Video

Teaching Guide

Warm Up (5 min)

Getting Prepared

Distribute: Make sure each team has their materials from previous lessons available.

Group: Have the students sit at their team tables.

Journal

Prompt: Today we will be testing our paper prototypes with other students in the class. If you needed to describe your app to a new user, what would you say is the purpose of your app?

Discuss: Have students journal individually, then share in their groups. There doesn't need to be a full-group share out for this prompt.

Discussion Goal

Goal: This prompt is preparation for part of today's activity where students will be introducing themselves & their teams to their user testers, and one part of that introduction is explaining the purpose of their app. Discussing this as a team first helps rehearse these talking points before discussing with other users.

Remarks

> Today we will be testing our paper prototypes with other users in the classroom. This is an important step to make sure we get feedback early and often so we can make changes before programming our app. By the end of the lesson, we should have some new ideas based on user feedback for how we can improve our app!

Question of the Day: What can we learn by testing our prototype with real users?

Activity (35 min)

Preparing for Testing

Distribute: Give each team one copy of the Paper Prototype User Testing Activity Guide. Also give each team a copy of the User Test Cases Activity Guide - one copy for each user the team plans to test with.

Paper Prototype User Testing

> **Overview:** Read through the (1) Overview section of the activity guide together. This gives an overview of today's activity.
>
> **Video:** Watch the What's For Lunch? Testing video. This gives a model for what the testing process should look like.
>
> **Discuss:** What did you notice about how this test was run? Ask students to share in their teams, then call out a few responses for the class. Specifically highlight the following observations:
>
> - The user is the person who is testing the app in the form of the paper prototype. They should pretend to execute the "app" by pressing on the prototype with their fingers in the way that makes most sense.
> - The user speaks through what they are thinking out-loud. They can also offer helpful suggestions in our critiquing form with sentences starting with "I like...", "I wish...", and "I wonder... "
> - The computer reacts to what the user does. If the user tries something that isn't a part of the app navigation diagram, then the computer doesn't react.
> - The narrator is the person who is running the test. This person will introduce the team members, app and its purpose.
> - The observers are the other students in the team. They will watch the interaction and write down in their notes what they see the user do in response to the computer. They don't make any comments themselves - they just take notes.

Assign Roles: Read through the (2) Assign Roles for Testing section of the activity guide. Have students discuss in their teams which roles they will take on in the first round of testing. There should be only one narrator and only one computer, and all other team members can be observers.

Create Test Cases: Read through the (3) Create Test Cases section of the activity guide. Students will work in the User Test Cases Activity Guide for this section, filling in the App Introduction section and completing the left-column of the table. They should not fill in the rest of the table - the user will do this instead.

Circulate: Monitor students as they fill in the User Test Cases Activity Guide. Make sure they are only filling in the left-most column with the tasks they want their user to test - the rest of the chart should be blank.

Test Your Prototype: Read through the (4) Test Your Prototype section. This section may still feel unclear after reading the directions - remind students of the video they watched that modeled this process.

Do This: Find another team to test your app with. Spend half your time for them to test your app, then take the other half of the time for you to test their app.

Circulate: Students will start their tests which should run for about 5-7 minutes each. Make sure they are following their roles. Encourage students to keep on task, and encourage the observers to write as much as they can.

Summarize Findings: Read through the (5) Summarize Findings section of the activity guide. Have groups discuss what they observed and record their findings on the activity guide. In particular ask them what their observations mean in terms of changes they'll need to make for the user interface of their prototype.

Teaching Tip

How Many Users? For timing reasons, this lesson assumes each team will get to have one other user test their app. However, you may have time for multiple teams to test each other's apps - or, you may encourage students to test their apps with members of the community outside the classroom (such as family members or other peers in school). If so, make sure each user has their own copy of the User Test Cases Activity Guide so they can record their own unique comments when testing the app.

Teaching Tip

Actionable Feedback: A key takeaway from this activity is that students leave with a plan for changes they can make to their app based on their testing. This usually requires setting your ego aside and seeing feedback as opportunities for improvement rather than evidence of failure. Remind students that these are just prototypes, nowhere near the final project. Also remind students not to take feedback personally - that all apps go through this process and they get better because of it.

Wrap Up (5 min)

Journal

Prompt: Did you notice a difference between the feedback you discovered yesterday and the feedback you received today? Did you notice any similarities?

Discuss: Have students journal individually, then share in their groups. If there is time, ask groups to share their responses with the class.

Discussion Goal

Goal: Students may notice that new users discovered new ways to use the app or encountered certain problems they never considered. This can lead to a conversation about bias - because the team was involved in the creation of the app, they may have overlooked different aspects of how the UI is designed or made assumptions about how the user would use it. This is why it's important to have an outside user test those assumptions early and often.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming

- ▶ **CS** - Computing Systems
- ▶ **DA** - Data & Analysis
- ▶ **IC** - Impacts of Computing

English

Lesson 14: Design Mode in App Lab

Overview

Question of the Day: How can we use App Lab and Design Mode to create apps?

Students are introduced to the App Lab programming environment that they will use to build their apps. Students work through a progression of skill-building levels to learn how to use the drag-and-drop design mode of App Lab. They end the lesson by making a plan to adapt one of their Paper Prototype screens into App Lab, focusing on having unique IDs for each element.

Purpose

This lesson introduces students to the design mode interface of App Lab, and to the process of translating a paper prototype to digital. They'll use this as a tool to iterate on their paper prototypes. In today's lesson, they build up an exemplar app screen. In tomorrow's lesson, they will build a screen from their paper prototype, incorporating the feedback from yesterday's lesson.

Assessment Opportunities

1. **Assign roles and responsibilities to each team member when collaborating to create a digital artifact**

   Activity Guide "Screen Ownership": Check that all screens have been assigned an owner and that the division of labor seems reasonable.

2. **Select the appropriate input element for a given type of information**

   Code Studio, level 9: See rubric

Agenda

Warm Up (10 min)

- **Getting Prepared**
- **Journal**

Activity (35 min)

- **Design Mode in App Lab**

Wrap Up (5 min)

View on Code Studio

Objectives

Students will be able to:

- Assign roles and responsibilities to each team member when collaborating to create a digital artifact
- Select the appropriate input element for a given type of information

Preparation

- [ ] Print one copy of the Screen Ownership activity guide for each group
- [ ] Print one copy of the Screen Design activity guide for each student
- [ ] (Optional) Print one copy of the Model Screen Design activity guide for each group

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

For the Students

- **Screen Ownership (2021)** - Activity Guide
  Make a Copy
- **Screen Design (2021)** - Activity Guide
  Make a Copy
- **Model Screen Design** - Resource
  Make a Copy

Teaching Guide

Warm Up (10 min)

Getting Prepared

Distribute: Make sure each team has their prototypes available. They should also have the Paper Prototypes User Testing Activity Guide from yesterday.

