Career exploration game encouraging creative middle schoolers to envision their future in STEM

ORGANIZATION
Carnegie Mellon
Human-Computer Interaction Institute

COURSE
Educational Technologies in the 21st Century

TIMELINE
Aug-Dec 2019

CONTEXT

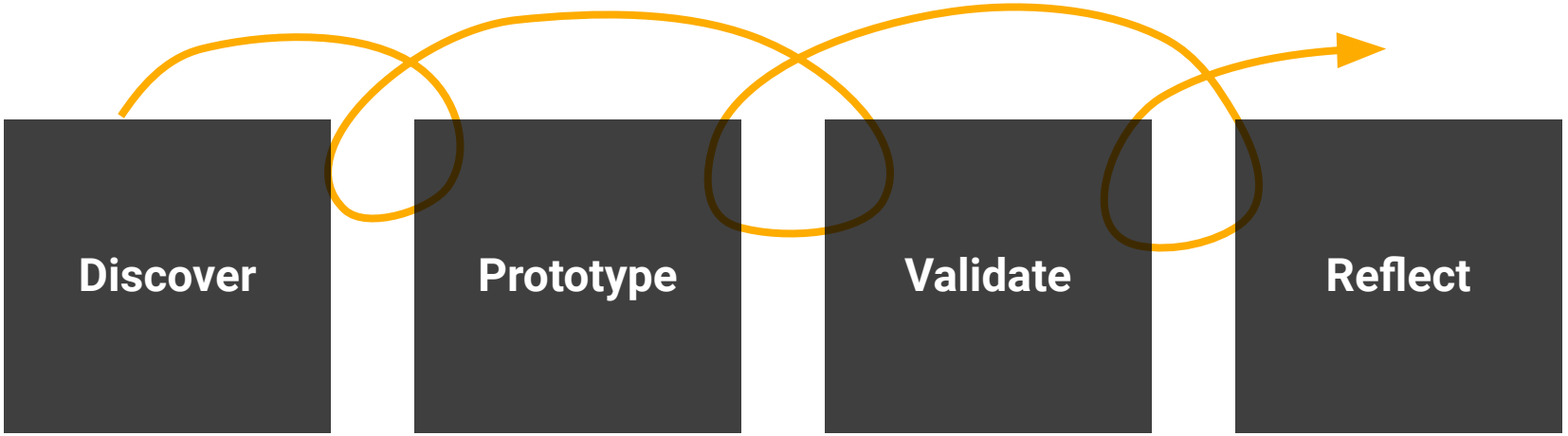
Though gender achievement in STEM topics is at parity through early high school, as girls approach college they are less likely to pursue advanced math & science classes or declare STEM majors than their male counterparts.

