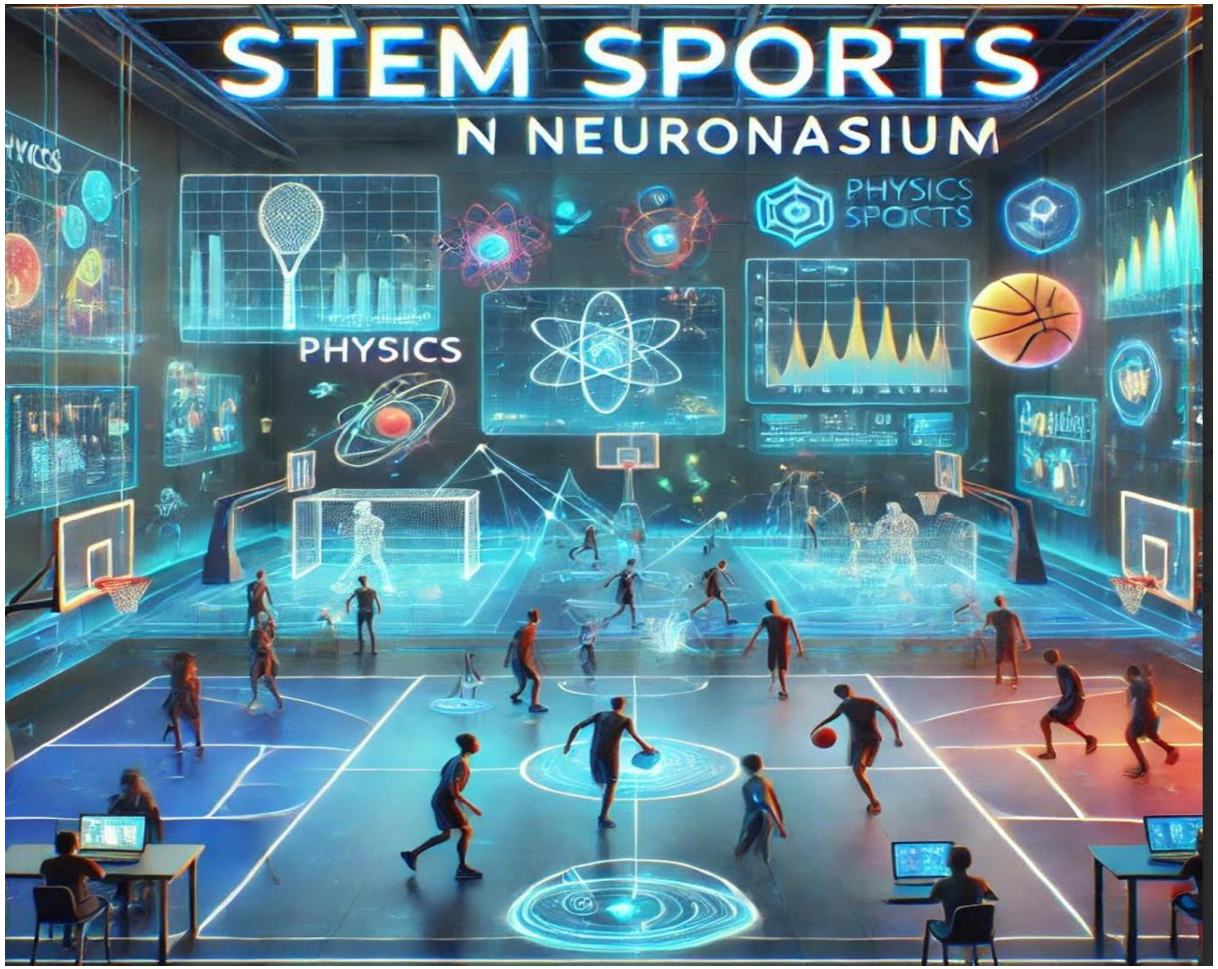
# STEM in the Gym: Enhancing Learning Through Physical Education




**Presented by Lisa Longino**
**2024 OAHPERD Workshop**

# Why STEM in Physical Education?

- Real-World Application: Connects STEM concepts to sports.
- Critical Thinking: Encourages problem-solving skills.
- Engagement: Combines active movement with intellectual challenges.
- Skill Development: Enhances analytical and observational skills.

