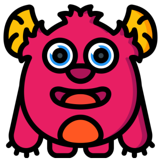

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Mystery Monster-Making Machine Project Guide

A Fast-paced, No-Tech Computer Science Game on Input and Output

Grades: 3-5, 6-8 (see below for k-2)

Time: 60-90 minutes

Objective: Students will understand the concepts of how a computer works with respect to input, processing, and output through a collaborative and creative exercise that mimics the process of programming and executing code in a fun, tangible way. It is somewhat like the game of "telephone" with three teams of two. Team 1 (Input Team) devises a monster and shares its description and materials needed with Team 2 (Processing Team), which then drafts a detailed monster sketch based on the input information received. This sketch (along with the materials needed) is passed to Team 3 (Output Team), which creates a model of the monster. The model's fidelity to the original concept is evaluated, offering insights into programming and execution processes in an engaging manner.

In applying this lesson to different grades, consider the cognitive and developmental stages of the students and their pre-existing knowledge of computer science. For younger students, the focus might be more on play-based creativity and the basic concept of input/output, while older students can delve deeper into the computational thinking and problem-solving aspects that mirror real-world programming and design challenges. A k-2 or pre-literate adaptable may include two teams (input and output) and a verbal description rather than written.

Materials Needed:

- 3DuxDesign GOBOX Classroom or PRO kit
- Color markers for each team of 2
- Timer
- Paper and pens/pencils for each team of 2

Overview

- Introduction (5 mins)
- Setup (5-10 mins)
- Input task (10 mins)
- Processing task (5-8 mins)
- Output task (5-8 mins)
- Discussion and reflections (10-15 mins)
- Optional: Student presentations

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Lesson Plan
Duration: 45-90 minutes
Introduction (5 minutes)

- Briefly explain the concepts of input, processing, and output in computer science: Input is the information or data sent to a system, and processing interprets the data in a way that can be used by the computer. Output is the information that comes out of a system after processing the input.
- Introduce the game "Mystery Monster-Making Machine" as a way to explore these concepts without using technology.

Initial setup: This should include one table for every group of 6 students. Each table should have the following materials:

1. an assortment of connectors including at least 12 obtuse angles.
2. 9-12 5 x10" cardboard pieces, 6 5x5" squares, and at least 50 assorted small shapes (these can include the internal pieces of some of the 5x5" squares)
3. Assorted markers with 3 of each color per table
4. Paper and pencils
5. Optional rulers

Proposed project script and flow

***** Feel free to use the pre-recorded YouTube version of the PPTX to guide the lesson: https://youtu.be/Rj7c_ofQHfw?si=nj0NfB5nROdlYQPh**

Teacher: "Hey there, brilliant inventors! 🌈 Today, I'm thrilled to introduce you to a fascinating project we're about to start - it's called the 'Mystery Monster-Making Machine' adventure! 🎉👾. And yes, you will be making monsters today, lots of them!"

[May share an example of a monster.]

Teacher: "Picture this: a machine of your own creation, not powered by batteries or electricity, but by something much more special - your very own ideas and teamwork! But this isn't just any machine; it's one that will function just like a computer, with the job of making monsters! 🤖💭"

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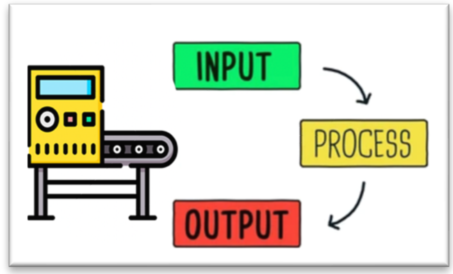
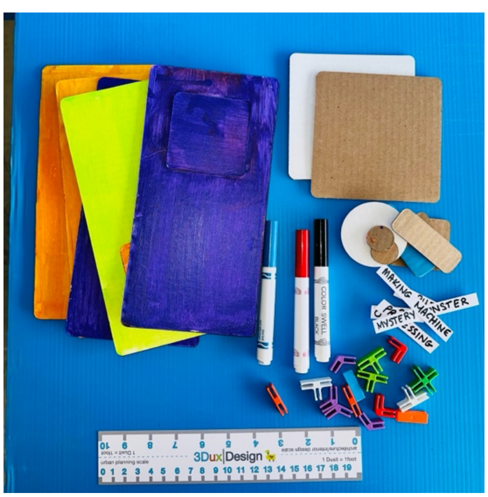
Teacher: **Slide 2** "How, you ask, will our 'Mystery Monster Making Machine' work like a computer.? Well, computers collect data (inputs), interpret the information to create instructions it can understand, (process), and then give us something back like information (words), an action (like a light going on), or even an object (like a monster). This is called an output. Today, we are going to act like a computer and use input, processing, and output functions to build Mystery Monsters!



