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A Journal of Adult Learning in Schools

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The 72-mile classroom. Photo courtesy of Erina Chavez

cover image: *HTH Astronomy Club's latest project: the quadcopter*
Photo courtesy of Brian Delgado

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Welcome

The Editors

Welcome to the eleventh issue of UnBoxed! We hope you will enjoy this collection of stories, designs, and reflections about teaching and learning in and out of schools. In every one of these accounts, the reader will note the powerful presence of learners' voices—and the readiness to explore uncharted territory.

Three of our contributors offer lively classroom reflections about instructional design. David Corner describes a his planning for a math unit that aims to foster mathematical habits of mind and self-directed learning. Alec Patton reflects on the stresses and rewards of exhibitions of learning—the role of authentic audiences, and the importance of balancing show and substance, or "sizzle and steak." Kelly Williams discusses the value of prototyping in developing writing projects—for the teacher, who can then anticipate and understand some of the struggles students may experience, and for students, for whom seeing the teacher write helps to demystify the process.

Other articles take us outside the school walls. Brian Delgado and his students move from a classroom Socratic seminar to space exploration

in the desert. Erina Chavez, a student at High Tech High in North San Diego County, describes a project that took students on a 72-mile Odyssey through five different biomes along the San Dieguito River. For Melissa Agudelo, the dialogue about teaching and learning starts at home—the student's home—with home visits building a two-way bridge of dialogue, understanding, and advocacy.

What about teachers as learners? Christine Hoyos and Michael Martin argue for the importance of regarding failure as an episode of learning, for adults as well as students. If adults are to grow as teachers, there needs to be room to try—and perhaps fail at—something new. Joan Soble describes the triumphs and tensions involved as teachers engaged in regular exhibitions of their own learning over a several-year span in an urban high school. Finally, Kathleen Gallagher shares a process and instrument for identifying effective teaching—what is it, how do we know, and how can we help new teachers develop their craft? It turns out that developing teacher effectiveness, too, is a matter of dialogue—of bringing teachers' voices into the conversation.

Four of these articles made their first appearance as posts to EducationWeek's *Learning Deeply* blog, http://blogs.edweek.org/edweek/learning_deeply/, hosted by Jal Mehta of Harvard University and Bob Rothman of The Alliance for Excellent Education. We encourage our readers to visit that blog, which features posts about purpose, policy and practice by educators and students from a variety of settings.

The UnBoxed cards in this issue offer glimpses of projects and practices that we find inspiring. These cards are freely available on our UnBoxed website in a printer-ready format. Simply print, fold, share and discuss. Each card refers the reader to a web address for further information.

We wish to thank the K-12 and university educators who have reviewed our submissions for this issue and offered invaluable counsel. We invite all of our readers to join us in conversations about purpose, policy and practice in education by submitting your thoughts for publication or serving as a peer reviewer. To learn more, visit www.hightechhigh.org/unboxed.

Read, enjoy, and participate!

—The Editors

Photo credit: Deryk Goerke, HTH 2016;
Julio Rodriguez, HTH 2017, Ashley Luna, HTH 2017

From Socratic Seminar to Space Science

Brian Delgado
Gary and Jerri-Ann Jacobs High Tech High

I have been doing Socratic Seminars in my physics class long enough to know when they go well. There is a buzz of dialogue that lingers for days or weeks afterward. Such a moment occurred this past fall with my 58 ninth graders, when we dialogued about an article on panspermia, focusing on professor Michael Mautner's argument that we have a moral obligation to seed the universe with terrestrial life. Later that evening, while driving some of these students to our local climbing gym, the conversation shifted to possible mechanisms for an earth-born panspermic mission. "What if we could send life out into outer space? Tardigrades on solar sails. That would be an amazing project!" I was hooked.

That night, pursuing the idea, I came across an article about a group of university students from Great Britain who launched a weather balloon into the upper atmosphere to capture a stunning photo of the curvature of the earth. Here was a potential entry point that seemed within our reach. Later that week I spoke to the seniors in our Astronomy Club. They all wanted to get involved. One student remarked, "You'll need a way to stabilize the camera so you don't get shake. There are balloons

rated to different altitudes, but you should be able to get one that will expand to a 20-foot diameter at about 100,000 feet and pop. Your most important system will be the parachute deployment and the GPS. You don't want your electronics to break on impact."

I opened the second semester by informing my 9th grade class that they would help develop a Space Science Program (SSP) at High Tech High. Our astronomy club had just been given an eight-inch Newtonian telescope, prompting an additional donation from our parent association to purchase a mount and camera. We needed to learn how to do astro-photography, and we would launch two weather balloons into near space to photograph the curvature of the earth. If we could make it work—a still-uncertain prospect—it would be the first of many balloon launches focused on science in near space. These ninth graders would be the pioneers.

I began working with two colleagues to develop the SSP: my co-advisor of the Astronomy Club, Andrew Lerario, and Blair Hatch, whose twelfth grade multimedia students created our web page and posted the photos we were capturing. Older Astronomy Club students started visiting my class to observe and converse with the ninth-graders as they developed their weather balloon designs. We set up teams to develop the imaging system, the safety and recovery system, the packaging, and the launch. Along the way, we learned how to use our equipment to take photos and process deep space objects. Students became teachers, and teachers became students, all learning together.

Early one morning in May, our launch and recovery team of eight students set out for the desert east of San Diego. There, we set up, made sure all our systems were go, and filled the IQPI Weather Balloon with helium. Just as we were about to attach the imaging package, a line broke. We watched the balloon float up—100 m, 200 m, 1000 m—without the package. The students sank to the ground, feeling they had failed and embarrassed to have let down their classmates. I shared their disappointment; however, I saw this as an opportunity. Back at school, I explained to our entire team how this failure would lead to eventual success, that this was how science and engineering are done, and that this was our moment to assess, make corrections and try again.

We had to wait three weeks to attempt the second launch, checking the University of Wyoming's Balloon Tracking Forecast for favorable winds in the upper atmosphere. When the window of opportunity finally came in early June, Andrew, two students and I journeyed out to the same desert spot. This time our lift-off was successful, and we retreated to a local restaurant to wait for the ping that would tell us our package had returned to earth.

The forecast predicted we should begin receiving GPS pings an hour and forty five minutes after launch, but three hours later we were still sitting there, waiting. No signal. Andrew went out to the car, getting ready to leave for home. The students sat across from me silent. We had already voiced every possible explanation for what might have happened. My eyes drifted toward the computer screen as it refreshed. Ping! The screen changed. "We have a signal!!!" I shouted to the entire restaurant. Deryk sprinted out the door as I started collecting our stuff. Andrew came in with an enormous grin on his face. "Where is it?" he shouted, and we were off on the recovery mission.

We recovered our IQPI-Pazuzu Near Space Balloon in a field outside of Yuma, AZ some 90 miles east of the launch point, where it had landed in soft farmland 150 feet from a road. In the imaging package we found nearly two hours of video from the ascent, with images of the deserts of California, Arizona, and Mexico, the Colorado River, the Pacific Ocean and the blackness of space against the curving earth. Now the science could begin.

Image captured by the IQPI-Pazuzu Near Space Balloon

It was fascinating to witness the explosion of ideas as the class looked at the images together. What if we put life on the next balloon? What if we filmed the balloon popping? What if we launched over the Sierra Nevada to get images of mountains? What if we launched before sunrise to get an image of the sun against the earth? What if we developed a first person viewer to see what the camera is filming in real time? What if we launched during a solar storm to look at radiation levels? What if we flew a glider off of the balloon? Can we get something into orbit?

In their year-end presentations of learning, ten in our group of 58 expressed a desire to study astronomy or astro-physics in college. Regardless of whether this would actually come to pass, I knew I had stumbled on something major. This big, hairy, audacious idea will be the cornerstone for what I will do in the coming years—studying space and looking beyond what we can normally see, whether through telescopes, microscopes or imaging systems in places we can't easily get to. Several graduating seniors are organizing a second launch this summer before leaving to college. Andrew will continue balloon experiments with this same cohort of students when they reach his class next year. I have been approached by 7th and 8th graders who want to be in my class. Our next steps will include adding sensors and a communications system to the balloon. We plan to connect with private clubs, university groups and other schools doing similar experiments. We are now even thinking about putting a satellite cube out into space. Who knows? Perhaps one day we'll send a microbe out and see where it ends up.

For more information and additional images visit:
www.hthspacescience.net.

For a video of the balloon launch, go to:
www.youtube.com/watch?v=mD0FrID9uPA&feature=youtu.be

Assessing Quality Teaching

Kathleen L. Gallagher
San Diego Unified School District

I always strived to be an excellent teacher, but it didn't always come easily or naturally. I am not sure I ever would have realized that my instruction could be different if I didn't read in the company of wonderful colleagues who cared about teaching and learning. In the first professional book study of my career I read *The Art of Teaching Writing* (Calkins, 1986). My colleagues and I used the book to transform our beliefs about writing instruction. Over the course of my career, many other professional texts written by powerful, practicing teachers taught me how to bring meaning to the content I was teaching. Marilyn Burns did it for me in mathematics. In addition to her books, I was lucky to have access to a group of gifted role models who showed me how to bring her ideas alive to create a classroom that buzzed with the joy of mathematical thinking and reasoning. These authors who wrote passionately about their craft, combined with the interactions I had with colleagues in professional learning communities, inspired me to continually transform and improve my professional practice.

After 17 years in the classroom I ventured into the arena of instructional coaching. In my first year, I quickly realized that everyone did not have

access to the resources and role models I had experienced. Working at two schools and in about 40 classrooms, I calculated that only about 25 percent of teachers were actively working to improve their instruction. These top teachers were the ones who most desired professional collaboration and support, but as a coach, I was challenged to also support the teachers who did not have an intrinsic desire to change. Many of these teachers seemed to feel that the potential for change in their classrooms and students was sourced outside themselves. In the course of learning to do this work, I realized that there really weren't any concrete tools for observing and providing feedback to teachers in ways that allowed them to reflect on the quality of their instruction.

The Art of Instructional Measurement

Accurately measuring the contributions that effective teachers make to children's learning is important not only to understand the characteristics and attributes of high-quality teaching, but also to assist the teachers who are having difficulty (Weisberg, Sexton, Mulhern, Keeling, Schunck, & Palcisco, 2009). One problem with standardizing a practice for the sake of measurement is that as soon as one begins to try to define it, we reduce it to its most technical aspects. We look at things like lesson plans, standards, learning objectives and test scores because those are easy artifacts to reference. Observations are strengthened when we consider the quality of teacher questions, student responses, and work products, but unfortunately, methods for evaluating these processes are implemented with varied levels of reliability and little or no consistency over time (Darling-Hammond, Amrein-Beardsley, Haertel & Rothstein, 2012; Hargreaves & Shirley, 2009). So we have the dilemma of measuring ineffectively or not measuring at all and both have the same deleterious effects on the improvement of teaching.

In order to effectively capture what Richard Elmore (1996) calls the instructional core of teaching, we have to be able to examine the constant and ongoing interactions that happen between teachers and students as they engage meaningfully with content. Since almost any person can walk into any classroom and in a minute or two assess whether or not learning is taking place, I thought it might be possible to describe that process using Elmore's instructional core as a guiding framework. I began by inviting the teachers at my school to join me in an action research project. Twelve teachers gave up a few prep periods

to observe our students learning. We collected examples of what students looked liked and sounded like when strong instruction was taking place. We generated a long list of student behaviors associated with student engagement. Our list included: students raising their hands excitedly, asking questions, learning cooperatively, enjoying their work, working out problems, reading for meaning, writing, persisting through difficulty, listening to the teacher, listening to each other, making a personal investment in the learning, presenting to their peers, getting feedback from the teacher, getting feedback from their peers, using materials appropriately, being creative, thinking hard, talking about their work, being accountable, sharing ideas, using manipulatives, and behaving responsibly.

Three general categories emerged from our observations in classrooms where learning seemed to be the most powerful. Students were actively participating. They were thinking critically about the content they were learning. And they were talking a lot to each other about their work.

We began experimenting with ways to measure these variables so as not to interfere with the creative work that teachers do to make learning come alive. Participation seemed the easiest to measure. We learned about Depth of Knowledge (DOK) levels for assessing the cognitive demand of learning tasks and used that to assess the thinking component (Hess, Jones, Carlock, & Walkup, 2009; Webb, 2007). As we studied classrooms where students were engaged in collaborative, content-focused conversations, we realized that the most artful teachers facilitated talk in their classrooms that gave students many opportunities to use academic language in contexts that made sense to them. We came up with a four-point rubric for each of the variables and noticed that if we tracked the variables throughout the course of a lesson, we could see what teacher actions were associated with the highest and lowest levels of student engagement.

