Curriculum Guide

NHL & NHLPA Future Goals Program – Hockey Scholar™

> *Your local NHL team has made it all the way to the Stanley Cup Final – and now you just need to win 4 games to bring home the cup! You've been asked to head down to your team's headquarters to help them prepare for each of the games. Each day leading up to the game you are faced with new tasks that require a strong understanding of science, math, and engineering concepts to succeed. Help get all the preparations done in time so your team can compete to win the ultimate prize: the Stanley Cup.*

Hockey Scholar brings science, math & engineering concepts to life using the exciting, fast-paced game of hockey. Through immersive hockey simulations, each online module enables students to explore real-life applications of fundamental STEM concepts. Designed for elementary and middle school students, this online course combines cutting-edge instructional design and game-based simulations to build students' confidence, mastery, and excitement around critical STEM topics.

Each online module is structured to reinforce scientific method by mimicking the steps of a typical science experiment. Student progression through a module parallels the steps of a science investigation: making initial predictions and observations, performing experimentation, and analyzing data.

Each online module is designed to:

- *Build student's conceptual understanding of foundational science, engineering and math concepts***.** Students must master a unique STEM challenge in each module. From understanding area calculations of an ice rink to exploring the conservation of energy involved in a falling puck, students are exposed to concepts that form the foundation of a strong STEM education.

- *Develop scientific and critical thinking***.** The online modules are structured so that students experience each part of the scientific method. Students perform every step of a typical investigation, from making predictions to analyzing physical phenomena and making evidence-based conclusions.

The online modules are accompanied by a variety of offline, paper-based lessons that reinforce and extend content covered by *Hockey Scholar.* Students can access these offline lessons directly through the course.

COURSE OVERVIEW

Hockey Scholar consists of:

- *Modules*: The course is composed of 12 online learning modules, each taking approximately 10-20 minutes. Cumulatively, the entire course requires approximately 2-4 hours of computer seat time.
- *Standards Alignment:* The curriculum aligns to Next Generation Science Standards (NGSS) and Math Common Core State Standards (CCSS) in elementary and middle school grades.
- *Assessments*: Pre- and post-assessments are used in each module to measure student knowledge gains.
- *Offline lessons:* The online course includes access to a companion offline curriculum that covers STEM topics from the course, related fitness and nutrition lessons, as well as PE lesson ideas to get your students up and moving!

DETAILED COURSE OUTLINE

The Ice

In Modules 1 through 3, students must work with the Ice Technician to prepare the perfect skating surface for the next game – everything from getting the optimal ice and air temperature in the arena to painting the correct geometric constructions on the ice.

Module 1: Uncover the Ice

- Overview: It's time to uncover the ice. To remove each individual section of the ice covering, students must first determine the area of the section to be removed. When the ice has been fully revealed, the user can use the collected information to determine the area of the rink itself.
- Learning Objectives:
    - SWBAT identify and explain the units of measurement used for area calculations
    - SWBAT describe how unit squares can be combined to create an object of a given area
    - SWBAT analyze area calculations to derive the area formula
    - SWBAT apply area formulas for whole-number edge lengths

Module 2: Prepare the Surface

- Overview: Help create the perfect ice surface for the upcoming game. Students have a molecular view of the ice surface, and explore the impact of different air and ice temperatures on the ice conditions. Students learn about the different states of matter – solid, liquid, gas – and how the temperature changes will affect skating and the motion of the water molecules.
- Learning Objectives:

- SWBAT explain that matter is made up of particles that are too small to see (i.e. molecules)
- SWBAT describe how changes in temperature affect molecular motion and kinetic energy
- SWBAT describe and compare the phases of matter (solid, liquid, and gas) based on temperature and molecular motion

Module 3: Paint the Ice

- Overview: The ice needs to be repainted. Before the next game begins, students must follow the mathematical instructions step-by-step to draw the lines correctly on the rink, and form the correct geometric constructions.
- Learning Objectives:
  - SWBAT define and identify points, parallel & perpendicular lines, line segments, radius, diameter and chords
  - SWBAT identify, compare, and construct circles of a given radius and diameter
  - SWBAT identify and define congruent figures
  - SWBAT use ordered pairs to describe and find the location of a point
  - SWBAT follow step-by-step instructions to draw and correctly place various geometric constructions on a coordinate plane

The Practice

In Modules 4 through 6, the Head Coach needs your help running the practice. Students must help the team with critical components of the game – from face-offs to passing and shooting - to make sure the team brings home the win.

Module 4: The Face-off

- Overview: Help your team maximize their face-off percentages by ensuring the perfect puck drop for your player. Students must select the best puck drop height for each player to ensure it reaches the ideal range of kinetic energy before hitting the ground.
- Learning Objectives:
  - SWBAT explain the difference between kinetic energy (KE) and potential energy (PE)
  - SWBAT identify the relative amount of KE and PE in a system, based on an object's speed and position relative to the ground
  - SWBAT explain the relationship between KE and PE in a closed system (i.e. energy is conserved)

Module 5: The Pass

- Overview: Students learn how to utilize angles to pass the puck around their opponents. Students must find and measure the correct angle for their bank pass – which causes the puck to bounce off the boards – to complete the play successfully.

