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Methods of STEM Education- Elementary
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Nature of Science & Math: Analyzing the Presence in Everyday Communication

I chose to read an article titled, Artificial Intelligence Learns Teamwork in a Deadly Game of Capture the Flag (Gent, 2019). This article discussed the use of artificial intelligence (AI) and how scientists and developers are studying how to have AI work in teams and collaborate with each other and humans. Their studies have been primarily completed through the use of the video game, *Quake III Arena*. From these studies, scientists have discovered that AI bots learned to play with both other bots and humans collaboratively and even invented new strategies in the game. This discovery led to other possibilities for collaboration with bots and humans.

When thinking about the Nature of Science and Mathematical Practice categories, I feel that this article was able to encompass the following:

Scientific Investigations Use a Variety of Methods

This article introduced the study on AI bots by wanting to know how AI would work when confronted with teamwork. How would AI bots behave when being required to collaborate with others? This question supports this category and its description which states that, "Science methods are determined by questions" (Next Generation Science Standards [NGSS], 2013, p. 5). Without scientists questioning how AI behaves in a collaborative state, this study and their technique of using the *Quake III Arena* video game to test their findings would never have occurred.

Scientific Knowledge is Based on Empirical Evidence

The scientists that performed the study in this article needed to recognize any patterns that might have arisen when the AI bots were playing the video game. There were 30 bots in this study who used "neural networks" to learn what to do in order to win the game (Gent, 2019, para. 5). From there, these bots created patterns through reinforcement learning. These patterns were observed and recorded and tested out again using different types of AI bots as well as humans. Using these AI bots, their patterns and observations, scientists were able to discover that AI can, in fact, be created to be in a collaborative state.

Scientific Knowledge is Open to Revision in Light of New Evidence

        The NOS Matrix states that "Science explanations can change based on new evidence." (NGSS, 2013, p. 5).   This article supports this statement based on the new information and data the scientists received from the video game study. Before the study, we had an understanding that AI can work effortlessly when independent as evidenced by them being able to drive cars and perform surgeries. Scientists did not want to stop there, they pressed on and found new evidence supporting that AI can work together as well as with humans. This changes the previous scientific explanations and data that was understood about AI bots and encourages the scientists to question, if AI bots can work together to defeat a video game, what else can these bots do?

CCSS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.

        Students who are proficient in this practice tend to identify real world problems and work through different solutions to solve those problems. They usually plan out a way for the solution to work rather than going straight into attempting the solution and will re-evaluate if needed (Common Core State Standards Initiative, 2019). Just like these students, the scientists in this study identified a problem, AI being a teammate, not just working independently to help others.   Yes, AI can drive cars and compete in games against humans but what about other avenues? From there, scientists developed an experiment that could possibly aid in finding a solution for their initial question. The tested out their theory with an initial set of 30 bots and consistently went back and changed the bot to make it more efficient. Because of these scientists persevering throughout the many different bots and test runs, they were able to identify that AI can be a team player with other AI devices and humans.

CCSS.MATH.PRACTICE.MP6 Attend to precision.

        AI is a very delicate concept to study and experiment with. When trying to train these AI bots, the scientists in the article only gave the bots a first person perspective as well as the game points. This data was communicated clearly to the AI bots and was both simple and precise. This allowed the scientists to see what exactly the bots did with the information. The result…..teams of FTW (For the Win) bots consistently did better than all the other groups combined (Gent, 2019)

CCSS.MATH.PRACTICE.MP8 Look for and express regularity in repeated reasoning.

        This mathematical practice states that students should notice that their calculations are being repeated and use that to look for a general method (Common Core State Standards Initiative, 2019).   Just like this practice, the scientists in the AI study did the same thing when the bots were engaged in the video game. They noticed that every bot acted randomly until they started scored points. These bots

were then able to connect what they did to the scoring of points and repeated their behavior to continue scoring points. This was completed various times with different mutated AI bots in order to come to a general method as to what the bot could do.

Citations

Gent, E. (2019, May 30). Artificial intelligence learns teamwork in a deadly game of capture the flag. *Science*. Retrieved June 5, 2019, from https://www.sciencemag.org/news/2019/05/artificial-intelligence-learns-teamwork-deadly-game-capture-flag

APPENDIX H – Understanding the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards. (2013). *Next Generation Science Standards,* 1-10. Retrieved June 4, 2019, from https://www.nextgenscience.org/sites/default/files/Appendix H - The Nature of Science in the Next Generation Science Standards 4.15.13.pdf.

Standards for Mathematical Practice. (2019). *Common Core State Standards Initiative.* Retrieved June 4, 2019, from http://www.corestandards.org/Math/Practice/