Student Engagement			
RUBRIC	Participation	Cognitive Demand (DOK)	Academic Language (AL)
0	0 Students	No thinking	No Language
1	A Few Students	Recall	One Word Answers or phrases
2	About Half	Apply a skill/concept	Sentences or scripted Academic Language
3	Most Students	Strategic	Phrases or sentences w/ Academic Language
4	All Students	Extended	Multi-directional communication w/AL

Teacher participants in many schools allowed me to begin using the measurement protocol to assess their instruction. As teachers taught, I scripted as much of the classroom dialogue as I could and did my best to capture the essence of the tasks on which students worked. For every five minute lesson segment, I assessed the class's participation, the cognitive demand of the task students were engaged in, and the academic language that students were using while they were learning. We figured out how to graphically display the feedback to show how each of the variables changed as a result of the instructional decisions the teacher made. This was the birth of a process we called the Protocol for the Assessment of Quality Teaching, or PAQT (see below). More recently, as teachers strive to align their instruction with Common Core State Standards, we realized that feedback was critical to the process and the Protocol for the Assessment of Common Core Teaching (ProACCT) was born.

Protocol for the Assessment of Common Core Teaching (ProACCT)

Teacher		Grade	7	Lesson Purpose	Review for Chapter Test/Rate and Unit Rate	Quality Indicators		
						RUBRIC SCORE	Active Participation (P)	Cognitive Demand (CD)	Academic Language (AL)
Date	3/18/11	# or Students	20	CCSS(s)	Math.Content.7.RP.A.1	0	0 Students	No thinking	No language
Subject	PreAlg	Period	3	Observer		1	A Few Students	Recall	One word answers or phrases

RUBRIC SCORE	Active Participation (P)	Cognitive Demand (CD)	Academic Language (AL)
0	0 Students	No thinking	No language
1	A Few Students	Recall	One word answers or phrases
2	About Half	Skill/ Concept	Complete sentences or Repeated AL
3	Most Students	Strategic	Sentence/Phrases with AL
4	All Students	Extended	Multi-Directional Dialogue with AL

Graph of Active Participation, Cognitive Demand (DOK), and Academic Language — Time (Approximate 5 Minute Intervals) — P, CD, AL

#	Time	P	CD	AL	T	Instructional Task
1	945	4	0	0	4	Pep Talk before students enter the room. Today we are going to review for the test we are taking tomorrow. It's important that we work together so we can all achieve the highest score possible. That means you need to be ready to think and ask questions. Grab your notebooks, join me at the rug, and write the six key concepts covered in chapter 6 on the next blank page (displayed for copying).
2	950	4	3	1	8	Now, look back at your notes, thinking about each of the concepts: Ratios, Rates, Proportions, Decimals/Fractions/Percents, Discount/Mark-Up, and Point of Change. Rank each of the six concepts from easiest to hardest (1 - 6).
3	955	2	3	4	9	Teacher surveying class to get more detailed information. It looks like everyone is still confused about rates and unit rates. Madee sure everyone had a partner. Explain to your partner: What do you understand right now about the difference between a rate and a unit rate?
4	1002	4	2	4	10	Whole class back together. Who can explain to the class how these two concepts relate to each other? S1-A rate is like 50 miles in five hours and a unit rate is like five miles in one hour. I remember its always one in the denominator. What does it look like visually? Everyone: A fraction. Right. T writing down what student said on P-Board. So if you travelled 50 miles in 5 hours, how many miles did you travel in one hour. Work with your partner and use the numbers to explain the difference.
5	1007	4	2	3	9	Checking for understanding: Mr. Torres, explain the difference between a rate and a unit rate. "We did miles per gallon. a rate would be 200 miles on 10 gallons and a unit rate would be 20 miles on one gallon." Good!. Now let's look at this one. Is is a rate or a unit rate? 100 heartbeats/2 minutes. tell your partner. Everyone, Rate, or unit rate? Rate. How do you know? The denominator is more than one.
6	1010	4	2	3	9	Pointing to 100/2. Let's turn this into a unit rate. Everyone do your own. Students working. A few knew immediately. Others doing division or reducing the fraction. Gizelle-You have to divide 100 by 2, right? Teacher nods. What's the final answer? 50/1! 50 what over 1 what? 50 beats per one minute!
7	1015	4	4	4	12	Now I want you to think by yourself of a rate that makes sense to you, then solve it as a unit rate. Some thinking, some thinking, some are stuck. If you are stuck, come over here and we'll work it out together. 7 students came over. Does someone have an idea for a rate? Hot cheetos. Group worked quietly w/ teacher on hot cheeto example while the rest of the students worked on their own. As students finished,they were challenged to explain their idea at their table groups and compare models to make sure they were correct.
8	1022	3	3	4	10	Now everyone turn to your partner and explain what you did. PT and pointing to their work. Who wants to share? Ms. Dean: I had 120 plates and 80 people. Come show us how you turned that into a unit rate. Student brought notebook up to the doc cam. I divided 80/120 and I got 1.5 plates. Hmmm? Does that make sense? Can you have 1.5 plates? Talk to your partner about this and see what you think. Class confused. Let's do it together.
9	1028	3	4	4	11	What is the rate? 120 plates/80 people. What is the unit rate? 1.5/1. PT about what that means. S1-I think you have one and a half plates for every person. S2-How does a person have one and a half plates? S3- I think there are three plates for two people (it's the same, right?) So they each have their own and then they have to share the other one. S1-Yeah like they can use that one for cake. Ms. Dean, can you explain what it means to you? Okay, there is one plate for every person. That's 80, and then everyone has to share their second plate with someone. That's the other 40. T-So what was the rate? 120/80. And the unit rate? 1.2/1. See if your partner understands now-PT.
10	1035	4	3	4	11	Now I want everyone. to summarize in your own words the difference between a rate and a unit rate. Write it down in your notebook and give an example. Just before bell-partners shared their summaries and one student shared out: "A rate is a fraction thats denominator is more than one and a unit rate always has a 1." What do we call a fraction that compares two quantities? A ratio (almost everyone).
TOTALS		**36**	**26**	**31**	**93**	Quality Indicators

The numbers used in this instrument represent measures of class participation, the level of thinking required by the task presented, and the degree that students have opportunities to use academic language in real-world contexts that make sense to them. The total score is a composite of all three variables.

For each Domain:		For Total Score:	
		100 - 120	Exemplary
30 - 40	Distinguished	80 - 100	Distinguished
20 - 30	Adequate	60 - 80	Adequate
11 - 20	Requires Devleopment	30 - 60	Requires Development
0 - 10	Unsatisfactory	0 - 30	Unsatisfactory

In the 7th grade pre-algebra class referenced in the table, 40% of the students were English learners, 5 students had IEPs, and 60% had scored Below Basic on the California Standards Test that had been given the previous year. While this lesson received a ProACCT score of 93, the 7th grade lesson next door, which was taught to students with similar demographic characteristics, received a ProACCT score of just 28. This means that only a small percentage of students participated, the cognitive demand of the task was very low, and the students had

few opportunities to use academic language in contexts that made sense to them.

The Characteristics of Quality Teaching

As we began to look at this data over time, we saw that the best teachers were scoring eighty and above and the struggling teachers were scoring in the fifties and below. We found that we could use the data to inform professional development and coaching sessions. We could team up struggling teachers with more competent peers so they could see high-quality teaching in action. We felt that we were beginning to get a sense of how to measure instruction without interfering with a teacher's capacity for creativity and innovation. We found that the protocol worked in all subject areas and at a range of grade-levels.

A careful analysis of the data from expert teachers allowed us to identify eight practices that resulted in high levels of student engagement. The practices include:

1. *Immediate engagement.* Teachers began teaching as soon as they had contact with the students and students knew exactly what to do upon entering the classroom. There was no wasted time or downtime, and students enjoyed the challenge of beginning their work right away. Usually the activity was a follow-up to some previous work, an assignment that was explained the last time they were together, or a warm-up activity that primed students' minds to engage in the next task.

2. *Scaffolded academic dialogue.* This is sometimes referred to as *partner talk,* but traditional partner talk does not always result in teachers providing adequate scaffolding (Kirschner, Sweller, & Clark, 2006; Westgate & Hughes, 1997). In our observations, scaffolded academic dialogue ensured that all students engaged with the material. Students saw themselves as co-teachers when they used academic dialogue and understood that being able to explain the concepts they were exploring was important evidence that they were learning.

3. *Real-world connections.* These sometimes served as springboards for studying a concept in depth, while at other times were woven into the tasks teachers assigned. The important thing was that students

connected the concepts they were learning to real-life experiences that made sense to them.

4. *Front loading.* This is a strategy often used with English Learners who struggle with academic vocabulary. The teacher "front loads" the vocabulary by providing meaningful experiences with key words prior to students being confronted with them in challenging texts or tasks.

5. *Differentiated instruction.* Because students at different ability levels or with different prior experiences will engage with the concept differently, knowing the strengths and needs of students enables teachers to plan activities that all students can access. Differentiated instruction requires that the teacher understand both the preconceptions and misconceptions that different children bring to the learning process and adjust the task accordingly to meet the needs of students at a variety of levels.

6. *Feedback and conferring.* Teachers provided immediate feedback and coaching to students as they tried on the skills they were learning. Teachers made a point of constructing tasks that allowed them to observe children's thinking. There was a sense that all of the students knew that the teacher cared about what they thought and that any misconceptions would be recognized and addressed.

7. *Structured reflection.* This proved to be a critical component of the learning process in all of the high-quality lessons that were observed. Reflection requires that students think on their own and reflect on the meaning of their work in order to improve their understanding. Reflection was not something that happened after the learning; rather, it was an integral part of the entire process.

8. *Lesson closure with connected homework.* Teachers brought the class together as a group and facilitated a synthesis of the big ideas of the lesson. Effective lesson closure is a result of the teacher paying careful attention to the different ways students interacted with the concepts of the lesson so that the best thinking could be made public and a bridge could be built between yesterday, today, and tomorrow's work. Connected homework means that assignments were directly related to what students worked on in class and served as an extension or reinforcement of what was learned.

The most artful teachers integrated these practices based on the feedback they received from their students as they taught their lessons. Some teachers used more than one practice at a time to create learning tasks that maximized students' participation, critical thinking, and students' use of academic language.

Ineffective Practices

Conversely, in classrooms scoring 50 or below, we identified six ineffective practices that diminished student engagement and achievement. These included: (a) students waiting with no academic expectations; (b) students copying from the board, texts, or each other; (c) rapid-fire questioning with one-word answers; (d) students being called on one at a time; (e) teachers answering their own questions; and (f) public reprimands for off-task behavior. In these classrooms, it was evident that mastery of the content would be difficult for students. The opportunities students had to make sense of concepts through critical thinking and discussion were limited due to ineffective decision-making on the part of the teacher resulting in low levels of student engagement and achievement.

Professional Learning

Of course the method presented here is not the only way to measure high-quality instruction, but it turned out to be a powerful first step. It allowed us to celebrate teachers who were making learning a rich and wonderful experience for children and also begin having conversations with teachers who were truly doing damage. The protocol has been field-tested in many different contexts, and the reactions from teachers have been overwhelmingly positive. Often, at the end of a lesson debrief, teachers are amazed that such explicit feedback is even possible. One teacher said, "Wow. I have never received feedback that has been so detailed." Another teacher stated, "When I saw my data, I wanted to figure out how I could make the low points more exciting and engaging for the kids. I would like to get this kind of feedback more often and if I could look at it with my peers, I feel I could really improve my teaching." Another teacher commented that it would be helpful to use the protocol with her peers to assess participation, cognitive demand, and academic language after collaborating on planning a lesson. She said, "Then we could really see where we need to tweak our own

language to make the instruction stronger." These comments represent an example of the new kinds of conversations needed regarding the public versus private nature of the teaching profession. Providing teachers with empirically valid data that allows them to understand the impact that their instruction has on students can be a powerful lever in fostering this level of professional dialogue.

While I look back fondly on my own experiences in professional learning communities, although they were rich and wonderful experiences, I never had an opportunity to get useful feedback on how I actually interacted with my students or on the quality of my lessons. I thought I was doing a pretty good job, but I didn't have any real way to know for sure. The feedback I did receive was generally positive, but not related to specific ways I could improve my practice. The protocol presented here attempts to provide useful data to teachers that inspires reflective practice. It is meant to foster more active engagement in the improvement process and more focused collaboration when working with colleagues to improve teaching and learning.

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To read more of Kathleen's dissertation visit: *http://search.proquest.com/docview/1429525668*

Photo courtesy of Erina Chavez

The 72-Mile Classroom

Erina Chavez
12th Grade Student
High Tech High North County

From the crest at Volcan Mountain, to the coast at Dog Beach, lies the 72-mile classroom—or at least as I choose to call it. This name perfectly describes my class's immersive hike along the 72 miles of the Crest-to-Coast Trail. We trekked this entire trail to learn all about biophilia, ecology, local history, and conservation. Yet arguably, what we didn't expect to find taught us the most. I came away from this project having a better understanding of my world, myself, and the different ways that lead me to enjoy learning. So, what did we do that made this project so influential?

My class team consisted of 70 students and four teachers: Dr. Patton, Mr. Leader, Mr. Hensley, and Mrs. Pierini. When we all returned from winter break, and our second semester was beginning, we knew we had enough time for one large project before spring break in April and junior internships in May. The new semester also signified new topics needing to be taught, such as ecology, local history, real-world purposes for writing, and finance. Our teachers took these different topics and combined them all into one grand project they entitled, "Choose Your Own Adventure."