Journal

Prompt: What is at least one change you would make to your paper prototype based on feedback from yesterday? You can use your Activity Guide from yesterday to help remind you of the feedback from user testing.

Discussion Goal

Goal: This is an opportunity for teams to remind themselves of the activity they completed yesterday, and synthesize the feedback into actionable steps. This brainstorm will lead into the activity they will complete today.

Discuss: Have students journal individually, then share in their groups. Encourage them to keep coming up with ideas even after everyone has shared. Then, invite one person from each group to share at least one change to their app.

Remarks

> Now that we've done a first round of testing and we know what changes we need to make, it's time to build a new prototype. But this time, instead of a paper prototype, we're going to make a digital prototype! Today we'll learn how to use AppLab to design apps, then tomorrow we'll turn our paper prototype into a digital prototype!

Question of the Day: How can we use AppLab and Design Mode to create apps?

Activity (35 min)

Design Mode in App Lab

Display: Show the Model Screen Design Resource. This image will also be available to them during the level progression, and can optionally be printed for each team to use as a reference.

Teaching Tip

Students will be using App Lab to create a simple prototype for their app. Students who want to go further in making their apps functional can learn more about App Lab, watch demo videos, and work through tutorials at **https://code.org/educate/applab**.

Remarks

> Before you start working on designing your own apps in App Lab, we're all going to work on converting this paper prototype into AppLab first. Look over the prototype to make sure you know what you are building toward. Notice that most of the elements on the screen are labelled - we're going to use these same exact labels when creating these elements in App Lab

Video: Watch the AppLab - Design Mode video as a class. This video introduces the design mode interface that students will use for the rest of the unit. Today's lesson focuses just on the drag-and-drop design elements; the Events in AppLab lesson focuses on the coding elements

Code Studio: Have students log into their computers and open Code Studio. If you've used Pair Programming in previous units, consider having students use it throughout these levels. Students should spend the majority of class completing these levels.

Circulate: Monitor students as they complete the levels in Code Studio. As they progress through the bubbles, they should be recreating the Recycle Finder app. The last level of this lesson has students check in with you for next steps.

Screen Ownership

> **Distribute:** Give each team a copy of the Screen Ownership activity guide

Do This: Have groups look through their paper prototypes to identify all of the unique screens they will need to create. From there, they can divvy up screens evenly among the group members and document it on the chart. If there are more screens than students, have groups consider the following factors when dividing up content:

- Is every page *actually* unique, or do some represent the same page with slightly changed content?
- Are there similar pages that could be easily created by the same person?
- Are there multiple simple pages that could be grouped together?

Teaching Tip

Rules for Screen Names: For each screen, groups should assign a short and clear screen name. This name will be used in App Lab to identify the screen, so they should contain no spaces or special characters.

Remarks

Now that we've practiced using App Lab and divided up our screens, it's time to plan what our screens will look like in App Lab. We will start this process today and finish it tomorrow. One of the most important steps is planning your IDs for each element. Just like in the Recycle Finder app, each ID will also have a prefix that helps identify which screen it's on.

Teaching Tip

Reducing Printed Materials: This Activity Guide can be completed as a journal activity. Classrooms that have chosen the online option may also do this activity on a separate sheet of paper, or use an online drawing tool to design the screen.

Distribute: After students have divided up their screens, distribute a Screen Design activity guide for each screen in the app. If a student is completing multiple screens, they will have multiple activity guides. Students can use this activity guide to sketch out their design and document the IDs for each design element.

Screen Design

Do This: Have students complete the Screen Design activity guide, listing the feedback they plan to incorporate from yesterday's tests and generating the IDs they plan to use once in App Lab. Students should work on this up until the end of the class period. Depending on the number of screens each student has, they may not finish this before class ends and will continue tomorrow.

Circulate: Monitor students as they plan their screens, checking that they are giving meaningful IDs to each of their elements. Make sure they are also including the screen name as a prefix for each ID. This step is important for the Linking Prototype Screens lesson, where students will be importing elements from each other's apps - if two elements have the same ID, the import will fail. Being vigilant about this requirement now will save time and frustration later.

Wrap Up (5 min)

Collect: Collect all the materials from each team in a safe storage location.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming
- **CS** - Computing Systems
- **IC** - Impacts of Computing

Lesson 15: Build a Digital Prototype

Overview

Question of the Day: How can I design a digital prototype from a paper prototype?

Having collaboratively developed a paper prototype for their apps, groups now divide and conquer to begin work on an interactive digital version based on the paper prototype. Using the drag-and-drop design mode of App Lab, students individually work through a progression of skill-building levels to learn how to build digital versions of a paper prototype. From there, each group member builds out at least one page of their app in App Lab, to be later combined into a single app.

Purpose

This lesson introduces students to the design mode interface of App Lab, and to the process of translating a paper prototype to digital. They'll use this as a tool to iterate on their paper prototypes, first by building up an exemplar app screen, and eventually building up to an interactive app prototype by the end of the lesson.

Assessment Opportunities

1. **Create a digital prototype of an application screen**

   Code Studio, level 2: See rubric. You may need students to turn in their paper prototypes, or circulate while students are working on the project, to ensure that the digital and paper prototypes are consistent.

Agenda

Warm Up (5 min)

- **Getting Prepared**
- **Team Check-In**

Activity (35 min)

- **Screen Design Planning**
- **Building Screens in App Lab**
- **Sharing Designs**

Wrap Up (5 min)

- **Journal**

View on Code Studio

Objectives

Students will be able to:

- Create a digital prototype of an application screen

Preparation

- [ ] Have extra copies of the Screen Design Activity Guide available for students

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

For the Students

- **Screen Design (2021)** - Activity Guide
  Make a Copy

Teaching Guide

Warm Up (5 min)

Getting Prepared

Distribute: Make sure each team has their materials available, including their paper prototypes and Screen Design Activity Guides from yesterday.

Discussion Goal

Goal: This is a quick task that helps transition students back into completing their Screen Design activity guides, or be prepared to jump into today's activity of designing these screens in App Lab. This is one last check that each team is preparing their IDs for a successful implementation in App Lab.

Team Check-In

Prompt: Lay out all of the Screen Design Activity Guides your team has completed so far. It's okay if not every screen is finished yet. Look over the IDs for each screen and check that:

- Each screen has a name that contains only letters and no spaces
- Each ID starts with the screen name
- All of the IDs are unique across **all** the screens

Discuss: Students don't need to write anything down for this prompt - they can complete it as a group via discussion.

