

User Requirements

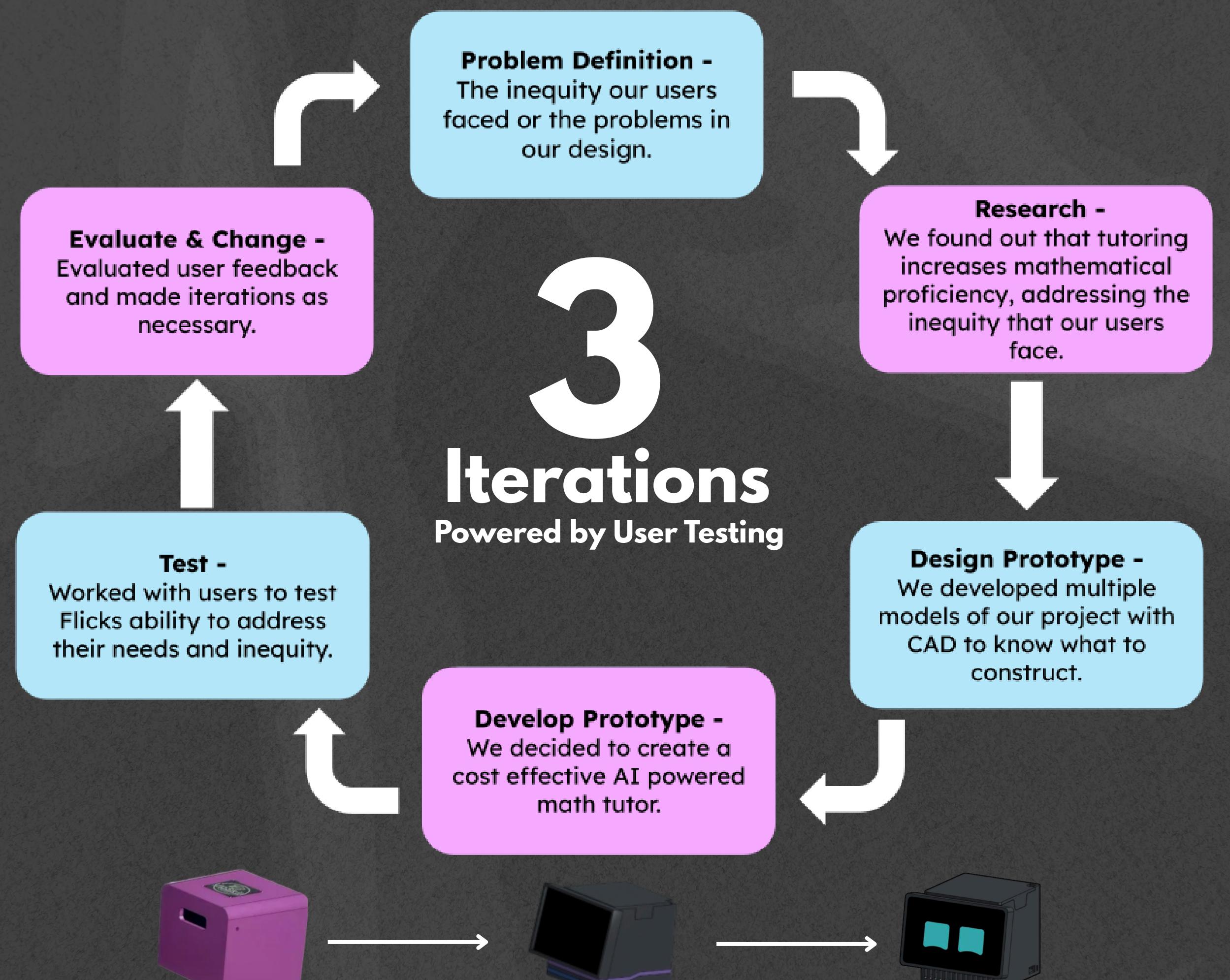
Established using user data and interviews, where students stated they needed a personal and engaging experience.

- Engaging Learning Experience → An engaging AI character with eyes, voice recognition, and a speaker for conversations.
- Personalized Help → AI-driven support that adapts to individual performance and needs.
- Understandable Presentation → Simple breakdowns and a screen to display images and text.