At the project launch, our teachers announced that the team would be dividing into two different classes for the entire first week of March. One class would immerse themselves into a finance and business world, where they would create their own business and products, and develop a plan for marketing and tracking their earnings. The second class would embark on a 72-mile hiking expedition that would teach them all about the wildlife within the San Dieguito River Park (SDRP). Within both options were further opportunities for students to tailor the lessons to their interests. Wishing to get outside of the classroom walls, I decided upon the hiking expedition before I even knew what I was getting myself into.

The SDRP's Crest-to-Coast trail begins at the summit of Volcan Mountain and winds through Julian, Santa Ysabel, San Pasqual, Escondido, Rancho Bernardo, and Del Mar, ending at the San Dieguito River's mouth that pours into the ocean at Dog Beach. The path travels through five different biomes, all home to a unique set of plants and animals. Our class partnered with the San Dieguito River Valley Conservancy (SDRVC) to learn about wildlife conservation, the need for it, and how we can help. Through rangers, research, and experiments we learned a lot about ecology and San Diego's diverse wildlife. We also learned important information about the habitats of the five biomes, and different ways to protect their shrinking land. With this knowledge, I chose to co-produce a 22-minute video that would describe our adventure to the public, and call out to them to help protect the SDRP's wildlife. This video would be given to the SDRVC to help them promote their conservation efforts. Other students were writing daily blog posts and snapping lots of photos for the Conservancy to use. As an entire class, we even worked closely with kindergartners to teach them more about nature and their important role within it. In other words, we were deeply involved, and making real change.

Along with this aspect of our journey, we unexpectedly learned a lot about ourselves and how we personally connect to nature. Namely, we learned not only the definition of biophilia, but where it lies within ourselves. This really isn't a discovery you could find another way. Throwing your head back to gaze at the canopy of trees high above your head, or lowering yourself upon the dirt to watch an ant carry a crumb of your lunch away, or suddenly realizing that your footsteps

and heart are beating in perfect rhythm, is how you find it. A textbook could never have given us this.

After our hiking journey was over, our class began to share and express their experiences in a variety of ways. This article is just one example. Other students created and wrote blogs, shared photos, and drew out some scenes along the trail. As an entire class, we are creating a book with a collection of different pieces of writing about the hiking journey, the business expedition, or another topic that piqued our interests. This helped us reinforce what we learned and how we can apply it to our lives in the future.

Within the 72-mile classroom, the earth was our teacher, our experiences were our lessons, and our curiosities led us to absorb it all. We learned because we wanted to, and I believe that knowing our work created real change, learning through experiences, and reflecting upon the entire adventure for the public to see, led us to feeling so. I hope others will use some of these ideas in their classrooms, as they come from one of the most important voices in education: the students.

For further information about the 72-Mile Classroom, visit the class blog at: *www.crest-to-coast.weebly.com*

Failure, The Mother of Innovation

Michael N. Martin
Christine H Hoyos
Seattle, Washington

I t was one of those moments that, as teachers, we all dread. In fact, I've had nightmares about this very instance. I'm standing in front of a group of people and I'm speechless. I have nothing to say. They are looking at me, I at them, and…nothing.

This incident happened a couple of summers ago. I was an instructional coach at a large urban high school in Washington State, working with a small group of eight teachers to fine-tune a presentation on the state's new teacher evaluation system in preparation for its rollout to the rest of the faculty. I presented the material just as it had been presented to me, but none of this was resonating. I lacked the depth of knowledge on the evaluation system to be able to come at the subject in different ways and I could feel the frustration level rise in the room. One teacher actually threw her hands up and said, "You are going to have to just tell us what to do."

After taking a short break to regroup, I asked for ideas on how to move forward. If the topic were producing this much anxiety in a group of eight, just think of how it would look in a group of eighty. If

my approach wasn't working, I asked, how might we change it so that it did work for our full faculty? After batting the question back and forth a bit, one of our veteran teachers spoke up: "You aren't giving us an entry point. You are starting with a lot of state-mandated policy that is making us feel more powerless than we are. The entry point should be something we have some control over."

"Start with assessment tasks," she added, "something our teachers understand, and move on from there." As she said this, the room nodded in unison. She had hit on something. The new evaluation system, with its heavy emphasis on student achievement, hinged on a teacher's ability to measure and report student growth using existing assessment practices. By linking it to something teachers already used in the classroom, we had found our way forward. The ensuing presentation to the full faculty went off without a hitch and much of the feedback from teachers thanked us for being responsive to their professional needs.

The planning meeting had ultimately been a success, but I was troubled by my own performance. My carefully constructed agenda for the meeting had been shredded. Worse, I had momentarily frozen. I had failed very publically and I was worried that, in some way, my credibility as a coach, as a leader, had been diminished. But in subsequent conversations with the planning group, I detected no negative effects. In fact, they seemed to warm up when we talked about the meeting and the way we had solved the problem. It struck me that maybe the incident hadn't diminished my expertise; it had, instead, humanized me. I had allowed myself to say, "I don't have the answer" and had, albeit unwittingly, modeled being fallible in a way that allowed for our eventual success and in a way that could work for any teacher in any classroom.

This vignette from our work in the field illustrates an interesting attitude we have, as educators, about failure. In education failure is often viewed as a deficit, embarrassing and to be avoided at all costs. Yet, in so many other contexts failure is key to success. We all know of many famous people whose fame is a product of a series of repeated failures, like Thomas Edison who struggled through 100 tries before he created the light bulb. In April 2011 the *Harvard Business Review* even devoted an entire issue to failure with articles that promoted the

relationship of failure to learning, suggesting that it is critical to (1) understand failure; (2) learn from failure; and (3) recover from failure. Tony Wagner detailed the relationship of failure to innovation in his research on young people who changed the world; without failure, many of today's innovations would not exist (Wagner, 2012). In education too, failure has the potential to transform learning and teaching and yet, as we ourselves experienced, failure is to be avoided.

To be sure, we are talking about a particular kind of failure here. This is failure writ small, the minor failures and mistakes that happen naturally in the context of larger, hopefully successful initiatives. This is different from failure writ large, which has real consequences. For those of us who work in high-poverty, high-needs environments, large-scale failure has catastrophic effects on our students, who, as a consequence of failed policies and initiatives in their schools, run the risk of dropping out of school and, as statistics tell us, stand a good chance of winding up in jail. But we shouldn't confuse this failure writ large with the small-bore mistakes and failures that occur naturally on the way to getting right something as complex and varied as education.

Embracing Failure

Traditionally, educators are expected to be experts in their field. But what does that expertise look like? Over the past few decades a more specific notion of the expert teacher has surfaced. Thanks to thinkers like Lee Shulman (2004) and Deborah Ball we know that in order to be effective in the classroom, teachers must be good in multiple areas. They should possess expert skills and knowledge not only in the content that their students must know, but also in the ways that content is taught to students (Ball, Thames, & Phelps, 2008). As well, there is the national reform context to think about that mandates the inclusion of student growth measures in teacher evaluation systems. Teachers are being asked to improve their practice beyond "delivering instruction;" they now have responsibility for student growth against measurable achievement targets. What was previously implied has now become explicit—and with stakes attached.

The changing definitions of teacher expertise coupled with the nationwide push to include demonstrations of student growth beg a

shift in how educators and others view teacher development. Effective professional learning for teachers will have to center on what Doug Lemov described as "development strategies" that focus on making teachers better at their craft—as opposed to hiring and firing or incentivizing to try to force teachers to better performance. This means shifting educator trainings from showing teachers how to do things the "right way" to creating opportunities for educators to be researchers into their practice, embracing the ebb and flow of trial and error. By expecting teachers to take risks and guiding them to learn from their failures, creative and innovative teaching practices will be uncovered, explored, used, and refined.

And this is the crux of our argument: in order to get better, mistakes will be made. It seems almost silly to mention, but schools are places of learning. And learning is messy—it's within that messiness that we learn and grow. So what might it look like for us, as educators, to get comfortable with failure—and even embrace it?

Fearing Failure

Carol Dweck's research on fixed and growth mindsets sheds interesting light on fear of failure. Through her observations of children, she discovered that learners who were constantly told they were smart were more likely to pursue only achievable performance goals, goals that preserved their self-image as smart. On the other hand, learners who were told that they made great effort or tried hard were more likely to take on ever greater challenges and learn from their mistakes, seeing mistakes as an opportunity to learn and improve (Kakovsky, 2007). Unfortunately, the pressures put on teachers by local and national mandates sometimes feeds back to them a perceived expectation to know it, do it well, and "be smart." As a result we see many teachers who inadvertently take on what resembles fixed mindsets. What education needs though is quite the opposite. Needed are teachers who are oriented towards growth, who will try things, will learn from what they tried and try again, wiser in pursuit of excellence.

We argue that the intentional act of learning from mistakes should be a constant feature of professional learning. Practice itself is predicated on the notion that mistakes and small failures drive learning and move anyone's performance forward. Just as a dancer practices a difficult

muscle extension to make it seem effortless or a musician works to master a difficult musical passage, teachers should be able to work out complex ideas and techniques in ways that improve each iteration. In the opening vignette we were, in a very real sense, practicing - rehearsing for a bigger performance in front of a larger group. As we surfaced our mistake, the feedback that followed provided the clarity we needed to find success in that larger performance. A musician hears the mistake in a recording or a teacher is questioned by colleagues about why he made a particular teaching move. These are the moments when the greatest learning occurs.

So how do we truly harness the power of learning from mistakes to transform the learning experience for adults and the students whom they serve? How do educators learn to embrace small failures and the role those failures play in an overall drive for success? How might schools and districts nurture risk-taking and the fostering of a growth mindset as a cultural norm, as a strategy for improvement? These are important questions to consider, particularly when asked in the context of an education environment that emphasizes evaluation-based accountability, often at the expense of teacher learning.

A High Trust Culture

Even under the best of circumstances, taking risks and embracing failure is not for the faint of heart. Making public one's uncertainties takes courage. But more than that, it takes a supportive culture—a high trust culture that doesn't shame people for failing but rather celebrates their learning and growth. Lemov, Woolway and Yezzi (2012) note that organizational culture needs to embody the notion that error and success are intertwined. They say it's important to "normalize error:"

> An organization has to help its people realize that failure rate and level of skill are independent variables; it has to help them feel comfortable exposing their weaknesses to their peers so they can help them improve; it has to make them feel trust and even joy, not only to practice but to do so with others (p. 144).

When we begin our work with schools and teachers, one of the first things we explore is the level of trust that exists in the culture. It

is essential that it be focused on a professional learning environment that prizes trust, respect, collegial dialogue and feedback in service of getting better. In a school where there exists a high incidence of welcome constructive feedback from peers and conversations around great teaching are seen as normal everyday occurrences, there is a strong basis for this norming of error and of mistakes. Where we see these conditions, such as those detailed below, we see schools that have made bold shifts in the way they understand and approach adult learning.

Risk-taking Builds Growth Mindsets

At Jewell Elementary School in Aurora, Colorado, Principal Lewis and her instructional leadership team selected inquiry learning as their primary improvement strategy. With this shift in focus came a commitment that adults would experience inquiry-based professional development. Understanding inquiry to be a new concept for her staff, Lewis recognized that she would be asking her teachers to step out of their comfort zones by taking some professional risks. Lewis now starts every professional development meeting with highlights from teachers who are trying new things with their students, sharing their successes and the experiences that were not successful, and any adjustments they may make for the future. Celebrating the learning that occurs from taking risks helps stoke the fire for individual and collective growth mindsets at Jewell.

Vulnerability Encourages Feedback

In Northern California, Chico Unified School District secondary teachers are researching the level of authentic intellectual work that occurs for students in their classrooms. Teachers collaborate around a set of teaching standards that serve as a guide for examining their own practice. Teachers, working alongside their colleagues, instructional coaches, and administrators, use protocols to put their work on the table for feedback on evidence of rigor and relevance in their academic tasks and instructional design. They use the feedback to tune their tasks and refine their practice. What these CUSD teachers have come to understand and value through this process is the importance of making transparent their own questions and challenges about powerful instruction with others. They have found that being "safely

vulnerable" is where they get the most traction. CUSD is learning that evaluation doesn't grow practice. Rather, opportunities for educators to give and receive collaborative feedback have the greatest impact on instructional effectiveness and student learning.

Normalizing Error for Improvement

Middle school teachers in an urban district in Northwest WA participate in "studio" classrooms, a professional learning structure similar to lesson study. The district's evaluation framework provides the language and focus, guiding conversations about mastery teaching. An important component of the process is direct observation. Teachers observe the interaction of teaching and learning in a colleague's classroom. Following the observation, the presenting teacher, who worked with colleagues on a framing question before the demonstration lesson, is given feedback by colleagues related to that framing question. Their high-trust culture that "normalizes error" is a crucial factor for the presenting teacher here, as the feedback can center on mistakes, miscues, or errors that occurred during the demonstration lesson. If feedback that notes error is not tightly linked to improved teaching practices on the road to mastery, the participating teacher cannot respond to the feedback in ways that moves his or her teaching forward.

