# Student-Generated 3D Animations of Physics Concepts for Conceptual Understanding and Interest in Technology

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Conceptual Physics (9), Physics I-II (10-12), AP Physics (11-12)

**Introduction:** Students enroll in my physics courses as a choice, yet many of them do not show interest in science, math, engineering, or technology (STEM). STEM related fields currently have more openings available than there are qualified individuals. Within Raytheon, employees created 3D models that could be explored in an immersive environment and physics simulations to communicate with stakeholders. The stakeholders and employees both increased their understanding of what was being visualized and interest in the tools used as a result of working collaboratively with the technology available.

For my action research, a software program called Blender was used collaboratively by teams of students. They communicated using technology similar to industry employees. They used the program to model, animate, and make physics simulations that they rendered and presented to the rest of the class. Throughout the school year, students completed projects using the software in the middle of each unit. The class started out with explicit step-by-step instructions and ended the year with open-ended projects that encouraged students to perform more like industry employees, working collaboratively to come up with creative solutions to requirements. This intervention wouldn't have been possible without my enriching experiences at Raytheon.

**Findings**: Physics students increased their depth of conceptual understanding of abstract physics concepts related to force and electricity after they participated in my intervention. They had the largest gains in concepts related to force interactions between systems, types of forces, inertia, electrical circuit layouts and physical aspects of DC electric circuits. The intervention activities made each of these concepts more accessible for students to visualize and understand. Students in Conceptual Physics and Physics I-II became more interested in science and technology while having the same or less interest in math and engineering after they participated in my intervention. In a pre and post survey, Conceptual Physics students had a substantial positive change in interest related to technology after participating in this intervention. The majority of Physics I-II responded to an end of year survey with a positive experience and interest in the technological tools used throughout the year.

**Action Plan**: The intervention will be used again this year but it will be modified to address deficiencies I observed in my data. Most students benefited from the intervention but a handful of students became less interested in technology when the software was frustrating to use. To address this, alternative assignments will be offered with easier to use but less robust software. I will also modify the pre-activity introduction and provide students with more resources like hotkey maps and clearer expectations/rubrics that demonstrate the learning goal/purpose of the activity more clearly. The activity for Newton's 2nd Law needs to be revised to address commonly held naïve conceptions related to what changing a force on a system does to the motion of the system. The activity will include opportunities for students to observe how changing the forces acting on their systems affect the motion of the objects mid animation and quantitatively analyze their peer's animation comparing their values to the other groups.