

Student Science Fair International Collaborative
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TEACHER GUIDE

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International Student Science Fair Collaboratives

Introduction

This document is for classroom teachers as a supplement to the series of powerpoint slide presentations on this Fulbright Distinguished Awards in Teaching project. It provides details on how the project was structured, evolved, implemented and continues to develop. For the teacher considering their own application for the Fulbright DAT grant, it is intended to encourage and share insights from the experience. It may be especially useful for a middle school classroom science teacher tasked with teaching to the new NGSS standards, or any teacher looking for innovative ideas on integrating student passion projects into the classroom experience.

The guide is organized into four sections:

1. **Inspiration:** how my project originated and the original vision for implementation.
2. **Project evolution:** how intensive summer PD before the travel informed changes in the structure and delivery of the project.
3. **Reality checks:** how I set up the project to be ready when I hit the ground.
4. **Obstacles:** identifying them, navigating them and lessons learned.

There are two additional powerpoint presentations: one on Presentations for Teachers and another on leading a Field Trip in India. All of the presentations include speaker notes to support and clarify the content on the slides.

At the end is an annotated list of selected resources and links that I hope are useful for classroom teachers.

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1. Inspiration

My teaching career began with the ambition to teach late elementary school with the intention of combining all curricular subjects within lessons. I imagined a class where students could not always identify the subject they were learning because there would be additional dimensions to every lesson. Science, art, reading, history, physical education, drama, and more could be combined to engage all students and open minds to all disciplines. As fate would have it, my first teaching assignment was middle school science and I have continued with that for over 13 years. My original vision for education is still active in my mind however.

As a middle school science teacher in an urban school in a major US city, I face many challenges that are common to the profession: Large class sizes, a focus on standardized instruction, changing curricular standards, demoralizing pink slips, lack of technology infrastructure, and isolation in my classroom. While these realities overwhelm and can in fact burn out many teachers, from the beginning of my career I strategized for longer term survival. For large class sizes, it became obvious that good classroom management was critical, so I prioritized that in my professional development. To the restrictions of the curriculum and assessments, I sought out the best curriculum I could find and diverged from the linear progression of my textbooks. To combat annual pink slips early in my career, I earned a second credential in science that helped secured my job. For technology I slowly built up my skills and reputation so that resources flowed towards me. Despite many successes, the challenge of classroom isolation, the lack of collaboration within my school and across other schools has been my biggest challenge. Addressing this was my main motivation for seeking out the Fulbright experience.

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A requirement for applying for a Fulbright DAT is earning a Masters degree, and I had recently completed my M.Ed. with a focus on educational technology at California State University, Northridge. The capstone project for the CSUN Ed Tech Masters cohort was an action research project. I learned the basics about educational research and attempted a topic that I needed to address in my teaching practice. The topic was “science fair”, the projects commonly assigned throughout schools, usually a trifold display board combined with a report and student “experiment”. These projects were difficult to work on in school, often completed with too much assistance from parents done the night before they were due. Then there was pressure to grade them all and put them into competitions.

There are many positives about science fair projects and I searched for guidance on how to structure the projects successfully. I tried making it “fun” with activities that could be modified with one variable into an “original” experiment. I tried integrating the projects into the curriculum by assigning every student an experiment, so that when combined together they could cohere into a biology unit. I offered after school workshops and curated online resources, as well as amassing a library of books on science fair topics and experiments. I reduced the size of the display boards so they would fit in student lockers and the work could be done at school and less by parents. I emphasized the importance of communication skills by delivering a good oral report, making it as valuable a score as the other components. To reduce the stress of public speaking I broke the class into groups of four and let them practice their oral reports repeatedly in class, improving with each delivery.

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Some of my students loved this assignment, excelled at it, and went on to enter regional science fair contests and even win awards at the state level. But the majority of students did not seem inspired- they were in fact stressed by the compulsion to complete a science fair project. If the compulsory aspect was lifted, it seemed doubtful that most students would choose to do the assignment. Even more alarming was an observation that some of the students who had been most successful had no desire to repeat their performance the following year with another science fair project. Something-perhaps everything- still had to change.

