Glassboro Education Foundation, Inc.

Send the completed application to the attention of:

Dr. Robert Preston
Beach Administration Building
Joseph L. Bowe Blvd
Glassboro, NJ 08028

SEP 1 2022

A. General Information

Applicant(s): Dr. Joseph Bell
School: Glassboro High School
Principal: Dr. Monique Stowman-Burke
Grade Level or Subject: 9-12
Phone: (school) 856-652-2700x1101 (Home): 856-298-3213
E-mail(s): jbell@gpsd.us

B. Statement of Assurances:

The applicant hereby assures the Glassboro Education Foundation that:

1. The applicant(s) meet(s) the eligibility criteria.
2. The activities and services for which the grant is sought will be implemented as written.
3. Any monies not expended within the school year shall revert back to the Glassboro Education Foundation, unless permission to carry it into the next school year is granted.
4. All publicity releases regarding a funded project will acknowledge the Glassboro Education Foundation and/or a particular mini-grant sponsor as the funding agency.
5. The grant recipient(s) will submit a final report summarizing the project's evaluation results.
6. The Board of Education authorizes the filing of this application.

We do hereby certify that all of the facts, figures and representations made in this application are true and correct to the best of our knowledge and that the assurances as stated above are understood and will be followed in their entirety.

Dr. Joseph Bell

Signature of Applicant

Signature of Principal

Please note: from this page on, please do not include your name or your school in any of your descriptions as all applications are coded to prevent bias.

C. Project Title and Description

Title of Project: _____Hands on Chemistry Through Modeling _____

Subject Area(s):_____Chemistry_____

Approximate Number of Students Participating: _____100_____

Project Starting Date:_12 September 2022 _Project Completion Date:_14 June 2023_

Need: Describe the problem or deficiencies that exist which require the improvements described.

As educators teaching in the fields of chemistry and biology, we have taught molecular structure, function and shape of compounds and the properties of solutions. However, as our number of students with language barriers and differing cognitive skill levels increases in our science classes, we find that explaining concepts with pictures and notes to be less effective learning methods. Instead, providing students with tactile stimulation, like models and miniature measuring devices, would allow for all students to be involved and to learn simple and complex chemical concepts in their own way.

As a first year but experienced science teacher at Glassboro, I have the honor of not only joining an exceptional science team of Mrs. Susan Powers (AP/Honors Chemistry) and Mrs. Michele Memis (AP/Honors/CP Biology) and Mr. Paul Albert (AP/Honors/CP Physics) but also teaching both Honors and College Preparatory (CP) chemistry to students. In my opinion, all levels of students in the sciences can benefit from tactile learning using models that can be manipulated from atoms to single and complex chemical and biological molecules and compounds, types of chemical bonding and electronic forces, genetic structures such as DNA and RNA and organic structures for advanced placement courses. As a science team member, I would like to ensure that each student in the classroom has an accessible model kit throughout the year's coursework.

Currently, our science teachers do not have any modeling kits nor instruments for measuring the concentration or conductivity of solutions derived from such compounds or molecules. Moreover, in the absence of said items, critical areas of subject conceptual, tactile and visual scaffolding are extremely hampered at the expense of student understanding. To achieve student success and advancement in both chemistry and biology, it's essential that each student recognizes and connects that in both chemistry and biology atoms through their structure and transformation from a single atom to more complex compounds, molecules and cells are intertwined and thus the "building blocks of

life and all matter. Therefore, the addition of molecular modeling kits and solution conductivity instruments/meters would immeasurably facilitate our lesson scaffolding and classroom instruction in promoting student science learning and achievement.

Strategy: Briefly describe your plan to alleviate the need/problem.