Remarks

> Preparing our screens is an important step that will make our digital prototypes more organized and save us time when preparing screens in App Lab. Today we will finish planning for any remaining screens in our app, then spend most of our time building these screens in App Lab.

Question of the Day: How can I design a digital prototype from a paper prototype?

Activity (35 min)

Screen Design Planning

Do This: Have students complete any remaining Screen Design Activity Guides for their app's screens, focusing on planning the ID names. If some team members finish before others, you can suggest that they help their other teammates finish their remaining screens.

Building Screens in App Lab

Code Studio: When students have finished their Screen Designs, have them log into Code Studio. There is a single level for students to design the screen for their app.

Teaching Tip

Multiple Screens: At this point, students haven't learned how to add multiple screens to their apps - this happens in the next lesson. However, if a student is in charge of designing multiple screens for their team, you can show them how to add a new screen from Design Mode so they can complete all of their screens on this single level.

Circulate: Monitor students as they build their screens in App Lab, answering questions and providing feedback to students on their design. Encourage students to use their teammates as resources, getting quick feedback or asking questions. Most of the class will be spent with students designing their screens.

Sharing Designs

Share: If there is time, have students share their screens with the class, focusing on the different designs that teams created for their apps.

Wrap Up (5 min)

Collect: Collect all the materials from each team in a safe storage location.

Journal

Prompt: How did your initial paper designs change when you recreated them in App Lab? What kinds of adjustments did you have to make?

Discuss: Have students journal individually first, then have students share with a partner before asking a few students to share with the class.

Discussion Goal

Goal: There is no single right answer to this prompt - the goal is to reflect on the process of converting a paper prototype into App Lab. Students may notice that the elements in App Lab make certain types of designs more difficult - for example, it's hard to have curves or wavy lines as part of the design. Students may also realize that their paper prototypes were too "compact" with too much information on one screen - when they tried to recreate in App Lab, the text or icons may have been too small to read.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming
- **CS** - Computing Systems
- **IC** - Impacts of Computing

Lesson 16: Events in App Lab

Overview

Question of the Day: How can I use events to create an app?

In this lesson students learn how to add screens to their apps, how to import screens created by other students, and how to program events to navigate between screens. Students learn basic event driven programming by building up the model app that they started in the previous lesson. At the end of the lesson, students make a plan for how they will stay organized when importing each other's screens in tomorrow's lesson.

Purpose

This lesson gives enough programming context for students to be successful creating their digital prototypes. The goal of this lesson is not to teach programming in App Lab (there will be time for that in Unit 6), but rather to teach the minimum amount of programming skills to allow students to make their apps interactive.

Assessment Opportunities

1. **Create an event that detects and responds to user input**

   Code Studio: See rubric on bubble 10.

Agenda

Warm Up (5 min)

- **Getting Prepared**
- **Journal**

Activity (35 min)

- **Events in App Lab**
- **Preparing for Screen Import**

Wrap Up (5 min)

- **Journal**

View on Code Studio

Objectives

Students will be able to:

- Create an event that detects and responds to user input

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

Introduced Code

- `onEvent(id, type, function(event){ ... }`
- `setScreen(screenId)`
- `console.log`

Teaching Guide

Warm Up (5 min)

Getting Prepared

Distribute: Make sure each team has their materials available.

Journal

Prompt: Think back to when you were programming in Game Lab. When you wanted a game to respond to user interaction, how did you do it?

Discuss: Students should journal individually, then share in pairs before asking a few students to share with the class.

Discussion Goal

Goal: Students should remember that Game Lab uses a 'draw' loop that runs constantly. If they wanted to check for a user interaction, they needed to use if-statements inside the loop to constantly check what the user was doing.

Alternate Prompt: If your students haven't completed Game Lab, you can adjust the prompt to have them think of a game they've played and ask how it gets input from the user. They may brainstorm things like pressing a button on a keyboard or clicking a character on a screen, or they could consider phone interactions like tapping the screen, or swiping or pinching for an action to happen.

Remarks

> In Game Lab, we used the 'draw' loop to constantly check if a user had interacted with the game. This technique works really well in games and animations where you need to be updating a lot of things all the time. However, most phone apps are *not* doing things constantly. In fact, a lot of apps do absolutely *nothing* but wait for the user to click on something - this is called an **event**. Today, we're going to learn how to add events in App Lab by continuing to create the Recycle Helper app. Tomorrow, we'll add events to our own digital prototypes

Question of the Day: How can I use events to create an app?

Activity (35 min)

Events in App Lab

Code Studio: Have students log into their computers and open Code Studio. If you've used Pair Programming in previous units, consider having students use it throughout these levels.

Circulate: Monitor students as they complete the levels in Code Studio. As they progress through the bubbles, they should be adding to the Recycle Finder app from previous lessons. Students will spend most of the class completing these levels. As teams start to finish up, begin to transition to the next stage of this activity

Teaching Tip

Video Review: The second half of the video from yesterday is a good guide for what students will be completing today. You may decide to re-watch just the second half where Caley creates a new screen and adds an event to the screen, since this is what students will be completing today.

Remarks

> A key part of adding events to your app was having different screens to link to. Today we learned one way to do that is by importing other screens. We will be doing this same process with your teammates - importing their screens into your app. To prepare for this, we need to plan how we will share our projects with each other.

Preparing for Screen Import

Do This: Have students discuss as a group how they will share their screen's import URLs with each other. They should decide on a plan that they will implement tomorrow.

Wrap Up (5 min)

Collect: Collect all the materials from each team in a safe storage location.

Journal

Prompt: What do you think will be a challenge when it's time to import screens and continue creating your digital prototypes tomorrow? How can your teammates help with these challenges?

Discuss: Have students journal individually first, then have students share with a partner before asking a few students to share with the class.

Teaching Tip

Preparing to Share: Having a system for students to share their project URLs is important for tomorrow's lesson. Common strategies include having a shared Google Doc where students paste their URLs, or send emails to everyone in the group and creating an email thread, or using your school's learning management system to have students communicate with each other. You can let students decide which method they would like to use, or you can instruct students to use a specific strategy to simplify the process.

Discussion Goal

Goal: Students may predict that they may have trouble staying organized with all the different IDs, or they may make coding mistakes with the events, or they may have import errors when trying to import screens. Encourage students to consider how their teammates can be a resource, such as acting like a "thought partner" to help with debugging or by using their Screen Design Activity Guide to help stay organized with IDs.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming
- **IC** - Impacts of Computing

Lesson 17: Linking Prototype Screens

Overview

Question of the Day: How can I combine screens to create a complete digital prototype?

