1. **Learning Objectives:**
   In this unit, students will create a simple but complete version of Pac-Man game while expanding knowledge of the AgentSheets software program. Students will apply basic and advanced design process to identify objects “agents” and interactions “operations”. Throughout this unit, students will be introduced to computational thinking patterns and skills, including basic object interaction, creating object instances, rule based programming, and message sending. Over the course of the unit, the difficulty of the game with ghosts with random movement will be contrasted to the difficulty of the game with ghosts with artificial intelligence.

   In this lesson, students will be creating the game board (wall and pellet agents) and ghost agents.

2. **Standards:**
   ISTE (International Society for Technology in Education) NETS (National Educational Technology Standards)
   - #1a apply existing knowledge to generate new products
   - #4b plan and manage activities to develop a solution or complete a project.
   - #4d use multiple processes and diverse perspectives to explore alternative solutions.
   - #6c troubleshoot systems and applications.

   ISTE NETS are referred to by CDE Performance Standards for Teachers #7- Technology, which states, “The teacher will have demonstrated the ability to instruct students in basic technology skills. He/She will: … instruct students in basic technology skills by imbedding them in their standards-based, content instruction (7.5.3)”

   Please check with your district’s technology department to see if there are additional standards at the district or school level.

3. **Anticipatory Set / Modeling: 5 minutes**
   Student work showcase: Select one of the student’s worksheets from the last lesson and project it on an overhead screen. Ask student to demonstrate what can be done so far on her/his worksheet (Pac-Man can move in all 4 directions and depiction changes to match the direction). Compare this to a completed version of Pac-Man so students can see where they are headed. Inform students that today they will be creating the game board (background, wall and pellet agents) and ghost agents.
4. **Teaching: 5 minutes**

   **Input** – Overview of project and AgentSheets
   
   Review components of AgentSheets:
   - Gallery - where agents are
   - Worksheet – where game is created
   - Behavior – how to tell each agent what to do

   And computational thinking patterns in Pac-Man:
   - **Collision**: Pac-Man collides with ghosts.
   - Artificial Intelligence using **Collaborative Diffusion**
   - the **Hill Climbing** algorithm

   Remind students about the nouns (the agents) and the verbs (the operations) of Pac-Man. Today we will be creating the next most prominent nouns – the walls, pellets and ghosts.

5. **Guided Practice / Monitoring: 25 minutes**

   Demonstrate how to open AgentSheets program and have students open saved versions of Pac-Man from last lesson. Check for understanding.

   Remind students how to create a new agent and have students make a wall and pellet agents.
   
   **Create_Pellets_and_Ghost_agents**
   
   Remind students that agents can be edited at any time, so they should not spend a lot of time on the art work right now.

   Have students create a maze by placing walls on worksheet using pencil tool and then adding pellets in-between the walls.
   
   **Place_new_agents_on_worksheet_to_create_complete_Level**
   
   Check for understanding.

   Students should save the worksheet periodically
   
   **IMPORTANT: Saving the Worksheet**

   Ask students to run their games. Highlight that Pac-Man no longer moves. Ask students why they think this is the case.
   
   **Play_Test: Testing_Level_with_Pellets**

   We have to program the Pac-Man agent to recognize the pellets and know what to do with them. We want Pac-Man to gobble up the pellets and not go over or through the walls. Demonstrate for students how to program Pac-Man to “eat” the pellets, complete with munching sound.
   
   **Pac-Man_moves_on_and_eats_Pellets**
Note: When making similar rules, it is best to make one rule and copy it using the duplicate feature of AgentSheets. Students can make a rule for one direction (up, down, right or left) and then duplicate this rule for the other directions making four rules total. Check for understanding.

Remind students to play test their games
**Play_Test: Pacman-moving_and_eating_Pellets**

Demonstrate how to import image of a ghost agent
**How_to_import_images_from_other_places**
Importing depictions can help cut down on some of the time required to create new agents from scratch.

We will program ghosts with random movement first, and we must slow down the ghost movements to give Pac-Man a chance to escape.
**Randomly_moving_Ghosts**

Students should save the worksheet periodically and check with the reset button to verify that it worked:
**IMPORTANT: Saving the Worksheet**
and play test their games:
**Play_Test: ghosts_moving**

### 6. Closure: 5 minutes

Restate the scope of the project.
Students will likely notice that the game has a major glitch – nothing happens to Pac-Man when he meets a ghost. Tomorrow we will fix this -- Pac-Man meets his match and gets deflated. We will be programming the collision of Pac-Man and the ghosts.

### 7. Extension/Remediation – students can edit the depictions of agents at any time.

Encourage students to spend a short time on the initial creation and edit later as desired.