

### **ST1.3 Empowered to Self-Direct STEM learning**

- Preschool - Preschool students have daily opportunities to engage in developmentally appropriate activities related to STEM using manipulatives; magnets, water play, sensory activities, cars, blocks (magnetic blocks, wooden blocks, foam blocks). Preschool staff facilitates conversations within the center to encourage learning through creative and critical thinking.
- Kindergarten: Students are presented with various tasks that require using the Engineering Design Process each day. The children problem solve as they work on 'improving' the design.
- First Grade: At the end of STEM days we have a reflection time to talk about what worked, what didn't work, how could we make it different?
- Second Grade: Students are given a task to solve, and materials, (ex: building towers with solids), where they are to determine which properties of solids are best for building bases, reaching heights, or providing stability. Students also participate in a number of online learning sites, including Zearn and MobyMax, where students build on their own successes.
- Third Grade: Students in third grade are empowered to personalize their learning in many ways. Science experiments in third grade in general are hands on and student led with guidance from teachers. For example, in STEM projects students are given a real world problem and asked to design a solution. A recent project asked students to design a botanical garden based on community needs and the native plants of the given location. Teachers facilitated discussion about what a community might need from the facility and provided students with a video that showed how real life landscape architects designed a park project to help inspire their design work. However, students guided their own research on the native plants of their region and made decisions about which plants best suited the needs of their garden in their community. Another example of a self-directed STEM project was to innovate and develop a solution to agricultural problems around the world to implement in the future. The "Future of Agriculture" problem-based learning project asked students to research current agricultural practices and shortcomings, design a model, and prepare a product to propose the solution. Students created the rubric to guide their own work throughout the process. Teachers facilitated discussions to deepen students' thinking, ask questions for students to consider when developing their plan. Ultimately, the students self-directed themselves through their research and decided the best plan to solve agricultural issues in their part of the world. Students also personalize their math learning through the zearn.org website which is aligned to district curriculum and state standards but can be explored at their own pace. Third graders design their own investigations based on the materials available. They are responsible for the plan, the execution of their plan, and the data collection. For example, third graders were presented with a counter full of different planting materials (seeds, gravel, soil, water, seed sprouted, hydroponics tub, cups, etc.) and they had to design an investigation regarding seed growth. Students developed their own lab reports including the purpose, question, hypothesis, materials, procedures, data collection, and analysis. Students self-guided through the investigation, deciding which materials are needed to design an investigation to answer his/her question and tending to the plant, as well as collecting data. Through their own investigations, they learned about a control and variable and the Scientific Method. Students developed theories for why his/her plant did not grow, made changes to the lab report, and replanted. Teachers guided the investigation by providing materials, facilitating discussion regarding plant growth, and asking questions to guide their analysis and conclusions of their investigations.
- Fourth Grade: 4th grade has incorporated STEM into their daily RTI time. Students are given the opportunity to work on real world problems such capturing cane toads in Australia. Students have since taken that scenario and are now applying it to the bark beetles in the mountain region of AZ. Students are also engaged in coding and logic games during RTI time as well as Genius Hour. All of these activities are student driven in which the adults are there as facilitators of learning. Students in 4th grade each present an invention during our annual STEM night. Students are encouraged to solve real world problems with their invention.
- Fifth Grade: We as a grade level, have our students reflect on their learning and how to improve the process whether it be through what they have learned and how they have grown in their thought process. Teachers act as facilitators, always having students chose their learning as to better have them internalize their learning.
- Sixth Grade: Khan Academy computer driven self-guided math instruction. STEM activities are problem based not project based which requires the students to explore, investigate, create, solve, test and improve their

solutions to the given real-world problem. All students have the opportunity to work deeper within the content and select learning experiences that are appropriate for their abilities.

- Seventh Grade - Students use the information they learn about Forensic Science to self-manage their progression through virtual crime scenes. Students have data binders in all core classes to keep track of their learning. Students are empowered to personalize and self-direct their STEM learning experiences by participating in virtual labs in Science (Gizmos). Students have opportunities to be owners and managers of their own STEM learning experiences by reflecting on assignments and setting their own goals. Students are using Khan Academy to self-direct their Math learning by watching short video clips and performing Math problems at their current level.
- Eighth Grade - Ten Marks extensively which is personalized to curriculum content and enables students to independently practice newly acquired skills and content. In STEM instruction give student's tools and guidelines needed to solve a problem and create a solution. As students are researching, brainstorming, planning and creating, teachers are facilitating these group discussions. Use of self-directions to point them back to where they need to be to use the tools given to them to use the engineering design process. All classwork and hands-on experiments are introduced by the teacher and then run by the students. Teacher facilitates classwork and hands-on science experiments so students may lead their own learning. Rubrics offer specific guidelines so student understanding of the expectations is always clear.
- Special Areas: Within and at the completion of units students create new or innovative games, set personal goals and design plans for future success within content areas. Famous artist tissue Box (see artifacts)
- Ren 6/7/8: Each teacher implements student self-directed learning through problem-based learning. Teachers are coaches as the students work on open-ended, loosely defined problems. Students are guided through selecting the criteria required to solve the problem, the verifiable facts and information needed to solve the problem, the plan of action needed to come to a solution that is workable and testable.