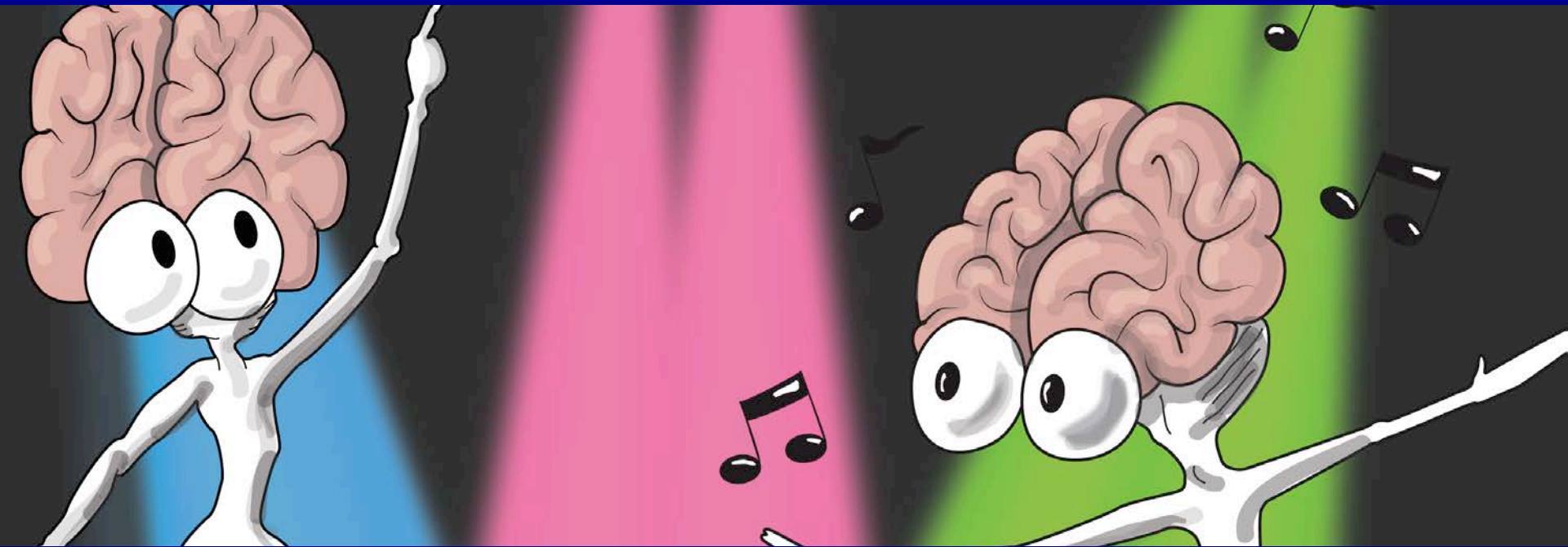


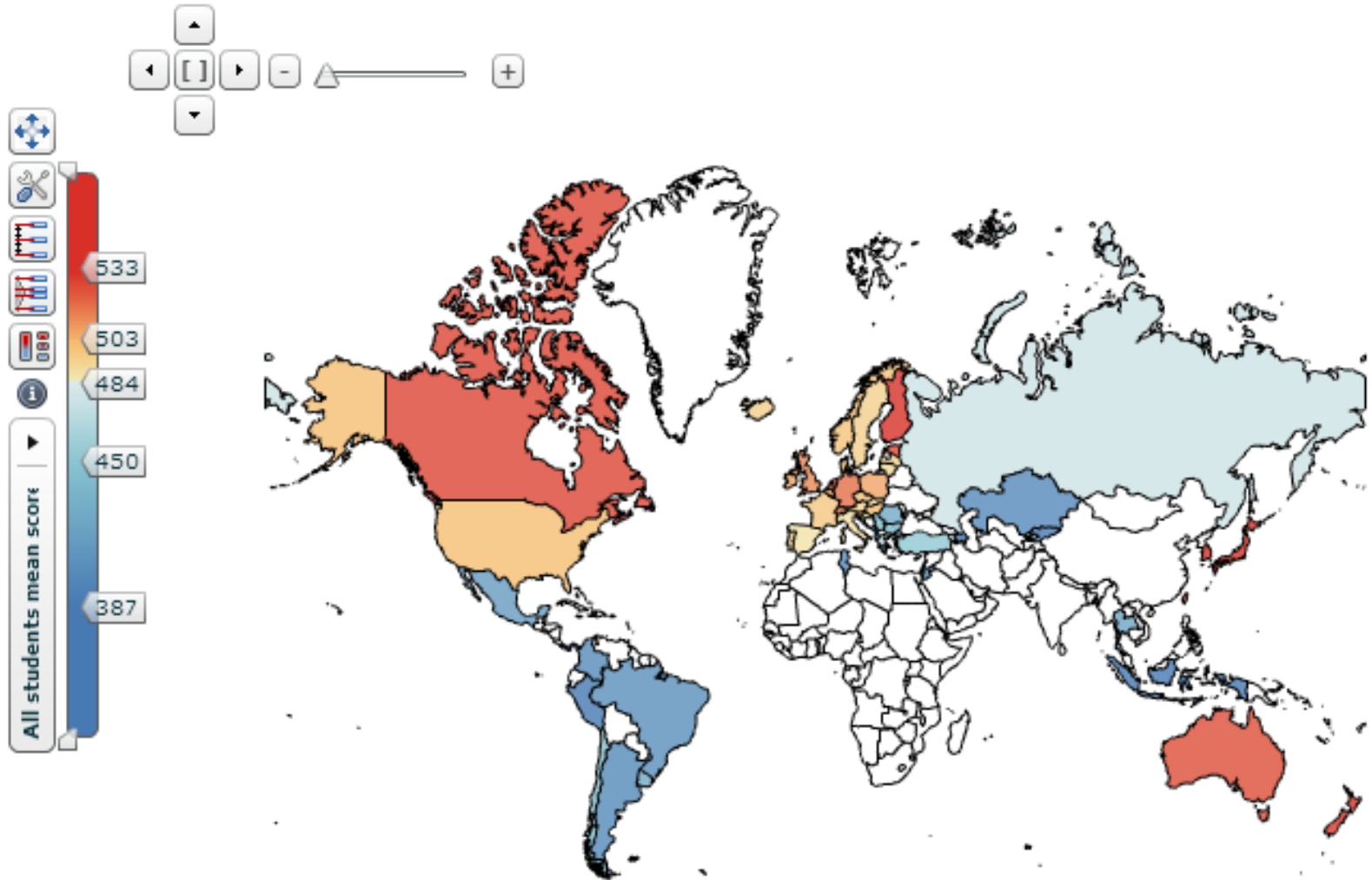
Leveraging the power of music to improve science education



