

Case Study #1: Math is for Girls

Evelynn was not pleased that her mom signed her up for “Math is for Girls*”. She was hoping to spend the summer hanging out with her friends she just met in high school. “What’s the point?” she said. “I already failed math and I’m no good at it”.

“That’s exactly why you’re going,” said her mom. “I may have been bad at math, but you don’t have to be. And look, they’ll give you a T-pass for the 4 weeks. You can use that to see your friends after the program ends each day. Plus, they’ll take your swimming, there’s dance, and you’ll even get to visit these companies and UMass Boston”.

Half way through the program

“How do you like the program, Evelynn? I mean, other than the free food.”

“Did I tell you I love our teacher Ashlee? She is really funny and smart. She’s the first person I’ve met who studies math in college. I think she goes to UMass Amherst. She grew up right here in Mattapan, AND she was a step dancer, just like I am! We danced and played math games. Ashlee made math make sense when she breaks it down like that. Like, I finally GOT graphs and percents. After Ashlee showed us a table with the numbers of black people who had college degrees or who went to jail, compared to white folks, and I figured how to make different charts of the proportion, I almost didn’t go on break. Wow!

“What’s more amazing? Ashlee gets all 15 of us to get along – we’re from 11 different high schools, you know. Well, except this one girl Taneshia. She keeps saying she hates the program, that her math teacher hates her. Ashlee said she herself got C’s and D’s in math in middle school because she felt lost. I don’t really believe her. Ashlee also said her math teacher in high school told her she was good at math, and can get to college and study math. We all wish we had a teacher like that”.

Comments at the Math is For Girls focus group, one year after the program

- Miss you girls! We had such a fun time together
- I like my new math teacher. She breaks it down for me.
- I still have the same math teacher from last year. I did well the first exam. My teacher didn’t even say anything nice to me and even said that it was a fluke! So now...well, I failed the last exam.
- I went into the school year thinking I would conquer math, but I haven’t been getting the help I need, so I’m struggling again.
- The kids in my class tease me for being good at math. So I don’t say as much, even though I still do well in my exercises and exams.

Program Description

The description below is based on an actual program in Boston. Names have been changed and the above account is fictionalized.

*Math is for Girls is a pilot program for high school girls, developed by the program director of a community youth center in Mattapan, together with Ashlee, a sophomore at UMass Amherst, who is majoring in mathematics. Ashlee is also the primary instructor for the program. The goal is to bring girls who are struggling in math up to their level and to build their confidence in the subject.

Ashlee is a tutor for the freshman algebra class at UMass. She is African American, and grew up in the Mattapan neighborhood. She did well in elementary school but struggled with mathematics when she was in middle school. A high school teacher uncovered her talents and encouraged her to study math. She is eager to share her knowledge and demystify mathematics for the young women.

15 high school freshman and sophomore girls from 11 Boston public schools were recruited to participate in the program – the target was 20. Recommendations were sought from teachers but unfortunately none was received, in spite of repeated email and phone request, since the program director wanted teachers to provide ongoing support in the school year. The participants were kids that the youth center already had interactions with, or otherwise, enrolled independently.

The 4-week full-day, summer program included interactive math lessons, team-building exercises, physical activities such as dance and swimming, and weekly field trips – to companies, or recreational facilities in the afternoon. The program provided breakfast, lunch and a T-pass.

A pre-survey identified several key issues

- math lessons in school did not relate to their lives
- one or both parents were “bad” math students
- most participants found math intimidating

A one-year post-survey/focus group revealed the following

- Over 50% of the students who have made gains in the summer reported D grades or below
- Students did not report any improvements in relationships with teachers
- Students have not received additional help or tutoring provided by the schools
- Student confidence in their math ability has declined (compared to immediately after the program)
- The majority of students continued to attend other programs at the community center

Case Study #2: Hip Hop Ed

Science Rap B.A.T.T.L.E.S. Bring Hip-Hop Into The Classroom

From <http://wunc.org/post/science-rap-battles-bring-hip-hop-classroom#stream/0>

"Modern-day rappers — all they talk about is money, and all these unnecessary and irrelevant topics," says Victoria Richardson, a freshman at Bronx Compass High School. Richardson's rhymes tackle a much less-popular subject: DNA.

Richardson and her teammates were finalists at the Science Genius B.A.T.T.L.E.S. (Bring Attention to Transforming Teaching, Learning and Engagement in Science) competition, where she faced off against other science rappers from nine different New York public schools.

"Science Genius is about harvesting the power of urban youth culture," says [Christopher Emdin](#), a professor of education at Columbia University's [Teacher's College](#) who created the program. "Once they are able to incorporate the arts and their culture into the science content, they take it and they run with [it]."

