Science Instructional Strategies (one paragraph, 1000 character count including spaces) Explain:

★ *Your science teaching philosophy*

★ *Strategies currently used to teach science*

SCIENCE INSTRUCTIONAL STRATEGIES

Students must build scientific knowledge by investigating and designing solutions for real-world problems. A good teacher facilitates learning by eliciting students' preconceptions to help them investigate those initial ideas and gather evidence to test them. Most of my students are current or formerly designated English Language Learners, necessitating a constant focus on developing academic language. We employ trans-language practices as my students access their native language and acquire English to conduct investigations and design engineering solutions. SIOP and GLAD strategies are utilized as well. The classroom-community connection is vital. Our study of ocean acidification featured a visit by a local shellfish farm to discuss industry and environmental impact. We studied water shortages by debating a local court decision regarding the balance of water rights for farmers and water level needed for salmon. Both local farmers and Native fisherman came to discuss the impact.

Current and Desired Lab Resources (1 page maximum; 2700 characters including spaces) Explain:

★ *Your current lab facilities, equipment, and/or resources*

★ *Why laboratory upgrade support is needed*

★ *How a lab upgrade would impact your teaching, and your students' content knowledge.*

CURRENT AND DESIRED LAB RESOURCES

Our current lab facilities, equipment, and resources make it difficult to fully teach the Next Generation Science Standards to our students, including English Language Learners.

While we are fortunate to have chromebooks and Discovery Education, we do not have many other science supplies or resources. Through the use of the chromebooks, students are able to do simulations and analyze datasets from NOAA and other government agencies. However, computer work does not suffice when students need to engage in sensemaking to understand the science concepts in the world around them. My students need hands-on experiences to build their science content knowledge and academic language. Our school district has a very limited budget; our entire science department of over 600 students in three grades is provided with just $600 a year for all of our science supplies. One economy balance alone is $130. As science teachers, we do the best we can to meet our students' learning needs. Our local community college has donated old goggles for us to use and has let me borrow some equipment. Often our science teachers buy supplies out-of-pocket and email colleagues to see if they have extra of things we could use.

Our students need a science lab that allows them to fully explore science content. With an upgraded lab and equipment, students would be able to conduct more investigations and collect their own data. NGSS Standard MS-PS2-3 states that students need to "ask questions about data to determine the factors that affect the strength of electric and magnetic forces." The clarification statement includes electromagnets, electric motors, or generators as example devices. While our students were able to use the Phet simulation on electromagnets, due to our very limited equipment they were not able to conduct their own investigations by asking and defining their own problems. The Science and Engineering Practice standard linked in this evidence statement requires students to ask their own questions to be investigated. This is just one example of many of how lab equipment and science supplies would improve our students' content knowledge.

Laboratory Activity (1 page maximum; 2700 characters including spaces) Describe:

★ *An innovative, replicable lab/science class activity that you have implemented using limited school lab resources with impact assessments*

- *Purpose and outcome with materials needed to implement lesson*
- *List of any standards used (i.e. NGSS, state and/or national standards)*
- *List of safety challenges and how you resolved them. ()*

LABORATORY ACTIVITY

One lab activity we performed this year was a paper rocket project where students designed and redesigned rockets to hit "Mars," a red exercise ball on the field. Students applied their knowledge of Newton's Laws to design a successful rocket. Students referenced Newton's Three Laws to better design their launch and explain the reason for their design decisions. NGSS middle school standard P.S.2.A. Forces and Motion focuses on Newton's Three Laws. This project was NGSS three- dimensional by having students use Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts. The Crosscutting Concepts addressed were Cause and Effect, students analyzed data to predict the effect of rocket modifications. NGSS Framework states "In engineering, the goal is to design a system to cause a desired effect, so cause-and-effect relationships are as much a part of engineering as of science. Indeed, the process of design is a good place to help students begin to think in terms of cause and effect." (NRC,2012,p.88) Students modified the number of fins, fin shape, weight with clay, air pressure, and launch angle. Students identified the criteria and constraints of the engineering problem, part of NGSS Science and Engineering Practices: Designing Solutions. I utilized NASA plans found online to make the launchers. Students worked in pairs to design their rocket to hit the target 30m away. Students recorded accuracy data into Google Sheets including specifics about their rockets so that other groups could learn from their launches. After the first launch, students looked at the data from all of the launches, not just their rocket, to modify their rocket to hit "Mars." Students relaunched their rocket and inputted the data into Google Sheets to share with their peers. Students made one more set of

modifications and launched a final time. After the students' final rocket launch, students analyzed the data in Google Sheets and prepared a poster presentation. Students learned to use Google Sheets, equation functions and graphing, to analyze optimal launch conditions utilizing a large data set. Students then prepared a presentation that included a description of Newton's Three Laws, how they utilized the Laws for their rocket launches, and how they used the rocket launch data to make modifications. Students presented to classmates and staff. Students presented their rocket projects at a School Board meeting. I have found paper rockets to be safer than Estes rockets and water bottle rockets. The PSI for launching paper rockets is much lower than water bottle rockets. Students wore safety glasses during launches to protect their eyes from wayward rockets.