Teacher: **Slide 3** "First up, we will get into teams of 6 then then create 3 smaller teams of 2. Each team of 6 will collaborate to build a single computing machine with 3 workstations and 3 tunnels, or conveyors. The workstations will be arranged in a triangle and the conveyors will be set up to transport monsters from one workstation to the next. But our conveyors and workstations need to hide the monsters from the other teams during the entire process. Yes- that's why they are called **mystery** monsters)."

Refer to layout below for details on constructing the machine.
This should take about 5 minutes. 5x10" cards and obtuse angles can construct the machine. 5x5" cards can act as additional "wings" to prevent neighbors from peeking. Students may create their own machine designs if time allows but it must contain 3 workstations and 3 conveyors.



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Mystery Monster-Making Machine Project Guide

A Fast-paced, No-Tech Computer Science Game on Input and Output

Teacher Slide 5: "Now that our machines are assembled, it's time for us to create our Mystery Monsters. For each team of 2, please go to a workstation. Each team of 2 will soon have 4 minutes to design, decorate, and construct a mystery monster. You can use up to 7 small cardboard shapes and up to 6 connectors of choice. Don't let the other teams peek!

[Set a timer to 4 minutes and call out "You may begin now" when ready. Notify students when the alarm goes off]

Teacher: **Slide 6** **"**Great monster-making folks! Time is up ☺ . Next, every team will become the **Input Teams**. You will have 5 minutes to complete 2 input tasks:

1. Collect fresh pieces of the exact cardboard shapes and connectors you used to create your monster. Your neighbors will be challenged to duplicate your monster or create an identical twin!
2. Use the paper and pencil to write a **highly detailed description** of your monster. Include the shapes used for each body part, and the type of connector used to attach it to other parts. Include the direction of cardboard pieces, colors and designs used, and anything that you can add that will help you're your neighbors processor the information and understand exactly what your monster looks like. Please begin!"

[Set a timer to 5 minutes and call out "You may begin now" when ready.]

Teacher: **slide 7**"Time is up Input teams! It's okay of you're not finished, that is part of the fun! Immediately place your collected materials and data sheet into the conveyor (or tunnel) and pass it along to the team to your right. Every team of 2 should now have your neighbor's material.

Teacher Slide 8 "Congratulations, all Input teams have now advanced to become the **Processing team**. Your next job will be to interpret the data you just received from your neighbors. You will have 5 minutes to

1. explore the materials,
2. read the data sheet,
3. draw a very detailed sketch of the mystery monster, and
4. color in the pieces exactly as described on the datasheet.

You may construct a prototype of the monster to help you draw a detailed diagram and decorate it but you will need to take it apart (dismantle it) at the end of the 5 minutes."

[Set a timer to 5 minutes and call out "You may begin now" when ready.]

Teacher slide 9: Time is up! Processing Teams please put your pencils down, dismantle your monster prototypes and pass the drawings and monster pieces through the conveyor to the team to your right. Do not pass along the input instructions, you can place them face-down and put aside for later use.

Teacher slide 10: "Congratulations Processing teams, you have all now advanced to the final task. You are now considered the Output Teams and will be responsible for using the data and materials provided to try to construct an exact clone of the original monsters designed by your neighbors. You will have 4 minutes to build the model."

[Set a timer to 5 minutes and call out "You may begin now" when ready.]

Teacher: "Okay Output teams, time is up! Now let's see how we did as computers. Were our input, processing, and output functions working? Every team, please pass your output monsters along with the drafting materials to the team to your right. Teams can also pass along the input notes to the original monster-making teams.