Katie Davis & Gregory J. Crowther
University of Washington

PISA 2009

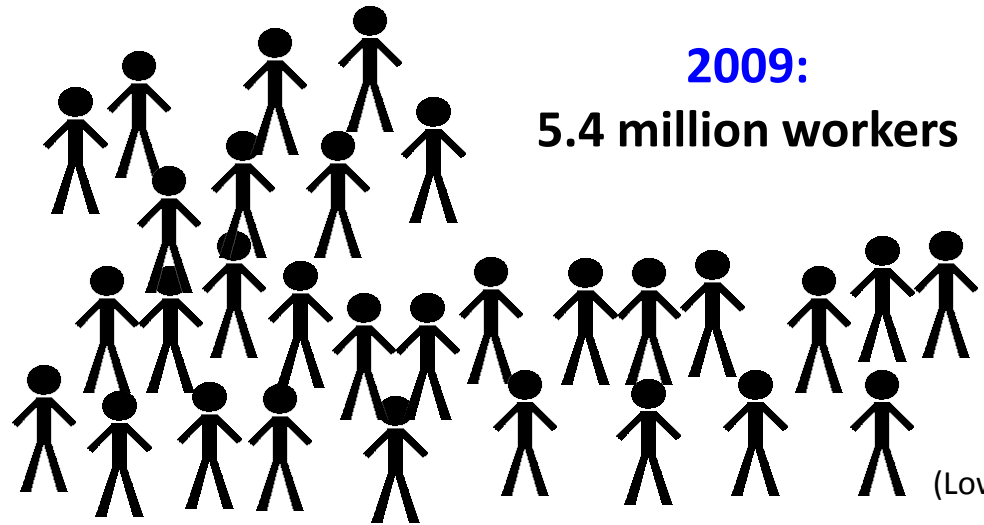
science performance by country (OECD, 2013)