In this lesson teams combine their digital prototype screens into a single app, which they can then link together using code. They share their project's import URLs with each other, then import each teammate's screen into their own app. Each student works independently to add events to their code to link the screens together, completing their digital prototype.

Purpose

This lesson is the final step in creating their digital prototypes, which they will then test and adjust in the next few lessons. Team Working skills are emphasized in deciding how to communicate their project URLs with each other, and design skills are emphasized when each student has imported their screens and is continuing to build their app.

Assessment Opportunities

1. **Integrate all components from collaborative work into a final computational artifact.**

   Code Studio: See rubric on bubble 3.

2. **Create a digital prototype that incorporates the user flow for a computational artifact**

   Wrap up: Student solutions should allow the user to click through several of the proposed tasks for the apps.

Agenda

Warm Up (5 min)

- **Getting Prepared**
- **Journal**

Activity (35 min)

- **Combining Project Screens**

Wrap Up (5 min)

- **Team Debrief**

View on Code Studio

Objectives

Students will be able to:

- Integrate all components from collaborative work into a final computational artifact.
- Create a digital prototype that incorporates the user flow for a computational artifact

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

Teaching Guide

Warm Up (5 min)

Getting Prepared

Distribute: Make sure each team has their materials available.

Journal

Prompt: Today we will be combining all of our digital screens into a single app. Based on yesterday's lesson, what are the steps it will take to get a button on your screen to click and change to a screen that a teammate created?

Discuss: Have students journal on their own, then discuss in a group then share as a class.

Discussion Goal

Goal: This prompt is a review of yesterday's lesson. Try to draw out that there are several steps to complete in this process:

1. import the screen your teammate created
2. add an event handler to your code using the button ID
3. use the `setScreen` block to change to the new screen

Remarks

> Today we will be combining all of our screens to create our digital prototypes! By the end of this lesson, each person on your team should have their own working version of your app that we will use for testing and feedback tomorrow.

Question of the Day: How can I combine screens to create a complete digital prototype?

Activity (35 min)

Combining Project Screens

Prepare: Give teams a few minutes to review the state of their screens, identifying any remaining work to be done before combining them. Once they are ready, have students share their screen import URLs according to the plan they made at the end of yesterday's lesson.

Code Studio: Have students log into their computers and open Code Studio. The first level has students import all of the screens from their teammates. The next level has students add the code for the event handlers so students can click through each screen.

Circuate: Monitor students as they complete the tasks above. Teams may be in different stages of development - some teams may still need support finishing their screens, some teams may need help sharing their screens with each other, and some teams may need help adding the events to their code. Regardless of each team's progress, provide support and encouragement to help teams progress and move to the next steps of their prototype development.

Share: Give students a chance to share their prototypes with each other and do some initial testing. Because every student is now working on a separate version of the team app, each app will likely be slightly different.

(Optional) **Share Via Phone:** Depending on the norms and rules of your classroom, you may decide to make a temporary exception and allow students to test their apps on their own devices. App Lab is modeled after the apps we use on our phones, so it can be incredibly exciting for a student to load the app they made on their own device. To do this, students press the "Share" button in the upper-left corner of their project and then press "Send to Phone". This opens a menu where students can send the app to their device via a text message, or scan a QR code. These instructions are also in the slides for this unit - if you decide to skip this step, make sure to also delete this slide from the presentation.

Wrap Up (5 min)

Team Debrief

Remarks

> Now that we have our digital prototypes, it's time to test them! Tomorrow we'll do another round of user feedback, where you will have a chance to test each other's apps. Right now, each team member has their own version of the team app. For tomorrow, we need to pick one of these versions that we will use for testing

Discuss: Have teams discuss with each other which team member's app they will use for testing tomorrow. If several students have apps "complete enough" for testing, teams can use a random process to make a decision (such as flipping a coin or rolling a dice).

Teaching Tip

Debugging Screen Imports: There are several potential stumbling blocks that teams may run into during the import process:

- *Miscommunicated urls:* The sharing URLS are long and complicated, so students will need a shared location where they can copy/paste their urls
- *Conflicting screen IDs:* Importing a screen with the same ID as an existing one will allow you to overwrite the existing screen. This is particularly troublesome when students leave the default screen ID "screen1"
- *Conflicting element IDs:* If students have properly namespaced all of their elements this shouldn't be an issue, but any elements that have the default ID or share an ID with an existing element will prevent a screen from importing

Working Independently: Once teams move to the programming phase of this project, it becomes much more difficult for students to collaborate on the same app. The design phase is the primary opportunity for all students to collaborate on the app - after this teams will still be working together, but each student will be working on their own copy of the app. Encourage students to use this as an opportunity to be creative and add personal style decisions to their personal version of the team app.

Teaching Tip

Testing Outside of Class: Now that each student has their own copy of the app, they can share the app with friends and family outside of the classroom. This is especially true if you've allowed students to share the app to their phones. Encourage students to do some initial sharing and testing outside of class. This helps get some initial feedback on the app, but also gives students a chance to share their excitement and hard work with their community.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- ▶ **AP** - Algorithms & Programming
- ▶ **IC** - Impacts of Computing

Lesson 18: Testing the App

Overview

Question of the Day: How does our digital prototype work when tested by real users?

By the end of the previous lesson each team should have a working prototype of their app. The primary purpose of this lesson is to have the team actually test the app with other people, preferably from the target audience the app is intended for, or from different teams in the class while observers from the team will record the results. As with testing the paper prototypes, teams will start by planning for the specific scenarios before running and observing tests.

Purpose

By now students should be fairly practiced at testing with users. This time around, the role of the computer is actually done by the computer! This means that the team running the test needs to focus their energy on getting carefully watching what the user does, and encourage the user to say aloud what they are experiencing. While it may seem at first that testing with an interactive prototype is easier (since no one has to manually change screens), it can actually be significantly more difficult to observe the user's experience.

Assessment Opportunities

1. **Design and run tests that use digital prototypes to gather feedback on a design**

   Activity Guide: Several relevant tasks should be identified in the chart on the second page, along with notes describing the user testing around those tasks.

Agenda

Warm Up (5 min)

Getting Prepared
Journal

Activity (45 min)

Preparing for Testing

Wrap Up (5 min)

Journal

View on Code Studio

Objectives

Students will be able to:

- Design and run tests that use digital prototypes to gather feedback on a design

Preparation

- [ ] Print one copy of the activity guide for each student
- [ ] If possible, have outside users available to test the teams' apps prior to this testing day

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

For the Students

- **Digital Prototype User Testing** - Activity Guide Make a Copy
- **User Test Cases** - Activity Guide Make a Copy

Teaching Guide

Warm Up (5 min)

Getting Prepared

Distribute: Make sure each team has their materials available and is able to open their digital prototypes on Code Studio.