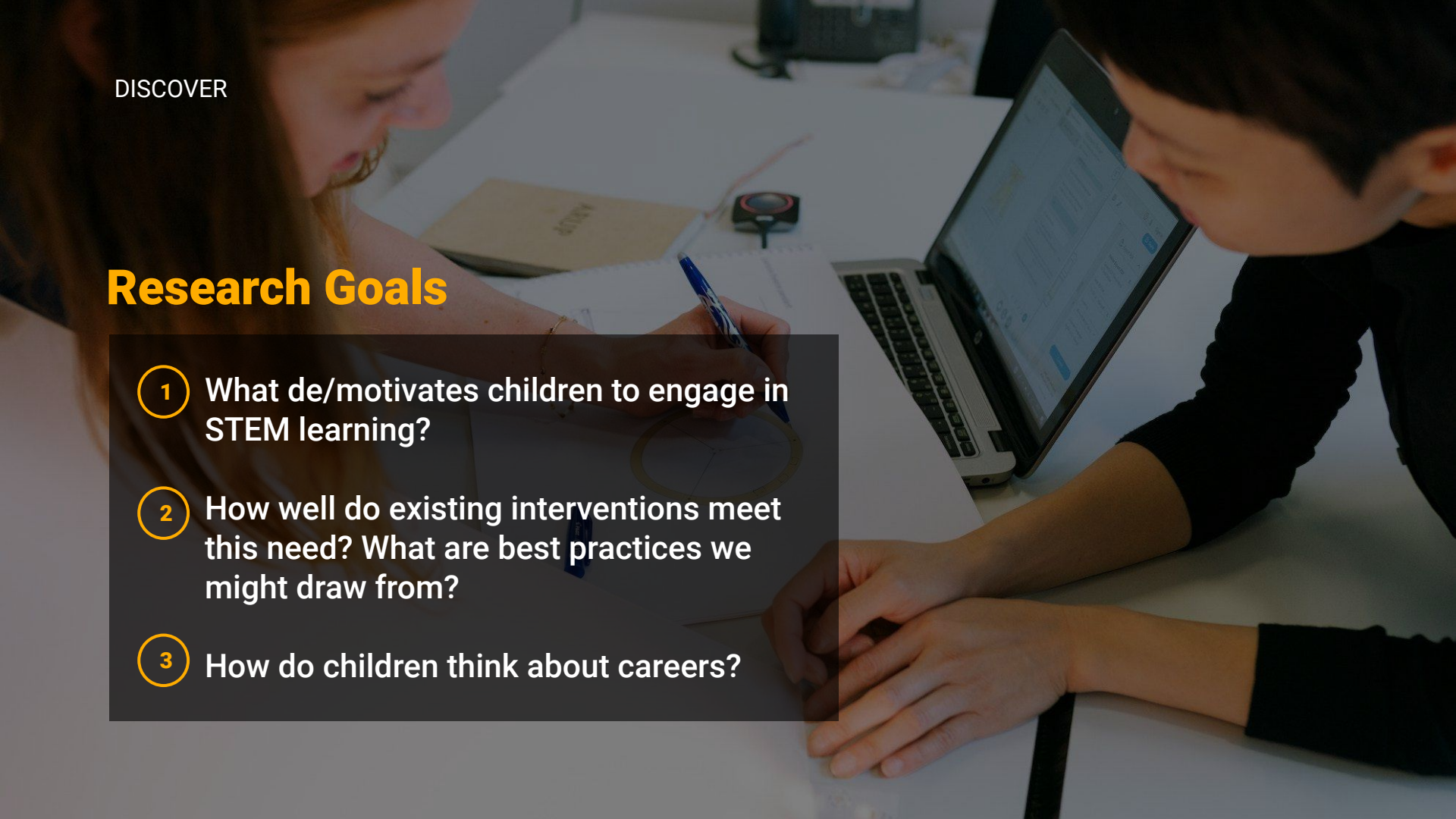
Current interventions like extracurricular camps or clubs have multiple barriers to entry for underserved STEM populations, including time, finances, and motivation.

CHALLENGE

How might we make STEM careers more appealing and accessible to an underserved middle school audience?

Design Process





Research Goals

1. What de/motivates children to engage in STEM learning?
2. How well do existing interventions meet this need? What are best practices we might draw from?
3. How do children think about careers?

DISCOVER

Methods

Secondary Research

Stakeholder Interviews

with educators, edtech designers & STEM program leaders

Contextual Inquiry

with middle school girls at Carnegie Mellon TechNights

DISCOVER

Insights

1

Middle schoolers seek extracurriculars due to boredom & repetition in the classroom.

One TechNights participant lamented about her science education: “We’ve learned about rain for FOUR years!”

2

Many STEM programs already require some amount of motivation & familiarity.

Girls attending TechNights were STEM "power-students," either encouraged by parents in STEM careers or discovering the program through robotics challenges.

