i3 Learning by Making Newsletter

Summer Institute - A Teacher's Perspective *(Jim Snyder)*

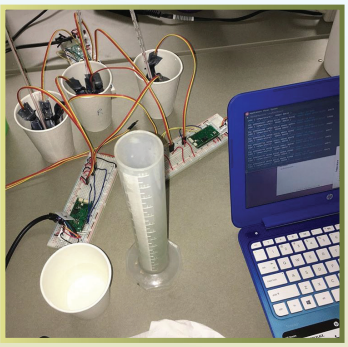
I have been a teacher in the Learning by Making program since the very beginning. Each summer since 2014, we gather together for the week-long Summer Institute with SSU. Here, we dive deeply into the curriculum, provide feedback over the past year's progress, and make plans for implementation in the year to come.

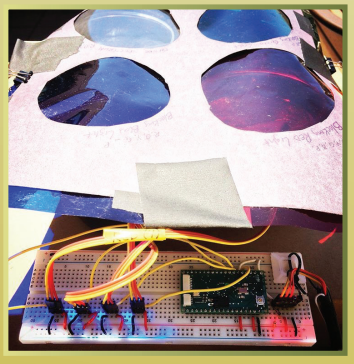
During the Summer Institute of June 2017, we focused on generating new experiment ideas for the year 2 course, Integrated STEM Physical Sciences. The SSU team presented a variety of sensors and science content about light, temperature, and sound. In small groups, we teachers worked to construct starter experiments that would inspire students to pose scientific questions and to design their own experiments.

My group created an experiment to test how filtering different wavelengths of light from the Sun would affect the amount of heat transmitted into a body of water. We filled four cups with water and fitted each with either a clear, red, green, or blue filters. Each cup held a temperature sensor hooked up to a BasicBoard. With SSU's help, we wrote jLogo and uLogo code to collect and plot temperature data at regular intervals. While we posed only one scientific question to start, we found ourselves generating quite a few more throughout this process. Curiosity drove us onward.

The Learning by Making program harnesses the process of inquiry to inspire questions about the physical world. Students design unique experiments from the ground up. This is different than the more traditional academic approach: following predetermined labs and step-by-step procedures. As we move towards full implementation of the Next Generation Science Standards in California, we are less concerned with students being able to follow directions as we are wanting them to reason out their own path. Rather than pose teacher selected questions, we want students to generate their own questions based on genuine curiosity. Students construct their own models of physical processes and then design experiments to improve or expand upon these models.

The Summer Institute of June 2017 allowed teachers to look at physical science phenomena through the eyes of our students. We generated our own questions and designed our own experiments. I firmly believe that this is the direction we all need to be moving in science education - putting the power of inquiry in the hands of the students.





Experiments designed by teachers during the June 2017 training.

Learning by Making STEM Teachers in the Spotlight

Anderson Valley High School Principal Jim Snyder was named as one of three 2017 California Finalists for the Presidential Award for Excellence in Mathematics and Science Teaching (PAEMST). Jim has been part of the inaugural Learning by Making teacher cohort that attended the first summer institute in 2014, and he taught the first LbyM curriculum starting in Fall 2015 to Anderson Valley High students. Congress established the PAEMST program in 1983, authorizing the President to recognize up to 108 teachers each year for their excellence teaching K-12 mathematics and science. The PAEMST award is the highest honor the United States government bestows for teaching these subjects at the K-12 level.

Thank you to the Fluke Corporation for contributing another 10 digital multi-meters for use in the classrooms! It's wonderful to be able to use professional equipment to train the LbyM students!

Sharing Discoveries in 2017

Learning by Making made a second appearance at the 2017 reMAKE Education Summit co-sponsored by SCOE in August. Educators from all grade levels and subject areas participated in in-depth, hands-on exploration of how maker education is changing the face of education and the world. SSU's Lynn Cominsky and Carolyn Peruta conducted sessions to demonstration the coding and sensor content of the STEM curriculum.

The LbyM project was invited to present at the Interaction Design and Children (IDC) Conference at Stanford University in June 2017. IDC is an interdisciplinary international community focusing on the promises of leveraging technology to enable children to participate in nurturing and empowering experiences and bring children's voice and sentiments into this process. The presentation summary was published in the conference proceedings. (See *https://dl.acm.org/inst_page.cfm?id=60014069*)

WestEd and SSU teamed up to present at the National i3/EIR Project Directors Meeting in Washington DC in July. For the conference strand, Challenges (and Solutions?) of Collecting Counterfactual Data from Schools and States, they shared learned strategies and best practices on trust-building to strengthen partnerships and data collection practices.

Ukiah Teacher Training, December 2017

At the December California STEAM Symposium at Moscone Convention Center in San Francisco, a LbyM workshop was offered as one of the "innovative approaches to teaching and learning happening throughout the state."

LbyM was slated for a demonstration at the California Science Education Association (CSEA) annual conference in October in Sacramento. Alas, in the immediate aftermath of the northern California fires, the SSU team cancelled the workshop.

WestEd researchers Linlin Li and Rachel Tripathy presented at the California Education Research Association annual conference in November. Their presentation, titled Science Education for the Next Generation — Lessons from a Hands-on STEM Curriculum in California, was based on their independent study of the LbyM curriculum.

What Does the Research Say?

WestEd conducted a rigorous study of the LbyM STEM curriculum in 2016/17. The findings were released this month. Some of the highlights:

- The curriculum was positively associated with significant gains in students' science content knowledge. On average, students who were exposed to the LbyM curriculum outscored their comparison group peers on the science assessment by 7 percentage points.
- On average, students who were exposed to the LbyM curriculum outscored their comparison group peers on the math assessment by 4 percentage points.
- The LbyM curriculum helped low-achieving students improve math understanding.
- Students demonstrated increased confidence and problem solving stamina.
- LbyM helped teachers integrate Next Generation Science Standards and project-based learning into classroom instruction.

> "Kids would come in a few minutes before school started. They would get their laptop out, and they would start working, and they would just be here. And I've never had that in a first period class, where the kids came, and they just started working without any instruction from me."

> "One of the things that I noticed last year but I feel like it's really happening [now] is that the kids are learning a lot of math. I feel like there's such a connection between what we do in this class... So I just think that the math that's embedded in the curriculum is really incredible. It's accessible to a real spectrum of kids with different math skills."

> "I love when I step back, because really I'm steering the ship, but they're really the ones that are making it go. And I like that."

The report concludes, "by refining and scaling LbyM, this project hopes to expand the reach of this innovative STEM curriculum, and make high quality, standards-aligned STEM learning accessible to more students. "

This Spring, WestEd is working on teacher and classroom case studies, as well as collecting data to report on program implementation. An executive summary with an overview of study design and methodology is available by request.

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To join our LbyM group page, send email to *lynnc@universe.sonoma.edu*.

*Sonoma State University * 1801 E. Cotati Avenue * Rohnert Park, CA 94928 * (707) 664-3122*