# Lessons Learned From Teaching Artificial Intelligence to Middle School Students

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## ABSTRACT

The AI4GA project is developing a nine-week elective course called Living and Working with Artificial Intelligence and piloting it in several Georgia middle schools. Since we aspire to educate all students about AI, the course addresses a wide range of student abilities, levels of academic preparedness, and prior computing experience, and leaves room for teachers to adapt the material to their own students' needs and interests. The course content is primarily focused on unplugged activities and online demonstration programs. We also provide small programming projects using AI tools as an option for teachers to incorporate. In this poster we describe lessons learned from initial pilot offerings by five teachers who taught 12 sections of the course totaling 299 students. We present evidence that middle school students can successfully engage with substantive technical content about Artificial Intelligence.

## 1 PROJECT OVERVIEW

The AI4GA (Artificial Intelligence for Georgia) project is developing a nine-week AI elective for Georgia middle school students [1]. This poster presents lessons learned from piloting the couse with 299 middle school students taught by five teachers across four school districts. The curriculum aligns with AI4K12's Five Big Ideas in AI [5] and middle school grade band progressions [2].

## 2 MIDDLE SCHOOL LEARNERS

One of the biggest lessons we've learned from this project is that middle school students have a strong preference for activity and design-based learning over knowledge mastery and awareness-focused instruction in elective courses. Unlike core classes, students expect electives to be fun and entertaining. However, they are willing to examine serious topics such as societal impacts of self-driving cars, especially when given a menu to choose from. Post-COVID, all students have laptops or Chromebooks and are comfortable working on individual assignments and research projects; and they prefer working at their own pace. Surprisingly for a computing course, both teachers and students want time away from the computers.

## 3 TEACHING MIDDLE SCHOOL STUDENTS AI

We taught breadth-first search as an unplugged activity using a Georgia highway route-finding task solved by graph coloring. Students thought this was fun. We then transitioned them to solving the problem by constructing a search tree, thereby introducing tree terminology and paving the way for later investigations of state space search in game playing and puzzle solving.

Using online demos, we helped students appreciate the linguistic knowledge required for computers to understand speech. One activity had them probe the machine's understanding by testing disambiguation of spoken homophones. Another used Google to translate idioms between languages to see when meaning was preserved. Teachers reported that students enjoyed trying to "fool" the computer with challenging inputs.

Using browser-based programming environments, students created programming projects using a sentiment analysis extension in Cognimates, a Scratch-based programming environment [3]. Students also explored path planning and obstacle avoidance for a simulated robot using Calypso [4].

## 4 CONTRIBUTIONS

Our results show that middle school students can engage with substantive technical content such as breadth-first search or the complexities of natural language if these ideas are presented through fun activities they can work through on their own.

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