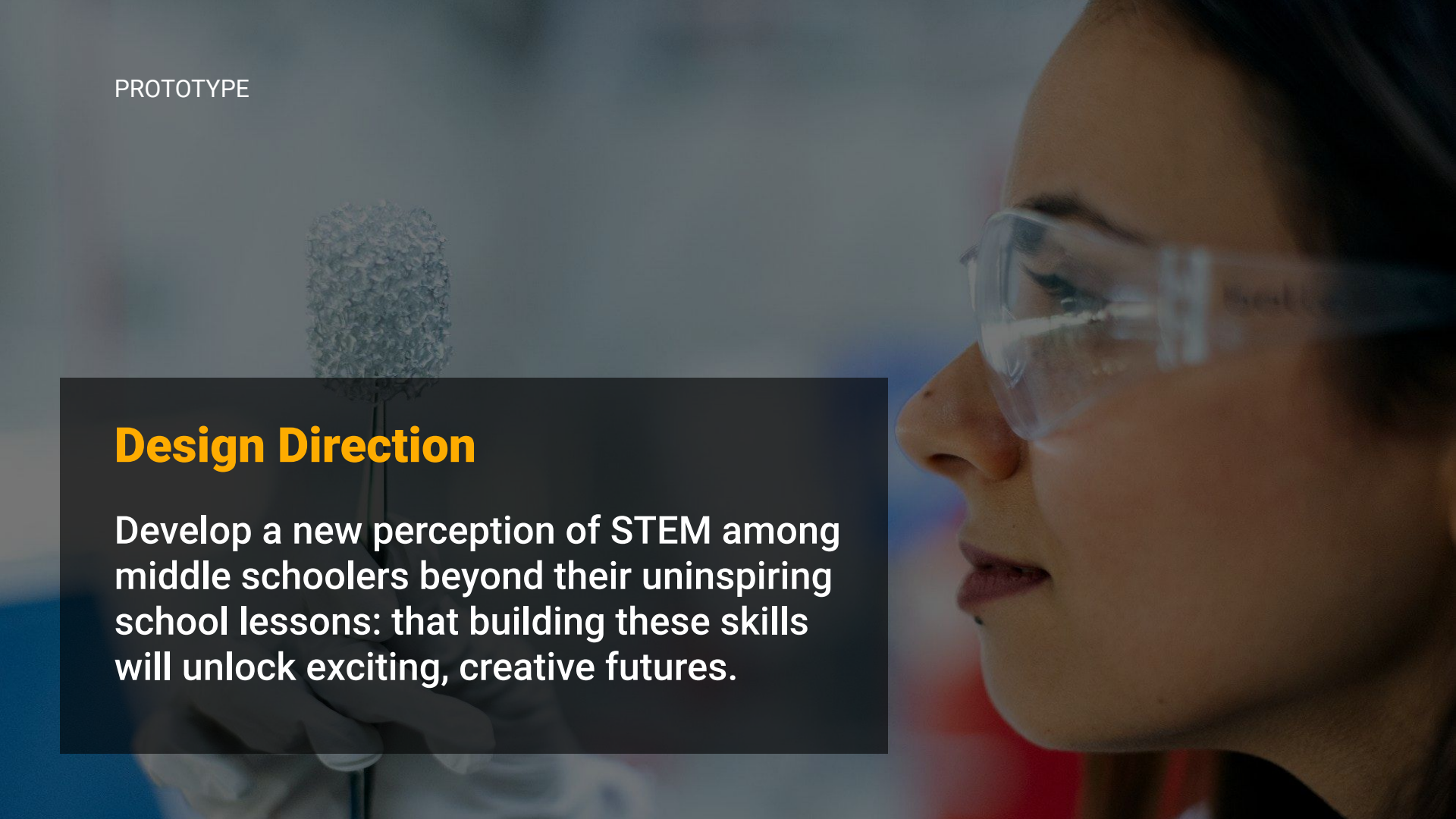
3

Middle schoolers are curious & excited to learn about STEM professions.

Some students as young as 10 were already thinking about college majors.

> *Personal barriers [for girls in computing] include lack of self-confidence, lack of fluency in technology skills, lack of early positive experiences, lack of information about careers and a belief that technology careers require a solitary lifestyle in front of a computer.*

Girls Creating Games case study



Design Direction

Develop a new perception of STEM among middle schoolers beyond their uninspiring school lessons: that building these skills will unlock exciting, creative futures.