While these examples describe practices that promote high-trust environments, the American school norm has been to administer and interpret teacher evaluations and other external mandates through a decidedly fixed mindset, often resulting in risk-adverse, compliance-based (and low-trust) work cultures. In districts such as these, however, we have also witnessed small working groups of teachers create their own high-trust environments, embracing risk and trial and error as means of getting better at their practice. These early adopters often start crucial conversations between teachers—and with administrators—about real paths to improvement that enable a growth mindset for all educators in a building.

No matter the context, it's time we change our perception of small failures and errors to see them for what that really are: steps, within a series of steps, that lead through the thorny paths of real improvement in institutions and organizations. Using the clarity created by failure

to reflect and revise one's practice is ultimately how educators will reinvent their craft. Finding and learning from failure is, paradoxically, respectful to the profession. It engages teachers with their learning selves. It liberates teachers, taking them beyond the ethos of "just tell us what to do" to become more self-directed educators who are reflective about their practice in a very authentic way. It shifts thinking from that of static compliance to one of growth and discovery. It is the stuff of reinvention and innovation. It is what school is all about: learning.

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Doing the Project Yourself: Reflections on the Writer's Craft

Kelly Williams
Gary and Jerri-Ann Jacobs High Tech High

In the world of project-based learning, prototypes are necessary for success. This is one of the most important steps in designing curriculum because it allows for the teacher to understand timing, scaffolding needs, and establish clear expectations. Many teachers are on board when it comes to creating a physical product whether it is building a model in engineering class, producing an animation in multimedia class, or creating a painting in art class. However, when it comes to Humanities, why do teachers tend to shy away from prototypes of writing? Perhaps because it is a long, sometimes tedious undertaking. Perhaps because our inner critic never believes our writing is good enough. Perhaps because writing is just plain difficult. No matter the reason, it is one of the most important models teachers can provide. I discovered this when partnered with Jeff Robin, a senior art teacher and project-based learning expert, through our 2013 project, The New Path of the Buddha.

* * * * *

It was painstaking. That judgmental, LOUD inner voice just would not seem to go away. This has to be the best writing you've ever done. All of your students and your teaching partner will judge you. You're

supposed to be the expert. These thoughts circulated as I attempted to write a short fiction piece about Sidney Allen, an upper-class school girl turned punk rocker in 1970s London. My narrative was to be the model for my seniors' spring semester project, which entailed students taking Hermann Hesse's Siddhartha and reimagining it in a new time and place. My teaching partner, Jeff Robin [Art], had already created the storyboard images, and now it was my job to make the images come to life with words.

I wrote feeling a combination of anxiety and joy. It had been years since I had written a long creative piece, so it was fun to climb inside the head of the characters and imagine the various scenes. However, I was anxious. That inner voice kept rearing its ugly head making me overly critical of each sentence. I lost count of how many times I re-read my opening or asked my poor husband what he thought of whatever paragraph I was muddling through. Normally, I write with abandon and then spend an exorbitant amount of time revising, but for some reason, I nit-picked desperately, needing each sentence to be perfect.

Four 8-hour weekend days plus the weeknights in between and I was finally ready to show the story to Jeff. I made sure he knew that it was still "a work in progress," not so much because of my belief that writing is never done but because I wanted to give a disclaimer in case it wasn't up to par.

Jeff read the story and said he was impressed. This brought some relief so that when he offered some revisions I felt less like crouching in the corner ashamed at calling myself an English teacher. He laughed at the inconsistencies in the story. I had Sidney eating pizza after a concert when fish and chips would have been the more accurate late night London choice. I had just had a baby, so for my pregnant protagonist, I wrote detailed scenes of doctor appointments, the length of the pregnancy, and the baby's weight and height. My experience was so fresh, yet I failed to realize that this type of detail was unnecessary for the purposes of our story. I made these and other necessary changes before the true test of my work—presenting it to the students.

Before distributing copies of "Sidney Allen" to my students, I told them of my anxiety. I told them how personal writing is and how difficult

it is knowing that someone is going to judge your work. I also gave them my disclaimer. "Keep in mind that it's still a work in progress. I'd love your feedback," I announced. Students then read and annotated the story for warm and cool feedback as I fretfully waited. Teenagers are so honest, which is great for feedback but sometimes hard on the ego.

As expected, the students provided insightful feedback. Delicately, they told me my dialogue needed to be more accurate to the character and the ending seemed rushed, but the students liked my description and overall storyline. The best part was that during this feedback, I was able to discuss my writing process candidly. I told them how I am typically a verbose writer and how it was difficult knowing when to expand and condense. I told them how the storyboard images really helped because I could focus on the description rather than determining the plot. I told them how it was difficult to get started, but once I did, I really enjoyed the process and hoped they had a similar experience.

I had always bought into the idea of doing the project yourself and had always provided models for my students in previous years. However, in the past, I used writing models I had collected from former students or wrote the shorter writing models myself. For instance, I created a 6-word memoir model, a 55-word fiction model, a one-page memoir— basically, I wrote anything I could complete during my prep period. With Jeff being the PBL expert that he is, I committed to doing the project in its entirety, which meant I had to do all of the writing.

Over the past two years, I have written much and learned more. I wrote an analytical essay identifying motifs in three of Steinbeck's novels. Because I wrote this essay, I was reminded of the importance of annotating the text and discovered there were several approaches to structuring the essay. Writing "Sidney Allen" allowed me to see the value of the storyboard and how the students should reference the images to capture the detail with their words. I wrote an essay model for my honors students who were to apply a chapter from Thomas Foster's *How to Read Literature like a Professor* to their book of choice. This allowed me to show students how to synthesize information and provide evidence from multiple texts. For each writing piece, the students could not only reference the model and requirements but could hear my struggles and insight, which made for better essays.

So, why should Humanities teachers complete writing prototypes? Yes, writing takes time, but it is beneficial to work on your craft and remember the struggle of writing. As you're doing the writing, you can see what scaffolding is appropriate, the different ways to organize the writing piece, the types of problems students might face, when to schedule benchmarks and critique, and how the final product will look.

> *"Not only did I learn what length and style the teacher wanted, but I also learned the voice, perspective, and general point she wanted us to convey. A full example helps clarify and generate ideas that I can then use in my own writing. The fact that she spent her own time writing a model showed me that she really cared about our final product. When reading it, you could tell she spent a great deal of time and effort writing an example for us to base our own writing on."*
> —*Josh Quiroz, senior at HTH*

Writing projects will be more solid and well-planned. The assignment transforms from an abstract idea to a tangible product. The students see what you are intending and have a reference for the trajectory of the writing piece. It provides a concrete example that students can better reference.

> *It is one of High Tech High's most fundamental design ideas to have teachers do the projects before the students do. It is a chance to iron out kinks and learn the best way to present the project to the students to achieve the best response. Knowing what the students go through when they do the project is another key benefit of doing the project before the students. It produces an understanding of what the students might be feeling - when they're stressed, when they're productive, when they are fed up. It makes it so the teachers can prepare for every question, comment, or complaint the students come up with. Lastly, it makes for a very smooth assessment process. The teachers who do projects beforehand know how much effort is put in to create good work. They'll have a good indicator of how much students have tried to produce the quality of work they do.*
> —*Britton Hayman, senior at HTH*

Most importantly, doing the project makes teachers remember what it is like being on the other side of the desk. For me, it reminded me of my procrastination and verbosity, which mirrors many of my students' struggles. I remembered the value of planning and organizing my essay, and it reinforced the importance of critique. Writing also allowed me to share in my students' frustrations, and it seemed like I gained

more buy-in because they knew I had been there. We had a shared experience. The writing process became visible for the students, and this was invaluable because many believed good writing was inherent and not something everyone struggled through in some way. Although it is scary to put ourselves out there, it is necessary, especially if we are asking students to do the same.

As Ray Bradbury said, "Quantity produces quality. If you only write a few things, you're doomed." So do the project, even the longer analytical essays, research papers, and creative pieces. Your students will benefit, you will benefit, and your projects will benefit.

Project Gallery

Teachers and Students
High Tech High Schools
and other Innovative Schools

In this gallery, we offer a set of *UnBoxed* "cards" that provide quick, concrete glimpses of projects we find inspiring and practices that support teaching and learning. These cards are now freely available on our *UnBoxed* website with additional teacher and student reflections, in a printer-ready format: *http://www.hightechhigh.org/unboxed/cards/*. Simply print, fold, share and discuss. As always, each card on the website refers the reader to a web address where further information is available.

Toy Story

Janna Steffan, Ruby Rodrigues, Jami Saville, 2nd Grade
High Tech Elementary, Chula Vista

In the Toy Story project, second graders explored the essential question, "What is the magic of toys?" To investigate this idea deeply, our students visited a local preschool and became buddies with these young children. They surveyed their new friends to learn about the types of toys they like, their favorite colors, favorite characters and so much more. After finding trends in the data collected, the students used this information to design the perfect toy for their preschool buddy. After many drafts, critiques, revisions and prototypes the students took their designs to MakerPlace (a DIY workshop in San Diego) in order to professionally create the toys. Students also studied story elements by reading a variety of stories that have a toy as the main character. They incorporated the elements they learned into a story about the toy they created for the preschooler. And then they learned the writing process in order to publish their story in a board book for their buddies. Finally, our second graders returned to the preschool to give both the toy and the book to the preschoolers.

Teacher Reflections

When designing this project, it was important for us to have a product that was minds on, hands on, and hearts on. Since every second grader loves toys we thought that would be the perfect fit. This project felt like a great blend of allowing the students to have choice and be creative while learning many essential math, reading, and writing skills. Throughout the project, we wondered if our students would be upset to give away a toy and story they had worked so hard on but we were pleasantly surprised at their eagerness to give a gift to another child. We felt like the authentic audience in the project was also another driving force in its success.
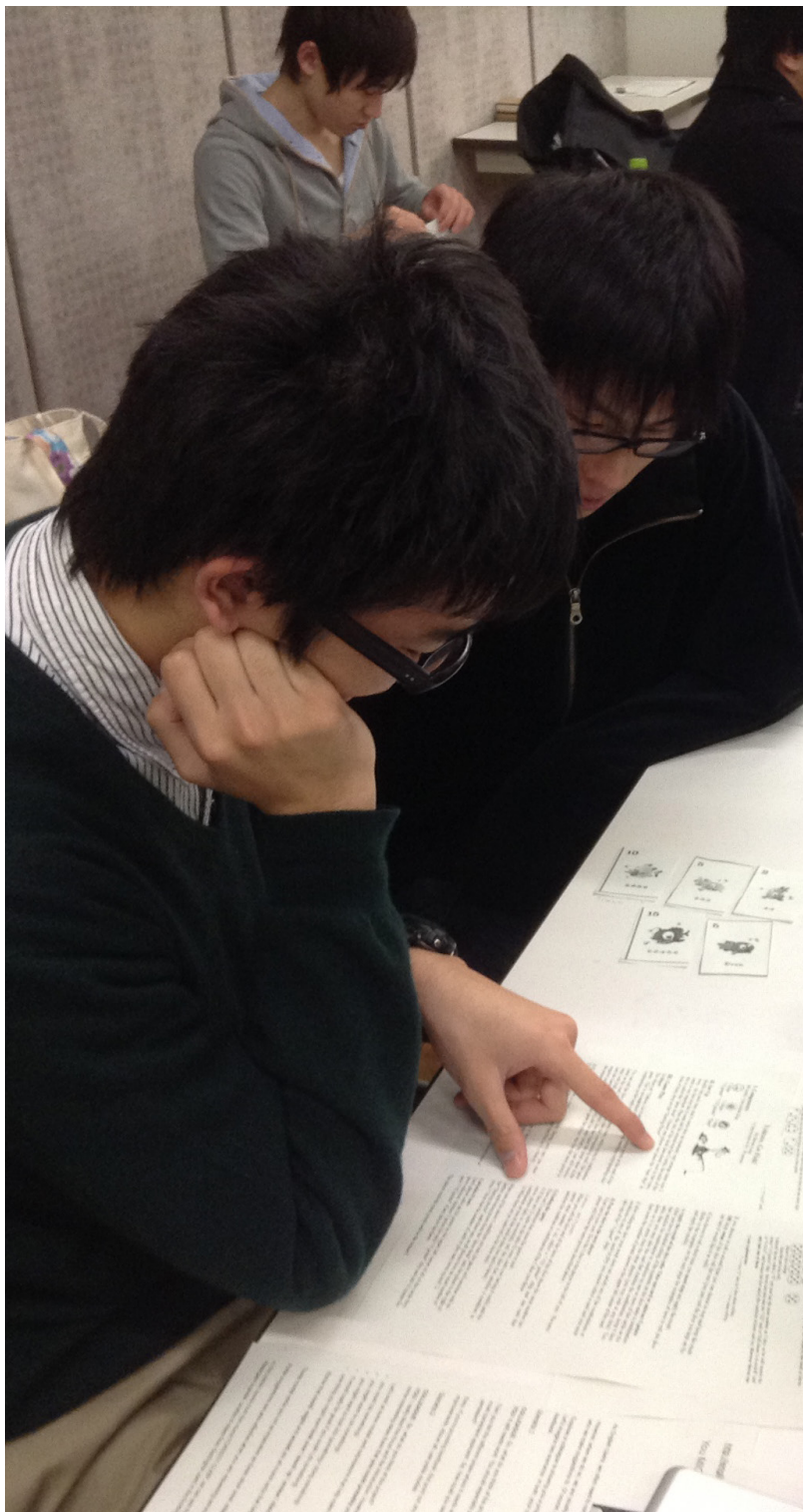
Student Reflections

"The magic of toys is they can come to life. They encourage kids. They're adventurous. They help kids imagine."   —Joshua

"The magic of toys is that they have feelings too. They can talk!"
                                                                        —Zuri

To learn more visit:
http://jsteffan9.wix.com/digitalportfolio#!toy-story/c5ic

Practicing English by Playtesting Games

Jonathan deHaan,
University of Shizuoka, Japan

In this project, 85 university students in Japan, all of whom liked board and card games, were supported for three 90-minute classes through the process of playtesting a card game for an independent designer on the Board Game Designer's Forum (www.bgdf.com). Groups read the game rules and the designer's questions about his game, then prepared the components and played several times. After a short lecture and exercises on giving polite suggestions in English (e.g., "you might not want to…." and "it would be really great if you could…"), students collaboratively wrote feedback and a short message. Their feedback was sent to the designer, who wrote an extensive response to the class expressing his gratefulness for the amount, variety and quality of their feedback. Each student reflected on the tasks and brainstormed how they could use their English skills to communicate and contribute in their personal areas of interest.