1950:
182,000 science &
engineering workers



2009:
5.4 million workers



(Lowell, 2010)

World Economic Forum says:

among the key pillars of global competitiveness...

- ✓ scientific innovation
- ✓ availability of scientists and engineers

(Schwab, 2012)



why music?

students learn best when:

- ✓ **individualized** instruction
- ✓ multiple **entrypoints**
- ✓ personally **engaged**



(Donovan & Bransford, 2005; Gardner, 1983, 2006)

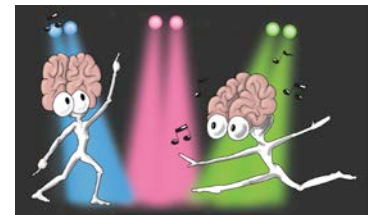
some promising evidence

Author (Year)	Finding
C.R.W. VanVoorhis (2002)	college: <ul style="list-style-type: none">➤ learning jingles was more effective than reading definitions in statistics
S.M. McCurdy et al. (2008)	high school: <ul style="list-style-type: none">➤ food-safety songs improved food-safety knowledge compared to control group
K. Smolinski (2011)	middle school: <ul style="list-style-type: none">➤ learning “Cell Song” led to higher scores on biology test



Research Question

Can watching science music videos improve students' comprehension of scientific concepts?



site & participants

site:

- five science outreach events in WA in spring '13

participants:

- approx. 550 people
- 278 males, 260 females (remaining unspecified)
- median age: 12 years (range: 3-76 years)



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QUIZZES

Watch a STEM (science, technology, engineering, mathematics) music video, then see if your quiz score improves! To launch the pre-video quiz, please select a video from the options below. (A new browser tab will open.) Don't worry if you aren't in the targeted age groups -- the quizzes are open to all! Also, feel free to do them more than once!

Recommended for Elementary School

- [The Double Life of Amphibians](#), grades 3-6
- [Five Senses](#), grades 3-7
- [Meet The Elements](#), grades 3-6
- [Shake](#) [states of matter], grades 4-6

Recommended for Middle School

- [Ain't It Beautiful?](#) [wheat agriculture], grades 5-9
- [Fossil Rock Anthem](#), grades 5-9
- [Nervous System](#), grades 5-8

Recommended for High School

protocol

- select video
- take pre-video quiz
- watch video
- take post-video quiz



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Recommended for High School

- **I'm A Virus!**, grades 9-12
- **Ode to the Brain**, grades 8-12
- **Tau** [geometry], grades 9-12

"Super-Advanced"

- **Necessary But Not Sufficient**
- **Sagebrush**

Please note that the music video is the property of SingAboutScience and is not to be used without their permission. The questions associated with the video are the property of SingAboutScience and are not to be used without their permission.

To request additional questions, please email crowther@uw.edu.



Overall, before the video, you did not get any of the questions right. After the video, you got all 4 regular questions right -- you are a Quiz Wiz! -- but not the bonus. You are an Attentive Viewer -- after watching the video, your score on the regular questions improved!

SENSES: Page 1

You are about to watch a music video about the five senses. Let's start by seeing how much you already know about this subject. Please answer the questions below and select "CONTINUE!" Then you can watch the video and answer the questions again.