# STEM Concepts by Sport

- Golf: Angles and precision.
- Bowling: Rolling force and momentum.
- Tennis: Reaction time and coordination.
- Marathon Running: Heart rate and endurance.
- Lacrosse: Aerodynamics and catching techniques.
- Volleyball: Trajectory and teamwork.
- Swimming: Hydrodynamics and speed.
- Flag Football: Strategy and motion analysis.

# STEM Lesson: Golf

- Objective: Apply STEM principles to improve skills in golf.
- Activity: Explore concepts like angles, speed, or strategy in golf.
- Assessment: Reflect on how STEM influenced performance.
- Connection: Relate golf skills to real-world STEM applications.

# Golf: Angles and Precision

- **Grade Level**: 4th–6th
  **Objective**: Students will understand the relationship between angles and precision in hitting targets during a golf swing.
  **Standards**:
- Math: Analyze angles in 2D geometry (Common Core: 4.G.1).
- Physical Education: Demonstrate control in movement patterns.
- **Essential Question**:
- How do angles affect the precision of a golf shot?
- **Materials**: Foam golf clubs, soft balls, targets, protractors, angle worksheets, cones, visual aids.
- **Instruction**:
- **Introduction (10 min)**: Explain the connection between angles and ball trajectory using a protractor and examples of different golf shots.
- **Guided Practice (15 min)**: Set up stations where students practice putting at varying angles using a protractor to determine the shot's angle.
- **Activity (20 min)**: Students predict and measure the angle needed to hit a target. Record data to find which angles lead to the most accurate shots.
- **Discussion (5 min)**: Analyze results and discuss what changes could improve precision.
- **Assessment**: Observation of golf swings, angle prediction accuracy, and completion of angle worksheets.
  **Exit Ticket**: "Draw a diagram showing how a specific angle affects a golf shot."

# STEM Lesson: Bowling

- Objective: Apply STEM principles to improve skills in bowling.
- Activity: Explore concepts like angles, speed, or strategy in bowling.
- Assessment: Reflect on how STEM influenced performance.
- Connection: Relate bowling skills to real-world STEM applications.

# Bowling: Rolling Force and Momentum

- **Grade Level**: 3rd–5th
  **Objective**: Students will learn how force and momentum affect the motion of a bowling ball.
  **Standards**:
- Science: Explain the effect of force on motion (NGSS: PS2.A).
- Physical Education: Perform rolling skills with accuracy.
- **Essential Question**:
- How do force and momentum impact the bowling ball's movement?
- **Materials**: Bowling pins, lightweight balls, ramps, measuring tapes, and worksheets for force calculations.
- **Instruction**:
- **Introduction (10 min)**: Brief explanation of force and momentum with demonstrations.
- **Guided Practice (15 min)**: Set up ramps and let students experiment with rolling balls of different weights at varying forces.
- **Activity (20 min)**: Students measure the ball's distance and observe its momentum.
- **Discussion (5 min)**: Discuss what happens when force increases or decreases.
- **Assessment**: Observation and completion of force worksheets.
  **Exit Ticket**: "Describe how changing the force would impact the momentum of the bowling ball.

# STEM Lesson: Tennis

- Objective: Apply STEM principles to improve skills in tennis.
- Activity: Explore concepts like angles, speed, or strategy in tennis.
- Assessment: Reflect on how STEM influenced performance.
- Connection: Relate tennis skills to real-world STEM applications.