The students researched and wrote rhymes about everything from gravity to evolution. Each school sent one group to the finals, where they were judged by a panel that included Wu-Tang Clan's GZA. (Jabari Johnson, a senior, [won the competition](#) with his rap "Quest for Joulelry.")

"Science is something I always failed, which prevented me from getting into the specialized high school I wanted to go to," Richardson says.

In the San Francisco Bay Area, Tom McFadden also teaches science through rap with a slightly different approach. His students pen rap battles about conflicts from the history of science.

"When you incorporate these stories, it allows you not only to make the scientific information much more fun to digest," McFadden says. "It allows you to discuss scientific process."

A group of seventh-graders from Oakland, Calif., worked with McFadden to create a music video about the discovery of DNA's structure. They nail the science, and also delve into the [shady behavior of the scientists](#) involved.

Hip-hop education is still in its infancy, and it's gotten some resistance; teachers are hesitant to set aside class time for experimental programs.

But Emdin says if the current system isn't working, you have to try something different.

"Not every student is going to be a straight-A student, and go on to college and declare a science major and be the next Einstein," he says. "But through this project we definitely are going to have more scientifically literate young people."

Excerpted lyrics about the discovery of DNA's structure by seventh graders. Beat from Kanye West's song "Clique". A 7-min video documentary is here: <https://youtu.be/35FwmiPE9tI>

RAY GOFF AND JABAR MURRAY: (Rapping) (as Watson and Crick) And ain't nobody fresher than Watson and Crick, Crick, Crick.

MURRAY: (Rapping) (as Francis Crick) Don't tell nobody, but we're gonna solve DNA hereditary molecules under our name... We're making models man, doing things our way...

MILAN GIBSON: (Rapping) (as Rosalind Franklin) Oh Crick.

RAY GOFF: (Rapping) (as James Watson) Here she comes. Run.

GIBSON: (Rapping) (as Rosalind Franklin) You showed my data behind my back, so it's not just going to happen like that. Let's recognize Rosalind Franklin. All eyes on Rosalind Franklin.

GIBSON: (Rapping) (as Rosalind Franklin) And I'll show it was a helix with phosphates on the outside. Calculating helical dimensions, and without my...

UNIDENTIFIED GIRL #1: It's not really stealing because it says like...

UNIDENTIFIED GIRL #2: I know, but he showed the picture, so like...

UNIDENTIFIED GIRL #1: I know listen, that's stealing. That's stealing from what she did. And even though she was...

UNIDENTIFIED GIRL #2: Claiming it as theirs?

UNIDENTIFIED GIRL #1: Yeah, that's kind of stealing in a way.

UNIDENTIFIED GIRL #2: OK. I see where you're coming from.

GIBSON: (Rapping) (as Rosalind Franklin) It has not escaped notice that you're a jerk. Shoulda got a Nobel for my work.

GIBSON: (Rapping) (as Rosalind Franklin) Let me hear you recognize Rosalind Franklin. F-R-A-N-K-L-I-N. Recognize Rosalind Franklin. F-R-A-N-K-L-I-N.

From YouTube Comments

- I just came back to this 3 YEARS LATER and still remember the lyrics and memories.
- I'm a freshman in college, but this helped me study for my biology quiz!
- Awesome, I learned about Rosalind Franklin while dancing! What?

HipHopEd is an approach to teaching and learning that focuses on the use of hip-hop culture and its elements in teaching and learning both within and outside of traditional schools. HipHopEd involves the use of hip-hop music, art and culture to create philosophies for teaching. It also uses hip-hop to develop and implement teaching tools and helps to create contexts for teaching and learning that youth are comfortable in. In its simplest form, HipHopEd involves the use of rap lyrics as text to be used in the classroom. In a more complex form, it involves raps created by students as classroom assignments that are used to measure knowledge. In its most advanced form, it uses the elements of hip-hop (b-boying/girling, graffiti, deejaying and MC-ing) as ways to describe/explain content, develop classroom activities, and create tools for empowering youth. A video describing the impact of hip-hop on teaching in science/STEM classrooms is here:

<https://www.youtube.com/watch?v=BoHjXIWrBvQ>

Case Study #3: Project Exploration

Janelle goes to Phillips High School in Chicago. As a high school student she has community service hours she needs to complete. Her science teacher mentioned a program called “Project Exploration.” Since Janelle likes her science class she thought this might be a fun way to serve her hours.

Once she joined she really enjoyed the hands-on aspect of the program. Janelle had this to say about her experience in the program.

They made it interesting to want to learn and want to become involved. It wasn't just sitting in a classroom and someone is talking to you about science and using terminology that you don't understand ... They broke it down to where you will understand it and you'll learn something from it. It was different from school.