1. The five senses are

- (A) sight, smell, hearing, listening, taste
- (B) smell, touch, sight, seeing, hearing
- (C) taste, touch, sight, smell, hearing
- (D) feel, smell, taste, hearing, touch
- (E) I don't know

2. Your nose can smell because its receptors sense

- (A) photons.
- (B) sound waves.
- (C) little molecules.
- (D) electricity.
- (E) I don't know



SENSES: Page 2

Please watch the music video, then select "CONTINUE!"

The Five Senses



SENSES: Page 3

If you want to see the video again before or while you answer the questions below, [click here](#). Otherwise just answer the questions and select "FINISH!"

1. The five senses are

- (A) sight, smell, hearing, listening, taste
- (B) smell, touch, sight, seeing, hearing
- (C) taste, touch, sight, smell, hearing
- (D) feel, smell, taste, hearing, touch
- (E) I don't know

2. Your nose can smell because its receptors sense

- (A) photons.
- (B) sound waves.
- (C) little molecules.
- (D) electricity.
- (E) I don't know





rody
ock Anthem"
MFAO

**FOSSIL
ROCK
ANTHEM**

protocol

- Bloom's taxonomy used to classify quiz questions
- "bonus" questions weren't covered in video
- random assignment to lyrics-only or visually-rich video



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Recommended for High School

data analysis

- pre- vs. post-video quiz scores
- lyrics-only vs. visually-rich videos
- knowledge vs. comprehensions questions



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Recommended for High School

results: science music videos can improve scores on science tests

Music Video Topic	# of subjects	Median age	Related questions (pre → post)	Unrelated question (pre → post)	Enjoyed video? (0-4 scale)
Amphibians (lyrics only)	52	9	1.87 → 3.10*	0.15 → 0.15	2.6
Amphibians (visually rich)	46	9	1.90 → 2.92*	0.18 → 0.33	2.8
Elements (lyrics only)	37	9	1.32 → 2.22*	0.22 → 0.22	3.1
Elements (visually rich)	32	9	1.50 → 2.09	0.25 → 0.28	3.2
Matter (lyrics only)	31	9	1.61 → 2.19	0.16 → 0.19	2.8
Matter (visually rich)	30	10	2.13 → 2.20	0.17 → 0.13	2.5
Five Senses	42	11	2.40 → 2.36	0.52 → 0.52	2.6
Fossils	69	12	2.32 → 2.97*	0.59 → 0.55	3.2
Nervous System	62	13	1.77 → 2.29*	0.21 → 0.27	3.0
Wheat Agriculture	35	13	0.77 → 1.74*	0.26 → 0.40	2.7
Viruses	41	15	1.20 → 2.10*	0.32 → 0.20	2.7
Brain	41	17	1.98 → 2.71*	0.27 → 0.27	3.3
Geometry	16	17	1.06 → 3.19*	0.00 → 0.00	2.5
Chemical Ecology	12	35	0.58 → 3.50*	0.08 → 0.25	3.1
Muscle Glycolysis	22	39	1.14 → 1.64	0.14 → 0.09	2.5
OVERALL	568	12	1.72 → 2.49	0.30 → 0.29	2.9

*statistically significant improvement according to a paired 1-tailed t-test ($p < 0.0033$)

scores increased for the video-related questions

no increase for the unrelated “bonus” questions

no difference between lyrics-only & visually rich videos

results: post-video improvement reflects genuine comprehension

Music Video Topic	Per Question Improvement by Bloom Level	
	Knowledge	Comprehension
Amphibians (lyrics only)	0.26	0.26
Amphibians (visually rich)	0.24	0.27
Elements (lyrics only)	0.22	N/A [#]
Elements (visually rich)	0.15	N/A [#]
Matter (lyrics only)	0.18	0.11
Matter (visually rich)	-0.02	0.05
Five Senses	-0.04	0.07
Fossils	0.14	0.19
Nervous System	0.12	0.14
Wheat Agriculture	0.29	0.11
Viruses	0.24	0.17
Brain	0.38	-0.01
Geometry	0.54	0.50
Chemical Ecology	0.75	0.71
Muscle Glycolysis	0.85	0.15
AVERAGE	0.24*	0.22*

scores increased
 for
knowledge
 questions
 &
comprehension
 questions

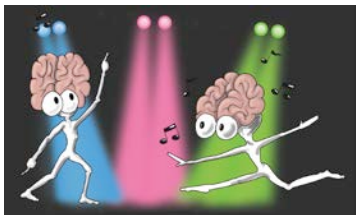
*significantly greater than 0 according to a 1-sample t-test (p<0.025)

