New Mexico STEM Ready! CONNECT

5.3.19
Vol. 1
Issue 14

Implementing the NM STEM Ready! Science Standards

Did You Know?

Concord Consortium Simulations, Google Spreadsheets, NetLogo, PhET Simulations, ScratchED, or Vensim are freely available online simulation or data visualization tools.

Share with friends!

Click here to subscribe to our biweekly newsletter and stay updated!

Science and Engineering Practices - Mathematical and Computational Thinking

Sense making requires students to be engaged in understanding the world by generating, using, and extending scientific knowledge around a phenomenon (Schwarz et al., 2017). When classrooms focus science education on application [phenomenon] then students are motivated to explain and the focus of learning shifts from *learning about* a topic to *figuring out* why or how something happens. *A Framework for K–12 Science Education* emphasizes eight practices that scientists and engineers use in their profession and that students utilize in their K–12 science education. Mathematics and computational thinking, one of the eight practices, enables predicting the behavior of systems and testing the validity of those predictions.

Mathematical and Computational Thinking

Students engaging in mathematical and computational thinking apply mathematical formulas to precisely, predictively model phenomenon. Mathematics requires students to identify and measure patterns or quantities in a way so peers can compare results consistently. Once students identify patterns and quantities, they address the relationship between those quantities and relationships (e.g. mathematical formulas). The equation $f=ma$ (force = mass x acceleration) describes the relationship between quantities (i.e. mass and acceleration) to the force of an object. Students are using mathematical formulas to explain the phenomenon, not to reinforce predefined data or to practice procedural fluency.

Visualizing data (i.e. computer models or computer simulations) gathered from investigations help students to refine their understanding of relationships and processes to explain a phenomenon. Students can use existing or create new online tools to design and simulate scientific systems. Computational tools help students understand systems that are too complex mathematically or that have random or probabilistic elements (Schwarz et al., 2017).

Classroom Practice

Supporting students utilizing this practice calls for a classroom culture promoting student sense making and providing the appropriate tools. Appendix F of the NGSS identifies ways to incorporate this practice in the classroom. Push students to take qualitative observations that lend themselves to quantitative measures. Students use visualization tools to find patterns and trends from quantitative measures. Students use those visual tools to help explain the phenomenon.

References:
Schwarz, C.V., Passmore, C., & Reiser, B.J. (2017). Helping students make sense of the world using next generation science and engineering practices. Arlington, VA: NSTA Press, National Science Teachers Association.

Reach out to the Math and Science Bureau staff with questions or for more information.