Journal

Prompt: Today we will be testing our digital prototype with users. How do you think this will be similar to when we tested our paper prototypes? How do you think it will be different?

Discussion Goal

Goal: Students should recall the user testing process, which they've already completed several times throughout this unit. Discussions will vary, but they should anticipate that some people will be observers taking notes on what the user does so they can incorporate it into feedback. Students may also realize that there is no more need for a "computer" because we've coded all of the navigation in App Lab!

Discuss: Have students journal individually, then discuss in their groups before drawing out conversations as a full class.

Remarks

> Today we will be testing our digital prototypes and getting one last round of feedback before we get our apps into a final state. After importing all of your screens yesterday, you should each have a copy of your team's app. The first decision we need to make today is: who's app are we going to use for testing?

Question of the Day: How does our digital prototype work when tested by real users?

Discuss: Have students discuss as a team which app they want to use for user testing. Teams may have already decided this at the end of class yesterday - if so, they can skip this discussion and jump right into the activity.

Activity (45 min)

Preparing for Testing

Distribute: Give each team one copy of the Digital Prototype User Testing Activity Guide. Also give each team a copy of the User Test Cases Activity Guide - one copy for each user the team plans to test with.

Digital Prototype User Testing

> **Overview:** Read through the (1) Overview section of the activity guide together. This gives an overview of today's activity.
>
> **Assign Roles:** Read through the (2) Assign Roles for Testing section of the activity guide. Have students discuss in their teams which roles they will take on in the first round of testing. There should be only one narrator and all other team members can be observers.
>
> **Create Test Cases:** Read through the (3) Create Test Cases section of the activity guide. Students will work in the User Test Cases Activity Guide for this section, filling in the App Introduction section and

Teaching Tip

Deja Vu The instructions and activity guide for this lesson will feel *very* familiar - it is basically a repeat of the Paper Prototype testing process. You may want to acknowledge this similarity with students, since it can help reinforce that they're acting like real app designers who test their apps multiple times before releasing it - the fact that it feels so familiar means they're getting more comfortable with the design process.

Teaching Tip

Testing Logistics You may want to decide ahead of time how students will be able to physically test each other's apps. If all students are using computers, consider having both teams gather around one set of computers for one test, then everyone moves and gathers around another set of computers for the other tests. Or, if students are able to use their personal devices and they are comfortable letting other students handle them, have students test the apps on each other's devices.

completing the left-column of the table. They should not fill in the rest of the table - the user will do this instead.

Circulate: Monitor students as they fill in the User Test Cases Activity Guide. Make sure they are only filling in the left-most column with the tasks they want their user to test - the rest of the chart should be blank.

Test Your Prototype: Read through the (4) Test Your Prototype section to remind students the process for user testing. It is the same process they completed when testing their paper prototype, except this time they will test using their App Lab digital prototype.

Do This: Find another team to test your app with. Spend half your time for them to test your app, then take the other half of the time for you to test their app.

Circulate: Students will start their tests which should run for about 10 minutes each. The tests should last a little longer than the paper prototype tests, since the apps are more developed now that they're in a digital form. Encourage students to keep on task, and encourage the observers to write as much as they can.

Teaching Tip

Actionable Feedback: A key takeaway from this activity is that students leave with a plan for changes they can make to their app based on their testing. This usually requires setting your ego aside and seeing feedback as opportunities for improvement rather than evidence of failure. Remind students that these are just prototypes, nowhere near the final project. Also remind students not to take feedback personally - that all apps go through this process and they get better because of it.

Summarize Findings: Read through the (5) Summarize Findings section of the activity guide. Have groups discuss what they observed and record their findings on the activity guide. In particular ask them what their observations mean in terms of changes they'll need to make for the user interface of their prototype.

Wrap Up (5 min)

Journal

Prompt: Think about the type of feedback from today's testing compared to the feedback from testing your paper prototype. What was similar between the two types of feedback? What was different?

Discuss: Have students journal individually, then share in their groups. If there is time, ask groups to share their responses with the class.

Discussion Goal

Goal: Students may notice that, once again, users may have discovered issues that challenged their assumptions. However, students may also notice that the feedback was targeted more towards cosmetic and aesthetic choices, such as the size of fonts or the color of elements on the screen. Even though these might seem like small details that are easy to fix, they can have a large negative impact on the user experience.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming
- **CS** - Computing Systems
- **DA** - Data & Analysis
- **IC** - Impacts of Computing

Lesson 19: Bugs and Features

Overview

Question of the Day: How can we create a plan to address bugs and features in our prototype?

Teams have at this point developed an app prototype that has gone through multiple iterations and rounds of user testing. With the information and guidance gained from the last round of user testing, each student has the opportunity to plan for and implement improvements to the team app. Depending on the time you have available, and student interest, you can run the cycle of testing and iteration as many times as you see fit.

Purpose

While improvement can mean adding programmatic functionality, it can also mean a more eye-catching design, more informative text copy, better uniformity of iconography, or any number of other non-programming related features. Encourage each student to find the elements of app design that interest them and focus on that for their personal improvements.

At this point in the development process, you can choose to spend as much time as you like iterating and testing. There is no further time budgeted for testing after this iteration, but feel free to use the previous two lessons as a guideline for cycling through further iterations.

Assessment Opportunities

1. **Analyze user feedback and test results on a computational artifact**

   Activity Guide: The left side of the T-chart on the first page should include at least four descriptions of things that happened in the test, and the right side should list a reasonable interpretation of the descriptions.

2. **Categorize and prioritize the issues according to impact and ease of implementation**

   Student poster: The chart should include several improvements to the app, categorized according to urgency and ease of implementation.

Agenda

Warm Up (5 min)

Getting Prepared
Journal

Activity (35 min)

Interpreting User Feedback

View on Code Studio

Objectives

Students will be able to:

- Analyze user feedback and test results on a computational artifact
- Categorize and prioritize the issues according to impact and ease of implementation

Preparation

- [ ] Print one copy of the activity guide for each team
- [ ] Set out sticky notes for each team
- [ ] (Optional) Have poster paper or a large whiteboard area prepared for each team

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

For the Students

- **Bugs and Features** - Activity Guide
  Make a Copy

- Brainstorming Session
- Bug and Feature Analysis

Wrap Up (5 min)

- Journal

Teaching Guide

Warm Up (5 min)

Getting Prepared

Distribute: Make sure each team has their materials available, especially the Digital Prototype User Testing activity guide from yesterday.

