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# Social Communication Fosters Student Collaborations

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**Abstract**

*Math teachers embracing social communication in the classroom is critical to students collaborating. Students today are easily distracted and need well-structured activities to engage them in learning rigors mathematics and science. We provide teachers with problem-based learning ideas that are interdisciplinary in nature and hands on. Students find them motivational and engaging.*

**Keywords:** STEM, discourse, math, science, learning, teaching, in-service teachers

How do you compete in a world of Facebook, Instagram, and Snapchat? This is a question that often plagues teachers as they fight to keep the attention of their students. Teachers are charged to help their students gain knowledge and demonstrate competency on end of year high stakes exams. As facilitators of learning, we know to do this we must create novel ways to engage students in the educational process that is both fun, social and informative while also fostering conceptual understanding. Teaching with creativity is not something that comes naturally to all of us. Many teachers work diligently at it and expend an enormous amount of thought and effort into what they are doing and what concepts they are trying to get students to master while designing the activities.

Social activities that foster collaboration and social interaction can be vital in helping students develop these concepts while they are at play. According to Shelby Strong (2016) in her NCTM blog on Communicating in the Math Classroom,

> "classroom discussion is a necessary component of a well-rounded math and science classroom, look no further than the Common Core's Standards for Mathematical Practice. These standards, written to apply across the entire K–12 math curriculum, highlight important and necessary characteristics of a proficient mathematician. Several standards address the need for communication, but none so clearly as Standard for Mathematical Practice 3: Construct viable arguments and critique the reasoning of others."

*A Science Classroom Discourse Community (SCDC)* promotes a culture of interaction that fosters scientific discourse, scientific habits of mind, and scientific language acquisition through inquiry. Central to a SCDC are experiences for students to communicate, create, interpret, and critique scientific arguments using scientific principles and data from inquiry activities (Baker, et al., 2009).

We were able to create learning activities that encourage sense-making as students practiced key mathematics, science, and social skills. During a professional development session with pre-service and in-service middle and high school math and science teachers, we introduced an interdisciplinary approach that incorporated math, science and social skills. During this program, teachers were encouraged to think outside of the box and to embrace project-based learning. To assist teachers in the understanding of how interdisciplinary collocation could benefit their students and the classroom we introduced them to our project called the Sun House. The Sun House was a 4-hour professional development workshop.

Teachers were asked to use mathematical and scientific concepts such as modeling, optimization, hypothesizing, and communication to collaborate building a Sun House (Hernández, et al., 2016). They had limited resources to complete the task (i.e. money, time, materials). The goal of the Sun house was to get students to meet several mathematics and science competencies while also modeling social interactions, discourse, appropriate use of technology in addition to ethics and learning while at play. The workshop facilitator gave detailed instructions on how to start the Sun House. For the house to meet expectations, it had to deliver on several criteria which covered the following themes:

- A working door that allows entry by a person at least 6'0"
- Two transparent windows
- A roof
- Running water that is above 40 degrees Celsius
- Working lights
- Be insulted against Heat/Cold/Sound

The Sun House Model Activity fosters collaboration, leadership, optimization, and it will also teach students how to use various technologies such as MS Excel, Geometer's Sketchpad and Desmos to name a few. Mathematical modeling has been defined in many ways. The authors of the GAIMME report define it as "a process that uses mathematics to represent, analyze, make predictions or otherwise provide insight into real-world phenomena" (GAIMME 2016, p. 8). The project gives a social scenario that has various possibilities however it is up to the team to discover optimization of resources and to build from to meet the criteria. During the workshop participants were put into groups of 4-5 and spent the first half of the workshop session gaining understanding and strategically planning. The second half of the workshop session consisted of implementation of the building plan. Through discourse, participants applied their knowledge of math, science, and communication therefore, building a bridge from theory to practice.

It has once been said that if you have a project to do that you should spend 90% of your time planning and 10% doing the project. Following that line of thought, we encouraged participants to spend a great deal of time planning. Each group consisted of the following: a leader, scribe, materials manager, and Researchers. The groups were not random but carefully selected to ensure a heterogeneous grouping of ability and gender. Groups were assigned members to foster social interaction and play within a group. More, importantly each group was responsible for a significant part of the overall project.

Six groups were assigned to ensure that all parts of the Sun house were completed. The groups were as follows: Doors and Roof, Windows, Water System, Lighting, Insulation, and Design and Presentation. In addition to the groups, overall project participants selected a project leader who was charged with responsibility for the entire construction of the sun house.

The project leader was the only one allowed to communicate with the workshop facilitator on behalf of the group. This forced participants to communicate ideas to each other and follow a chain of protocol while using math and science to create the various parts of the sun house.

During this period, it was an excellent time to remind participants of the various things they know to solve real-world problems and how to apply the theoretical knowledge from the classroom such as using algebraic concepts of optimization. The overall group was given a limited budget to buy materials for the construction process, and each group had to communicate their needs and provide justification to the project leader. Participants used geometry and measurement to build doors, windows, the roof and several other components. Participants also utilized science concepts integrated with mathematical concepts to complete the construction. Participants reviewed concepts of matter, energy, heat, light, and sound.

Each group decided how to create the parts they were responsible for and developed a prototype design on the computer or paper. Participants were able to use mathematical software such as Geometer's Sketchpad much like an AutoCAD. Furthermore, participants were able to make budget projections and create mathematical models on MS Excel to aid in calculating the estimated cost and to optimize the budget for the Sun house (Krajcik & Merritt) . Utilizing technology allowed the participants to make budget adjustments as they saw fit to stay within the project.

During the second half of the workshop participants were tasked with translating theory to practice. Prototypes and budget were realized in this half of the workshop. Participants were able to see the mathematics and science come alive through the application and social communication of those ideas. It was interesting to observe how participants translated ideas to practice and communicated these ideas for mutual understanding for the successful completion of the Sun House. We were able to observe the social interactions among the various groups and how they communicated and understood how ideas were applied in the given context. We observed how ideas changed and how the change in ideas was communicated to the group. Working together fostered social communication but it also required the ability to negotiate for needs versus wants within each group. Participants were challenged to set aside their desires for the betterment of the group. The groups were also highly competitive and used peer pressure to engage, which resulted in social misfits being challenged and enjoying a sense of belonging, through the active engagement. As facilitators, it was our task to encourage participants when they incurred obstacles and became frustrated. We were able to provide just enough of a nudge to get them through challenges.

As a result of this problem-based project, we observed that participants were much more engaged with math and science concepts. They were excited to do the modeling, which gave them the motivation to be excited about the math concepts that we needed to cover. By design, we strategically made the project to cover key concepts that students were already required to master. As outlined in *Principles to Actions: Ensuring mathematical success for all* (2014) learning through social communication, mathematical modeling and play served as a strategy for participants to be engaged. The Sun House became motivation for the participants, and they desired more.

Positive peer pressure became a motivating factor, in that each member of the group did not want to let the other member down. Therefore, the best effort was put forth to make sure that they followed all regulations and that each group's objectives were met. Each group was graded based on meeting the objective that was given to them from the start.

Social communication and modeling activities such as the Sun House are great projects that bring in multiple facets of learning. They can encompass every part of the learning process if planned strategically. The project can cover writing, math, science, reading, leadership and social communication to name a few. Besides highly sought-after soft skills are developed through this activity. Modeling is a huge part of the curriculum and is strongly encouraged by in National Council of Teachers of Mathematics in that it helps students to understand their natural world. Consider using social communication and modeling in your classroom to bring social engagement to a subject that students find less exciting or feel intimidated. Activities like this help us to compete with the various social media environments and help participants develop other skills.

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