AI Planning is Elementary: Introducing Young Learners to Automated Problem Solving

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ABSTRACT

Recent years have seen growing awareness of the need to advance AI literacy for K-12 students to empower them in understanding, evaluating, and using AI. Automated problem solving is a fundamental aspect of AI, enabling machines to mimic human problem-solving abilities. Fostering awareness and interest in AI capabilities such as automated problem solving should begin early, including in the elementary grades. Although AI planning can be a complex topic, leveraging the benefits of game-based learning offers a promising approach to engage young children in learning about this important AI concept. In this work, we explore the interactions and outcomes of upper elementary students (ages 8 to 11) playing a quest on AI planning embedded within a game-based learning environment. Results indicate that students experienced positive learning gains from pre-test to post-test, while analyzing trace data from the game provides insights into challenges students faced as they attempted the in-game missions.

1 OVERVIEW

Efforts are underway to foster K-12 AI education [1]. PrimaryAI is a game-based learning environment that engages upper elementary students in learning AI concepts through story-driven problem solving. In this virtual world, students undertake an investigative journey to unravel the mystery behind a dwindling penguin population as they encounter a series of quests centered on AI. One of the quests asks students to formulate AI planning tasks using a block-based visual interface [2] to automate the collection of data about the local penguin population using an in-game robotic penguin (Figure 1). The five missions of the quest are organized around a Use-Modify-Create scaffolding progression. A pilot study examining the effectiveness of the game was conducted using an assessment with 11 multiple-choice questions on AI planning. The items were designed to assess how well students could apply what they learned in the game.

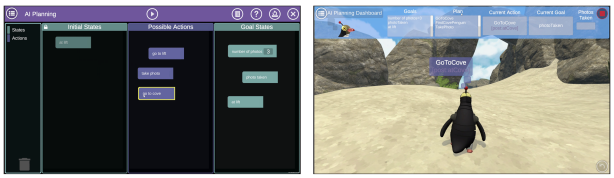

Figure 1: In-game planning interface and robotic penguin.

2 FINDINGS AND CONCLUSION

Data from 12 students who participated in the pilot was examined. Overall, students demonstrated positive learning gains as measured by the difference between their post-test (M = 5.90, SD = 1.68) and pre-test (M = 3.18, SD = 1.79) scores, while a matched pair t-test indicated the differences were significant, $t(11) = 3.60$, $p < .01$, and a Cohen's d value of 1.56 indicated a large effect size.

Engaging young children in learning AI concepts through game-based learning shows considerable promise. Our findings suggest that PrimaryAI's planning quest offers students an engaging and effective learning experience. This poster will provide details on the design of PrimaryAI as well as insights from analyzing game trace data that highlight critical junctures where students appear to need additional support and interaction refinements are warranted.

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