Pipeline Challenge

Mid-Valley
STEM-CTE HUB

www.midvalleystem.org
midvalleystemctehub@linnbenton.edu
Linn-Benton Community College
Albany Campus - CC-212

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Pipeline Challenge

The Pipeline Challenge STEAM Kit engages students in hands-on engineering, teamwork, and problem-solving by challenging them to transport a golf ball from one point to another using colorful 2-foot plastic half-pipes. With limited materials and two goal cups, teams must strategize, design, and adapt their "pipeline" to navigate space, curves, and distance. This collaborative kit emphasizes communication, iteration, and physical science principles like gravity, force, and motion—perfect for indoor or outdoor use and ideal for team-building and STEAM integration.

Grade Level

3rd - 9th

Group Size

3 - 5 students per group

Time Duration

30 - 60 minutes

Content of Kits

Components

- 60 plastic half pipes in various colors
- Golf balls
- 2 cups
- Tape

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Usage

Getting Started

1. **Introduce the Challenge Objective -** Explain that students must transport a golf ball from one point to a goal cup using only the half-pipes—no hands allowed once the ball is moving.

2. **Demonstrate a Simple Run -** Show how one or two pipes can guide the ball, emphasizing teamwork and handoffs to keep the ball moving continuously.

3. **Set Up a Defined Start and Goal Area -** Use cones, tape, or markers to clearly identify the starting point and the goal cup, creating boundaries for each challenge.

4. **Break into Cooperative Teams -** Assign roles such as "launcher," "stabilizer," "strategist," and "recorder" to promote inclusion and shared responsibilities.

5. **Encourage Trial and Error -** Let students test, adjust, and repeat designs, reinforcing iteration and communication as part of the engineering process.

Storage

- Break down projects in between class sessions and store in the bin provided.

Troubleshooting

- **Pipes Separate During Use -** Allow students to use a small amount of tape to stabilize junctions, or reinforce holding positions with clear role assignments.
- **Ball Launches Off Track -** Encourage slower, more controlled handoffs and have students practice coordinating the pipe angles before the official run.
- **Students Struggling with Coordination -** Start with a short, straight course before introducing turns, inclines, or longer distances.

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Activity Guide

Beginner

Straight Line Roll
Students form a straight line and work together to guide the golf ball from the start point to the goal cup using only the half-pipes. This introduces timing, communication, and gravity-based motion while minimizing complexity.

Intermediate

Curved Course Relay
Teams design a course that includes at least one curve or directional change using limited pipe sections. They must reposition themselves and the pipes mid-run to complete the ball's path to the goal, promoting collaboration and iterative testing.

Advanced

Timed Delivery Challenge
Teams are tasked with getting the ball from start to finish in the fastest time possible without dropping it. Each dropped ball adds time penalties, encouraging students to refine their process, adjust pipe handling, and balance speed with precision.

Extension Activities:

Obstacle Pipeline
Introduce obstacles like cones, chairs, or taped zones that the ball must go around, over, or under. Students adapt their pipeline designs and positioning to meet the new challenge, applying critical thinking, spatial reasoning, and collaboration to solve real-time problems.

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Learning Extensions

STEAM Connections: Physics - Engineering - Math

Learning Objectives:

- Apply principles of gravity, motion, and force to control the movement of an object through a constructed system.
- Collaborate to plan, test, and refine physical designs using trial-and-error and iterative thinking.
- Strengthen spatial awareness and coordination through movement-based problem-solving.
- Demonstrate the value of communication, timing, and precision in executing team-based challenges.
- Reflect on design outcomes and adapt strategies based on performance feedback.

Career Connections:

- **Civil Engineer –** Designs systems like pipelines, bridges, and transportation channels with flow efficiency in mind.
- **Industrial Designer –** Creates product pathways and systems that depend on human interaction and motion control.
- **Logistics Planner –** Develops efficient systems for moving goods and materials through planned routes and conditions.
- **Project Manager –** Leads teams to accomplish shared goals through clear planning and collaboration.
- **STEM Facilitator –** Uses dynamic, hands-on challenges to teach problem-solving and teamwork.

Essential Employability Skills:

- Teamwork
- Problem-Solving
- Communication
- Adaptability
- Leadership

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Resources and Accessibility

Safety Guidelines

- Use Caution During Movement – Students should walk (not run) while repositioning to avoid collisions or stepping on pipes.
- Avoid Swinging Pipes – Remind students to hold pipes securely and close to the ground to prevent accidental hitting.
- Designate a Clear Play Area – Set boundaries for the activity space to reduce tripping hazards and distractions.
- Supervise Group Size – Ensure team sizes are manageable and that all students are engaged and accounted for.

Accessibility

- Allow Flexible Timing – Provide additional setup or testing time to ensure all students can contribute meaningfully.
- Use Visual and Verbal Prompts – Reinforce instructions with demonstration and team dialogue to support diverse learning needs.
- Offer Seated or Stationary Roles – Students with mobility limitations can stabilize pipes, give verbal directions, or manage timing and data collection.
- Adjust Course Height – Place start and goal cups on tables or platforms to accommodate students who use wheelchairs or have difficulty bending.

Library Catalog

Library Resources

Feedback

QR to feedback survey