- Learning Objectives:
    - SWBAT measure angles in whole-number degrees using a protractor
    - SWBAT identify individual angles, including adjacent angles, within a diagram.
    - SWBAT identify and describe that non-overlapping angles that lie on a straight line have a measurement of 180 degrees
    - SWBAT analyze data in tables to reveal patterns that indicate relationships (e.g. additive angles and the Law of Reflection) and to predict future results
    - SWBAT describe the Law of Reflection and list real-life examples where it occurs

Module 6: The Shot

- Overview: Students are tasked with hitting the puck across the ice such that it will stop at a specific spot. However, the friction of the ice changes depending on how fresh and how cold the ice is. Students must adjust their shot force and the friction force of the ice to successfully land the puck in the target area.
- Learning Objectives:
    - SWBAT define force, magnitude, direction, and friction
    - SWBAT describe real-life examples of forces being applied.
    - SWBAT explain how different forces (ex: friction, applied force) will influence the motion of the puck
    - SWBAT identify the differences in an object's motion when forces are balanced or unbalanced
    - SWBAT to describe Newton's 1st law (an object in motion will stay in motion unless acted upon by an outside force) and how it applies to real-life scenarios.

The Drills

In Modules 7 through 9, students must help the Skating Coach prepare the players for the next game. Students collect critical data during the players' drills to analyze their speed, strength, and endurance.

Module 7: Speed

- Overview: During a game, most races towards a loose puck are won or lost in the first strides. To help prepare for the next game, you are running drills to time your players and analyze their speed over short and long distances. Once each sprint is complete, determine the average speed by calculating distance over time.
- Learning Objectives:
    - SWBAT identify correct units of measurement for time, distance & speed
    - SWBAT calculate average speed using distance and time data from multiple trials

- SWBAT identify and utilize the formula for speed
- SWBAT explain the importance of performing multiple trials in a scientific experiment

Module 8: Strength

- Overview: You need to build your players' leg strength to help with their speed on the ice. No two skaters are alike, however, so you'll need to train each player in their target zone to make the training effective. Students can adjust the mass or the speed of each player to reach each individual's target training zone.
- Learning Objectives:
  - SWBAT identify and define independent and dependent variables
  - SWBAT recognize patterns and correlations in data sets
  - SWBAT define kinetic energy (KE) and describe real-life KE examples
  - SWBAT explain the positive relationships between mass, speed (velocity), and kinetic energy
  - SWBAT identify that changes in speed (velocity) have a greater impact on kinetic energy than changes in mass

Module 9: Endurance

- Overview: Help the Skating Coach closely monitor the players' vitals during each shift to ensure they are training in the most effective zone. Students help meet heart rate and breathing rate target zones during a 30-second shift on the ice, and see how physical exertion can impact these factors.
- Learning Objectives:
  - SWBAT describe the components and function of the respiratory and circulatory system
  - SWBAT collect data to analyze the relationship between physical exercise and heart rate and breathing rate
  - SWBAT describe the relationship between cells, tissues, organs and organ systems

The Equipment

In Modules 10 through 12, students are tasked with helping the Equipment Manager get all the players' gear ready for the next game. Students must learn about the engineering design behind the team's skates, sticks, and padding to help the team's performance.

Module 10: The Skate Blades

- Overview: Students learn the effect of the skate blade's radius of hollow on stopping distance. Students test players' stopping distances with different radius of hollow values and analyze the impact on stopping performance.
- Learning Objectives:
  - SWBAT define and identify independent variables, dependent variables, and controls in an experiment

- SWBAT define and describe correlations
- SWBAT identify the radius of a circle
- SWBAT construct, analyze and describe patterns from scatterplot graphs

Module 11: The Stick

- Overview: In this engineering design task, students must design the perfect stick given a player's individual preferences. Students explore the variables of stick design (flex, lie, and curve) and apply this knowledge to a player's design criteria.
- Learning Objectives:
  - SWBAT define and identify variables and criteria in an engineering design task
  - SWBAT analyze data tables to discover patterns and correlations
  - SWBAT select an optimal design solution to meet given criteria

Module 12: The Goalie Pads

- Overview: Students test different materials and shapes for the goalie's leg pads, and determine which combinations provide maximal protection and maneuverability.
- Learning Objectives:
  - SWBAT to define and identify controls (or controlled variables) in an engineering design task
  - SWBAT perform controlled experiments by adjusting experimental variables
  - SWBAT analyze data tables to find patterns and correlations
  - SWBAT select an optimal design solution based on given requirements