

Building with Rules (Smart Systems)

40 minutes

Hands-On Logic Challenges

WHAT THIS LESSON DOES

In this lesson, you'll explore the world of smart systems by designing your own. Start with understanding rules in everyday systems, learn conditional structures, and create a smart system with logical rules in a group activity.

WHAT STUDENTS SHOULD BE ABLE TO DO

- Understand the concept of rule-based systems and their application in everyday scenarios.
- Identify and articulate conditional logic using IF-THEN structures.
- Apply logical operators like AND and OR to create complex conditional rules.
- Design a smart system by developing a set of specific, non-conflicting rules.
- Recognise the connection between rule-based design and real-world programming concepts.

BEFORE THE LESSON

- This is an unplugged lesson: no devices needed. Have a whiteboard or board space to write the IF-THEN and AND/OR structures where all can see.
- Prepare a stack of index cards, enough for at least five per group.
- Have the class Smart Locker example rules ready to write up, and one or two probing questions in mind to test them.

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HOW THE LESSON RUNS

Introduction

Rules Are Everywhere

The Basic Structure of Conditionals

Smart Systems

Designing a Smart Locker

Group Challenge: Design Your Own Smart System

Presenting Your Smart Systems

Connect to Real-World Code

TEACHING MOVES

- 2. Rules Are Everywhere. Draw out a game or machine pupils know, then reframe its rules aloud as an IF-THEN statement so they hear the structure before you name it.
- 3. The Basic Structure of Conditionals. Write both IF-THEN and IF-THEN-ELSE on the board. For AND and OR, test each with a quick example: with AND both parts must be true, with OR just one.
- 5. Designing a Smart Locker. Build the locker rules with the class, then deliberately break one: 'What if the code is right but the door is jammed?' Let them see rules can conflict or miss cases.
- 6. Group Challenge: Design Your Own Smart System. Set the five-rule minimum, one rule per card. Circulate and push groups to use AND or OR in at least one rule rather than five plain IF-THEN statements.
- 7. Presenting Your Smart Systems. As each group reads their cards, ask one why: 'Why AND here?' or 'What problem does this rule solve?' Keep the focus on their reasoning, not the machine idea.
- 8. Connect to Real-World Code. Name the link plainly: an app or game is thousands of rules like theirs. Point back to a card a group wrote as proof.

WHAT TO WATCH FOR

- Pupils use AND when they mean OR, expecting a rule to fire if either condition is true. Test their rule aloud with a case where only one part is true. Ask: should the machine act now? If yes, the rule needs OR.
- Pupils write rules that conflict or leave gaps, assuming the machine will 'know' what to do in an unhandled case. Feed them an awkward situation their rules do not cover. Show that a machine only does what a rule tells it, so a missing rule means nothing happens.

DIFFERENTIATION

- Emerging: Give a half-written card, IF [...] THEN [...], and let them fill only the blanks. Start them with a single plain IF-THEN rule before asking for AND or OR.
- Developing: Ask them to add an ELSE to one of their existing rules so it handles two outcomes. Have them read one rule back to you and say when it would fire.
- Proficient: Challenge them to find a case their five rules do not handle and write a sixth rule to cover it. Ask them to combine two conditions with AND or OR in a way the class locker did not use.