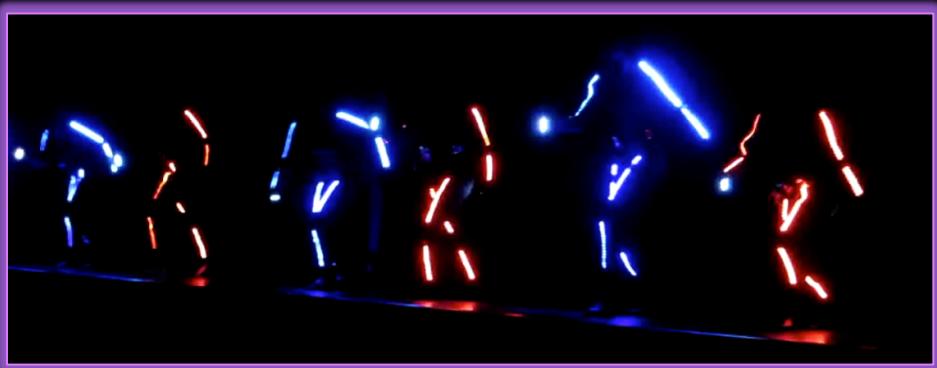


LumiDance

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Bonnie Destakasi², Joseph Chase², Lea Ann Smith²,
Joshua Pauly², Carla Beecher and Mary Harmon¹**



**Blending Artistic and Technological
Creativity in STEAM Education**

SCIENCE TECHNOLOGY
ENGINEERING MATHEMATICS
THE ARTS



¹Create It Lab & IBM Systems & Technology, ²Essex High School,
Essex Junction, VT USA





The LumiDance Project

- A collaborative STEAM project developed by *Create It Lab* with the *STEM Academy, the Robotics Club* and the *Academy of Visual and Performing Arts* at Essex High School (*Essex Junction, Vermont*)

Goal

**To enhance high school education
In such a way that
all student participants are motivated
So that
they are better prepared to manage
Design/Build challenges in
post secondary school...**

...and in the real world



Create It Lab

Lu•mi•Dance

/lōōmēdans/, noun

The intensity of light emitted from a dance per unit area in a given direction



Prototype LumiDance Costume



The LumiDance Project

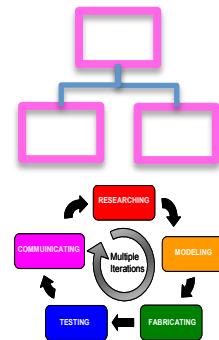
Educational Objectives:

(1) Engage nearly all students by integrating **STEM into the **Arts****

=> **STEAM**



(2) Create Hierarchical Teams with a motivational, unifying purpose



(3) Introduce the Design Cycle for Project-based Learning in the Arts



(4) Coach students in Brainstorming and Design Focusing

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(5) Provide a real-world application of Mathematics (Programming)



(6) Explore Collaborative Education in a high school environment



The LumiDance Project

TEAMS: The Best Way to Spell STEAM

The LumiDance Project used Hierarchical Teams, reflecting a real world design project.

The Dance 2 subteam engineered the Dance & the Robotics Club engineered the Lights.



Dance 2 Team



Robotics Club

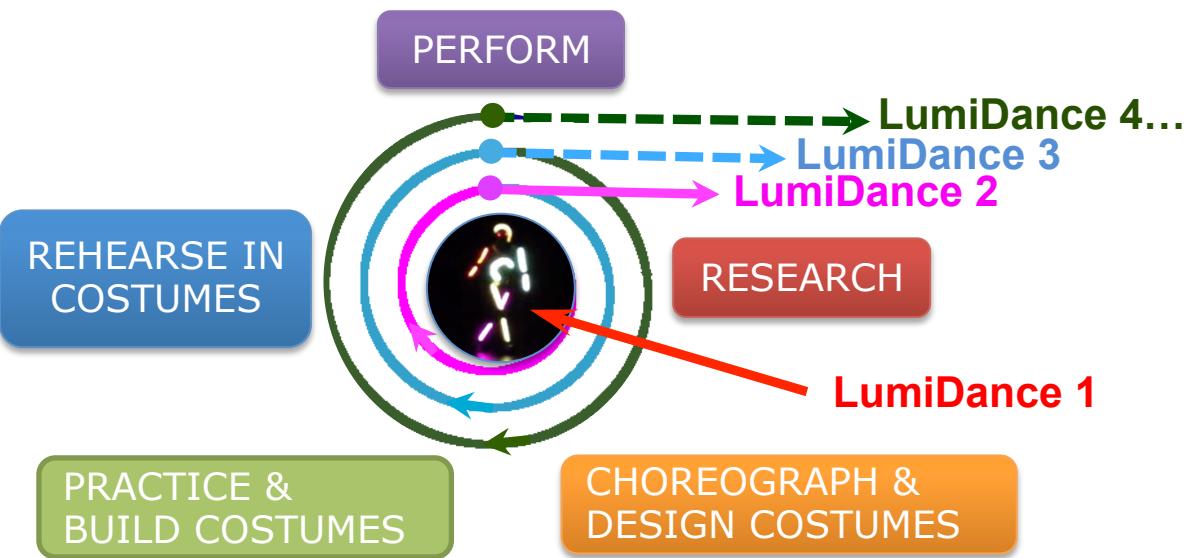
Synchronization of the lights with the dance required the collaboration between subteams.