A lot of the people/scientist/teachers I met were very down to earth, and I felt I could relate to them. I was able to hear that they were not straight A students in high school and they did not know what they wanted to do, but in time they figured it out and did it. They did what they wanted to do, no matter what people said or thought, and they made it so I believe I can too.

But it was the welcoming staff and new friends that kept her coming back. No one minded when she got her nose pierced and dyed her hair blue. *“I feel like I can really be myself at PE.”* Janelle also found the staff very supportive. *“There was this one time that we finished up really late. My mom was working and couldn't come pick me up and the next bus wasn't for an hour. One of the staff gave me a ride home. Another time, K helped me with some homework for math class because she new I was struggling in the class. They are awesome!”*

Her friends at school didn't really understand why Janelle kept going to Project Exploration but she enjoyed the new friendships she made at Project Exploration with other students interested in science. *“But everyone who was involved with PE wanted to do more than what was asked of them. So, that sort of helped me sort of say, “No, there are other people out there who want to do more than what is asked of them,” and you shouldn't feel uncomfortable because of that, feel like you're an overachiever or you're trying to show off.”*

Janelle continued to participate in the program throughout high school and plans to participate in alumni programs when she can take a break from college, but she was, *“sad to see two friends drop out of the program. John needed to get a job to earn money and Sheila had to help out her mom by watching her younger siblings at home.”*

About Project Exploration:

Project Exploration is a nonprofit science education organization that works to ensure communities traditionally overlooked by science—particularly minority youth and girls—have access to personalized experiences with science and scientists.

Founded in 1999, Project Exploration seeks to expand access to science. Our youth programs impact the lives of hundreds of students each year by fostering a long-term involvement in science, and are supported by public programs that provide a window into science in action through exhibits, online initiatives, and contributions to the field of science in out-of-school time.

Project Exploration targets students who are open-minded and curious, regardless of academic or economic standing, and gives them the opportunity to explore a variety of scientific disciplines alongside scientists.

Our highly-personalized approach includes hands-on programming, authentic fieldwork, leadership development, and long-term relationships—our motto is, “Once a Project Exploration student, always a Project Exploration student!”

Our students are more likely to graduate high school, go to college, and major in science than their peers: over 96% of Project Exploration fieldwork participants graduate from high school. These students are three times more likely to enroll in a four-year college than their peers, and over one third of Project Exploration field alumni major in science once in college.

PE programs’ potential effects on students are worthy of examination. PE reports that 95% of students who have attended their field programs (Junior Paleontologists and All Girls Expedition) have graduated from high school, and 58% have enrolled in a four-year college. And 32% of all field program students and 40% of girls who graduate from high school as PE field alumni choose to major in science (Project Exploration, 2009).

This is in contrast to Chicago Public School students in general, where *only 35% of CPS graduates who enrolled full-time in a four-year college in the year after high school graduated with a four year degree within 6 years*. If we take into account high school drop outs, only about 6% of CPS students earn a four-year college degree by the time they are 25. For African-American males, this number is around 2%.

*Janelle is a fictional representation of students who participated in an evaluation of Project Exploration. Some quotes are directly from “Project Exploration, 10-year Retrospective Program Evaluation, Summative Report by Chi and Snow, 2010.” others are a paraphrase of expressed sentiments. <http://www.projectexploration.org/>

Case Study #4: A Science Experiment Gone Awry?

“Jamie”, a 16-year-old Junior at North Central High School had an avid interest in science and an exemplary academic and behavioral record. Here is their personal account of an event related to their science project:

My science teacher said we could each pick a science project that has to do with biology, chemistry or physics. He said we couldn't do a baking soda and vinegar volcano because that was at the fifth grade level. I especially like chemistry, and the reacting. I like seeing two or more different things become something else. So I was asking friends around for project ideas. Someone suggested to me to combine aluminum foil and toilet bowl cleaner in a water bottle to make a volcano.

That morning I was taking the experiment to be approved by my teacher. My friends and I were outside, and they wanted to see how it worked. Eventually they convinced me to try it. It did not react the way I expected it to. The lid popped off and smoke came out. If I could go back in time, I definitely wouldn't have done it.

The principal and dean of discipline came over and asked me to tell them what happened. I was kind of scared, but I thought they'd understand it was an accident.

Thought Questions:

How do you think the principal and dean reacted?

How should they have reacted?

Have you made any assumptions Jamie's gender or race?

Do you think the reaction would be (or should be) different if Jamie was male or female? Or how about Black, Hispanic, White, or Asian? What if the student had some behavioral issues at the school in the recent past?

While “Jamie” is a pseudonym, this is a real student account. We will provide details on how the school actually reacted, and references, at our session at the STEM Summit.