One idea for reform was to leverage the emerging use of online collaborative documents such as Google Docs, that might make it more engaging and easier to work with a partner. The selling points for me were the opportunities to give students working feedback in their documents, the ability to track actual workflows in revision history, and the ease in which to publish finished reports online for an authentic audience. Those reports could then be curated online and presented as an online science fair to complement the physical one.

These innovations led to my action research: would the use of these technology tools increase student engagement and ownership of a science fair project. While hardly a professional study, the results I gathered were informative, at least for me. As before, some students naturally accept and do well on a science fair project. But most students expressed resentment at the compulsory and competitive aspects of the project. Using the online technology to collaborate did very little to mitigate those attitudes in this very limited study.

What if the collaboration was international though? That was the essence of my Fulbright proposal. A focus on cooperation not competition and the potential to impact science learning and instruction on a large scale. In the process, cultural exchanges would likely occur in meaningful contexts. Two teachers from different countries who've met in person could begin collaborating by sharing knowledge about their students in order to partner them with other students in the other country. Gradually, the scaffolds of teacher direction can be removed until the inquiry becomes more student-directed. Student inquiries will be guided towards ideas for service learning projects either about their local environmental issues or local ecology. Any topic might be connected to a discipline of science, demonstrating the universality of the nature of science across cultures and physical environments.

2. Project evolution

Following the excitement of being selected as a Fulbright DAT, I focused the summer on professional development for methods to refine and implement the project. In May I attended the Bay Area Maker Faire and became convinced that “making” was the most exciting way to combine science and engineering with a multitude of other disciplines. In the Maker culture I identified the potential to realize my dormant ambition to blur the lines of discipline content. During July there were workshops from my three primary professional affiliations, NSTA, NAGC and CUE. I also attended trainings on NGSS Standards, and online course offered for Google Educator Certification. The workshop that perhaps had the most impact on me was the CUE Rock Star Camp. At this multi-day event I was exposed to several innovative teaching techniques and a network of passionate educators. Subjects that inspired me included Google Classroom,

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Breakout.edu, gamification, using virtual reality, blogging and using twitter for professional development.

One idea that took root a little later was “20 percent time”, also referred to as “Genius Hour”. As I learned more about it, I enrolled in an online course. Here was a method to break open student resistance to doing a project by challenging students to identify their own interests and then design a project around that. The structure provided for Genius Hour seemed to be just what I needed to inspire my students. It wasn’t until near the end of the project that I announced to them the international potential for their projects. The TED Talk style videos that they created about their project could be used to give students in India a quick entry into the project and an exciting chance to work together.

Reality checks

Taking an ambitious project from idea to prototype to successful implementation was a process that mirrored the “failure” ethics of Genius Hour itself. Within my school district, our Google Apps For Education (GAFE) accounts were severely restricted so that none of the student created videos could be viewed outside of school. I needed to collect a separate media release waiver for each parent and student and then re-upload each video under my own account outside my district firewall. After that I needed to learn the basics of Wordpress in order to set up both the inquiry project and the Fulbright blog in one easy to find location.

Having completed that preparatory work and using email to contact schools in India to gain invitations, I made my way from Los Angeles to India. My first reality check was observing some

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formal science fairs at the National Science Center in Delhi. While I was invited to present my project to an audience of science fair participants, the enthusiastic response was tempered by some confusion around the logistics of the work.

Immediately I realized that I would need to utilize multiple avenues to engage with Indian students. If they had a great science fair project already made, perhaps they could make a video that I could share with my students. However I found that the students were not experienced enough with making videos and I did not have enough access or resources to help them realize that goal.

I expected that students would likely have mobile phones and that they might be able to use them to participate in my project, even without access to computers and internet. What I did not know is that most students in my target age range (11-14) do not yet have their own email addresses .The next reality check was finding out that students did not seem to have the time or resources to watch my students youtube videos, let alone respond directly to them.