[#]no test questions about "Meet the Elements" were rated as comprehension-level

takeaways:



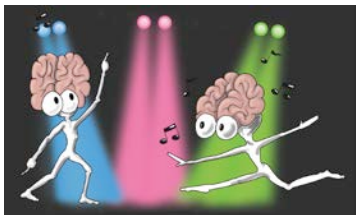
- ❖ students can learn science through science music videos
- ❖ music represents a promising entrypoint into science concepts



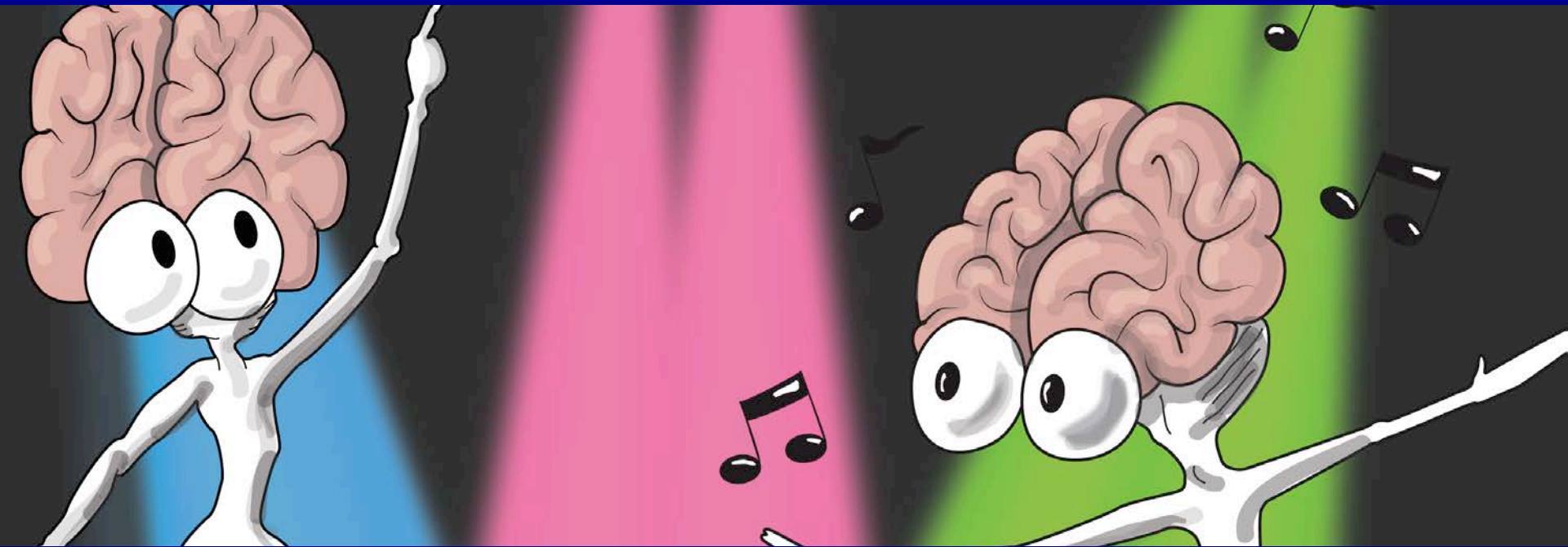
where to go from here



- ❖ investigate longer term impacts
- ❖ compare to nonmusical versions
- ❖ embed within ongoing science curriculum



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