Teacher Reflection

Each stage of the project seemed meaningful: the students read carefully in order to play; they had a great time exploring a new game together; and they thought and wrote critically. I think the success of playtesting projects depends on matching students with the right game (length, complexity, language). Students could be asked to use online analysis tools like http://www.lextutor.ca/vp/eng/ or http://www.lexicool.com/text_analyzer.as to find new and important language. Video game playtesting using sites such as http://www.betawatcher.com/,http://massively.joystiq.com/category/betawatch, http://gamingbetas.com/ or http://www.deathbybeta.com/ might also workwell. I want to do more to help students use their language skills to communicate and collaborate in other (self-chosen) niche Internet communities.

Student Reflection

Some said that the project was "really fun," "a little difficult, but got easier," and "it improved my critical thinking skills." Other said it was "rare and meaningful;" "the years of studying English bear fruit. English enables us to have connection with many people in the world."

To learn more visit: *http://jonathandehaan.net/*

Wild Pond Protectors

Shelley Glenn Lee, Science Exploratory; Kari Shelton, Kindergarten
High Tech Elementary North County

At the beginning of the year the kindergarteners learned about their own community and how individuals depend on one another, and then their attention turned to the communities around them. Through an interdisciplinary, collaborative project that lasted five months, the students tackled these essential questions: How are plants and animals helpers in their communities? How can we help protect our local ponds? To build content knowledge, students studied the wildlife at several locations in the local watershed, built and observed their own pond models in science exploratory, and became an expert on one local pond animal with the help of students from Matt Leader's 11th grade biology class. In the end, each student created three distinct products:
1) A "Wild Pond Protectors" television episode using a combination of stop motion animation and live action video to teach viewers about how pond animals use special features for survival.
2) A conservation poster featuring their animal that will be displayed in the San Dieguito River Park.
3) A page for our collaborative children's book, *Protect Our Ponds!*

Teacher Reflections
We exhibited our project work with a Pond Discovery Center in the spring and intended to move on to a new project, but the students were more dedicated to their work than ever after exhibition. They really wanted to spread their message of conservation to an even bigger audience, and it was their idea to create a television show and posters, so we followed the interests of the students and continued the project for two more months. In addition to teacher collaboration, having community partners, an authentic audience, and meaningful work in the classroom can really inspire students, even kindergarteners, to make a real difference!

Student Reflections
"Don't kill bees because they pollinate the flowers" —Bryan Ramirez

"I felt good about exhibition because we got to celebrate ponds."
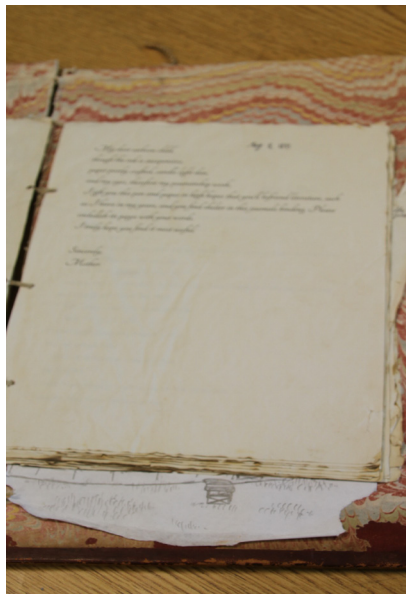   —Desmond McDonald
To learn more visit: *http://sglennlee.weebly.com*

In Their Skin

Karly Robinson, 8th Grade Humanities
High Tech Middle Media Arts

In Harper Lee's *To Kill a Mockingbird,* Atticus Finch famously encourages his daughter Scout to try to see things from other people's points of view, to "climb into (their) skin and walk around in it." All too often we focus on our immediate impressions when considering other's perspectives, forgetting that there is a world and a history that tails our every move. During this project, students examined three major themes in 1860 - 1960 American history: racism, modernization, and youth culture. The class read *To Kill a Mockingbird* and students chose a book with similar themes to read in a group. Using these readings as guide, students wrote a work of fiction based on a character's journey in *To Kill a Mockingbird*. In order to be able to fully inhabit their characters, students needed to do significant research about their character's world.

Teacher Reflection
This project is now in its third iteration and each year I find new entry points to make this classic novel relevant to a modern audience. This project is about so much more than reading, writing and research. It's about understanding the motivations that drive individuals and society. Through the research and the fictional writing, students are forced to consider these forces as they construct character stories that fit with the time periods and development within the book. Parents who hated this part of the required reading when they were in school are often surprised to see how much their kids (some of them reluctant readers) thrive in this project.

Student Reflection
I learned a lot about the past from *To Kill a Mockingbird*. I thought it was a well portrayed story of a terribly true time period. Every time I read a well written story it helps my writing improve. *To Kill a Mockingbird* gave me a knowledge of that time that I really needed to make a good character. The research process helped me find reliable secondary and primary sources.　　　　　　　　　　　　—Rose Wilson

To learn more visit: *https://sites.google.com/a/hightechhigh.org/krobinson/home*
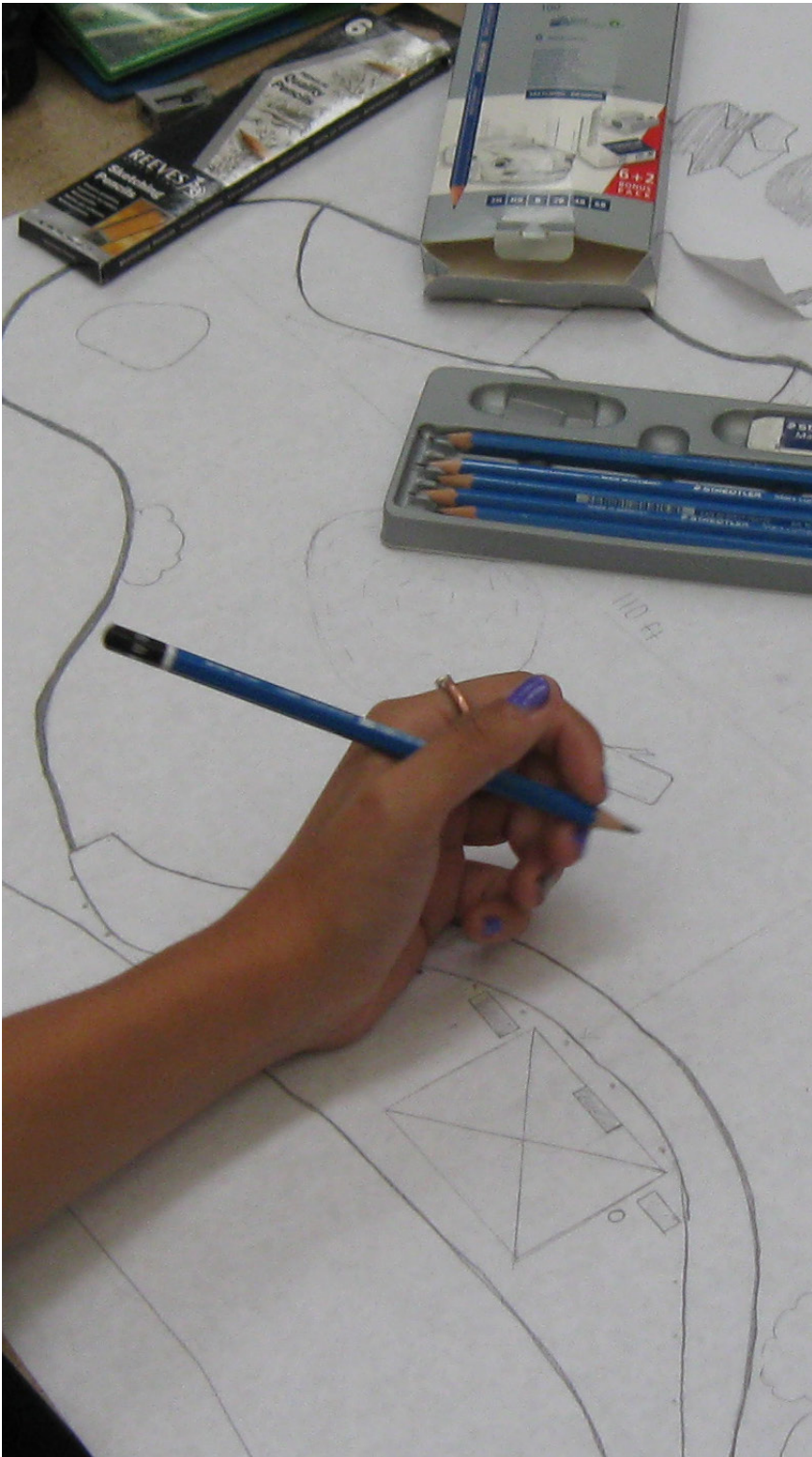
Zoomanity

David Gillingham, Leily Abbassi, Maggie Miller, Mary Williams
High Tech Middle 7th Grade

In this nine-week project, students worked in groups of four to de-sign an enclosure for a soon-to-be-renovated section of the San Diego Zoo called Africa Rocks. Using the actual shapes and dimensions for the planned enclosures, all group members offered input on what the enclosure should contain (structures, vegetation, viewing areas, etc). Each group member had an individual job within the project: Site Plan Designer, Project Manager/Blogger, Education Expert, or Sketch-Up Technician. Throughout the process, students utilized critique from adults in the field (architects, zoologists, landscape designers) to work through drafts/designs of their enclosure. Eventually, each group pre-sented their designs to a panel of volunteers and employees from the San Diego Zoo.

Teacher Reflections

Having the students design an enclosure in the Zoo's Africa Rocks us-ing the actual architectural site plans was a stroke of luck that led to a natural "buy in" for the project. The students became passionate experts about the animals in their enclosures—often having heated debates, based on their research, about design decisions such as water depth, sleeping locations, and number of play structures. When they moved into their individual job for the project, students were able to demonstrate their own strengths, either perfecting an area in which they had previous experience, or pushing themselves to learn a new skill. Having a final audience of actual zoo experts was a powerful experience for 7th graders, which they took seriously. The zoo panel-ists were able to give authentic feedback and ask probing questions about each group's design choices.

Student Reflections

I could put all of my artist talents in the illustration part of the project, and it showed me how architects draw up buildings and how they work. It was cool to get critique from real architects.   —Simran

I liked how we got to use real dimensions and got to see the layout of the zoo. It was really a challenge creating an enclosed space in 3-D, but I really enjoyed it. Now I can design my dream home...   —Guy

To learn more visit: *http://millerwilliams.weebly.co*

Creative Collective: An Integrated Project of the Arts

Charlie Linnik, Art; Mike Vasquez, Multimedia
High Tech Middle

Our 6th and 7th grade students collaborated to create an art piece that combined the digital and visual arts. Each group created one unified piece that showed how design choices, color schemes and imagery would enhance and support the overall emotion and tone of the piece. Students learned how color psychology helps artists understand the power of color, and students applied color theory to help them develop color schemes and palettes. Students designed custom fonts by hand which conveyed the tone of their piece, then used Adobe Illustrator to create a vector graphic version of their typography, necessary for use with a laser cutter.

Teacher Reflections

Students take separate visual and digital arts classes over the course of their middle school experience. This project offered students an opportunity to see how it is possible to blend different types of media in the creation of an art product. The integration of our classes helped students to see how the arts are composed of multiple styles, mediums and techniques; no longer was hand made art and technology separate in the art process. Creative Collective helped students to understand the process involved in solving creative problems/challenges and how art can be a beautiful by-product of this process. Students were more open to the art process and engaged in finding solutions as a result of being given these creative challenges.

