

The Cotton Gin and The Westward Expansion: AI Concepts in Middle School Social Studies

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The Cotton Gin and The Westward Expansion: AI Concepts in Middle School Social Studies

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Abstract

Through an NSF funded ITEST program, ImageSTEAM, a summer workshop was conducted in June 2023 with diverse middle school teachers. Specifically, we focused on introducing artificial intelligence (AI) concepts in the K-12 curriculum through computer vision and AI tools that will substantially augment science and technology teaching and Learning. We introduced visual media as a key bridge technology to engage students in middle school, especially in 7th-grade social studies with AI topics. After co-designing and developing the lesson module with the team, the teacher practiced "The Cotton Gin and The Westward Expansion" with students at the workshop. Based on the feedback, the teacher further improved the lesson module to present to her social studies class during Fall 2023. The results, including the experiences of the teacher as well as the impact on student learning through AI tools, were obtained through a student survey. The results demonstrated teacher satisfaction with AI integration in classroom instruction of social studies and increased student engagement in AI-based activities that fostered critical thinking and creativity.

Keywords

AI, Images, Middle School, Social Studies.

Introduction

AI and related technologies driven by engineering disrupt innovations in many industries by developing products and tools that help optimize time and efficiency. As such, this development requires educating students at multiple levels (K-12 and pre-engineering) and preparing the workforce for opportunities in the future. AI requires an integrative body of knowledge from computer science, mathematics, and data science to cognitive neuroscience and psychology, and thus lies outside the traditional disciplines taught at the K-12 levels. Teachers have little to no experience with AI, and it remains an open challenge to train teachers in these ideas. Recently, the AI4K12 organization (AI4K12) created a set of guidelines for teaching AI in public schools, and Zimmerman outlined lesson ideas for AI and design thinking and project-based Learning for STEM (Zimmerman 2018). Introductory AI books have been introduced at the middle and high school levels (Enz 2019a,b; Klepeis 2019b, a). There has also been a focus on teacher professional development through workshops incorporating AI concepts into STEM classes for high school students (Lee and Perret, 2022). Due to the importance and impact of AI in our lives, it is essential that any teaching of AI for grades 6-8 aligns with the NGSS (Next Generation Science Standards) and GA (Georgia) standards within the existing curriculum to be effective.

This NSF ITEST project is centered around AI topics, including computer vision, machine learning, and computational cameras, to facilitate the professional development of middle school teachers in these AI topics and develop lesson modules that can be developed and implemented in their curriculum for middle school students.

A summer workshop was conducted in the summer of 2023 at Barrow County Innovation campus in Winder, GA, by the project team to empower middle school teachers to integrate AI topics in the curriculum through an NSF-funded ITEST program titled *Image STEAM*. Teachers were introduced to AI topics for the summer workshop, including computer vision, machine learning, and computational cameras. The lesson modules were co-created with middle school teachers and then tested in a week-long workshop with students. The *Image STEAM* program focused on using visual media as a bridge technology between computer vision and AI concepts with core science/math topics that are standards-aligned. We briefly discuss project details, including lesson module development and evaluation of results below.

Project Details

The Cotton Gen AI project was inspired by the teacher's (Ms. Zonila Robinson) participation in a 2023 summer workshop to learn AI concepts. She developed a lesson module incorporating the tools learned in a 7th-grade social studies class. After co-designing and developing the lesson module with the team, the teacher practiced the lesson with students at the workshop. Based on the feedback, the teacher improved the lesson module to present to her class during Fall 2023. The details of the lesson module are briefly described below.

Lesson Module Design and Development

The lesson module titled "The Cotton Gin and the Westward Expansion" begins with an introduction to how the United States benefited from the invention of modern technology to help grow the economy in Georgia and gradually the other regions included in the movement of people to the west. Then, students were introduced to the cotton gin and how the solution was developed to further their understanding of its importance to the nation's economic growth.

The lesson module addresses the GA standard SS8H4 - Explain significant factors that affected westward expansion in Georgia between 1789 and 1840. The main topic of the lesson is: what does a cotton gin look like, and how was it used in different states/regions? This topic is addressed systematically by involving several AI tools (teachable machine and TinkerCAD) and an interactive game-based approach.

