

RC Durr Foundation Technology Faculty Grant

Carroll County High School

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Program: Science and Engineering Department

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Project Abstract:

I am proposing to purchase materials to be used in tandem by the Science, Agriculture, and Engineering programs at Carroll County High School. Many of the science concepts discovered in the Integrated Science 10 curriculum overlap with topics in Engineering and Agriscience and thus the materials purchased will allow more students to engage in the coursework. The materials requested will allow students to discover science concepts with a hands-on, data-based approach instead of the traditional theoretical approach.

The materials needed to make this a successful program are: Vernier Dynamics Cart and Track System with Go Direct® Sensor Cart, 5 additional Go Direct Sensor Carts, and 5 Chemistry Go Direct® Gas Pressure Sensors. The total costs of this technology is \$1994.

Statement of Need:

At Carroll County High School, we believe that all students enrolled in our core science classes and in career pathway courses should have the opportunity to engage in hands-on, data-based experiments. The three dimensional nature of the Next Generation Science Standards (NGSS) outlines a vision for proficiency in science. This vision includes practices, cross cutting concepts, and disciplinary core ideas that combine to create a “body of knowledge and an evidence-based, model and theory building enterprise that continually extends, refines, and revises knowledge.”

Our integrated curriculum is designed for students to gain a conceptual understanding of physical, life, and earth space sciences. Students will use their understanding of the disciplinary core ideas to design engineering solutions for real world problems. The science and engineering practices that are embedded into the curriculum include all the steps necessary for students to investigate the natural world and what engineers do to design and build systems. They practices include: Asking questions and Defining Problems, Developing and Using Models, Planning and Carrying out Investigations, Analyzing and Interpreting Data, Using Mathematical and Computational Thinking, Constructing Explanations and Designing Solutions, Engaging in Argument from Evidence, and Obtaining, Evaluating, and Communicating Information. We believe that with the purchase of this equipment our students will be able to fully engage in these eight practices.

However, due to our lack of equipment, many learning experiences have been limited to theoretical approaches. Without an evidence-based experience, students do not fully understand and apply their knowledge. With the purchase of the Vernier technology, students will be able to collect real time data of their designed solutions, make revisions to their designs, all while refining their knowledge of science concepts.

The specific technology that we are requesting will allow students to explore the concepts of forces in motion and chemical properties/reactions. The Go Direct Dynamic Cart and Track System will

allow students to explore force, position, velocity, and acceleration through real time data collection on their one-to-one devices. Students will analyze and manipulate their data using the free graphical analysis software. They will determine the relationship between variables leading to Newton's Three Laws of Motion, including inertia, position, speed, velocity, acceleration, momentum, and impulse. We will then research types of collisions and the science behind reducing their impact. As a culminating event, students will complete a performance task where they will design a device that reduces impact for a subject. They will build and test a prototype, make revisions, evaluate, and then communicate their final design, naturally embedding the eight science and engineering practices.

Next in the integrated curriculum is the exploration of chemical properties and chemical trends. Students will explore various chemical properties and processes ranging from structure and function to reactions and chemical kinetics. Using the Go Direct Gas Pressure Sensor, students will explore properties of gases and their effects on natural systems, including grip strength and muscle fatigue, oxygen productions from the catalase enzyme, and plant transpiration. The culminating project will include studying human impacts on natural systems and designing or refining a device that reduces these impacts. Students will build and test a prototype of their device, make revisions, and then display their solutions.

New to the 2021-2022 school year, our science department will host a fall and spring science showcase event for students to present their designs to our school's administration and community stakeholders. This will give students an authentic audience to communicate information regarding their designs and receive feedback from experts in the field. This will also give students the opportunity to practice their speaking and professional skills.

Science and thus science education is essential to the lives of all Americans. The disciplinary core ideas, science and engineering practice, and cross-cutting concepts discovered in the integrated science curriculum will provide students with the skills they need to solve problems and thrive in a global society. By providing real-world problems and experiences for our students, we are giving them the opportunity to develop the essential skills to overcome challenges for a lifetime.

Program Description:

Budget:

Forces in Motion Equipment

[Dynamics Cart and Track System with Go Direct® Sensor Cart](#) (\$535)

[Go Direct Sensor Cart](#) (\$169*6 = \$1014)

Chemical Properties Equipment

[Chemistry Go Direct® Gas Pressure Sensor](#) (\$89*5 = \$445)

Total=\$1994

Evaluation: Students' understanding of disciplinary core ideas and their growth in the science and engineering practices will be assessed throughout the school year and by their performance in the culminating projects. Using performance rubrics developed by the science department, students will

self-assess and create growth goals for the science and engineering practices. Teachers of the integrated curriculum will develop their own SMART goals that will measure their growth in evidence-based instruction.

Grant Requirements:

July-August 2021

1. Purchase all equipment requested.
2. Send receipt to Durr Foundation that all equipment was purchased and received.
3. Teachers set up and train on equipment in the science lab.
4. Modify current curriculum to include the usage of data collection technology.
5. Ensure that the technology department installs proper graphical analysis software on student and teacher devices.

September - December 2021

1. Provide instruction that aligns to corresponding physical science standards using appropriate sensors to model the phenomenon.
2. Introduce and explain the data collection software to students.
3. Engage students in exploring Forces in Motion using the Dynamics Cart and Track System with Go Direct® Sensor Cart and related lab equipment.
4. Students design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
5. Students present their designs at the first annual fall science showcase.

January -April 2022

1. Provide instruction that aligns to corresponding physical science standards using appropriate sensors to model the phenomenon.
2. Review the data collection software to students.
3. Engage students in exploring Gas Laws using the Gas Pressure Sensor and related lab equipment.
4. Students design a solution that reduces impacts of human activities on natural systems.
5. Students present their designs at the first annual fall science showcase.

June 2022

1. Send Durr Foundation and End of the Year Report with the impact of the technology.