Student Reflection

It was fun to combine these two types of art classes, and to work with the 7th graders. I used to think art was either on the computer or hand-made. Now I see how they can be used together to make one stronger art piece. At first the creative challenges were hard, but after a while we worked together and came up with good ideas and solutions. The project ended up being so much bigger by mixing the classes and the grades. —Giselle, 6th grade

To learn more visit: *http://dp.hightechhigh.org/~mvasquez/* or *http://charlielinnik.weebly.com/*
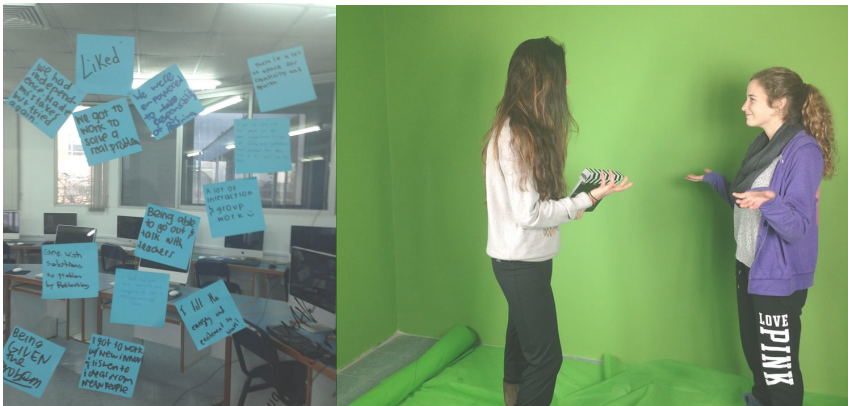
iWeek CHALLENGE

![logo] Roosevelt Innovation Academy

Making New Members Feel Welcome:
A Design Thinking Challenge

Corey Topf, William Cotter, and Joseph Bonnici
Roosevelt Innovation Academy, Peru

To kick off the school year, a mix of grade 10, 11, and 12 students were given a design challenge in the form of a question: "How can I help new people feel welcome to Colegio Roosevelt and make their transition to our secondary school better?" Students were divided into three mixed-age groups. Each group was assigned a different target audience that included new teachers, new students to the school, and new students entering middle school. Using methods of design thinking, along with the Lean Startup "Learn, Build, Measure" cycle, students had three days to design a solution. They presented their proposed solutions to an audience of parents, counselors, board members and fellow students, who judged the projects for desirability, feasibility, and viability.

Teacher Reflection

Rather than begin the school year with the traditional syllabus and "rules of the class," we wanted students to feel what the Roosevelt Innovation Academy was all about by experiencing its core principles for one week. In this design process project, students learned how to define project roles, set deadlines and understand the needs of an authentic audience, while developing empathy and a real world solution.

Student Reflections

I learned the importance of having everyone on the "same page" during the project and how communication is much more effective in smaller groups. Also, I learned the importance of having a good prototype so that you can get good feedback on your idea.   —10th grade student

I learned that we don't always learn by listening; it's achieved more effectively by doing. This is because when taking action, we go more in depth and this drives motivation.   —11th grade student

We were able to overcome the distrust that held us apart by clarifying what kept us together: our passion towards learning. We learned that "group work" was most effective when we found out each other's strengths and organized ourselves around them.   —12th grade student

For a video summary of the process visit: *https://www.youtube.com/ watch?v=FlyBrZXBOA0;* To learn more about the Roosevelt Innovation Academy visit: *http://www.rooseveltinnovationacademy.com/*

Food for Thought

Mariah Mellinger, 9th Grade Chemistry
Colleen Green, 9th Grade Humanities
High Tech High International

The goal of this project was to create a 100% sustainable aquaponics garden that the school community could enjoy and use. Students learned how urbanized gardens positively affect the community, how the aquaponics system itself works and is regulated, and how other sustainable garden practices, such as vermi-composting and use of heirloom seeds promote sustainability. In humanities, students wrote OpEd pieces and created original political cartoons on topics relating to controversial food topics (such as fat shaming, false advertising, misleading nutrition, etc.). In chemistry students learned the science behind what fat does to our body as well as the chemistry of aquaponics.

Teacher Reflections

This project was truly student-led and student-driven throughout. They made daily work plans for themselves (and followed through), encouraged each other, problem solved together, and made connections within their communities to make this project a success. They also articulated their vision in their writing and political cartoons, revising their work five and six times, for no grade, to make sure they were proud of their finished products. At exhibition, all students were fully engaged, passionate, and eager to share what they had learned and what they had worked so hard to build. At every step, the students showed resilience and tenacity, completely driven by their passion to make the world a better place. In the process, we felt much less like teachers and more like mentors, working to support the vision and excitement of our students.

Student Reflections

I really liked how we took a serious look about what comprises the American food diet especially the industrial side of it. It has made me conscious about what I eat. I enjoyed seeing this project come together and seeing everyone working as a well-oiled machine. —Will

I enjoyed building the aquaponics system and learning that we can use environmental resources to make a sustainable garden —Rebecca

I learned a lot about wood building, chemistry, writing OpEd pieces, aquaponics, gardening, and most of all friendship. —Connor

To learn more visit: *http://cgree4.wix.com/colleengreen#!projects/cm8a*

photos courtesy of Joan Soble

When Teachers Exhibit

Joan S. Soble
Cambridge Public Schools

How can teachers further develop new professional learning and then share it? Is there an "authentic audience" for us, beyond our classrooms, and can that audience also learn? When 25 Cambridge Rindge and Latin School faculty members attended professional development institutes offered by the Harvard Graduate School of Education's Project Zero (PZ) in two consecutive summers, we tackled this question in a new way: we became a learning group whose collaborative inquiry culminated in a public exhibition. To date, there have been seven exhibitions of teacher learning—complicated, enriching, frustrating, worthwhile works-in-progress. Each of them has attempted to respond to our colleagues' and our own hopes, questions, and needs, despite our school's increased focus on national, state, and local mandates.

Why an Exhibition

Our learning group's original decision to share our new learning through an exhibition lay in the nature of exhibitions themselves.

- *Exhibitions, because they are voluntary, invite.* While presentations and workshops often focus attendees' attention on presenters' interests, realizations, and theories, good exhibitions motivate visitors to choose what to learn by highlighting the inherent richness and complexity of carefully selected and organized displays, artifacts, and questions.

- *Exhibits combine media to reach more people.* While articles communicate primarily through analytical language, exhibitions speak in multiple languages—writing of different genres and voices, images (static and moving), sound, color, and graphic symbols— arranging these attractively but strategically to stimulate visitors' learning. Different languages speak more loudly to different visitors.

- *Exhibitions can last longer.* While presentations and workshops are often finite events of a morning or afternoon, exhibitions generally have duration in a public space: visitors can choose when to interact with exhibits.

In general, exhibitions provide space, time, and stimulation, with suggestions about why and where to listen and look. Rather than preach and assert, they encourage and entrust visitors to observe, wander, wonder, and interpret—to make their own meanings.

A Major Exhibition: Intentions and Realities

The invitational spirit of exhibitions was particularly important to the large group of us who attended the 2007 PZ Classroom (PZC) summer institute, some as participants and others as faculty members. Both eager and expected to share PZC practices and ideas when we returned to CRLS in the fall, we feared that our initiative-weary colleagues–in an eight-year period, CRLS had had four different principals and multiple improvement plans—would resist any ideas and practices they themselves had not chosen to explore. Most of our group had voluntarily attended PZC because we were discouraged by the deficit view of children, primarily based on quantitative data, that prevailed in the climate of *No Child Left Behind* (New, 2007). At PZC and other PZ learning events, we encountered a conception of "children as competent, resourceful, inventive, and having ideas that

are worthy of being listened to" (Fraser, 2007, p. 18), along with new tools, methods, and frameworks for making our classrooms places of student empowerment and rigorous, personalized learning. Upon returning to CRLS, we began experimenting. When our initial results made student thinking processes, products, and "answers" equally visible—and revealed the interests, capabilities, feelings, and attitudes of students as well as their academic weaknesses and knowledge gaps—we re-envisioned our anticipated exhibition: not only would it present innovative ideas, examples of their implementation, and student results (qualitative data); but it would solicit our colleagues' responses to those results, broadening school-wide conceptions of student assessment in the process.

On the afternoon of March 6, 2008, *Listening to Learn, and Learning to Listen* opened in the CRLS Teachers' Resource Center. The exhibition consisted of seventeen brightly colored triptych display boards representing a variety of PZ and other innovative ideas that one or more of us had incorporated into our work with students. Nearby posters explained key aspects of the ideas our boards featured. Two commonalities unified our exhibition. The first was a common question: "How can listening better improve teaching and deepen learning at CRLS?" The second was a common focus: students' and teachers' learning, especially as developed through reflective, often collaborative engagement with stimulating artifacts, problems, and questions. Four prompts accompanied each exhibit and explicitly invited visitors to contribute their own perceptions, theories, questions, and relevant experiences on nearby chart papers and post-it notes.

Over the next six weeks, roughly one third of CRLS' 200+ faculty members visited the exhibition. Some visited it multiple times; others lamented being unable to visit even once. To some extent, exhibition visitors, most of whom were CRLS faculty members, did respond to its invitation to engage and learn. At the festive yet serious opening event to which all CRLS staff members were invited, many expressed their interest in and appreciation for our work, and their pleasure at seeing students represented as engaged, capable, caring, and progressing. Several said they wanted to be part of next year's exhibition, while others asked about opportunities to learn more about featured pedagogical ideas. Some voluntarily explored "Listening at Fifteen," Susie Bonsey's exhibit about the listening attitudes of tenth-graders,

using a *See Think Wonder* thinking routine. As the weeks passed, post-it note and chart paper responses slowly accumulated. Though less abundant than we had hoped for, they included thoughtful questions, comments, and suggestions that truly provoked our thinking and sometimes referred to other visitors' responses.

Elaine Wang's final reflection captured the difficulties of assessing the exhibition's impact:

> I sense sort of a collective disappointment that our colleagues may not have learned as much or reflected as deeply as we hope they would have. I'm wondering how we can assess whether that impression is valid or not . . . [since] we certainly don't know what we made people ponder about unless they record their thoughts. Furthermore, there's some definite value to written comments/reflections, but I wonder if it's somewhat "artificial" and not inviting of continued dialogue.

The post-exhibition reflections of other members of our group expressed a similar sense that the CRLS teacher-learning exhibition needed to evolve in theory and practice.

Revisions and Paradoxes

Between 2008 and 2013, our group experimented with various exhibition designs and grew more adept at designing exhibits that could be fully explored in 15 minutes. We also expanded the exhibition to include the learning of colleagues working on other school-wide initiatives. 2010's *Under Construction: Moving from Abstract to Concrete* featured the learning of the teachers mentoring seniors creating graduation projects. 2012's *"Who's Behind the Data?": Making Our Diverse Learners Visible* included the exhibits of CRLS student "teacher apprentices" who were exploring their own teaching-and-learning questions. 2013's *The Power of Our Own Questions* featured the inquiry not only of the teacher apprentices, but of members of the large cross-disciplinary faculty cohort learning to use the Right Question Institute's *Question Formulation Technique*.

And yet, despite our group's efforts, the thorniest questions and challenges we identified in 2008 persisted. The exhibition never

became the stimulus for focused, whole-school inquiry into teaching and learning that we envisioned, despite our colleagues' positive perceptions of it: 73% of the faculty responding to the 2010 CRLS professional development survey agreed or strongly agreed that "The CRLS Teacher-Learning Exhibition contributes positively to teacher learning and to our sense of being a school-wide professional learning community."

The Exhibition Group as Learning Group

But even if our exhibition didn't have a large impact on our colleagues' learning, it had a marked effect on our own. As Doug McGlathery explained in May 2008 to a visiting teacher group (through our PZ connections, various educational researchers and school groups became annual exhibition visitors), "[W]e just loved being together. We loved sharing our work and . . . it really strengthened the twenty people who participated whether or not it had a big impact . . . on the culture of the school." Our group, composed annually of veteran members and newcomers, developed confidence in ourselves as a highly functioning learning group: "a collection of persons who are emotionally, intellectually, and aesthetically engaged in solving problems, creating products, and making meaning—an assemblage in which each person learns autonomously and through the ways of learning of others" (MLV Web Site, Learning groups). Various group members particularly nurtured the group's consciousness of its own learning power: photography teacher Debi Milligan, for example, routinely shared when and how she learned "through the ways of learning of others" who taught other subjects, reminding us to take advantage of the diverse perspectives within our group (MLV Web Site, Learning groups).

Contributing also to our learning capacity were our regularly scheduled meetings, designated leadership, connections to the *Making Learning Visible* (MLV) Project, knowledge of the *Teaching for Understanding* (TFU) framework, experience with collaborative inquiry processes, and trusting intellectual interdependence.

Meetings: We met in regularly scheduled two-hour workshop—eight before and two after the exhibition opening—to prepare for and learn from the exhibition.

<u>Leadership:</u> From 2006 to 2014 when I retired, I was responsible for facilitating the group's regular meetings and guiding the exhibition's creation.