Take some time to investigate the output monster, compare it to your original and see what parts worked and where the computer fell short. Did your monster-making machine create an identical twin of your original model? Was the input data accurate and detailed enough for the processor? Was the processor's interpretation accurate?"

Allow students about 5 minutes to compare the original and output monsters.

Discussion and Reflection (10 minutes) Facilitate a discussion and allow student teams to share monsters and data. You may consider questions like:

- Did the final monster look like what the input team envisioned? Why or why not?
- Were the instructions/details provided by each team clear and sufficient?
- What could the Input Team have added to their description to improve the output?
- What could the processing team have added to their sketch to improve the output?
- How does this activity relate to programming and the importance of clear, detailed instructions in computer science?

Conclusion (5 minutes)

- Highlight how this activity demonstrates the concept of input and output, emphasizing that the quality of output is directly related to the quality and clarity of the input.
- Discuss how this lesson can be applied to computer programming and other areas where clear communication and detailed instructions are crucial.

Standard alignment and scaffolded learning goals:

Grades 3-5

Applicability:

- Simplify the concepts of input and output by relating them to everyday examples (e.g., using a vending machine).
- Focus on creativity and basic teamwork, with less emphasis on detailed design and construction.

CS Standards Covered:

- **Computational Thinking**: Understanding the basic idea of algorithms and sequences as it relates to following instructions to achieve a specific outcome.
- **Collaboration**: Working effectively in teams, understanding roles, and contributing to a shared goal.

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Mystery Monster-Making Machine Project Guide

A Fast-paced, No-Tech Computer Science Game on Input and Output

Grades 6-8 (Middle School)

Applicability:

- Introduce the concepts of input, output, and processing in the context of computer science, making analogies to how computers function.
- Emphasize detailed instructions, clarity in communication, and the iterative process of design and development.

CS Standards Covered:

- **Computational Thinking**: Understanding and applying the concept of algorithms and the importance of clear instructions in programming.
- **Problem Solving and Critical Thinking**: Analyzing the outcome of the activity (the created monster) and considering what could be improved in the process.
- **Collaboration and Communication**: Developing teamwork and communication skills, with an emphasis on clear, precise, and effective exchange of ideas.

Grades 9-12 (High School)

Applicability:

- Discuss the concepts of input, output, and processing in more technical terms, drawing parallels to programming languages, software development, and user interface design.
- Encourage complexity in the design and story elements, incorporating discussions about user experience (UX) and how software meets user needs.

CS Standards Covered:

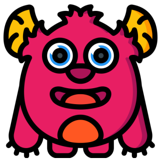
- **Computational Thinking and Programming**: Deepening understanding of how detailed and clear inputs (code) produce specific outputs (program behaviors) and the role of testing and debugging.
- **System Design**: Exploring the principles of design and how they relate to the development of effective software and user interfaces.
- **Project Management and Collaboration**: Fostering advanced teamwork, project planning, and management skills.

Cross-Grade CS Standards Themes:

- **Creativity and Innovation**: Encouraging students to think creatively in designing their monsters and stories.
- **Technology Operations and Concepts**: Although this is a no-tech activity, discussing the parallels between the activity and technology operations can enhance understanding.
- **Digital Citizenship**: Foster a discussion on teamwork, respect, and the collaborative process, which are key aspects of participating responsibly in digital and real-world environments.

Customization for Different Educational Goals:

- **Inclusivity and Accessibility**: Ensure that the activity is accessible to all students, including those with disabilities. Adjustments might be necessary to ensure everyone can participate fully.
- **Interdisciplinary Connections**: This activity can be connected with language arts (through the storytelling aspect), technology (through presentations)



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Mystery Monster-Making Machine Project Guide

A Fast-paced, No-Tech Computer Science Game on Input and Output

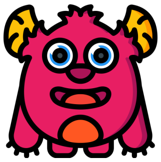
Early Learning Version for k-2

Learning goals:

