



CATHEDRAL SCHOOL FOR BOYS

*Minds, Hearts, Hands, Voices*

# Making wearable electronics



to inspire self-expression in 5<sup>th</sup> & 6<sup>th</sup> grade boys

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# About CSB

- K-8 Episcopal day school founded in 1957
- Located at Grace Cathedral in San Francisco, California



5<sup>th</sup> & 6<sup>th</sup> graders in Wearable Electronics PBL

- Approximately 267 boys, Kindergarten to 8<sup>th</sup> grade

*“Being the recipients of empathy, understanding, and compassion, boys learn to become caring and compassionate people.”*

*- CSB Mission*

# Research Context

- San Francisco/Silicon Valley as a center of innovation
- Boys were fascinated with wearable electronics (e.g.- iWatch, Nike fuel band) but didn't realize how they could be involved
- Making wearable electronics is hands-on and inherently involves personal choice – *will it be fun and inspiring for boys?*



Sewing



Electronics



Programming

# Driving Question

“How might making wearable electronics inspire self-expression in middle school boys?”

self-expression (n.): *the process of making one's feelings, thoughts or ideas known, as through speech or art.*

## Research Action

- Each boy writes a driving question to guide his project.
- Students record progress in a journal, sharing feelings about the process and its challenges.
- Boys make their own wearable artifact with teacher support.
- Each boy demonstrates the features of his wearable artifact to peers at the PBL Expo.

# Results

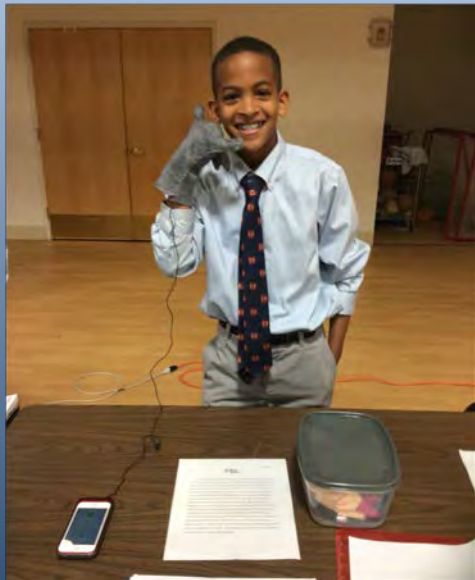
“I get to show people what I like and what I like to do.”



“How do I make basketball shoes with imbedded motion-sensing LEDs?”



“How can I create a body suit with lights that turns on when I clap for a public audience?”



“How can I make a glove that works like a cell phone?”



Student #1 Interview: Wearables and Self-expression

# Results (cont.)



“How do I make a soft (fabric) video game controller for gamers?”

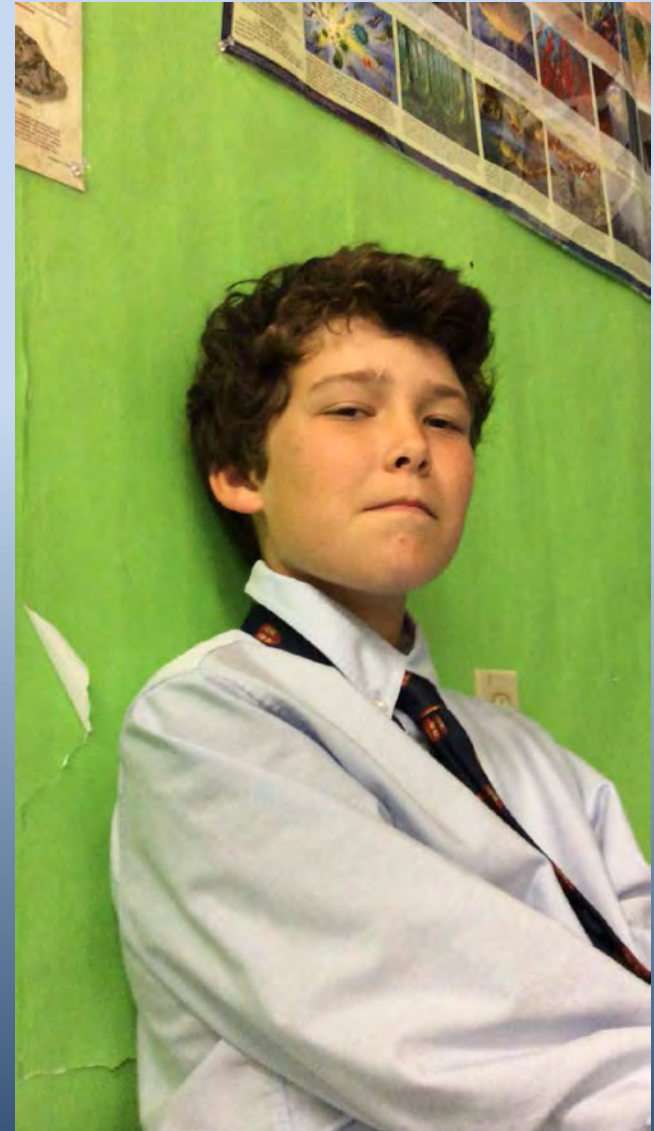


“How can I create a multipurpose backpack with solar panels to charge my iPhone/iPad?”



How can I make a jacket with LED's that blink when your hear beats?

“People get to see that I am creative, and I can make stuff with my hands.”



Student #2 Interview:  
Wearables and Self-expression

# Results (cont.)

- Students enjoyed making wearable electronics  
*“I really enjoyed learning to solder. It was pretty fun - not that hard to do.”*
- It provided a means for self-expression  
*“I will be able to express myself electronically! People will try to make things like I did.”*
- Despite an aversion to the school uniform, they didn’t share a common sentiment that clothes helped students express themselves or connect with others.



How can I create shoes that play my favorite music?



Parent volunteers gave programming support.

- Process over Product:  
Students were understandably frustrated at points. Keep it fun and developmentally appropriate.

# Implications of the Study

- Voice and choice: Making can facilitate powerful ways for students to communicate their learning and express themselves.
- Stay focused on process over product. Expect to revise students' driving questions to keep the project manageable and positive.
- CSB students feel quite connected to their peers. What role does the school play in this, and what might we facilitate for students that don't feel connected? How might PBL mentoring improve students' feeling of connection with adults in the school community?
- Continue the study through allowing students wearing their electronic artifact through the school day and record the responses.



Thank You!

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Backup Slides

# Recommended Resources for Wearable Electronics

Martinez, S. L., & Stager, G. (2013). *Invent to learn: making, tinkering, and engineering in the classroom*. Torrance, Calif.: Constructing Modern Knowledge Press.

Stringer, E. T. (2007). *Action research* (3rd ed.). Los Angeles: Sage Publications.

Buechley, L., & Qiu, K. (2013). *Sew electric: A collection of DIY projects that combine fabric, electronics, and programming*. Cambridge, MA: HLT Press.

Lovell, Emily. *Getting hands on with soft circuits: A workshop facilitator's guide*.  
<http://alumni.media.mit.edu/~emme/guide.pdf>

Sparkfun Projects

<https://learn.sparkfun.com/tutorials/tags/projects>

Adafruit Learning Systems

<https://learn.adafruit.com/category/wearables>

# Data Collection and Analysis Methods

Read student journals. Select comments that are representative of the class' sentiment in each of the three categories.

Videotaped interviews viewed carefully and transcribed. Notes also considers body language, non-verbal cues.

Triangulate survey results with journal and interviews for each student. An average among all participants recorded for each question.

Final questionnaire looks for any changes in sentiment after the PBL Expo. Changes in any of the three categories are noted.