# Tennis: Reaction Time and Coordination

- **Grade Level**: 3rd–6th
  **Objective**: Students will develop reaction time and hand-eye coordination while understanding its importance in tennis.
  **Standards**:
- Science: Explore reaction time in physical processes.
- Physical Education: Demonstrate racquet control and coordination.
- **Essential Question**:
- Why is reaction time essential in tennis?
- **Materials**: Racquets, foam balls, stopwatch, reaction time worksheet.
- **Instruction**:
- **Introduction (10 min)**: Explain reaction time with simple examples (e.g., catching a dropped ball).
- **Guided Practice (15 min)**: Partner students to practice rallying foam balls with increasing speed.
- **Activity (20 min)**: Conduct a reaction time test where students measure how quickly they can hit a ball after a drop.
- **Discussion (5 min)**: Compare reaction times and discuss how to improve coordination.
- **Assessment**: Reaction time logs and successful rallies.
  **Exit Ticket**: "What exercises could you do to improve reaction time?"

# STEM Lesson: Marathon Running

- Objective: Apply STEM principles to improve skills in marathon running.
- Activity: Explore concepts like angles, speed, or strategy in marathon running.
- Assessment: Reflect on how STEM influenced performance.
- Connection: Relate marathon running skills to real-world STEM applications.

# Marathon Running: Heart Rate and Endurance

- **Grade Level**: 5th–6th
  **Objective**: Students will understand how endurance activities affect heart rate and stamina.
  **Standards**:
- Science: Human body systems and exercise (NGSS: LS1.A).
- Physical Education: Engage in sustained physical activity.
- **Essential Question**:
- How does running impact heart rate and stamina?
- **Materials**: Stopwatch, heart rate monitors, cones, endurance log sheets.
- **Instruction**:
- **Introduction (10 min)**: Explain heart rate and its role during physical activity. Demonstrate how to measure heart rate.
- **Guided Practice (15 min)**: Lead a warm-up run, stopping periodically to measure heart rates.
- **Activity (20 min)**: Students participate in a timed jog, recording heart rate every 2 minutes.
- **Discussion (5 min)**: Discuss the relationship between endurance and heart rate changes.
- **Assessment**: Heart rate data logs and participation.
  **Exit Ticket**: “Why does heart rate increase during exercise?”

# STEM Lesson: Lacrosse

- Objective: Apply STEM principles to improve skills in lacrosse.
- Activity: Explore concepts like angles, speed, or strategy in lacrosse.
- Assessment: Reflect on how STEM influenced performance.
- Connection: Relate lacrosse skills to real-world STEM applications.

# Lacrosse: Aerodynamics and Catching Techniques

**Grade Level**: 4th–6th
**Objective**: Students will explore aerodynamics and apply catching techniques using lacrosse sticks.
**Standards**:

- Science: Properties of motion and aerodynamics (NGSS: PS2.B).
- Physical Education: Apply proper catching and throwing techniques.

**Essential Question**:

- How does aerodynamics influence the movement of a lacrosse ball?

**Materials**: Lacrosse sticks, foam balls, measuring tape, visual aids.

**Instruction**:

1. **Introduction (10 min)**: Demonstrate how aerodynamic properties affect the ball's movement.
2. **Guided Practice (15 min)**: Teach students to throw and catch using proper technique.
3. **Activity (20 min)**: Students practice passing the ball, noting how changes in speed and angle affect its path.
4. **Discussion (5 min)**: Reflect on successful throws and catches.

**Assessment**: Observation and successful completion of passing drills.
**Exit Ticket**: "What factors help a lacrosse ball travel smoothly?"

# STEM Lesson: Volleyball

- Objective: Apply STEM principles to improve skills in volleyball.
- Activity: Explore concepts like angles, speed, or strategy in volleyball.
- Assessment: Reflect on how STEM influenced performance.
- Connection: Relate volleyball skills to real-world STEM applications.

