**Lesson Title: Exploring Outcomes of Logic Gates through Minecraft**

**Materials:**

Teacher's computer with projector

Logic Gates Presentation

Worksheet for Logic Circuits

Computer with MinecraftEdu installed

**Lesson Details:**

Students will learn about the different kinds of logic gates before turning to Minecraft to document the outcomes of each type of circuit. At the beginning of class the teacher will explain to the class how they will be using Minecraft for the planned lesson. Students will be divided into teams of two or three, with the hope that one student in each group will be in some way familiar with the game. A small period of time will still be given tot he groups to figure out the controls after a demonstration on Minecraft is presented by the teacher. Since the game will be running on a private server, each group will be able to begin building structures, unto which the teacher has enforced a 27x27 block area for the group. Hopefully after a period of 10-15 in-game minutes, the teacher will then give the class a basic introduction to logic gates as well as a demonstration on how to follow the input through these gates. The teacher will then construct the first circuit in Minecraft as an example, before setting each group off to construct the rest of the circuits and document the input and output values of each gate. A handout will be given showing the different circuits to construct, as well as space for students to record the outcomes. Students will be designated a space on the server, thus the teacher can later access each groups circuit recreations.

**Content Area:** Computer Science

**Grade Level:** 9-10

**UBD Stage I: Identify Desired Results**

**Standards:**

**CT.L2-01:** Use the basic steps in algorithmic problem-solving to design solutions (e.g., problem statement and exploration, examination of sample instances, design, implementing a solution, testing, evaluation).

**CT.L2-06:** Describe and analyze a sequence of instructions being followed (e.g., describe a

character’s behavior in a video game as driven by rules and algorithms).

**CT.L2-07:** Represent data in a variety of ways including text, sounds, pictures, and numbers.

**CT.L2-08:** Use visual representations of problem states, structures, and data (e.g., graphs, charts, network diagrams, flowcharts).

**CL.L2-03:** Collaborate with peers, experts, and others using collaborative practices such as pair programming, working in project teams, and participating in group active learning activities.

**CD.L3A-04:** Compare various forms of input and output.

**Learning Objectives:**

Plan and create a functioning circuit by attaching logic gates together (Assessment 1)

Use the created gates to identify and record the correct input and output values for each circuit (Assessment 2)

Discuss the lesson at the end of class, compare results of gates and what difficulties they may have run into (Assessment 3)

**Essential Questions:**

How do gates affect input data?

How does Minecraft implement logic gates?

What is the purpose of learning about logic gates?

**UBD Stage II: Determine Acceptable Evidence Assessments:**

Students will be informally assessed of their ability to recreate circuit boards in Minecraft. Students will be informally assessed of their ability to work in groups and discuss the outcomes of the logic gates as well as their participation in the group work. At the end of the lesson, students will participate in a class discussion about the gates to further their understanding of the gate properties. Students will be formally assessed of their understanding of logic gates through turning in the worksheet with their collective data. Students will be formally assessed of their ability to recreate the circuit boards in Minecraft from the worksheet.

**Rubric/Scoring Criteria:**

Completion of Worksheet / 2

Every member of Group Participated / 2

Group Didn't Deviate from the Task at Hand in Minecraft / 2

Correct Values/ Greater Understanding of Logic Gates / 8

Correct Recreation of Circuit Boards in Minecraft / 6

Total / 20

**UBD Stage III: Plan Learning Experiences and Instruction Procedures and Content:**

**Introduction to Minecraft:**

**T:** Introduce Minecraft as a building tool, show basic mechanics of the game as well as explain the restrictions of our special MinecraftEdu server.

**S:** Break into groups and have a discussion about the basics of Minecraft. Experience the mechanics of the game, as well as explore the server and get a feel for the controls.

**Introduction to Logic Gates:**

**T:** Disconnect the students from the server and direct attention to the front of the classroom. Present an overview of logic gates, and the idea behind them. This entails:

-A review of the binary system, where there are two states (1, 0) which are interpreted as True or False respectively.

-An explanation of what a logic gate does:

-Logic Gates take one or two input values (1 or 0) and output a value (1 or 0)

**T:** Introduce three kinds of gates (AND, OR and NOT), introduce the class into a discussion about these types of gates.

**S:** Participate in a discussion about what they believe each type of gate (AND, OR and NOT) will do.

**T:** Show the class in diagram form how each gate effects the input value.

**Introduction to circuitry:**

**T/S:** Show an example of a circuit on the projector and with student participation, follow the input value through the gates into the output.

**T/S:** After a few examples, show on projector how to create a logic gate through Minecraft. After asking for questions, tell each group that they will be constructing an AND, OR and NOT gate on the Minecraft server, after each group has successfully created each type of gate, they will raise their hands to receive a worksheet with different circuits to build. They will then document what they believe will be the outcome of the circuit, and then document what the actual output is from the game.

Building Circuits:

**T/S:** As students look at the circuits on the worksheet they will first predict what the output will be before constructing them in game. Students will raise their hand for questions, as the teacher is in a “roam” mode, going around the classroom to informally assess the groups and help students that need further instruction.

**Discussing Results:**

**T:** Near the end of class, students will be once again disconnected from the server in order to participate in an encompassing discussion about logic gates. The teacher will ask questions about the AND, OR and NOT gates in order to drive the topic home. This discussion will also touch on the uses for gates in programming. The teacher will ask the students what kinds of technology implement logic gates.

**S:** Students will raise their hands to answer the teacher's questions and demonstrate their greater understanding of logic gates.

**T:** The teacher will ask what highlights and problems the groups had and facilitate a classroom discussion about MinecraftEdu. The teacher will need to assess if further time is needed for next class, or make the decision to assign whatever was unfinished on the worksheet as homework as Minecraft is not needed in order to get the correct outputs.

**T:** Pass out the homework assignment that is more or less an introduction to the next topic of advanced gates (NAND, NOR, XOR and XNOR). Assignment is to be worked on outside of class and completed for the next class period.

**Adaptations:**

Students with Learning Disabilities:

Ensure that the student is able to access Minecraft or make sure that they are in a group that can give them extra help. Perhaps if the student couldn’t use a computer, they could use a version of Minecraft on a tablet or phone.

**Homework:**

The homework will have more examples of circuitry containing (AND, OR and NOT) gates, as well as information about the advanced gates (NAND, NOR, XOR and XNOR). Since these build upon the gates already established, the teacher should feel confident assigning this work for outside of the classroom.