<u>Making Learning Visible:</u> Since CRLS participated officially in the PZ MLV project, which sought "to create and sustain powerful cultures of learning in and across classrooms and schools that nurture and make visible individual and group learning" (PZ Web Site), our group regularly explored ways to advance learning by making it public and visible in classrooms and in exhibitions. In 2008, we began to understand "documentation" collectively as possible indicators of learning deliberately selected, arranged, contextualized, and then shared for the sake of learners' further learning. But because our understanding was still evolving, many of us were unsure what to exhibit and how to exhibit it. For example, initially, Vera Outeiro had no plans to include the story of the day that one of her English language learner students had begun a sentence with "I wonder," eliciting his classmates' laughter because "we weren't even doing *See Think Wonder*." For Vera, this moment signified a transformation, given her students' formative experiences in schools that generally encouraged rote learning, not curiosity and questioning: that one of her students was wondering without being prompted to do so while his classmates were affectionately teasing him suggested that their ideas about learning in school might be shifting. After consulting with others, Vera decided to share this story as part of her exhibit in order to illuminate an aspect of learning not reflected in her students' responses and related reflections.

<u>Teaching for Understanding</u>**:** The TfU knowledge that many of us had led us to view our exhibits not only as documentation, but as understanding performances requiring us to develop deep understandings of our chosen innovative ideas. As Natasha Labaze explained in 2008, "This exhibit was basically a culmination of the work started this summer. It allowed the summer institute . . . to flourish through a real pragmatic attempt for me to reflect and share what I learned."

<u>Learning from Protocols:</u> Protocols, structured conversations that promote deep listening and reflection, routinely shaped our group's professional learning, even though not all of us chose to share work or

questions. In their exhibit "Exploring Shared Reflection as a Teaching and Learning Tool," Danielle Corke and Mia Grassia acknowledged the critical role that a protocol about Carrie Dodson's students' work had played in their classroom-based inquiry. Meanwhile, newly intrigued by the interactive web-based technologies other group members were exploring, Carrie decided to shift her inquiry focus away from the work that had inspired Danielle and Mia, and to focus instead on the quality of listening in her Advanced Placement history students' online conversations.

Community/Productive Interdependence: All of us experienced the value of the group's—and on a number of occasions, the MLV researchers'—intellectual contributions and emotional support as we learned together and went public together. As Quilda Macedo explained, "I'm a doer and planner, always looking ahead to tomorrow, not back to yesterday. Working on this exhibit has made me have to look closely at what I actually did. It's been hard (pause) but it's been good. (Longer pause) But it's been hard." At some point, every one of us described the group not merely as an emotional support, but as an essential intellectual context for doing our best individual and collective thinking, learning, and public sharing.

The Challenges of Exhibitions as Teacher Learning Opportunities

But even as the aforementioned factors helped our group thrive in some ways, our efforts were complicated by the conflicts and contradictions inherent in our simultaneous commitments to continuing our own learning and supporting the learning of others. Other groups attempting to mount exhibitions of teacher learning might expect to encounter tensions similar to those we experienced, and also to those experienced by teachers who help students prepare for public exhibitions of learning:

- *Learner/Purpose Tensions:* Whose learning matters most, the exhibitor's, the exhibition group's, or the whole faculty's?

- *Product/Process Tensions:* When—and for how long—should group members spend their time pursuing their own learning? Creating exhibits for others' learning? To what degree is creating an exhibit/exhibition part of the learning process?

- *Communication Tensions:* What's the right content—and right amount of content—for an exhibit? An exhibition? What's the relative importance of content and design?

- *Success Tensions*: How many faculty members need to engage with the exhibition—and how deeply—for it to be deemed a learning success?

- *Assessment/Accountability Tensions*: How much can commitments to personalized, student-driven, student-empowering learning matter in a mandate-driven, standardized educational climate? What role can and must teacher-driven professional development play in schools, and what kinds of time, resources, learning support, and leadership support must be allocated for it?

Teacher Learning Exhibitions and "New Actions"

The CRLS teacher-learning exhibition experience has been fraught with difficult tensions—and replete with inspiring examples of teaching and learning. Currently, new district-wide mandates are shaping professional learning and sharing at CRLS: last summer, several CRLS educators shared their work at a district-sponsored professional development institute. But to date, no one has been appointed to facilitate the CRLS teacher-learning group's work toward a next exhibition. Still, as Reggio Emilia educator Loris Malaguzzi once said, "'Teachers—like children and everyone else—feel the need to grow in their competences; they want to transform experiences into thoughts, thoughts into reflections, and reflections into new thoughts and new actions" (Malaguzzi, 1998, p. 73). Perhaps those "new actions" will dictate new directions for the still vital learning group who created past exhibitions; perhaps they will join with other colleagues to develop a more relevant, inspired, and effective way to share and extend faculty learning. Until they do, though, other school-based learning groups should consider mounting teacher-learning exhibitions of their own. For those who create them, exhibitions offer powerful opportunities to make their collaborative and individual deep learning real, visible, beautiful, and available for their own and others' further exploration. For those who visit them, exhibitions offer powerful reminders of the always important, often complicated relationships between teaching and learning, and between teachers and students, all of whom are learners.

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To read more of Joan's work, visit her blog: So Already: A Blog about Moving Forward and Staying Connected at: *soalready.blogspot.com*

Photo courtesy of Isabella Venezia

Sizzle and Steak: Why Exhibitions Matter

Alec Patton
High Tech High Chula Vista

I love exhibitions of learning. Before I began teaching at High Tech High, I was thrilled by the very idea of an "exhibition"—a public event where students display the work they have created during a project. On the other hand, there will be a moment during the week before a big exhibition when anyone involved in setting up an exhibition will wonder why they ever thought it was a good idea—because, like all authentic learning experiences, exhibitions can become immensely stressful. I remember spending forty-five minutes in a parking lot with two students, talking them out of storming off the campus because they were so offended by what another student had said to them, after their idea for a sign had been vetoed. More recently, when I asked my students for their thoughts about exhibition for a blog post, a student wrote, "One thing I learned throughout the years is that you really get to know who your true friends are. Arguments start, tears are shed, and words are spoken that really should have just been left unsaid."

So, exhibitions can be exceptionally stressful for everyone involved, but that's no reason not to do them—quite the opposite: they are stressful because they matter. At a school where exhibitions are part

of the annual calendar, students feel a weight of expectation not only from their soon-to-arrive audience, but also from the exhibitions put on by their predecessors.

Before I was a teacher, I imagined that students would be looking towards exhibition from the moment a project began. I've come to believe that most people, whatever their age, tend to put off thinking about exhibition as long as possible, and at the beginning of a project, most students focus on understanding what I, their teacher, expect of them. When I have seen students commit most to their work, it is not the prospect of an exhibition, but the nature of the work itself that drives them—creating videos based on interviews with family members about illness, for example, or creating paintings about diseases that were commissioned by the scientists researching them. For students working on these projects (both were components of the multidisciplinary In Sickness & in Health project), exhibition was an exciting prospect, but not a primary incentive. On the other hand, the exhibition certainly focuses my mind from the beginning as a teacher, and encourages me to come up with a project design that leads to something that will be interesting for visitors to look at/listen to/read/contemplate.

This is not to say that exhibition doesn't affect students' relationship to their work—it has a profound effect, just not always in the way you'd expect. In the past I overestimated the role of exhibition as an incentive from the very start of a project, but underestimated the power of exhibition to give students an opportunity to excel in disciplines that the regular school day gave them no chance to work on. This became most vivid for me when I asked a student how he thought we should display our oral history videos on exhibition night. He told me to talk to a group of students who I would not, up to that point, have thought to put in charge of the centerpiece of my exhibition—because they had not, up to that point, shown a great deal of interest in my class. However, they took up the challenge with a level of passion, imagination, and expertise that I have never seen before or since. I watched them dismantle and rebuild a table and create a program to run four computers off the same hard drive. I took a trip to an electronics store with them in which they made sure to get every component we needed as inexpensively as possible, treating my budget even more parsimoniously than I did. We stayed

in the room during lunch, before and after school, as solution after solution presented an unexpected weakness. Finally, when they had gone so far as to remove the scroll wheels from four computer mice so nobody could accidentally advance too quickly through the videos, and installed a discreet fan to keep the whole system from overheating, we were ready to go (and with a couple hours to spare before the exhibition opened!). That experience transformed my relationship with that group of students. They didn't suddenly love to read and write, but they trusted me to help them get better at both, as I trusted them to deliver, whatever we were working on.

One final point about exhibitions: an exhibition is an exercise in making your learning both interesting and comprehensible to non-experts. This, I believe, is one of the fundamental aspects of literacy in the 21st century, where many jobs require frequently explaining specialist information to non-specialists, and where the ubiquity of information means you will need to be very interesting to keep their attention. I think about this when I hear teachers talk about a food metaphor that comes up whenever we talk about how student work is displayed: the "sizzle" and the "steak." The "sizzle" normally refers to the look of an exhibition—particularly the transformation of classrooms into unrecognizable, magical-looking spaces—while the "steak" refers to the actual content of the exhibition—the way that learning is demonstrated through work.

I want to push a little on this perceived dichotomy: "sizzle" and "steak" are generally described as different, even opposing qualities, but when you cook a steak, the "sizzle" is the sound of raw material being transformed into something digestible. So "sizzle" strikes me as a defining feature of beautiful work—information shaped by students into something that is both palatable and comprehensible to visitors who attend the exhibition. In an email, a former student of mine wrote that "To me, a great exhibition needs to have two main parts. It needs to be engaging, and interesting. This means it needs to be visually appealing. It also needs to have lots of important, useful information that connects to the visual parts. They should be connected." I can't say it better than that.

For further information about Alec Patton's work, visit his digital portfolio at: *http://alecpatton.weebly.com/*

Designing a Collaborative Learning Environment in Math

David Corner
High Tech High North County

What do I want for my students? I want them to be active learners, able to ask questions and engage in critical discourse about the world around them. I want them to be able to show how something does or does not work, and I want them to be able to do all these things with each other. That means that I want students focused more on each other as a source of math learning and less on me.

My role as teacher is to be the designer and engineer of the mathematical learning environment. In this reimagined classroom culture, students working in groups conduct inquiry and construct their understanding of mathematical problems, developing habits of a mathematician and deepening their understanding of mathematics along the way. But what does this look like? Here I want to share my approach to a typical lesson, including the successes and struggles that I encounter as I try to foster this kind of learning.

Planning

For a unit on creating average rate of change equations on different linear and nonlinear functions, I set the following goals:

- Students use linear expressions to represent situations involving constant growth rate.
- Students use linear expressions to compare rates of change.
- Students understand that the constant growth rate is a ratio of the variables being used.

Having set these goals, I needed to select the math task and plan out how the lesson would flow. The problem I chose for this lesson was "What a Mess!"—a Year 3 problem from the Interactive Math Program (IMP) (Fendel et. al., 1999. Figure 1).

What a Mess!

An oil tanker has broken up due to an explosion out at sea, and thousands of gallons of oil are spreading across the ocean. Linda Sue is flying overhead in an airplane and sees that the oil slick appears to be in the shape of a circle.

When Linda Sue first sees the oil slick, the radius of the circle is 70 meters. She flies overhead for a while and perceives that the radius is increasing at a rate of 6 meters per hour.

Make an In-Out table in which the *In* is the number of hours since Linda Sue first observed the oil slick and the *Out* is the radius of the oil slick after that many hours.

Draw a graph based on your In-Out table, and find a rule for your graph and table.

Figure 1: IMP Year 3 Math Assignment

As a planning guide, I used Smith et. al. (2008), "Thinking Through a Lesson: Successfully Implementing High-Level Tasks." The article provides lesson-planning structures whereby students are given an opportunity to reason through a problem as peers with minimal but necessary input from the teacher. A colleague helped me plan the lesson. The first step was to work through the problem ourselves and solve it.
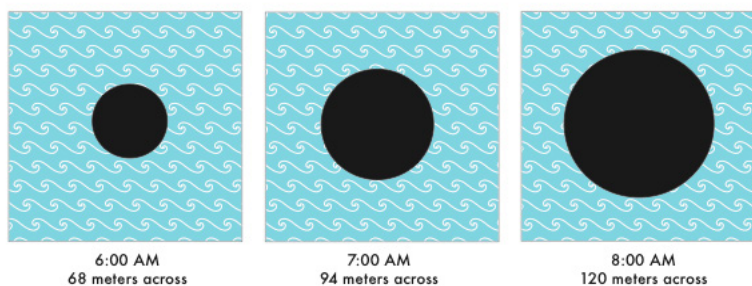
THE OIL SPILL

Name: _____

| 6:00 AM | 7:00 AM | 8:00 AM |
| 68 meters across | 94 meters across | 120 meters across |

Figure 2: Sample problem based on 'What a Mess!' Rendered Visually"

Next we turned the IMP word problem into a visual problem. Our aim in this representation was to simplify the task so that all learners could access it, and to allow for wonder and exploration with no direct instruction on the paper.

Our third step was to hypothesize student approaches to the problem, the difficulties they might encounter, and the misconceptions that might get in the way. During group work they might get stuck, which could lead to student frustration and tuning out. I needed to be able to anticipate these potential problems. Next, we identified possible "mathematical habits or practices" that students would use in exploring the problem. These are math habits that the class created at the beginning of the year and are posted in the classroom (Figure 3).