Discussion Goal

Goal: Students can use this prompt to remind themselves of the user feedback from yesterday and as a transition into the main activity.

Journal

Prompt: Based on your user testing yesterday, what are some issues you discovered in your apps?

Discuss: Have students journal individually first, then share in their teams.

Remarks

> Based on our feedback from yesterday, we're going to take some time to do one last round of improvements on our prototypes. However, before we get started, we're going to spend today looking at a new way to analyze our feedback from yesterday and prioritize which tasks we want to incorporate into our next prototype. One of our first tasks is grouping our feedback into two categories: a **bug** or a **feature**.

Question of the Day: How can we create a plan to address bugs and features in our prototype?

Activity (35 min)

Vocab: introduce the following vocabulary terms:

- **Bug** - Part of a program that does not work correctly.
- **Feature** - Part of a program that adds functionality for the user

Remarks

> When testing your program, your users may have identified bugs in your prototype. These could be programming bugs, where an event didn't work the way you expected. Or these could be design bugs, where a piece of text was too small or the design of a screen wasn't very clear. Your users may have also given you feedback requesting new features for your app that may be worth investigating. Let's see if we can classify our feedback as either a bug fix or a feature request.

Teaching Tip

Reducing Printed Materials: This Activity Guide can be completed online or as a journal activity.

Distribute: Sticky notes and a copy of the activity guide for each team. Optionally, also distribute poster paper to each group or provide a large whiteboarding area for teams to work at.

Bugs & Features

Interpreting User Feedback

Do This: Teams start by completing a T chart that will help connect specific user testing observations to the potential bugs or missing features they reveal. They should rely on their notes from yesterday's lesson when testing with another user. This information will be the basis of a brainstorming session to create a list of bugs and features the team would like to focus on in the next activity.

Teaching Tip

Deja Vu: The chart on this activity is identical to the one from yesterday's activity guide. If students had enough time to complete the chart yesterday, they don't need to re-copy it onto this activity guide. However, if students continued to test the app at home with their family or members of their community, then they can use the chart on today's activity guide to summarize that feedback.

Circulate: Monitor students as they create their list, ensuring all voices within the team are heard and acknowledged. Look for clear connections between the observations students made as their users tested their apps, and the changes they want to make to their apps based on those observations.

Brainstorming Session

Do This: Once teams have organized all of their feedback into the T chart, they can move into the brainstorming phase. Directions for this stage are in the activity guide and on the slide:

- The top of the sticky note should say **BUG** or **FEATURE**.
- The middle of the sticky note should be a description of what the bug or features is.
- The bottom of the sticky should have a quick estimate of how long (in minutes) it will take to fix this bug or implement this feature.

Teaching Tip

Including All Team Members: It's tempting to focus solely on bugs that are the cause of, or can be solved with, code. Remind students that there are many roles and skillsets on a software development team, and not all bugs and features are dealt with by programmers. Inconsistent color, confusing text, and counterintuitive layouts are all potential bugs that are important to deal with.

This is an opportunity to let students with other skillsets shine and make a strong contribution to their apps, so make the extra effort to help highlight those students.

Circulate: Monitor students as they create their sticky notes. Help answer questions students may have on whether a task is a bug or a feature. It's okay if this distinction isn't always clear, as long as teams can make a best guess. Also help teams determine time estimates for each task - small changes to design elements may not take very long, but entirely new features requiring new screens could take a significant amount of class time.

Bug and Feature Analysis

Do This: On the second page of the activity guide, students will categorize the post-its they generated in their brainstorm. For each sticky note, discuss whether it is urgent or not, and whether it seems to be easy or difficult to implement. Based on that discussion, place the sticky in the appropriate quadrant. Optionally, you can have teams re-create this chart on poster paper or a large whiteboard and organize their sticky notes there.

Circulate: Monitor students as they categorize their post-its. The goal is to think intentionally about both urgency and complexity, which will further help them prioritize their work when they begin implementing these changes.

Discussion Goal

Goal: Students should realize that urgent goals should be higher priority than non-urgent goals, and that easier fixes will probably get done faster than harder fixes. This means the upper-left quadrant is the first group teams will probably tackle. After that, teams may debate which quadrant is more important - urgent fixes that are harder to implement, or non-urgent fixes that are easier to implement. It's worth discussing the pros and cons of both approaches, since teams will have to make this decision tomorrow when implementing their changes.

Prompt: Now that you have your bugs and features categorized, which of the four categories should you tackle first? Which should be the last?

Discuss: Have students share in their teams first, then facilitate a class discussion by asking each group to share their thoughts with the class.

Remarks

> You all have come up with a really organized plan to start making your changes tomorrow. This is a similar process to what real software developers do when updating their apps - they collect feedback and categorize it so they know what changes they will make and how long each change will take. Tomorrow we'll pick which post-its we want to focus on and update our apps

Wrap Up (5 min)

Collect: Collect all the materials from each team in a safe storage location. Try to keep the post-its organized from today's activity. If teams used a whiteboard for their post-it notes, consider having them take a picture of how they organized their post-its.

Journal

Prompt: This process of organizing tasks and categorizing into a chart is used a lot when designing new apps. What are some other tasks this process could be used for in your life outside of class?

Discuss: Have students journal individually first, then have students share in their teams before asking a few students to share with the class.

Discussion Goal

Goal: Students should make a connection between this organization process and different tasks they have outside of class. Some examples may include:

- Deciding which homework assignments to prioritize
- Deciding which chores to complete at home
- Deciding how to plan for an event, such as a birthday party or school event

If possible, connect this process to strategies related to stress management and not being overwhelmed. When faced with a lot of work all at once, writing each piece down in bite-sized steps is a good strategy for getting started on large projects and managing stress.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- ▶ **AP** - Algorithms & Programming
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Lesson 20: Updating Your Prototype

Overview

Question of the Day: How can I track my work while we make updates to our app?

Teams make a decision about how they will incorporate updates to their app, then they begin updating their app based on their post-its from yesterday's lesson. They use a "To Do / Doing / Done" chart to organize their work and track their progress. Teams spend the majority of the class working on updating their app, with time at the end to re-combine into a single app if necessary.

Purpose

Students should focus the majority of their time on updating their apps based on user feedback, but they should also use the "To Do / Doing / Done" chart to stay organized and track their work. Moving a task across the board to the "Done" stage is a major accomplishment and, by the end of class, teams can celebrate how many tasks they completed in a single period.

Assessment Opportunities

1. Track progress while making changes to their app

   Activity Guide: Monitor students as they move post-its across the "To Do / Doing / Done" chart, ensuring that their current work is reflected on the chart.