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The Dance Design Cycle



The Design Cycle is a natural fit for Project-based Learning in the Arts



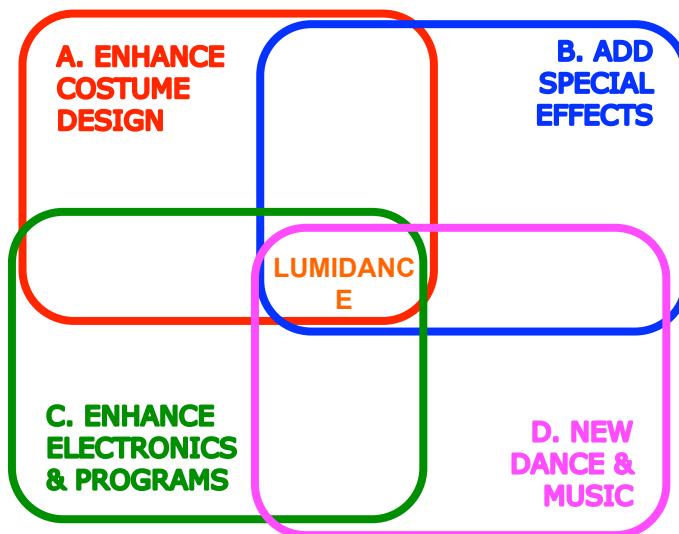
The LumiDance Project

Brainstorming

Question: What would make this dance cooler?

Answers:

- Illuminated Musicians
- Lasers & Fog
- More Lights
- Vary Brightness
- More Robust Wiring
- Better LED Attach
- Improve Box Attach
- EL Wire Lights
- Improve Sync
- More Accessible Programming
- Non-Stretch Costumes



Brainstorming Areas



The LumiDance Project Design Focusing

Question: What is the benefit/value and the cost/difficulty for each idea?

P.I.C.K. Chart

Answers:

P: Illuminated
Musicians

P: Lasers & Fog

I: More Lights

I: Vary Brightness

I: Robust Wiring

I: LED Attach

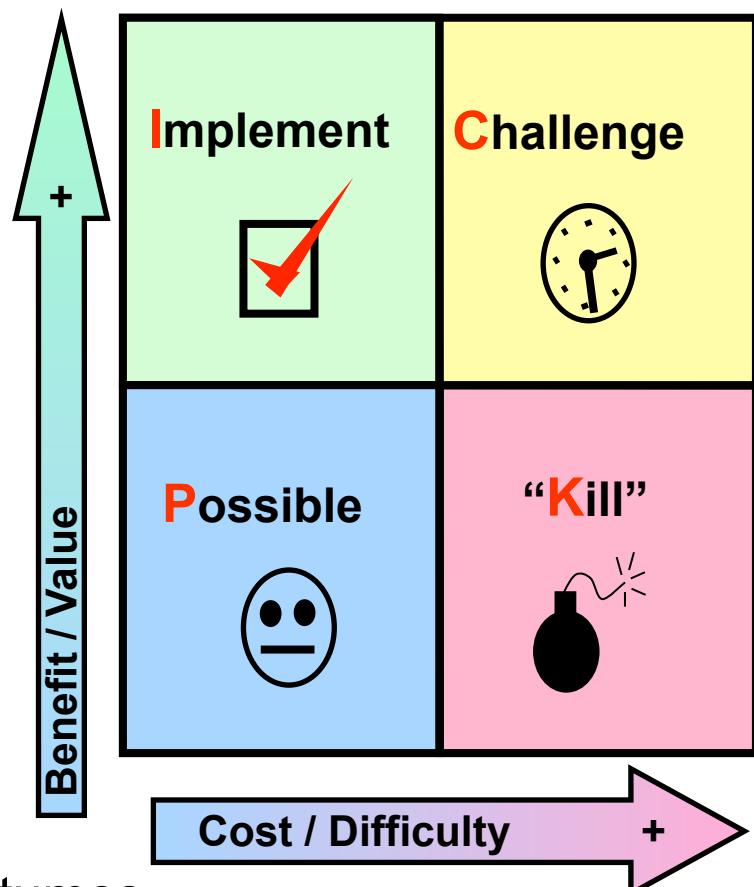
I: Box Attach

C: EL Wire Lights

C: Improve Sync

K: More Accessible
Programming

K: Non-Stretch Costumes



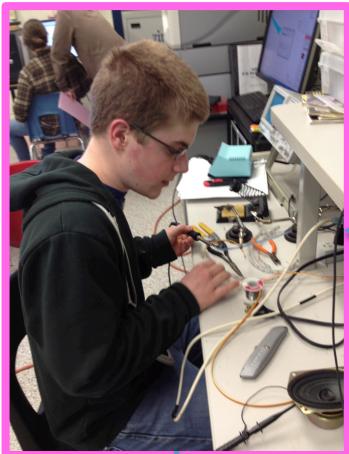
Constraints: TIME and MONEY



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The LumiDance Project Costume Building Flow

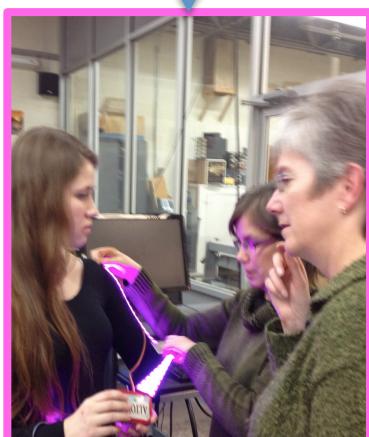
LED Wiring



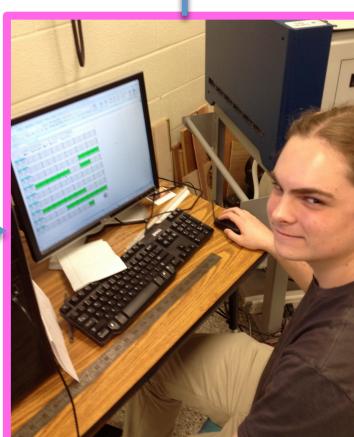
Control Wiring



Synchronizing



Sewing



Programming



The LumiDance Project

LED Controller Decision

Choices

Personal Computer
Tablet
Raspberry Pi
Arduino
TI-430
Beagle Bone
PIC ←
FPGA

Selection

PIC 16F1823

8 MIPS
Flash (3.5KB)
RAM (128B)
Oscillator (32MHz)
EEPROM (256B)
ADC (8 Ch, 10b)
PWM (ECCP)
MI2C,SPI,EUSART
TIMERS (2) 8b, (1) 16b
Watchdog Timer
...

Price: ~ \$0.99 ea.

Over 12 Billion PIC
microcontrollers
have been sold...



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The LumiDance Project

Control Box Design

Custom PIC pc board* with voltage regulator & LED output drivers (second PIC optional)



PIC



9V Batteries

* Custom PIC board* designed by B. Green



The LumiDance Project

Programming Decision

Choices

“C” Language

Assembly Language

Selection

Lower required memory allowed more complex programs

Provided students with a new skill

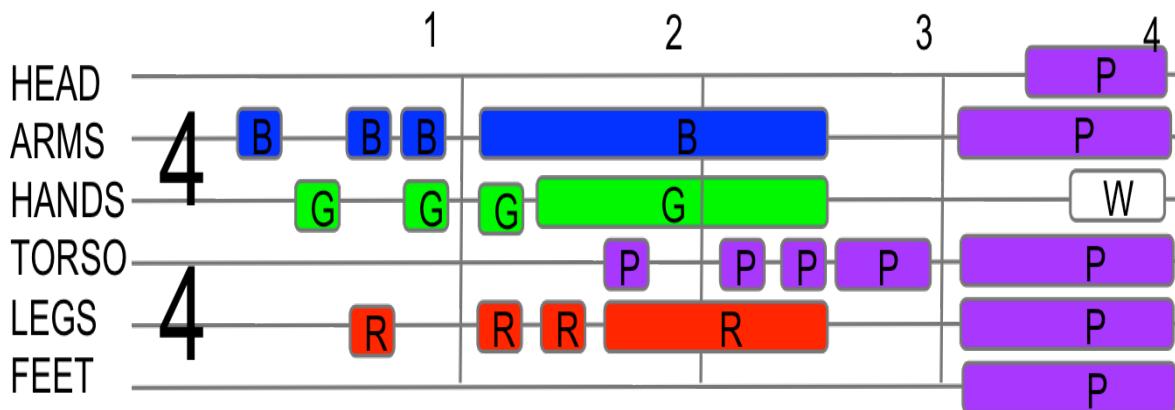
Small RISC instruction set, easy to learn