PROTOTYPE

Design Decisions

Connect academics to interests

through apprenticeship-like challenges

Mass-market accessibility

via mobile/desktop web-based game

Focus on inspiring, diverse mentors

over educational tutorials

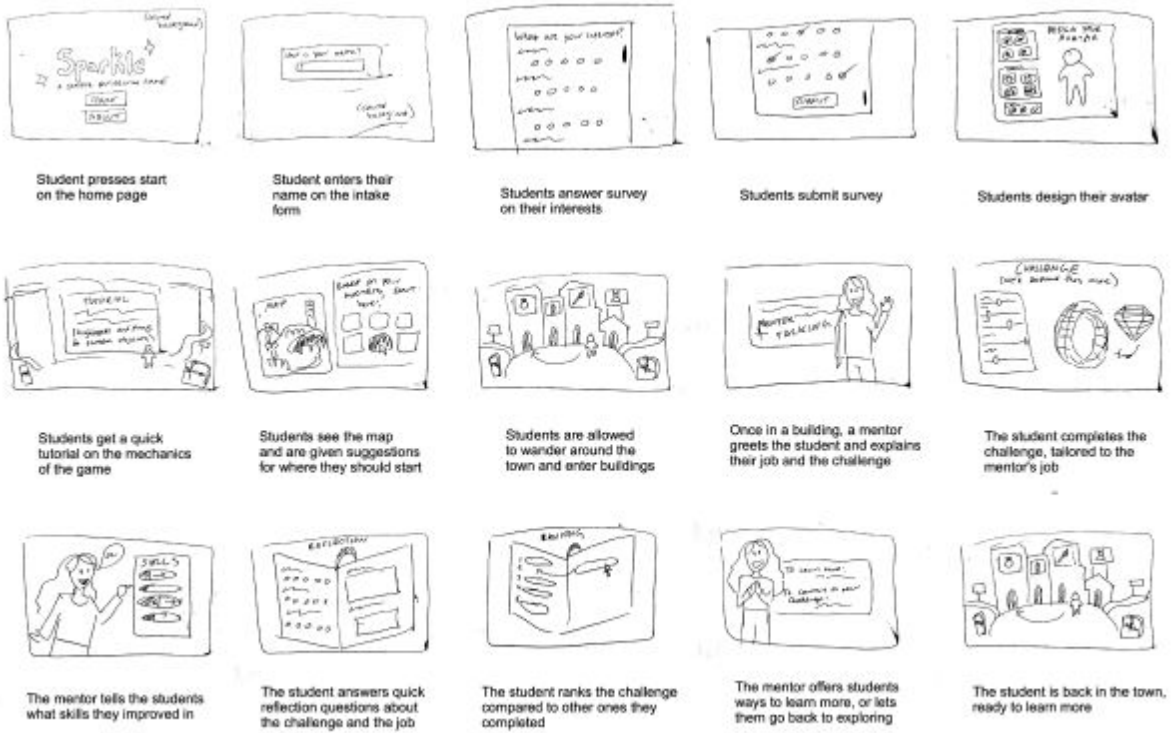
Dispositional learning & reflection

through Explorer's Journal feature

PROTOTYPE

Storyboards

Using my background in content design for metalsmithing classes, my project partner and I wireframed a sample challenge within the game to develop into a concept video.