Objectives

PRIMARY	SECONDARY
Increase mathematics proficiency among economically disadvantaged students.	Create an engaging, interactive, and aesthetically appealing experience.
Provide a cost-effective alternative to traditional tutoring.	Optimize the device for quick response times and a distraction-free environment to support focused learning.
Develop an adaptive device that delivers personalized instruction tailored to each student's learning needs	FACTORS <ul style="list-style-type: none"> Personalized Education Accessibility for Economically Disadvantaged Students Ease of Use Engagement & Motivation Distraction-Free Design

Design Process



Citations

Kohlmoos, L., & Steinberg, M. (2024, May). *Contextualizing the Impact of Tutoring on Student Learning: Efficiency, Cost Effectiveness, and the Known Unknowns*. Accelerate.

<https://accelerate.us/wp-content/uploads/2024/05/Accelerate-Research-Report-Efficiency-and-Cost-Effectiveness-1.pdf>

Montgomery County 2023 - 2024 School Report Card. (2024). Maryland State Department of Education.

<https://reportcard.msde.maryland.gov/Graphs/#/ReportCards/ReportCardSchool/1/E/1/15/XXXX/2024>

Student, H. W. M. S. (2025, June 4). [Personal interview].

Ashrit Mandava | Rian Ganesh | Sameer Singh | Summit Lu
Hallie Wells Middle School | Dustin Deem | Clarksburg MD | JHU APL



Flick

AI Math Tutoring with the Flick of a Switch

The Problem

Economically disadvantaged students struggle mathematically, with only **8.7%** being proficient (MSDE, 2024). Tutoring can help address this (Kohlmoos & Steinberg, 2024), but remains unaffordable, hindering SDG 4.5, equitable education.

Prototypes

Version 1

Description:

- Screenless interaction
- LED interface
- Cardboard & paper construction

Weaknesses:

- Low durability
- Poor user experience
- Not aesthetically pleasing

Version 2

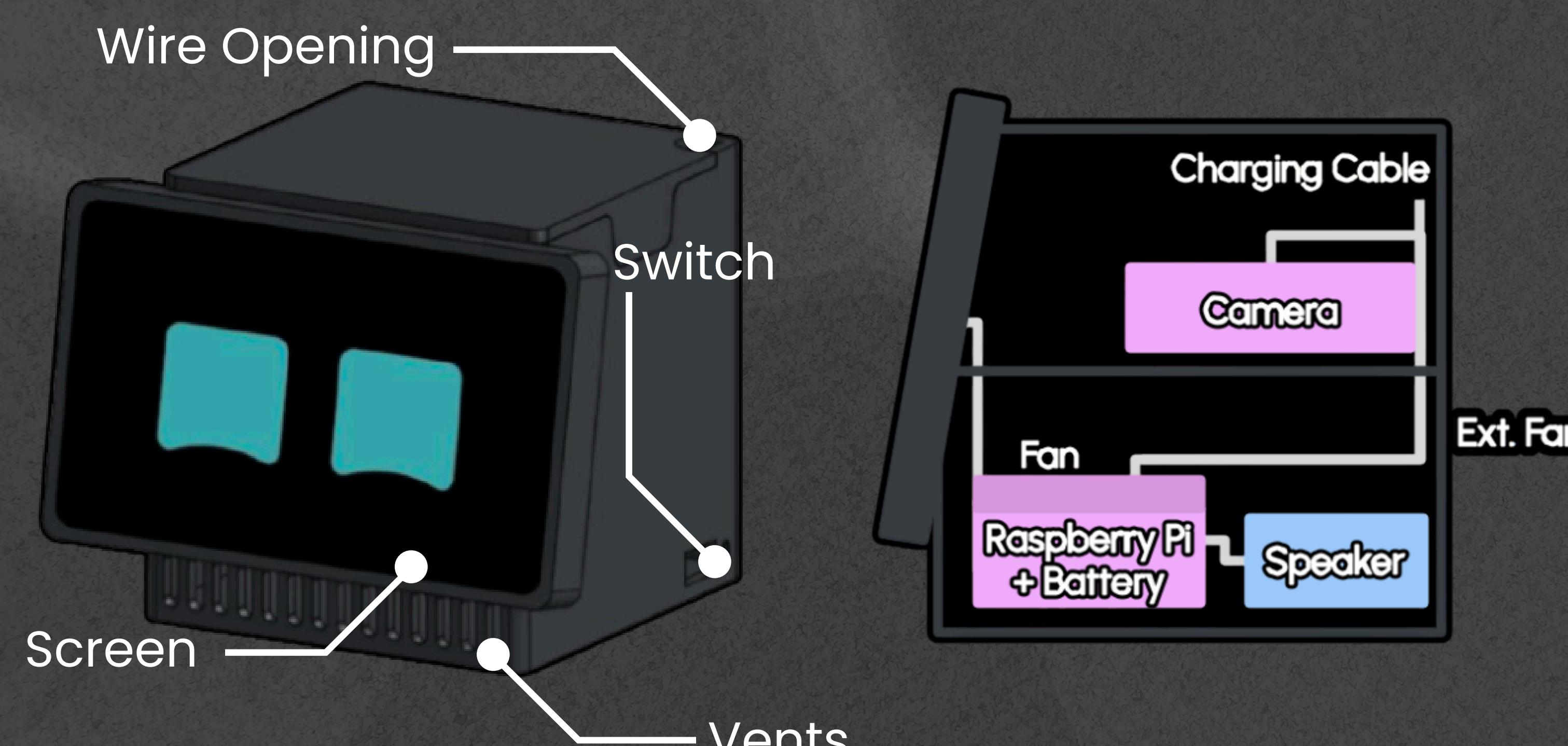
Description:

- Touchscreen display
- Stowable camera
- 3D printed construction

Weaknesses:

- Poor ventilation led to overheating
- Minimal software aesthetic
- Camera lacked auto-focus

Final Iteration



Overview:

Flick is an AI powered alternative to tutoring to assist low-income students in mathematics via the fun AI character, a camera to take pictures, a speaker to initiate conversations, and a screen to visually explain concepts. Its audio can be slowed or sped up. We not only made a functional project, but an aesthetically pleasing, user friendly and engaging AI-powered tutor.

Improvements:

- More engaging
- Faster response time
- More user-friendly
- Better hardware

New Features:

- Neural Voice
- Efficient Image Scraper
- Camera Reverse Renderer
- Effective Cooling System

User Data

To understand student needs, we surveyed 123 middle school students about their experiences with math and personalized education.

66.7% reported struggling with math, and **76.9%** favored personalized education.

Based on this

data, we created an

interactive, AI-powered

tool that offers tailored

support, visual

explanations, and on-

demand help.

Do you struggle or have you struggled with math in the past?

Can personalized education support your mathematical proficiency?

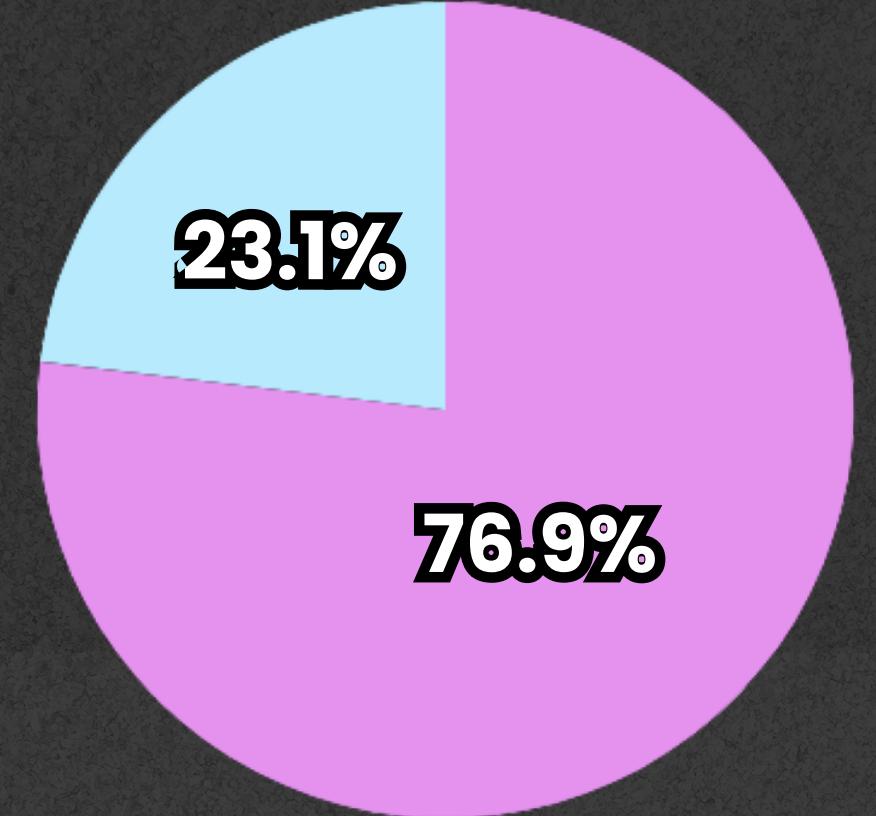
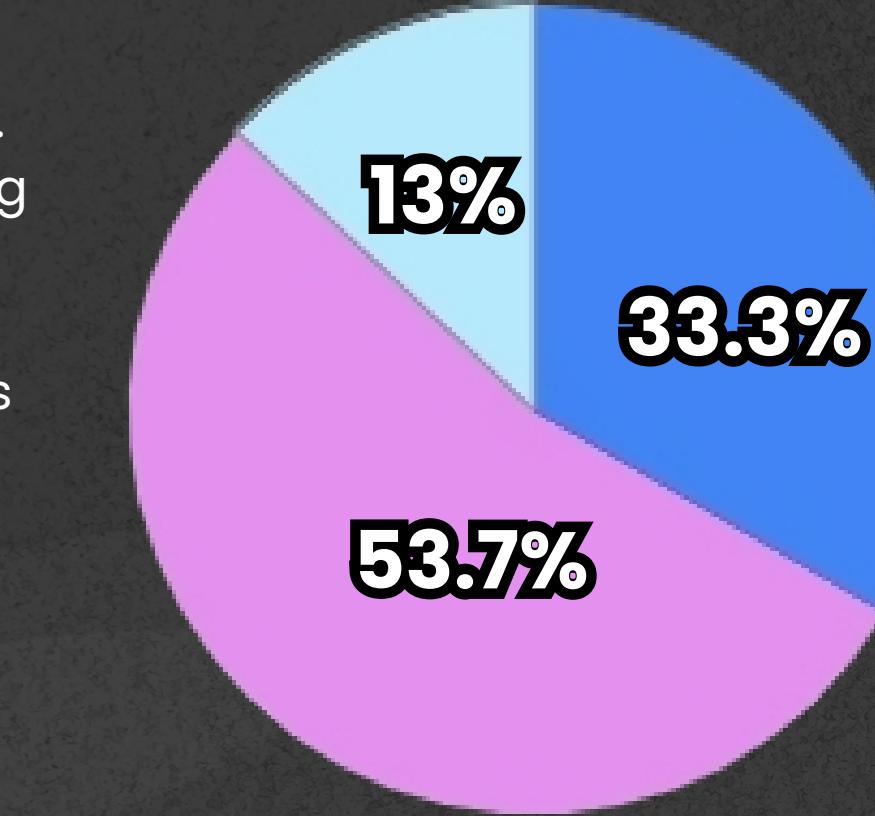
Never