1. **Communication Skills:** The activity encourages students to articulate instructions clearly and succinctly. This not only enhances their verbal communication skills but also helps them learn how to convey complex information understandably.
2. **Listening Skills:** By requiring the listening student to follow verbal instructions without asking questions, the activity strengthens their ability to listen attentively and follow directions accurately, a crucial skill in all areas of learning and everyday interactions.
3. **Understanding Geometry:** As they build the monster replicas, students engage with basic geometric concepts and shapes. This hands-on manipulation of geometric forms helps solidify their understanding of spatial relationships and properties of different shapes.
4. **Introduction to Computer Science Concepts:** Discussing terms like input and output in the context of the activity introduces young learners to fundamental concepts of computing. By relating these terms to real-world actions (describing and building), students can begin to grasp how computers process information.
5. **Fine Motor Skills Development:** Handling small shapes and connectors to assemble the monsters enhances fine motor skills. This aspect of the activity is crucial for young children as it develops hand-eye coordination and precision, skills that are important for writing, drawing, and other academic tasks.
6. **Collaboration:** Working in pairs teaches students the importance of collaboration. They learn to cooperate with a partner, share resources, and work together towards a common goal, skills that are essential for team-based activities in school and beyond.
7. **Problem-Solving and Adaptability:** As students encounter discrepancies between the described and the built monster, they engage in problem-solving to interpret and adapt the verbal instructions they receive. This fosters adaptability and critical thinking skills.

Materials Needed:

- One pre-created monster model per team of 2 students
- One bag of identical shapes and connectors for each team
- 3DuxDesign cardboard and connectors needed for building "monster caves" (a space to prevent students from seeing each other’s work).



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Time: Allow 30 minutes for activity plus discussion

Activity Setup:

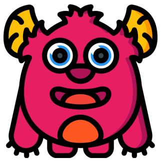
1. **Form Teams:** Pair up the students into teams of two. Each team will receive a bag containing the exact shapes and connectors needed to build a replica of the pre-created monster.
2. **Create Monster Caves:** Instruct each student to build a monster hideout to prevent partners from seeing each other's work. This will be their "monster cave."

Activity Instructions:

1. **Monster Description:** One student in each team (Student A) will be given the monster model. This student is responsible for describing the monster to their partner (Student B) using clear, step-by-step verbal instructions.
2. **Building the Replica:** Student B will listen to Student A's description and attempt to build the replica based on verbal instructions alone. Student B is not allowed to ask any questions; all necessary details must be provided by Student A without any prompting.
3. **Completion:** Once Student B believes they have completed their monster, both students take monsters out of their "monster caves" and compare the built replica with the original monster model.

Discussion Points:

- **Discuss Input and Output:** After the activity, discuss the concepts of input (the instructions given by Student A) and output (the monster replica built by Student B). Explain how this relates to how a computer functions, where input (data/instructions) is processed to produce output (results/actions).
- **Compare Results:** Allow students to observe the similarities and differences between the original monster and the built replica, emphasizing how clear and precise communication can affect the outcome, similar to how precise input affects a computer's output.
- **Take two.** If time permits, students may dismantle both monsters and Student B may build a new monster using the same materials. Student B may now describe their monster as student A attempts to build a replica. In this way, both students have an opportunity to hone their communication and listening skills.



Cross-curricular Extensions

Life science/adaptations extension:

Ask students to investigate the anatomy of their monsters and notice prominent features or features that are missing. Ask them to imagine their monsters in nature, what could that feature tell them about the behavior, habitat, or needs of the monster?

For example, extra-long arms might mean that the monster needs to reach for its food, thus maybe it eats fruit from trees. A monster with no arms at all might float or swim in rivers with an open mouth like a fish and catch food that floats by. Extra big ears might suggest great hearing and perhaps it catches its food in the wild (or is someone else's food and needs to hear predators getting too close)

Literacy extension:

Expanding on the life science/adaptations activity, students may pretend they are creating a museum (or zoo/nature preserve) exhibit for their monster and create a one-page description of their monster for visitors. Including details like the name of the monster, description, size, diet, habitat, special behavior, fun facts etc.

Technology extension: green screen/videography

- Students may photograph their monster with a green screen and place it in it's natural habitat
- Using the literacy extension, students may create an informational video about their monsters.