

Designing a Collaborative Game-Based Learning Environment for AI-Infused Inquiry Learning in Elementary School Classrooms

Seung Lee¹, Bradford Mott¹, Anne Ottenbreit-Leftwich², Adam Scribner², Sandra Taylor¹, Krista Glazewski², Cindy E. Hmelo-Silver², and James Lester¹

¹North Carolina State University, Raleigh, North Carolina
{sylee, bwmott, smtayl23, lester}@ncsu.edu

²Indiana University, Bloomington, Indiana
{aleftwic, jascrib, glaze, chmeliosi}@indiana.edu

ABSTRACT

Recent years have seen growing recognition of the importance of enabling K-12 students to learn computer science. Meanwhile, artificial intelligence has emerged as a technology with the potential to profoundly reshape society. This has generated increasing demand for fostering an AI-literate populace. However, there is little work exploring how to introduce K-12 students to AI and how to support K-12 teachers in integrating AI into their classrooms. In this work, we explore introducing AI learning experiences into upper elementary classrooms (student ages 8 to 11). With a focus on integrating AI and life science, we present initial work on a collaborative game-based learning environment that features rich problem-based learning scenarios. This will enable students to gain experience with AI as it applies to solving real-world life-science problems.

KEYWORDS

Artificial Intelligence; K-12 education

1 INTRODUCTION

Inquiry-based learning approaches for computer science (CS) education have yielded encouraging results that demonstrate improved student engagement, student achievement, and student attitudes towards CS [2]. Similarly, game-based learning approaches that motivate students with compelling virtual worlds can be used to create engaging CS and AI learning experiences in K-12 classrooms [4]. Efforts are beginning to explore how to incorporate AI more intentionally at the K-12 levels [3]. Because problem-based learning [1] and game-based learning both have the potential to support student engagement and achievement, we propose that integrating these instructional approaches could offer significant potential for promoting AI education at the upper elementary school level.

2 OVERVIEW

Recognizing the need to provide all students with AI learning opportunities, we are creating PRIMARYAI, a collaborative game-

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the Owner/Author.

ITiCSE '20, June 15–19, 2020, Trondheim, Norway

©2020 Copyright is held by the owner/author(s).

ACM ISBN 978-1-4503-6874-2/20/06.

<https://doi.org/10.1145/3341525.3393981>

based learning environment. In PRIMARYAI, students learn by engaging in problem solving with AI tools designed specifically to support inquiry-based life-science adventures (Figure 1). PRIMARYAI integrates AI-infused block-based programming to teach a range of AI methods including image recognition, machine learning, planning, and automated decision making.

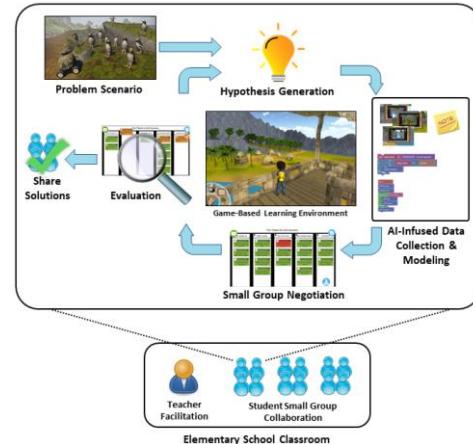


Figure 1: AI-Infused Collaborative Game-Based Learning

3 CONCLUSION

Integrating game-based learning and problem-based learning, offers significant promise for creating AI-infused learning experiences. This poster presents the theoretical framing of our work, insights from teacher interviews, and design of PRIMARYAI.

ACKNOWLEDGMENTS

This research was supported by National Science Foundation (NSF) Grants DRL-1934128 and DRL-1934153. Any opinions, findings, and conclusions expressed in this material are those of the authors and do not necessarily reflect the views of the NSF.

REFERENCES

- [1] C. E. Hmelo-Silver, M. Kapur, and M. Hamstra, 2018. Learning through problem solving. In F. Fischer, C. E. Hmelo-Silver, S. R. Goldman, & P. Reimann (Eds). *International Handbook of the Learning Sciences*. 210–220.
- [2] B. Hoffman, J. Rosato, and R. Morelli, 2019. Student engagement is key to broadening participation in CS. In *Proceedings of the 50th ACM Technical Symposium on Computer Science Education*. ACM Press, 1123–1129.
- [3] D. S. Touretzky, C. Gardner-McCune, F. L. Martin, and D. Seehorn, 2019. Envisioning AI for K-12: What should every child know about AI?. In *Proceedings of the Thirty-Third AAAI Conference on Artificial Intelligence*. AAAI Press, 9795–9799.
- [4] N. Wang and M. Johnson, 2019. AI education for K-12: Connecting AI concepts to high school math curriculum. In *Proceedings of the Workshop on Education in Artificial Intelligence K-12 held in conjunction with IJCAI-2019*.