I fully plan to include these models in my regular chemistry class as we discuss topic like:

- atoms & atomic structure
- the formation of ions
- the formation of covalent molecules & compounds
- covalent and ionic bonding
- the shape of water and its polarity
- the formation and structure of common everyday compounds
- the shapes of common molecules including tetrahedral, trigonal planar, linear and others · electron transfer during ionic bonding
- sharing of electrons and hybridization of orbitals during covalent bonding
- chemical reactions & change
- organic molecules and structure
- Genetic & medicinal molecules (i.e., DNA, RNA, insulin, ibuprofen/aspirin)
- Solutions and solution concentrations and conductivity

These are just some of the subjects and shared scientific ideas and concepts in chemistry and biology that will be affected by having modeling kits. From upper level AP chemistry down to the struggling student who just can't seem to understand, these models will have a huge impact on understanding and remediation of science misconceptions. In terms of the future, incorporating these models into our existing classroom structure should be relatively easy. In conjunction with online virtual programs, the use of models "in hand" by students will now allow them to build atomic, molecular and compound structures that are used in the lab and biologically and medicinally relevant, so that students can understand on a molecular level what is happening. Once incorporated, I contend that the use of models becomes not only a great way of teaching but most importantly, elevates the conceptual acuity of all students, thus leading to higher student achievement in the sciences.

Since solutions and their properties are an integral part of chemistry and biology, the conductivity apparatus kit provides students to test the properties of compounds and molecules dissolved in solutions. When used in partnership with the modeling kit, students can now construct visual representations of the compounds and/or molecules being dissolved in solution, while analyzing and testing its properties with the conductivity instruction/meter. When paired, the modeling kit and conductivity instrument/meter provides a platform for students to achieve higher order learning, especially in the areas of explaining the 'why's', the

'how's' and the interconnection between them.

Lastly, all of my co-teachers are so excited about the potential and ramifications of this grant in enriching student science learning and experience. If awarded, the model kits and conductivity apparatus will be used often in our lectures and explanations.

Outcomes

There have been extensive amounts of research done about student learning styles. As teachers, we realize that not all students respond to traditional verbal lectures, paper-based diagrams or online modeling programs. I assert that placing a model in the hands of a student takes a chemical concept from the abstract to the understandable.

In previous secondary teaching positions, I have been using modeling kits to help my students understand atomic structure, shapes and solubility. Based on student comments and their improved scores and achievement, the importance of having atoms "in hand" cannot be underscored.

Throughout our chemistry and biology class, students say that they like to 'touch' things in front of them that they would otherwise have to imagine or visualize. They also enjoy breaking away from the traditional means of learning to manipulate something other than their pencils. Another benefit of both the modeling and conductivity kits is improving student learning by providing a means of communicating in a meaningful way with my English-language learners. I have seen an increase in interest and understanding among my ESL students as I have worked to include more models in my classroom.

As a means of measuring progress, I plan on comparing this year's labs and tests to the scores next year. More importantly, I hope to see an increase in lab and test scores and a decrease in the amount of remediation and tutoring required for some of my more difficult topics. Lastly, I also plan on working with the other teachers on my team to continue to implement and document our progress.

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D. Objectives, Activities and Evaluation Techniques (This page may be duplicated if necessary)

- Listed below are several chemistry topics and concepts that will be covered during the 2022-23 school year but where student acuity and scoring and achievement would be immeasurably enhanced by the awarding of the grant.
- Given that success in chemistry is based on student comprehension and expression of the transition of atoms from simple to complex compounds/molecules and the effect on their electronic properties.
- All Units topics are accompanied by Next Generation Science Standards (NGSS).

Objectives	Program Activities to Accomplish Objectives	Completion Date	Evaluation Techniques

Unit: The Atom - Build an Atom Modeling of Atomic Structure • Obj: Students will model the structure of atomic particles in an atom in terms of charge and location (NGSS: HS-PS1; DCI: Structure and Properties of Matter; SEP: Developing and Using Models; CC: Patterns)	Students will model the structure of atoms using an guided inquiry, • Students will draw/illustrate select atoms and molecules from modeled forms • Students will compare and contrast structural properties of select atoms from the Periodic table	September - October 2022	The *Build an Atom* investigation is the last portion of the students' learning the parts of the atom. Modeling and questioning are my main focus for this unit. This activity really hit home with getting students to do both. After completing the investigation students will complete the Atomic Structure Exit Slip that summarizes PS1.A and lets me know whether or not more teaching needs to occur. If more teaching needs to occur, students can either revise their concept maps, or if a good portion of the class is struggling, the following class will begin by going over the *Build an Atom* investigation. Formative assessment will incorporate models and concept notes while the summative is based on their submitted modeling lab.

