

# Adapting K-12 AI Learning for Online Instruction

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**Abstract.** Due to classrooms moving online during COVID-19, educators are faced with the challenge of adapting in-classroom curricula for online instructions. This poses challenges and opportunities for AI learning given the project-based learning approaches of existing curricula. We taught a 5-hour synchronous online class about AI to 17 middle school students. In this paper, we discuss challenges in adapting to online learning and future opportunities. Our contribution is valuable to educators and curriculum designers that are adapting their AI curricula for synchronous online learning.

**Keywords:** K-12 AI Education, Online Learning, STEM Education, Middle School

## 1 Challenges of Adapting AI Learning to an Online Environment

Researchers and educators have been working to embed AI into K-12 curricula [1]. At the beginning of 2020, K-12 education was faced with the unique challenge of rapidly moving classrooms online. Now, researchers must explore AI in K-12 within the constraints of remote online learning.

We designed an introductory workshop for middle-school students to learn about AI as part of an afterschool STEM program. Due to COVID-19, we adapted our curriculum for remote synchronous online instruction. In accordance with the school's remote setup, we utilized Google Classrooms tools for instruction, activities and assignments. The four, one-hour learning modules covered the following topics: (1) definition of AI, (2) introduction to algorithms and algorithmic bias, (3) decision trees, and (4) image classifiers. The workshop involved unplugged activities that enabled students to understand complex AI concepts through abstract metaphors. Further, the workshop curriculum incorporated project-based learning techniques [2] and explored ethical design concepts [3]. Our instruction team, composed of educators, learning scientists, and AI researchers, encountered several unique challenges and opportunities. While these challenges and opportunities are relevant for all fields of learning, they are especially relevant for AI curricula due to the following reasons:

- **Unplugged activities:** AI curricula leverage unplugged activities which abstract out complex topics in AI into easy-to-understand activities [3, 4]. These activities utilize physical materials that aid students' understanding of concepts [5], which is difficult when students are not physically co-located.
- **Project-based learning:** AI curricula leverage project-based learning to help students apply theoretical to tangible artifacts in a peer group [6]. In an online environment, we found that students have different hardware and software set-ups. Furthermore, collaborating and debugging moves from intimate interactions to an interaction shared with the entire classroom.
- **Discussions:** Societal impact is one of the main pillars of AI education [1]. We observed that online learning made classroom conversations around societal impact more difficult. A few students did not have access to a microphone or video camera or did not feel comfortable speaking out loud, and teachers had a hard time keeping track of who wrote in the chat.

## 2 Recommendations for Synchronous Online AI Learning

- **Use familiar, interactive tools:** Use tools that students are familiar with instead of developing new tools to host the activities. In addition to messaging and conversation, make use of interactive web tools that allow direct manipulation. These tools are often lightweight and intuitive to use.
- **Technological accessibility:** In order to be inclusive, adapt lessons to allow for the lowest hardware and software dependency. Such as, encourage chat interaction for students without microphones, do not be dependent on having a webcam or sharing screen, try to use low data requiring tools, and finally, record lessons so they can be made accessible to students who cannot attend in real-time. It is also helpful to collect information about hardware availability before the class begins.
- **Encourage participation:** It is beneficial to design activities such that they provide every student a chance to participate. For large online classes, we suggest forming small sub-groups and branching out to different calls for group activities. This encourages conversation and collaboration.
- **Accommodate for pace diversity:** Students may have a different pace of completing their activities. For those who finished early, we made use of online games such as QuickDraw [7] or 20 Questions [8] that are fun and related to the AI concepts students were learning in class.
- **Witness activities real-time for debugging:** If your curriculum involves interactive web tools, having access to their work, such as through the back-end or screen sharing, can help with debugging.

In this workshop, we will discuss our recommendations for designing effective AI curricula for synchronous online learning through interactive activities where educators and researchers adapt existing AI learning modules for online learning.

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