Agenda

Warm Up (5 min)

- **Getting Prepared**
- **Journal**

Activity (35 min)

Wrap Up (5 min)

- **Journal**

View on Code Studio

Objectives

Students will be able to:

- Track progress will making changes to their app

Preparation

- [ ] Print one copy of the activity guide for each team
- [ ] (Optional) Prepare poster paper or a large whiteboard space for each team

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides

For the Students

- **Updating Your Prototype** - Activity Guide Make a Copy

Teaching Guide

Warm Up (5 min)

Getting Prepared

Distribute: Make sure each team has their materials available, especially their Bugs and Features activity guide and post-its from yesterday.

Journal

Prompt: Look over all the post-it notes your team created yesterday. Which one do you think is the most important to complete for your app? Why?

Discussion Goal

Goal: This prompt previews the decisions students will make today, where they will "claim" different post-its to work on for improving their app. This also allows teams to hear different perspectives on how important certain features are to their program - some students may focus on adding new features, whereas others may focus on making the app more usable in the first place.

Discuss: Have students journal individually first, then have students share in their teams before asking a few students to share with the class.

Remarks

> Today we will update our apps based on the bugs and features we identified yesterday! We'll start by picking the post-its we want to prioritize first, then start updating our apps with new features and big fixes! Throughout today, we'll keep track of our tasks using a new chart so we can see how many tasks we've accomplished by the end of the class period.

Question of the Day: How can I track my work while we make updates to our app?

Activity (35 min)

Distribute: Give each team a copy of the Updating Your Prototype Activity Guide. Optionally, students can copy this guide onto a poster paper or a large whiteboard area to use instead.

Display: Read through the Overview of the Updating Your Prototype activity guide. Have each team member select two post-its to work on throughout today (if they finish these, they can always select more). Those team members should write their names on the post-its and put them in the To-Do column of the chart.

Update Your App: Teams will need to decide how they would like to continue working on their app, since every team member has their own copy of their app after they imported each other's screens. There are three suggested options below. You can have teams decide which of these three they would like to consider, or you can choose one for the entire class:

- **Stay Together on One App:** Each team chooses one of their team's apps to focus on and add updates to - for example, the app they used for testing. During class, the entire team works together to implement one feature at a time using Pair Programming - one team member is the driver while the rest of the team helps navigate
  - **Pros:** Everyone is working on the same app, and there is one completed app at the end

Teaching Tip

Additional Time: Depending on your school calendar, your student's enthusiasm and how complex their apps are, how much you've involved the school community, etc - you may decide to extend how much time students work on these updates. This is especially true if students want to re-combine their updates back to a single app - the process for re-importing screens and sharing code requires some extra time in AppLab.

If you decide to dedicate more time, continue to use the activity guides from today (To Do / Doing / Done) and yesterday (Four quadrants of Urgent vs Easy) as a way for students to manage their tasks and for you to monitor progress throughout this process. Students can create new post-it notes for new features or bugs, then add them to this chart to track their progress. This can help determine how much time to give students to work on these updates.

    - **Cons:** Won't be able to implement as many features since everyone is working together, and can be less engaging for navigators when there are large teams.
- **Split Off For Some Updates, Then Recombine to One App:** Half of the team works together on one app to implement any bug fixes or feature updates on existing screens, and the other half of the team works on new features and new code that requires whole new screens. Before class ends, both teams re-share their project share URL so they can re-import the screens into their projects. They will also have to find a way to share code with each other - this usually involves converting to text mode and sharing with another student, such as via a shared Google Doc.
    - **Pros:** Easier to implement more features and, after the sharing, there is one completed app at the end
    - **Cons:** Re-importing screens and sharing code can get messy and takes time away from implementing new features
- **Everyone Works on Separate Apps:** Each team member works on their own version of the app, implementing their bug fixes and new features just in their app.
    - **Pros:** Easiest way to implement features and most of the class time is spent updating the app
    - **Cons:** There is no "unified" app with all of the features in one place, and there's less opportunity for collaboration and teamwork

Code Studio: Have students log into Code Studio and begin working on the updates to their apps.

Circulate: Monitor students as they update their apps, focusing on their use of the "To Do / Doing / Done" chart. Each time a student tackles a new task they should first move the sticky from **To Do** to **Doing**, and then finally to **Done** when they have finished implementation. You can use this chart for an at-a-glance view of how each team is progressing. Make a big deal and encourage celebration when students move a post-it to the "Done" column.

Wrap Up (5 min)

Collect: Collect all the materials from each team in a safe storage location. Try to keep the post-its organized from today's activity. If teams used a whiteboard for their post-it notes, consider having them take a picture of how they organized their post-its.

Journal

Prompt: Remind students of the **five practices of CS Discoveries** (Problem Solving, Persistence, Creativity, Collaboration, Communication). Choose one practice you thought was especially important for the activity we completed today. What made it so important?

Discuss: Have students reflect individually, then give them the option to share as a class. Since this is a more personal and introspective prompt, it may not be appropriate to have a full-group conversation.

Standards Alignment

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Lesson 21: Project - App Presentation

Overview

Question of the Day: How can I present the steps in our design process to people outside of our team?

At this point teams have researched a topic of personal and social importance, developed and tested both a paper prototype and a digital prototype, and iterated on the initial app to incorporate new features and bug fixes. Now is the time for them to review what they have done and pull together a coherent presentation to demonstrate their process of creation. Using the provided presentation template, teams prepare to present about their process of app development, including the problem they set out to solve, the ways in which they've incorporated feedback from testing, and their plans for the future.

Purpose

This lesson is the culmination of the last several weeks of project work. In preparing to present their work, it's important that students see this as more than just the programming element of their app - the goal of the presentation is to acknowledge the research, design, testing, and iteration that teams have gone through.

Assessment Opportunities

Use the project rubric attached to this lesson to assess student mastery of learning goals of this chapter. You may also choose to assign the post-project test through Code Studio.

Agenda

Warm Up (5 min)
- **Getting Prepared**
- **Journal**

Days 1 and 2 (80 min)
- **Inspecting the Exemplar**
- **Wrap Up**

Days 3 and 4 (10 min per team)
- **Warm Up**
- **Presentations**

Wrap Up (5 min)

Extension Activities
- **App Celebration Night**
- **Submit to Competitions**

View on Code Studio

Objectives

Students will be able to:

- Present technical information clearly to non-technical users
- Reflect on the development of an ongoing project

Preparation

- [ ] Determine how much time each group has to present. Typically this is 8-10 minutes per team, but remember to leave time for transitioning between teams
- [ ] Create a copy of the presentation template slide deck for each team
- [ ] Print one copy of the rubric for each team.