# Volleyball: Trajectory and Teamwork

**Grade Level**: 4th–6th
**Objective**: Students will learn how trajectory affects ball movement and practice teamwork strategies during volleyball games.
**Standards**:
- Science: Understand trajectory in motion (NGSS: PS2.A).
- Physical Education: Demonstrate teamwork and proper volleyball techniques.

**Essential Question**:
- How does the ball's trajectory affect its movement in volleyball?

**Materials**: Volleyballs, net, cones, trajectory charts, teamwork rubric.
**Instruction**:
**1.Introduction (10 min)**: Discuss trajectory and its role in volleyball movements (e.g., serves, spikes). Demonstrate proper passing, setting, and serving techniques.
**2.Guided Practice (15 min)**: Students work in pairs to practice passing the ball, focusing on the height and angle of their passes.
**3.Activity (20 min)**: Divide students into small teams for a modified volleyball game where they observe and adjust their ball trajectories.
**4.Discussion (5 min)**: Reflect on how teamwork and trajectory contributed to the game.
**Assessment**: Teamwork rubric, observation of passing technique, and trajectory charts.
**Exit Ticket**: "What strategies help a volleyball team succeed?"

# STEM Lesson: Swimming

- • Objective: Apply STEM principles to improve skills in swimming.
- • Activity: Explore concepts like angles, speed, or strategy in swimming.
- • Assessment: Reflect on how STEM influenced performance.
- • Connection: Relate swimming skills to real-world STEM applications.

# Swimming: Hydrodynamics and Speed

- **Grade Level**: 4th–6th
  **Objective**: Students will explore hydrodynamics and how it affects speed in water.
  **Standards**:
- Science: Principles of hydrodynamics (NGSS: PS2.B).
- Physical Education: Perform basic swimming strokes and improve speed.
- **Essential Question**:
- How does water resistance impact swimming speed?
- **Materials**: Access to a pool, kickboards, stopwatches, hydrodynamic visual aids.
- **Instruction**:
- **Introduction (10 min)**: Explain how water resistance impacts speed and demonstrate streamlined swimming techniques.
- **Guided Practice (15 min)**: Students practice using kickboards to work on proper body alignment and reduce drag.
- **Activity (20 min)**: Students swim short races to measure their speed and observe the effects of streamlined positions.
- **Discussion (5 min)**: Analyze techniques that improved speed and efficiency in the water.
- **Assessment**: Observation of swimming techniques and recorded swim times.
  **Exit Ticket**: “What changes can reduce water resistance in swimming?”

# STEM Lesson: Flag Football

- • Objective: Apply STEM principles to improve skills in flag football.
- • Activity: Explore concepts like angles, speed, or strategy in flag football.
- • Assessment: Reflect on how STEM influenced performance.
- • Connection: Relate flag football skills to real-world STEM applications.

# Flag Football: Strategy and Motion Analysis

- **Grade Level**: 5th–6th
  **Objective**: Students will use motion analysis to create and implement strategies in flag football.
  **Standards**:
- Math: Use motion analysis to interpret speed and direction (Common Core: 5.MD.1).
- Physical Education: Develop and execute offensive and defensive strategies.
- **Essential Question**:
- How can understanding motion improve flag football strategies?
- **Materials**: Flags, cones, footballs, whiteboard for strategy mapping.
- **Instruction**:
- **Introduction (10 min)**: Explain how speed and direction affect offensive and defensive strategies. Demonstrate a basic play.
- **Guided Practice (15 min)**: Students practice running routes and flag-pulling techniques, analyzing speed and movement patterns.
- **Activity (20 min)**: Students divide into teams and create a basic play to execute in a short game.
- **Discussion (5 min)**: Reflect on what strategies worked and why.
- **Assessment**: Observation of game strategies and successful flag pulls.
  **Exit Ticket**: “Describe how motion analysis can improve a play.”

# References and Bibliography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- 4. Engineering in Sports. (2020). Hydrodynamics and Human Performance.