The students were shown an image at the onset of the lesson and asked to identify it. This activity was completed in the form of a game using www.flippity.net. The students were asked to click on the link, and the first one to guess what the picture is wins the game. After the students guessed that the image was a Cotton Gin, they answered a poll question: "What was the function of the Cotton Gin." If the students answered, "The Cotton Gin was used to extract the sticky seeds from the fibers," they would be correct. After all that fun stuff, they watched a short video on "How inventions (such as the Cotton Gin) changed history."

The advantages and disadvantages of the Cotton Gin and how it revolutionized the economy in Georgia and the rest of the country were then briefly discussed along with how it made the enslaved people's lives easier after its invention. The concept of Manifest Destiny was introduced next, and the students were asked to play another game of "naming the states/regions" as fast as possible. After this brief discussion and scaffolding, the teacher introduced two AI tools (Teachable Machine (www.teachablemachine.com) and TinkerCad (www.tinkercad.com)) to students. After that, teacher explained how these tools can be used to enhance the learning process related to the Westward Expansion. A teachable machine (AI tool) was used to identify different regions per the slides' instructions and sorted by colors. The machines were trained to identify specific regions with 100% accuracy. The students found this activity to be exciting and engaging.

After students were trained to use the machine, they were introduced to TinkerCad and its capabilities. The students used this AI tool to create the states involved in the westward expansion movement. The students created the states on the plane material per the instructions. After a few trials of practice, the students completed their tasks and were proud of their creations.

Resources

The lesson module incorporates various resources and activities to enhance student engagement, including www.flippity.net, content discussing the impact of inventions on history, a Manifest Destiny rap, and a word wall resource dedicated to westward expansion.

Instructional tools such as *Teachable machine* and *TinkerCAD* enabled students to interact with AI technologies, allowing them to train machines and construct 3D representations of states.

Evaluation and Assessment

The lesson module's evaluation encompassed post-activity surveys completed by 16 students (5M and 11F). The following is a summary of the survey results.

- Most students (81.25%) reported learning about AI concepts as part of their social studies curriculum this year, while a smaller portion (18.75%) indicated they had not received such instruction.
- Most students found the clarity of AI concepts explained in their social studies lessons fairly clear, with 43.75% rating it as a 4 and 37.5% rating it as a 5 (very clear). A smaller percentage of students (18.75%) rated 3, suggesting room for improvement.
- Most students, 81.25%, believed that learning about AI in social studies has improved their understanding of historical events, social issues, or global perspectives. A smaller portion (18.75%) did not think it had such an impact.
- Most of the students (68.75%) found their AI-related social studies lessons engaging, with 43.75% rating them as a 4 and 25% rating them as a 5, the highest level of engagement.

- Most students (75%) reported that their Social Studies teacher explained how AI is used in the real world, especially in social and historical contexts. A smaller portion (25%) indicated that their lessons did not cover this.
- Most students (75%) reported that learning about AI in social studies has sparked their interest in AI or related fields. Some students also expressed a desire to explore potential career interests and societal benefits of AI (percentage?).
- In summary, the survey results indicate that most of the 7th graders who were introduced to AI concepts in their social studies class found the integration helpful and improved their understanding of concepts.

Concluding Remarks

In conclusion, integrating AI tools in the curriculum enhances the teaching and Learning experience, and fosters students' critical thinking, and creativity. The incorporation of AI concepts in social studies education has the potential to revolutionize traditional teaching methods. Teacher's satisfaction with using tools such as the Teachable Machine and TinkerCAD underscores the effectiveness of AI integration in education. Overall, the two AI tools used in this lesson allowed students to engage in completing hands-on activities and further enhanced their learning and understanding of social studies concepts.

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John Mativo holds doctorate degrees in Mechanical Engineering, and in Technical Education. He is Professor at the University of Georgia in both colleges of Engineering and Education. His research interests are in best practices in teaching and learning (K-16), workforce development, and energy harvesting. John teaching include Engineering Science (Dynamics), and Workforce development (Education). He is faculty advisor of the University of Georgia Motorsports. John international engagement has resulted in developing and Mechanical Engineering curriculum for International University of Grand Bassan in Cote d'Ivoire, and a robotics education curriculum at Mwenge Catholic University in Tanzania. John has been ASEE member and served in various capacities for over 20 years.

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