The LumiDance Project

LED State & Timing Notation

- LEDs indirectly synchronized to the choreography via the music
- Music staff adapted for LED notation



	RED LEDs
	GREEN LEDs
	BLUE LEDs
	RED & BLUE LEDs
	RED, GREEN & BLUE



The LumiDance Project Design Issues

Issue A: LED strips not staying in place

Issue B: Wires pulled off the ends of LEDs

Root Cause Analysis: Sewing fixed-Length LED strips tightly to stretchy costume material strains the wire connections and pulls LEDs out of place

Solutions:

- (1) Sew tulle pockets over LEDs and sew each section down hard at just the top
- (2) Develop more robust wire attachment scheme

Issue C: Internal LED strip wires breaking

Root Cause Analysis:

Bending LED strips during dance weakens the connections between LED segments

Solutions:

- (1) Remove end segments at max flex points
- (2) Reinforce joints with clear heat shrink tubing



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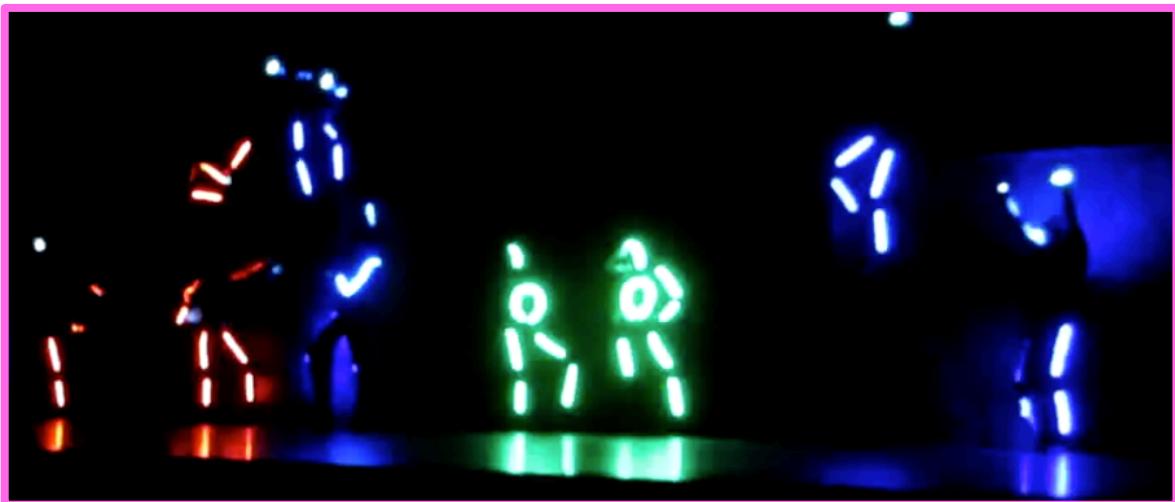
The LumiDance Project



Performance!



Design Pass 1: Fine Arts Night, April 1, 2014



Design Pass 2: Final Dance Recital, May 28, 2014



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The LumiDance Project Awards



Create It Lab
Awarded Emily
Moehn the TEAM
STEAM Award for
Participating in
Both STEM and
Dance Subteams

Honorable Mention

Dance and Choreography:
Erin Johnson

Electronics and Programming:
Ian Ballou and David St-Pierre



Create It Lab

The LumiDance Project

Thanks!

Choreography

Erin Johnson

PIC Programming

Ian Ballou

David St-Pierre

Electronics

Ian Ballou

Jon Bonning

Elijah Danyow

Emily Moehn

David St.Pierre

Riley Wilbur

Dance

Sarah Abeling

Nipunika Coe

Cheslea Faure

Brittany Gratton

Sade Hankey

Megan James

Erin Johnson

Allie Matthews

Emily Middleton

Emily Moehn

Holli Trudeau

Alyssa Wieland