Sometimes

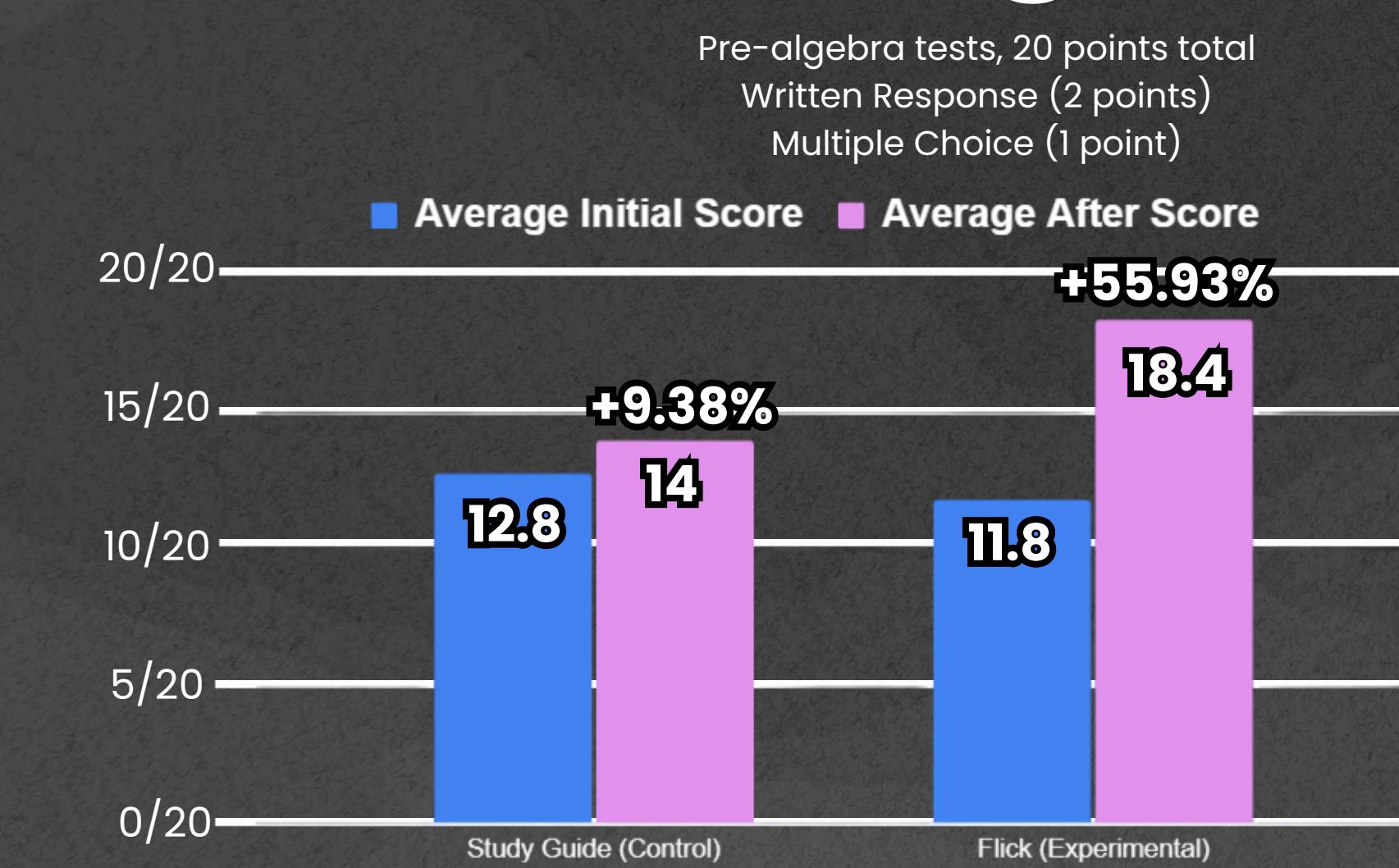
Often

Yes

No



Testing Data



We gave 10 pre-algebra students an initial test about a new topic with minimal background knowledge. Following this, five studied only using a learning guide, while five used Flick and a learning guide. On the post-study test, Flick users improved **46.55%** more than their counterparts.

Programming

```
Encode image to send to LLM
Feed message and image to LLM
Get response and end function

if prompt(message):
    with open("image.jpg", "rb") as imagefile:
        image = base64.b64encode(imagefile.read()).decode('utf-8')
        message = {"role": "user", "content": [
            {"type": "text", "text": userInput},
            {"type": "image_url", "image_url": {
                "url": "data:image/jpeg;base64," + image}
        ]}

        messages.append(message)
        completion = client.chat.completions.create(
            model="gpt-4o-min",
            messages=messages
        )
        reply = completion.choices[0].message.content
        messages.append({"role": "assistant", "content": reply})
        return reply
```

We used the OpenAI API to power our LLM. We tried many different models, but settled on 4o-mini due to it being the most balanced and cheapest.

Results

User testing has confirmed that Flick helped students learn, providing a personalized AI-powered tutor available anytime. It was able to effectively explain concepts, provide visual cues, and output precise feedback utilizing the camera. Students using Flick improved by 46.55% more than those who only used traditional methods.

Conclusion

Flick successfully meets all targeted user requirements by offering a durable, cost-effective, and engaging AI-powered learning experience. It such as improved ventilation for prolonged usage, an autofocus camera, external charging ports, and easy-to-use power switch

Future

We aim to integrate additional academic subjects to broaden Flick's capability beyond mathematics. Planned upgrades include expanded content interactivity, multilingual interaction, and continuous improvements driven by ongoing user testing and feedback.