Saint Paul Public Schools

Ecolab Teacher Grants Narrative Form - Team Application

Applications are peer reviewed – do not include details that identify staff or schools/programs

Project Title:	Manipulative Kits to Support Learning Chemistry during a Pandemic

Part One: Project Details

1. Describe your project. (1000 Characters max)

As a team of science teachers and language specialists, we have identified manipulative materials which are proven to support students with a variety of learning styles and English language levels. In the traditional pre-COVID classroom setting we were able to provide hands-on materials to be shared within our class. However, it is a challenge to meet the needs of the kinesthetic learner in a distance learning setting.
We will create and deliver kits to approximately 228 Chemistry students in the fall. These kits will include hands-on materials which we know to support all students, including English Learners (ELs), in learning the abstract concepts of chemistry. The materials in these kits will be used by students to support their learning at home. Furthermore, sharing materials in the classroom may not be prudent even if we are back together in fall 2020. In that case, individual kits will keep students from touching each other's supplies.

2. Describe what the money will purchase. (500 Characters max)

Each student kit will consist of a labelled container, plastic page protectors, white board markers, copied reference sheets (periodic table, bohr atom model outline) materials to model atoms (beads, pipe cleaners, markers), Legos (to model ratios, elements, compounds, and atoms bonding,) Modelling clay/play doh, "ball & stick" molecule building sets, dropper bottle, funnel, scoop, pipette, and simple measurement sets: graduated cylinder, syringe, weigh tray, scale

3. How will you specifically use those services/supplies? (1000 Characters max)

In distance learning this spring, our team noticed reduced student engagement and achievement. The kits will increase equity by ensuring that each student, including those in poverty, have access to materials needed to complete their lessons. The building materials will allow for activities in multiple modalities, instead of being inequitably reliant on reading skills. Students will create models to clarify and solidify their thinking; an important support to development of writing skills, especially for ELs. The legos and atom models will be used during synchronous lessons and tutoring to portray abstract concepts. Clay will make props to allow for alternative assessments such as stop-motion videos. Students will use plastic-covered reference sheets and dry-erase markers to draw patterns on templates, such as trends on a periodic table. Measurement sets will allow inquiry based lab activities at home. In whole, the kits will increase student's self-efficacy regarding Chemistry.

Part Two: Project Justification

1. Describe the need for this project. (500 Characters max)

Learning chemistry requires hands on materials and student models give teachers insight about misconceptions. Modelling abstract concepts with manipulatives is invaluable for chemistry learning to support multiple learning styles. Also, about 50% of our 228 students are ELs. Many have come here within the past 5 years with interrupted formal education. This is their first experience learning chemistry. We cannot accommodate these realities if 76% are in poverty and can't buy supplies.

2. Describe why you chose the items/services listed above to fulfil this need. (500 Characters max)

Chemistry seems difficult even to many adults. Visual and hands-on models increase students' understanding and confidence, an observation corroborated by research.* Even inexpensive materials allow the creation of helpful models. We know we can get a lot of bang for our buck using these kits. *Min, K.J.; Jackman, J.K.; and Chan, J.C.K., "Visual models for abstract concepts towards better learning outcomes and self-efficacy" (2014). Psychology Conference Papers, Posters, and Presentations.4.

Part Three: Relationship to Student Learning and SPPS Achieves

1. What classroom unit of study/lesson plan/MN academic standard does your project align with (e.g. aligns with calculus curriculum in preparation for AP STEM test)? (250 Characters max)

MN Standard:
3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions and/or explanations, and communicate ideas to others.

2. How does your project support the classroom curriculum listed above? (600 Characters max)

Chemical systems, molecules, and atoms are all discussed by scientists using models like the periodic table, molecule kits, the Bohr model. Models are used to identify patterns, develop questions, make predictions, and provide explanations about the chemical systems, molecules, and atoms. Creating their own models is an effective way of students applying knowledge, building vocabulary and representing understanding of abstract concepts. Student models communicate understanding and misconceptions to the teacher. Basic lab materials allow for testing of hypotheses and doing inquiry at home.

3. Which SPPS strategic focus area or long-term student outcome does the project align with? (300 Characters max)

The project fits the focus area of Effective and Culturally Relevant Instruction: increasing the capacity to meet the instructional needs of each learner. Students/teachers "storify" concepts; uses a collectivist style: building and talking together; supports (not relies on) reading/writing skills

4. How does your project support the focus area or long-term outcome listed above? (700 Characters max)

Manipulatives and realia offer students an additional mode beyond the oral/aural modes typically used in education. Students' comprehension and retention will increase as they build models of the concepts we study. Content-based language development is enhanced using manipulatives. Students can explore and visualize before they even have the technical vocabulary. Attaching the vocabulary to concepts is made easier for ELs (and all students) in this way. Effective science education is not an accumulation of facts but instead is learning to think like a scientist. Developing these skills in all learners requires using a variety of techniques for exploration and discovery.

Part Four: Measuring Project Success

1. What will success look like? (300 Characters max)

Submissions of photos/videos will show student use of kits for inquiry and representation of concepts. In google meets, students will be seen using their kits to build understanding.The kits will increase engagement. As a result, more students will turn in assignments and use teachers' office hours.

2. How will you specifically measure that success after project implementation? What positive changes to you anticipate? (500 Characters max)

We expect higher test scores, more meaningful written explanations, and more creative applications of learning. We predict 1) 80% of students will use the kits for 4/5 assignments, as evidenced by submissions. 2) 50% increase from formative to summative assessments due to using the kits to model abstract concepts and teachers addressing misconceptions revealed by student models. 3) Higher engagement and self-efficacy shown by a 50% increase in attending chemistry google meets over spring 2020.

Part Five: Additional

1. What different roles will team members have? What will the team accomplish together? (600 Characters max)

We three are a PLC which has been collaborating successfully for the past year. Together we will order and organize materials, plan for distribution, assess student engagement with the materials, and identify successes and needs for adjustment. The two licensed chemistry teachers will have primary responsibility for planning the content-based connections that can be maximized using the kits. The EL teacher will have primary responsibility for optimizing engagement with the materials to build students' use of academic and scientific language in writing and speaking.

2. Will any groups or community organizations (nonprofits, foundations, etc.) work with SPPS for this project? (500 Characters max)

Not applicable

3. Is there anything else you would like to share about your request/students/school? (Demographics, achievement scores, why this project can't be funded otherwise, etc.) (500 Characters max)

Our high school is 93% non-white, 76% free-reduced lunch, 34% English Learners. We estimate 80% of students are unlikely to buy their own materials. This creates an equity issue.
Our science department budget is based on much sharing of materials between classes and students within classes. Without this grant we don't have the means to supply materials to individuals. Finally, even if we are in school, we will need the kits to reduce the risk of spreading COVID-19 through proximity or touch.