As I began to visit schools, I faced other reality checks. Foremost was the pressure of exams, rendering classroom lesson into rote-style review sessions called “revisions”. While observing classroom lessons, when a teacher prompted students for misunderstandings, instead of saying “does you have any questions”? , the expression was “does you have any doubts”?

Within my first few weeks in India I also met with representatives from the NCERT (National Council of Educational Research and Training) which is responsible for all the national textbooks

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and curriculum. These are freely available for review and download (the link is provided in the resource section). The textbooks promote teaching science with inquiry and avoiding rote learning, but what I observed in practice appeared to me mostly to be rote learning.

Within some time I asserted myself to teach some classes and whenever possible present the details of my project, but it became increasingly clear that I would not gain much traction. Trying not to be discouraged, I attempted to provide schools whatever services I could. If they wanted a presentation on the Nature of Science, Effects of Urbanization or any other topic, I was happy to do that.

My reception at schools was very positive overall, and while the students seemed somewhat passive during discussions, when class was over I was overwhelmed by their enthusiasm and desire to connect with me and my students back home.

My initial hope was to “click” at one school and just stay there the entire three month duration of my grant. But when that proved unrealistic, I endeavored to get to as many schools as I could looking for a good fit. Despite some disappointments, there was an international school that had invited me for an extended stay and they were excited not only about my project but also a “plan b” curriculum I was eager to share. This school had ample technology infrastructure, shared my passion and interest in the Maker movement, and was even trying to implement the NGSS. I thought it would be a perfect fit. Unfortunately when I arrived the reception did not match my hopes and I was only allowed to observe some classes, and not given the opportunity

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to pitch the project to students or teachers. Again I was forced to pivot, to make personal connections with teachers as best I could so I could try and follow up with them later.

Obstacles

I visited a wide spectrum of schools, from the much maligned government schools to very elite international schools, but mostly private schools geared to middle classes in India. I focused on the urban areas of Delhi, Bangalore, Kolkata and Mumbai. As I realized that my project was not going to be quick and easy to implement in the short time frame I had, and with the timing around exams, I thought more about the longer term and developing contacts I could continue to work with after I returned home. To get the word out I designed and printed a series of flyers to distribute to the students at the schools I visited.

If gaining access to schools and thus students was an obstacle, I also learned that there are NGOs in India that provide informal learning opportunities to students of different ages and economic circumstance. Making contact with some of these organizations gave me more hope to implement my project with them, but again it would take more sustained effort and time to build the project from the ground up.

While I had designed my project to allow Indian students to have access to students and collaborate immediately, I found that they were much more interested in starting their own projects than just commenting on or joining another. I had thought that the novelty of meeting a student from another country would be motivation enough but I may have misjudged that.

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The cultural differences between the students themselves and the school systems they were in was just too wide to bridge in the time and space I had. With the help of a Fulbright alumni, however, I was able to get the support of a parent from a school who organized a student workshop series in her home. Here I was able to work with students directly and with minimal pressure for two afternoon weekend sessions. During these sessions there were several students who expressed interest and a few who made videos to introduce themselves to my students. From there the email exchanges began and the project gained momentum after all.

From this experience I gained the insight that appealing directly to parents would be more effective than just going to schools or presenting at student assemblies. While I could inspire great enthusiasm at schools, unless the schools and the teachers bought into the process, the enthusiasm seemed to fizzle out. My project appeared to Indian educators as a non-curricular or after school project when in fact it was intended to take place during the school day within the regular classroom.

As the third and final month of my grant period was ending, I approached the schools I had visited and offered to return with one condition: that I have an opportunity to present to parents directly. When parents want something for their children, they are often able to pressure the school to provide it. Most importantly, and somewhat obvious to me now, the students are only able to work on a project with parental support.

While I've returned home to the pressures in my own classroom and the call to take more leadership responsibilities, I do intend to continue working on this project and advocating for the kind of educational reform that India seems ready to embrace if presented in the right way.