Unit: Periodic Table and Trends Based on PowerPoint slides, students will be able to explain the trends for electronegativity, ionization energy, and atomic size on the Periodic Table by performing an activity, taking notes, modeling and doing practice questions. (NGSS: HS-PS2; DCI: Structure and Properties of Matter; SEP: Developing and Using Models and Obtaining, Evaluating and Communicating Information; CC: Patterns and Structure and Function)	During initial lessons, I lead students through the trends. My goal is for students to learn what the trends are but also understand why the trends occur. • Inquiry based - Students groups will be given periodic trend data to analyze. and interpret. Students will record their analyses on a graphing periodic trends activity sheet to compare to an answer key. • Student will construct atomic structure models of atoms across a period/row and down a group to evaluate the properties of each trends • Present videos on Periodic Trends (i.e. atomic radii, ionization energy, electronegativity) • Using a periodic table, students will construct a color coordinated map of Periodic Trends for future references.	October - November 2022	Students will be assessed through various measures through the unit. • Formative assessment based on inquiry based graphing periodic trends activity sheet • Construction of color coordinated periodic table highlighting Periodic Trends • Formative assessment on notes and properties and modeling diagram • Summative assessment continuing multiple choice, short responses and matching on Periodic Trends

Unit: Moles and Molar Mass Students will be able to explain the concept of a mole and molar mass and be able to perform mole-mass conversions through lab activities, notes, whiteboards, and practice calculations. (NGSS: HS-PS1-7; DCI: Chemical reactions; SEP: Using Mathematical and Computational Thinking and Scale, Proportions and Quantity ; CC Energy and Matter)	Students will perform dimensional analysis based on PowerPoint problems, online chemistry program on molar concentration (i.e., PhET) • Students will learn scientific notations and significant figures • Students will calculate the molar concentration of select and unknown compounds based on reference data • Students will learn to use a science balance to determine concentration from molar data	December 2022 - January 2023	Students will be assessed through various measures through the unit. • Formative assessment based on inquiry based the calculation of molar concentration of select compound • Construction and diagram of ionic/covalent compound models undergoing phase changes • Formative assessment on notes and graphic representation of experimental data • Summative assessment continuing multiple choice, short responses and matching the properties and dimensional analysis calculations of select compounds ○ Dimensional analysis of daily used ionic versus covalent compounds

Unit: The Energy of Phase Changes Students will be able to explain how the effect of phase changes on molecules.compounds and be able to perform calculations using latent heat of fusion and vaporization through taking notes, working with partners, watching a video, performing a lab, and answering practice questions, • Students will develop and use models to learn about the interaction of two or more atoms and the effects on their electron cloud and valence electrons in solution. (NGSS: HS-PS3 and HS-PS5; DCI: Relationship between energy and forces; SEP: Developing and Using Models; CC: Cause and effect)	Inquiry based lab(s): Students will calculate the molar concentration of select ionic and covalent compounds to determine their effect on the boiling point of water. • The structural properties of ionic and covalent compounds will be modeled and their physical/chemical illustrated through drawing/graphic programs. • Students will graph and compare the difference in boiling points based on concentration and different compounds • Students will measure the conductivity of solutions based on concentration and type of compound • Students will compare their experimental findings with reference data through graphic extrapolation.	January - February 2023	Students will be assessed through various measures through the unit. • Formative assessment based on inquiry based the calculation of molar concentration of select compound • Construction and diagram of ionic/covalent compound models undergoing phase changes • Formative assessment on notes and graphic representation of experimental data • Summative assessment continuing multiple choice, short responses and matching the properties and effects of ionic versus covalent compounds. ○ Determination of the types of commonly or daily used ionic versus covalent compounds

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E. Itemized Budget

Materials/Equipment	Services	Evaluation Techniques
Item(s): 1 Chemistry Molecular Model Kit 444PCS Organic and Inorganic Modeling Students - Teacher Set with atoms bonds, a fullerene set and Instructional guide (Brand: Reliancer) **Cost:** $31.85/kit (Amazon) **36 kits x $31.85 = $1,146.60** **Item(s)**: 2 Flinn Conductivity Meter AP1493 **Cost:** $36.00/item (Flinn, Inc) **30 kits x $36.00 = $1,080.00** **Sub-total:** **$2,226.60**		**Grand Total** _____