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the Teachers

- **Unit 4 The Design Process** - Slides
- **App Presentation - Exemplars**

For the Students

- **App Presentation** - Rubric Make a Copy
- **Computer Science Practices** - Reflection Make a Copy
- **App Presentation Template** - Slide Deck
- **App Presentation** - Exemplar

Teaching Guide

Warm Up (5 min)

Getting Prepared

Distribute: Make sure each team has all of their materials available from the entire unit.

Journal

Prompt: Look through all of the activity guides and materials you've created throughout this unit. Make a list of all the things you've completed while working to create your team app.

Discussion Goal

Goal: This has been a large project, and students may not fully realize how much they have accomplished so far. Use this as a moment to celebrate everything they've created, starting from their initial brainstorms to their completed app they worked on in previous lessons. Emphasize the planning steps that they completed as well, such as tracking their bugs and features or performing market research.

Discuss: Have students write individually, then share with their team to create a team list. Ask each team to share one thing on their list with the class, keeping a class list at the front of the room. Continue to have teams share until there is nothing left on their lists.

Remarks

> This has been a serious project, and we've come a long way from our initial brainstorming to having a working app that you can send to someone's phone - very exciting! To celebrate these accomplishments and help explain the problems we were trying to solve, we're going to present our apps to the class and highlight all the steps we've taken to build this app.

Question of the Day: How can I present the steps in our design process to people outside of our team?

Days 1 and 2 (80 min)

Inspecting the Exemplar

Distribute: Hand out the rubric to each team. Use the rubric as a reference while going through the Exemplar project below.

Display: Show the Exemplar project for the What's For Lunch app. These resources are provided in a separate slide deck based on the template that students will use. Go through each slide in the deck with students, highlighting each piece of the project. This is the same structure that teams will use when presenting their app. Remind students that they have already completed the majority of this work throughout the unit in their activity guides - they only need to apply it to the presentation. Let students know that presentations should be no longer than 10 minutes.

Do This: Provide a digital copy of the App Presentation Template for teams to build their presentation in. Most of the content of this slide deck should have already been completed in previous parts of this project. The last few slides (particularly Future Work and Reflection) will require more group thought or group work.

Presentation Template

> **Create Your Slides:** The directions below are also available in the App Presentation Template slide deck, either on the slide itself or in the Speaker Notes at the bottom of the screen.
>
> **Slide 1:** Application name and team roster
>
> **Slide 2:** A brief Introduction of the problem the app is intended to address, core requirements of the solution, how the solution meets those requirements, and the social impact of this app
>
> **Slide 3:** Describe the market research that was done, including specific apps that were used as inspiration and their strengths and weaknesses in meeting user needs
>
> **Slide 4:** Show images of the paper prototype and describe the state of the app during paper prototyping

Slide 5: Show images of the digital prototype and describe changes introduced in this iteration

Slide 6: Demo the app, attempting to address all major functionality. Teams may choose to focus on the most functional version of their app, or they could demonstrate functionality across multiple app versions.

Slide 7: List out the key feedback found in each round of user testing. Encourage students to focus on the feedback that most directly affected following iterations.

Slide 8: Describe what the next 3-5 changes would be if the team were to pursue an additional iteration. These changes should be driven by user feedback that the team didn't have time to address.

Slide 9: Reflect on the process as a whole. What went well? What didn't? What did you learn and what would you do differently?

Slide 10: Document any resources used during this project, including the apps found during market research, the source of any pictures used, and any other resources or websites used.

Circulate: As teams work on developing their presentations, push them to write in a way that is accessible to a non-technical audience. It often helps to "play dumb" while asking them to present slides to you in order to point out where their presentation may be difficult to understand for some audiences.

(Optional) Practice: If time, pair teams up to practice giving their presentations. Remind teams that their goal is to keep their presentation no longer than 10 minutes.

Wrap Up

Collect: Each day, collect all the materials from each team in a safe storage location. Make sure teams know where to find their slides ahead of their presentation.

Teaching Tip

Who Is The Audience? This presentation is framed as informational to let other students in the class know about the progress each team has made in their app. Optionally, there are a few other ways this presentation could be framed for different audiences that you could choose to adopt:

- **Target Users:** Teams could imagine they were hired by their target users from the beginning of the projet and they are reporting back on the app they have developed for them. Their goal would be to highlight how the app will fit the needs of their community.
- **Investors:** There are several popular programs where inventors “pitch” an app idea to an investor. Teams could pretend they are on one of these shows and are “pitching” their app. Their goal would be to get the audience to invest in their app and help fund future development.

Teaching Tip

Polishing Up The App Even though teams should be focusing on their presentation, they can also devote some time to adding finishing touches to the app they decide to present. If a team finishes the presentation preparation early, they can also practice demoing and presenting the app to their peers.

Teaching Tip

If students are “stuck” about what went right or wrong in the project, prompt them to think about the communication between team members, or the lack of time to complete the task. Usually these are the two major things that can be problematic on a project.

Days 3 and 4 (10 min per team)

Warm Up

Distribute: Make sure each team has all of their materials available from the entire unit. Allow students to load their presentations ahead of time. Consider letting students rehearse and practice in their teams for 5 minutes before beginning formal presentations.

Presentations

Transition: Remind each team how many minutes they have for their presentation. Decide ahead of time how you will be keeping time and how you will load their presentations so everyone can see.

Do This: Call up each team individually and allow them to present their work. Each team should allow some time (30 seconds) for questions from the other students.

Teaching Tip

Individual Presentations: It is important to keep the class on time with the presentations not only so all of the presentations can get done, but also so the students can see the value of presentation preparation.

1 Day Or 2 Days? Depending on how many teams you have, you may end up having presentations end during awkward times on your second day of presentations, or you may not even need a second day of presentations. Consider how long you think these presentations will take and plan short enrichment or extension activities for any extra time you may have after the presentation.

Wrap Up (5 min)

Code Studio: Have students log into Code Studio and complete their reflection on their attitudes toward computer science. Although their answers are anonymous, the aggregated data will be available to you once at least five students have completed the survey.

(Optional) Extension Activities: Depending on how long presentations take, you may have extra time with students during class. Consider if you would like to offer any enrichment or extension opportunities for students during this time.

Extension Activities

App Celebration Night

Invite parents, other members of the school, and anyone who was interviewed outside of class to come in for a celebration night. Teams can set up booths where they can present their apps and talk about the experience.

Submit to Competitions

Look into having students submit their creations into one of the many youth app competitions. National competitions such as the **Verizon App Challenge** and the **Congressional App Challenge** are available to pretty much everyone, but if you look around you may also find smaller local competetitions to participate in.

Standards Alignment

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