Overall I found that schools and teachers were mostly overwhelmed with their responsibilities and unable to accommodate something new and not well understood on short notice. If the school was wealthy or elite, they seemed almost suspicious of something being offered for free. But I benefited greatly from all my experiences, collecting resources from the schools to inform my own practice. I've also committed myself to find ways give back to this beautiful and inspiring country in the years to come.

Some Recommended Resources

Biology for Every Kid by Janice Pratt VanCleave

An elementary book of experiments that could be divided up to a class so to create a themed science fair.

Tools for Teaching by Fred Jones

Outstanding resource for classroom management and instructional design. Referred to extensively in the presentations I made to teachers.

It's Due When? and other books from Loose in the Lab by Bryce Hixson

Workshop leader and equipment supplier who invigorated my classroom with countless fun science activities.

We Dare You by Vicki Cobb

Delightful book of 'science dares' to inspire even the most reluctant student to be engaged with doing science.

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Sourcebook for Teaching Science by Norm Herr

Encyclopedic resource of teaching techniques and activities mainly for High School students by the renowned trainer of science teachers at CSUN.

Science Surprises by Larry Flammer

Extremely engaging student ebook and teacher guide to the Nature of Science.

10 Things All Future Scientists Must Know (But are Rarely Taught) by Edward Zaccaro

Outstanding resource for teachers and parents to use to teach the nature of science and critical thinking.

Complete Handbook of Science Fair Projects by Julianne Blair Bochinski

Encyclopedic collection of possible science fair projects for the advanced student.

Journal of Student Research Abstracts (CSUN, annual)

Ongoing series of published student abstracts that inspired me to collect my own students abstracts to make an online science fair.

Exploratoria staff of the Exploratorium

Beautiful book for elementary age students to become excited about science.

You Can Create a Killer Science Fair Project by Kris Hirschmann

The best step by step breakdown of how to do a science fair project for students that I have used.

Science Is.. Susan Bosak

Encyclopedic resource of hands-on science activities.

Why Science Fair Sucks and How You Can Save It Adam Shopis

Sincere if not very academic book, intended for busy teachers who want to reform their science fair curriculum.

Teach Like a Pirate by Dave Burgess

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A provocative and inspiring book that encourages teachers to innovate passionately in their classroom.

R&D Your School How to Start, Grow & Sustain Your School's Innovation Engine American School of Bombay

Powerful synthesis of a schools commitment to innovative practices.

Launch: Using Design Thinking to Boost Creativity and Bring Out the Maker in Every Student by John Spencer and A.J. Juliani

Easy to read teacher guide by some leading implementers of Genius Hour in the classroom.

Learn Like a Pirate Empower Your Students to Collaborate, Lead, and Succeed by Paul Solarz

Teacher resource to shift responsibility for learning from teacher to student.

Explore Like a Pirate: Gamification and Game-Inspired Course Design by Michael Matera.

Teacher guide to radically transforming the curriculum around mission challenges and student choice of what and how to learn.

Maker Faire Classroom Playbook

Maker magazine's official guide to classroom activities

School Maker Faire Playbook by Sabrina Merlo Maker Media

Guide for teachers to design awesome School Maker Faires

Youth Makerspace Playbook by MakerEd team

Guide for schools to design practical and effective makerspaces.

Invent to Learn by Gary Stager

Excellent resource with great ideas on infusing engineering and fun into all subject areas.

Research to support implementation of Genius Hour in the classroom

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Choice Theory in the Classroom by William Glasser

Drive by Daniel Pink

Flow: The Psychology of Optimal Experience by Mihaly Csikszentmihalyi

Finding Your Element by Sir Ken Robinson

The 20% Doctrine by Ryan Tate

World Class Learners by Yong Zhao

Weblinks

Cue Rock Star Camp

Google Certified Educator Training (free)

Genius Hour online course and blog

Zoo Tiger vs. Jungle Tiger *resource by Trevor Ragan*

NCERT Textbooks from India

Online access to all NCERT textbooks. Interesting to compare the official Indian curriculum with what we teach in the USA.

Kate Petty's: 20 Time in Education

The Genius Hour Wikispace

The Global Genius Hour Project Wikispace

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