

Workshop/Training: Computational Thinking Across the Curriculum: Agent-Based Modeling

Instructor: Dr. Robert Panoff

Moderator/Organizer: Aaron Weeden

Dates: October 6 and October 13, 2021

On the October 6 and 13, 2021, Shodor Education Foundation conducted workshop/training focused on computational thinking and agent-based modeling. The workshop outlined traditional ways of computational thinking and introduced new ways that combine the use of agent-based modeling. The goal was to show how the inclusion of these new methods into your classroom could improve the student's interest in computer programming and motivate them to learn computer programming. Also, the workshop/training wanted to show how simple tools like Microsoft Excel can be used to simulate real-world applications and logic.

Throughout Day 1, we were presented to agent-based models examples that were very relatable. We were shown how to implement, use, and demonstrate the models in already created environments that could assist in your classroom instruction. Day 2 focused on building new environments that used agent-based modeling. The new environments were created based on situations that simulated real-world activities. These real-world situations help students relate to the programmed simulation.

In agent-based modeling, an instructor can use the individual components of the models to teach computer programming concepts. The students learn to use and modify the models. By using and making modifications, the student can see how the changes affect the behavior, outcome, or output of the program. An instructor could identify the fundamental programming concepts and show what they represent and why they are needed.

Dr. Panoff made some interesting points on how computation thinking is viewed and discussed in the classroom. One particular thing that stood out to me was an equation that stated: $\text{Right Answer} = \text{Wrong Answer} + \text{Corrections}$. I thought it fit perfectly with a freshman learning computer programming. I focus too much on making sure they can provide the "right answer" until I never thought about allowing them to provide an answer for which I provide them with feedback and they are allowed to make the corrections if necessary. Through the use of agent-based modeling we can simulate real-world applications/models. As the students interact and understand what these models represent, we can show and teach fundamental programming concepts essential to learning computer programming.

This approach could provide more interest and motivation toward computer programming because the students are not initially writing their own code but rather understanding how already written code works and how to make modifications that changes the program's behavior. For my computer programming I course, I plan on creating a model that features I/O operations, conditions, looping, functions, and objects that simulate actions and behaviors the student can relate to. As they are shown how to make modifications to model to change the actions or

behaviors, they will also be provided lectures, activities, and discussions on understanding the core computer programming concepts.

Dr. Robert Panoff and Aaron Weeden provided their contact information and offered additional assistance and resources at the Shodor Education Foundation. I plan on reaching out to them for assistance in selecting or creating an agent-based model that will fit my computer programming I course. Dr. Panoff had a different perspective as to how we should introduce students to computer programming and I interested in seeing the results if I incorporate the concepts into my course.

My HPC efforts are currently incomplete. I plan on introducing the concepts the spring semester for Data Structures. The students should have a pretty good foundation in computer programming where I can introduce methods on processing and utilizing large datasets. Datasets so large that computer programming has to use HPC. Most of the tools used during the workshop involved using Python, so I also looking for an equivalence in C++. I have a final project that will utilize HPC, but I have to create some smaller project/assignments to help the student build up to the final project.