Scope and Sequence for Robotics: Grade 5

Programming and Building

Unit: Not-So-Simple Machines

Students explore the properties of gear systems to create motorized arms to accomplish precision shots for robotic sports and use sensor programming to activate machinery and detect, sort and transport objects in a fully automated warehouse.

GRADE 5	LEARNER'S PERMIT	OPERATOR'S LICENSE	MISSION POINTS	ROBOTICS ENGINEER
No-So-Simple Machines!	**Building:** • Gear systems have a driver and a follower. • Gear systems change speed, direction, and/or turning force (torque). • There is a tradeoff between speed and power. • Gearing down increases torque and reduces speed. • Gearing up reduces torque and increases speed. • The gear ratio is determined by size of the driver and follower. • The gear ratio of a compound gear system is found by multiplying the gear ratios of the individual gear systems. **Tasks to complete:** • Build, analyze, and improve gear system models.	**Building:** • The robot has a medium speed, low torque motor for arm attachments. • The motor has 2 output axles for direct (1:1) and geared down (24:1) applications. • The worm gear on the drive axle turns a 24-tooth follower. • The 24:1 gear ratio reduces speed and increases power and accuracy. • Modular "plug and play arms" can be attached easily and removed quickly without changing the body of the robot. **Programming concepts:** • The medium motor command is used to control the A motor. • A negative power level reverse s the turning direction. • The "move steer" command sets the speed and direction of the driving motors at the same time. **Tasks to complete:** Build and program arms to kick, putt, throw, lift, and drop balls.	**Building:** • The ultrasonic sensor swivels to detect distance from the side of the table for wall tracking. **Programming concepts:** • The "move tank" command allows different motor speed and direction settings for arc and spin turns. • The robot turns right when the speed of the left motor is higher. • The robot turns left when the speed of the right motor is higher. • The greater the difference between the power levels the tighter the turn. • The gyro sensor allows turns to be measured by degree. • Positive numbers are used for right turns and negative for left. **Tasks to complete:** • Multi-step sequences with turns to navigate activate ball-launching mechanisms.	**Independent programming and engineering challenge:** • Design and build the attachments to detect, sort, and transport products in a fully automated warehouse.

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Academic Content, Deep Learning Proficiencies, and Ed Tech Standards

The eight-week Robotics unit provides students with the opportunity to apply STEM (Science, Technology, Engineering and Math) concepts and skills and develop and practice CFSD's Deep Learning Proficiencies required of 21st Century learners. Students work collaboratively and think critically and creatively in planning, testing, and refining programs; solving problems; and accomplishing engineering tasks.

GRADE 5	MATHEMATICS	SCIENCE	DEEP LEARNING PROFICIENCIES	EDUCATIONAL TECHNOLOGY
No-So-Simple Machines	**Number and Operations – Base 10:** • 5.NBT.1. Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left • 5.NBT.3. Read, write, and compare decimals to thousandths. • 5.NBT.7. Add, subtract, decimals to hundredths, using concrete models or drawings and strategies based on place value. **Mathematical Practices:** • 4.MP.1. Make sense of problems and persevere in solving them. • 4.MP.5. Use appropriate tools strategically. • 4.MP.6. Attend to precision.	**Interaction of Science and Society:** • SC5.2.1 Describes how diverse people and/or cultures, past and present, have made important contributions to scientific innovation. **Physical Science - Interactions of Matter:** • SC5.7.2 Describes how simple machines help us do work.	**Collaboration:** ▪ Fulfills various basic roles and responsibilities in order to complete a task. ▪ Uses strategies to respectfully resolve conflicts with another team member. ▪ Completes individual action items to achieve the team goals. ▪ Submits products that meet the specifications for the group tasks. ▪ Acts upon feedback that suggests changes or revisions to work, based upon provided criteria for success. **Critical Thinking and Problem Solving:** • Uses established criteria to identify errors in the thinking or problem-solving process. **Creativity and Innovation:** • Integrates ideas from others with own ideas in order to address the problem or task. • Assesses the quality of the performance and creative process in response to feedback and/or established criteria.	**Technology Operations and Concepts:** • ET5.6.2 Defines and applies knowledge of various technical process terms. • ET5.6.14 Transfers understanding of current input/output devices and symbols and icons to learning new technologies.