- Visualize
- Stay Organized
- Look for Patterns
- Seek Why and Prove
- Be Confident, Patient and Persistent
- Experiment Through Conjectures
- Solve a Simpler Problem
- Collaborate and Listen
- Be Systematic
- Generalize

Figure 3: Habits of a Mathematician

Ideally, students use them on a daily basis and reflect upon them during assignments. Finally, we created an anticipated lesson flow in three phases: launch, explore and summarize.

Launch

I launch the problem in class by showing the visual in Figure 2 and posing the following: "Here is a picture of an oil slick in the ocean. What do you notice?" I then ask the students to create an individual list, discuss the list at their table through a pair-share protocol, and then share out. During this process of sharing out, I serve as facilitator and class scribe, capturing what each table group notices. Here is what the students notice:

- it increases 26 meters by the hour
- they are perfect circles
- it doesn't specify how deep the oil spill was
- the whole thing increases by 52 meters from 6 am to 8 am
- it has constant growth

I then ask, "What do you wonder?" We follow the same protocol for sharing out. Here is what the students wonder:

- is it a perfect circle?
- how will this affect the wildlife?
- how long will it be spreading?
- how large is it going to get (the diameter)?
- what is the problem we are supposed to be finding a solution to?
- **does it grow in a linear pattern?**
- how many meters are in a mile?
- **what time did it start? what was the starting amount?**
- how much clean water is surrounding the oil spill?
- **what is the relationship between the hour and the diameter?**
- **is there an equation we can find to determine the diameter based on the hour?**

We then decide as a class which questions we want to explore. These are represented in bold above. Students from each table group of four decide as a group what they want to explore and then sign up for that question.

Explore

Now we are ready to move to the explore phase, where students collaborate in groups on their chosen inquiry question. Here is a portion of one group's conversation.

Student A:	So 68 minus 26. Right?
Student B:	Yep. 68 minus 26.
Student A:	So at 5:00 a..m the oil slick is at 42 (meters).
Student C:	So at 5:00 a.m. it was 48 (meters)?
Student B:	No. 42 (meters).
Student A:	At 4:00am it was at 16 (meters).
Student B:	16 (meters).
Student A:	That is going to be negative.
Student B:	3:00 a.m. was probably the starting time. At 3:00 a.m. it will be zero.
Student D:	Half of 26 is 13, so it will be around 3:30.
Student B:	I don't know how we could find zero. It's 3 meters across at 3:30.
Student D:	It is? Are you sure?

The conversation continues as the students try to determine the exact starting time of the oil spill. I notice that Student C and Student D are now engaged. This sort of peer-to-peer engagement is encouraging, because when I speak in front of the class, Student C, Student D and other students are not so engaged.

I listen for lulls in conversation and signs of students getting stuck. I want them to continue to explore the problem. I extend the problem by asking, "Now that you have gotten the starting time between 2 a.m. and 3 a.m., how can we determine the exact time?" (As anticipated during the planning session, the students struggle most with coming up with a relationship between time and diameter.) I then give the students more time to talk and test their ideas with each other. I move onto other table groups to see where they are in the task. I continue to check for engagement and ask questions. During this time, I am looking at each group's work and finding examples of student work (Figure 4) that can be shared during the summarize phase.
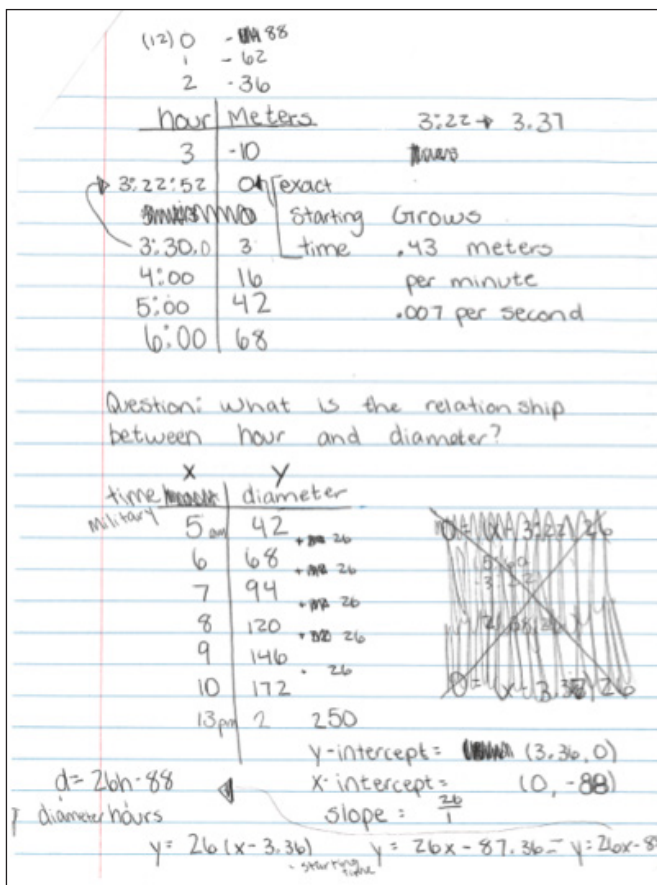
Figure 4: Example of Student Work

Summarize Phase

The summarize phase is where the story gets told. Students present data and evidence, followed by a class discussion. Students are expected to share out, support and question each other. My role is to redirect and ask probing questions if this is not already occurring.

For example, when my first student shares her data, she conjectures that the starting time of the oil spill is between 3:30 a.m. and 3:45 a.m., but then she gets stuck. Frustrated, she says, "This is hard to explain." I ask the class, "How can we know that the oil spill does not start before 3:30 a.m.? This prompts another student to challenge her conjecture and suggest another approach for finding the starting time. This interaction is done in a supportive way and allows the struggling student an opportunity to explore the problem another way.

Eventually, some equations begin to emerge from the presented student work. The first equation that is presented is y = 26x − 88 (where x is time and y is diameter). This is immediately challenged by another student who says the equation is y = 26x + 16. At this point, I put all the proposed equations on the board, honoring each group's contribution to the problem. Another group jumps in and says, "We got y = 26x-10. Lastly, a student offers d = 26H - 624D - 88 (where d is diameter, H is hours, and D is days).

This is where the lesson ends for the day, leaving more questions than answers. The class must reconcile the difference in the equations. Also, an opportunity emerges to discuss the use of alternative letters, other than x and y, to describe variables.

Reflections

At the end of each assignment students write a reflection about the problem, including a habit of a mathematician that they used in addressing it. Sample student reflections for this assignment follow:

- *I invented numbers by using the rate of growth I discovered to test my conjecture and (equation) and went through several equations. I am proud of the work that I did on this problem.*

- *During this problem, I made a lot of conjectures. I just tried what I thought might work and experimented to see if there was any validity to my hypothesis (equation).*

- *The first habit of a mathematician I used was looking for patterns. I used this in the beginning to see how the area increases each time.*

- *As to how I used being systematic, I made small changes to time to look for changes in diameter when I was trying to find the time the serious environmental hazard would occur.*

Designing a collaborative mathematical learning environment is about empowering students by having them reason through complex problems. Students struggle with these tasks, which leads to disagreement and confusion; however, students must attempt to

reconcile this cognitive disequilibrium. This becomes the foundation for classroom instruction. In this lesson, some students did a great job of engaging and exploring the tasks. They worked together to discover patterns in the data and create generalizations. The students who were able to do this found it rewarding and it showed in their attitude and confidence.

The use of protocols in the launch phase gave the students time to think as well as a chance to share out with each other and the whole class. That being said, there needs to be a stronger emphasis on making sure more structured protocols and norms are in place during the exploration and summarize phases so that all students are put in a position to contribute. If no other group norms are in place, students will often assume roles based on their previous experiences and comfort with the subject matter. This can create an inequitable situation where some are participating and learning more than others.

My focus this year has been on increasing participation in groups and whole class discussions. I have assigned group roles (e.g., Facilitator, Team Captain, Accountability Manager and Skeptic) and strive to incorporate these into my lesson planning so that each student is able to participate and develop some agency. I rotate the groups and roles at the beginning of each new unit so that each student gets a chance to work in that role. We also carry out a team building activity so that positive socio-group norms are reinforced. My hope is that participation increases through supportive, equal-status interactions and that students see that participation is expected of them regardless of prior achievement. As always, this continues to be a work in progress and I am always trying new ways to encourage my students to engage in critical discourse about the world around them.

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photos courtesy of Melissa Agudelo

Home Visits

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High Tech High Media Arts

L̲ike every other house in the neighborhood, the lawn is impeccably manicured; the hedges perfectly shaped, surrounded by flowers in full bloom. Her mom opens the door and greets me with a fast smile and an enthusiastic handshake. The kitchen has been recently remodeled and the living room couch is new. Mom apologizes for the yapping Jack Russells in the back yard. As we sit, my new advisee comes out of the back room, trailed by her sister. We talk about the coming year in easy and friendly conversation. There is talk of the dress code and what might work in her current wardrobe. There aren't many questions, as she attended our middle school, but there is clear anticipation and nerves. We talk about teachers who have been important for her. Mom asks if she can talk in private and walks me to my car. She shares her concern about another student, simply hoping to relay what she knows to someone at the school who might help.

The drive to this advisee's home takes 28 minutes. Heading east, the green of the coast disappears halfway through the drive. Her home is brown stucco with a small yard, which is mostly dirt. Outside,

everything is neat and unadorned. Inside, the living room is decorated with family portraits and a remembrance of her older sister's high school graduation. In broken English, Mom proudly shares that the older sister is already in college. I offer that I speak Spanish and Mom is appreciative but continues in English. My advisee comes out and takes the couch opposite where I am. She sits on her hands. I ask about middle school and why our school is the place for her. They share that she is the only person from her former school attending and express relief that she will have a fresh start. She tells me of the bullying she endured and her hope that she won't experience that again. Academically, she likes school and dreams of college. Mom echoes her hopes. Her aunt and her grandmother come out of the back room. We talk about my role and what an Advisor does. Mom has very few questions and seems hesitant. I turn to talk to her daughter, my new advisee. What are her hobbies? What does she like to do? She smiles coyly, answering everything. Then, as I rise to leave, Mom offers me lunch. She has some fish cooking and doesn't want me to go hungry. She wraps me a plate and I go.

He lives in a small apartment complex, just off of a busy San Diego street. I push the buzzer, then notice the gate has been propped open. I walk through and see his mother. I greet her as if we have met before and we shake hands. She invites me into a small living room whose walls are lined with portraits of the two children in the family at various ages. My jaw drops as I point to a particularly cute one of him. He smiles. Mom asks if I would like something to drink and I accept a glass of iced water. His little sister comes out and I ask if he is a good brother. She says he is, but they fight sometimes. His mother explains that his father is in the shower as he has just gotten off of work at a local restaurant. Because this ninth grader is new to our system, I start by explaining my role as advisor then ask what kind of student he is. We slip easily between Spanish with mom and English with him. Mom says he struggles at school. He has ADD but doesn't like the medication as it makes him nauseous. She was told by a teacher at his middle school that he will never make it at our school as he can't focus and won't use the work time effectively. Mom says this teacher 'guaranteed' he would fail. I talk about how we can support him and work to develop the skills he needs for college. I ask him if he sees himself in college. He says he wants to be a lawyer. I tell him that will be our goal. Dad comes out and shakes my hand. Mom shares her

appreciation for the home visit and that she is now much more hopeful that he will make it. As I prepare to leave, Mom tearfully tells me that his father works in a restaurant and she cleans houses. All they want is a better life for him and his sister. They take down my number for any concerns and we all hug as I leave.

Every student in our school belongs to a cross-grade advisory group that meets weekly to discuss personal plans and school issues. As an advisor and an advocate, I am expected to visit the homes of all of my incoming advisees. In the years I have been doing home visits, I have gone to dozens of homes. At first, I worried about intruding or making the families feel they were being judged. What I've come to know, however, is that spending time in the home of each student gives me insight I couldn't gain otherwise. I get to feel what home is like for them. I walk their neighborhood and get a sense of what their weekends and evenings are like. Home visits give me a window into their world, so when I talk to them about how things are going, we can have a real conversation that balances the reality of their home and their experience as a student. Our relationship is stronger because there are things they don't need to explain.

As I try to give my advisees a sense of belonging in our school, home visits remind me that community building is a two way street. If students are to feel that they belong, they need to know that someone in the school understands the community from which they come. Learning—real learning—requires a huge amount of trust. In order for students to take the risks necessary to explore and articulate their thoughts and opinions, they need to feel safe, connected, valued and known. Spending the time to visit each student's home builds a bridge into our learning community and back.

Melissa Agudelo currently serves as dean of students at High Tech High Media Arts. A graduate of the HTH Graduate School of Education, her greatest interests are student voice and the creation of inclusive school culture. High school kids are her favorite people on earth.

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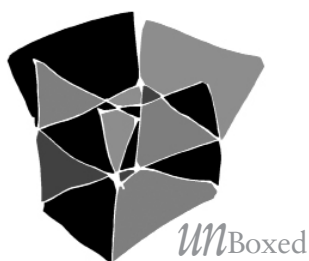
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