PROTOTYPE

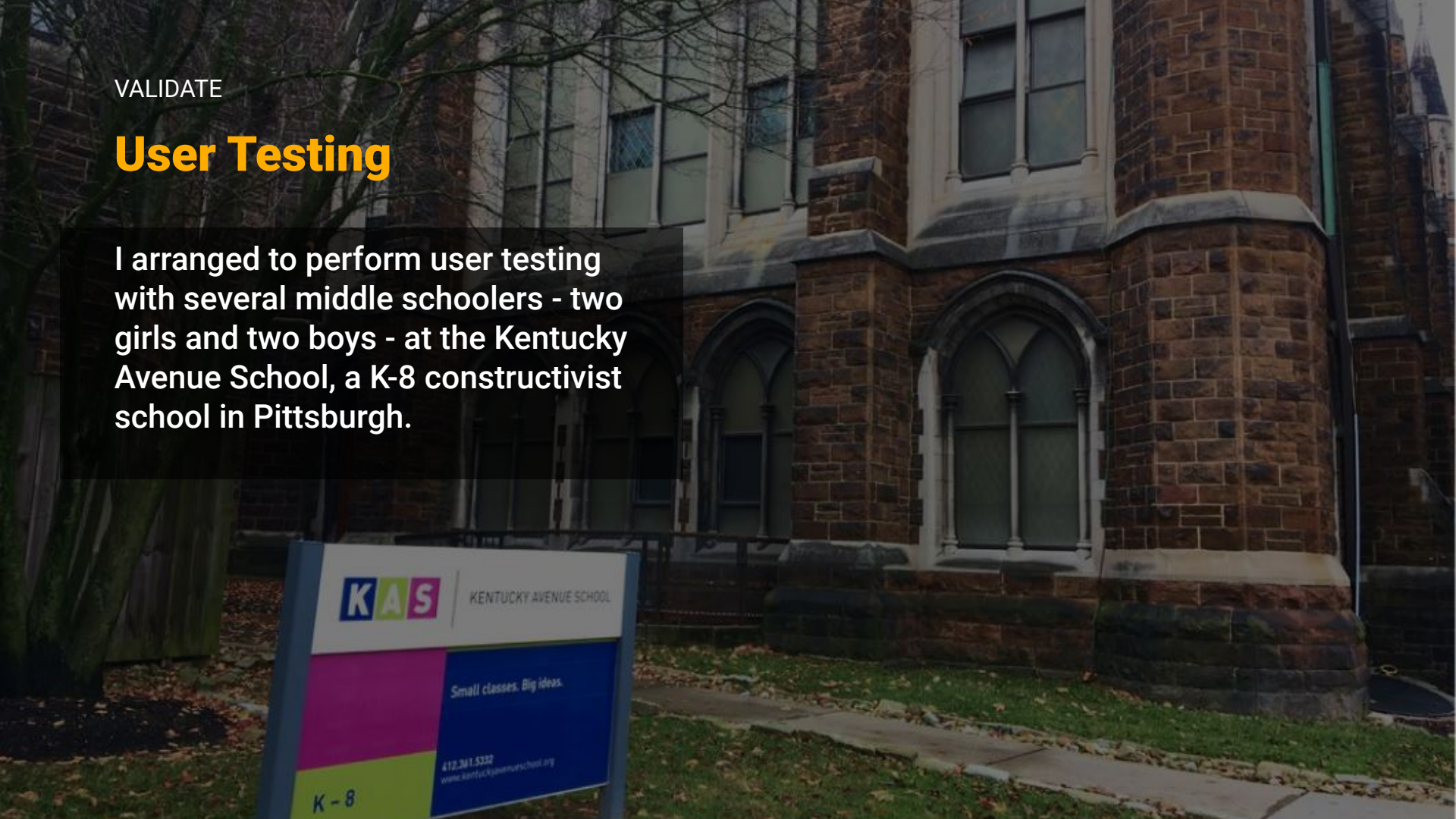
Concept Video

Click to view.
All assets and content are original, excluding footage of CAD from 0:53-0:57 and 2:07-3:09. This was drawn from a public YouTube video and was used purely to convey the concept of CAD within the challenge for user testing.

VALIDATE

User Testing

I arranged to perform user testing with several middle schoolers - two girls and two boys - at the Kentucky Avenue School, a K-8 constructivist school in Pittsburgh.



VALIDATE

User Testing

In the session students took a pre-survey, watched the concept video, took a post-survey, and participated in a followup discussion.

GOALS

1. Was the game age-appropriate and interesting?
2. Did students show improved self-efficacy scores in STEAM subjects before vs. after watching the concept video?

VALIDATE

Results

Participants were drawn by the ability to choose a multitude of categories of interest before entering the game, especially ones outside of traditional school subjects.

The students were universally excited by the game. Unprompted, the girls noted that they would pay for it.

> *Is this a real game? If this is ever published I would love to get it. I would pay money for it.*

> *I would beg my mom to get it. Even if it cost money on the app store.*

VALIDATE

Results

Kids want games that are age-appropriate and interesting, but they need parent approval to play them.

Parents want to limit kids' screen time and use of non-educational games. Sparkville poses an opportunity to meet the needs of both parties.

> *[This game] is cool because your parents will let you do it. It's still educational but it looks really fun.*

VALIDATE

Results

Participants universally agreed that a game about career exploration was relevant, interesting, and important.

Two of four participants already had careers in mind, one noting he wanted to follow either his mother's career path (doctor) or his father's (engineer). The two participants who did not have a career in mind - one boy and one girl - emphasized that it was important to learn about different careers.

> *[When playing this game] I would try out different stuff outside of my comfort zone and see if I might like it.*

VALIDATE

Results

Pre- and post- survey responses did not reveal a marked increase in students' assessment of the value of STEM topics to the jewelry design career.

Males' scores did show improvement in the value of art and science. However, across both males and females, and females especially, they reported higher attitudinal scores post-video related to working within the subject domains shown in the challenge video.

Results analysis

Type	Question	Δ FEMALE	Δ MALE	Δ ALL	Δ %
attitudinal	*designers must be good at art*	0.0	0.5	0.3	5%
	designers need to know science	-0.8	0.5	-0.1	-3%
	designers need to know mathematics	-0.5	0.0	-0.3	-5%
	designers need computer skills	-1.0	0.0	-0.5	-10%
awareness	*I know that 3D modeling software exists*	0.0	0.0	0.0	0%
attitudinal	*I could see myself using 3D modeling software*	1.3	0.0	0.6	13%
awareness	*I am familiar with the properties of stones and minerals*	4.0	2.0	3.0	60%
attitudinal	*I could see myself working with stones and minerals*	2.0	-0.5	0.8	15%
	With training, I could be a designer	0.0	0.0	0.0	0%

REFLECT

Next

Build out high-fidelity animation with a focus on open-ended exploration.

Participants enjoyed the town layout and opportunity to explore. They cited small details like the building styles as interesting, and one participant noted that he would want the freedom to walk around the town and not just go into buildings.

Explore more ways to explicitly feature STEAM content in challenges,

given participants' varying attitudinal change on the value of STEAM topics to the featured career.

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