"Quick Twenty" lists: a fast, fun, easy way to introduce instructors and administrators to STEM songs for teaching

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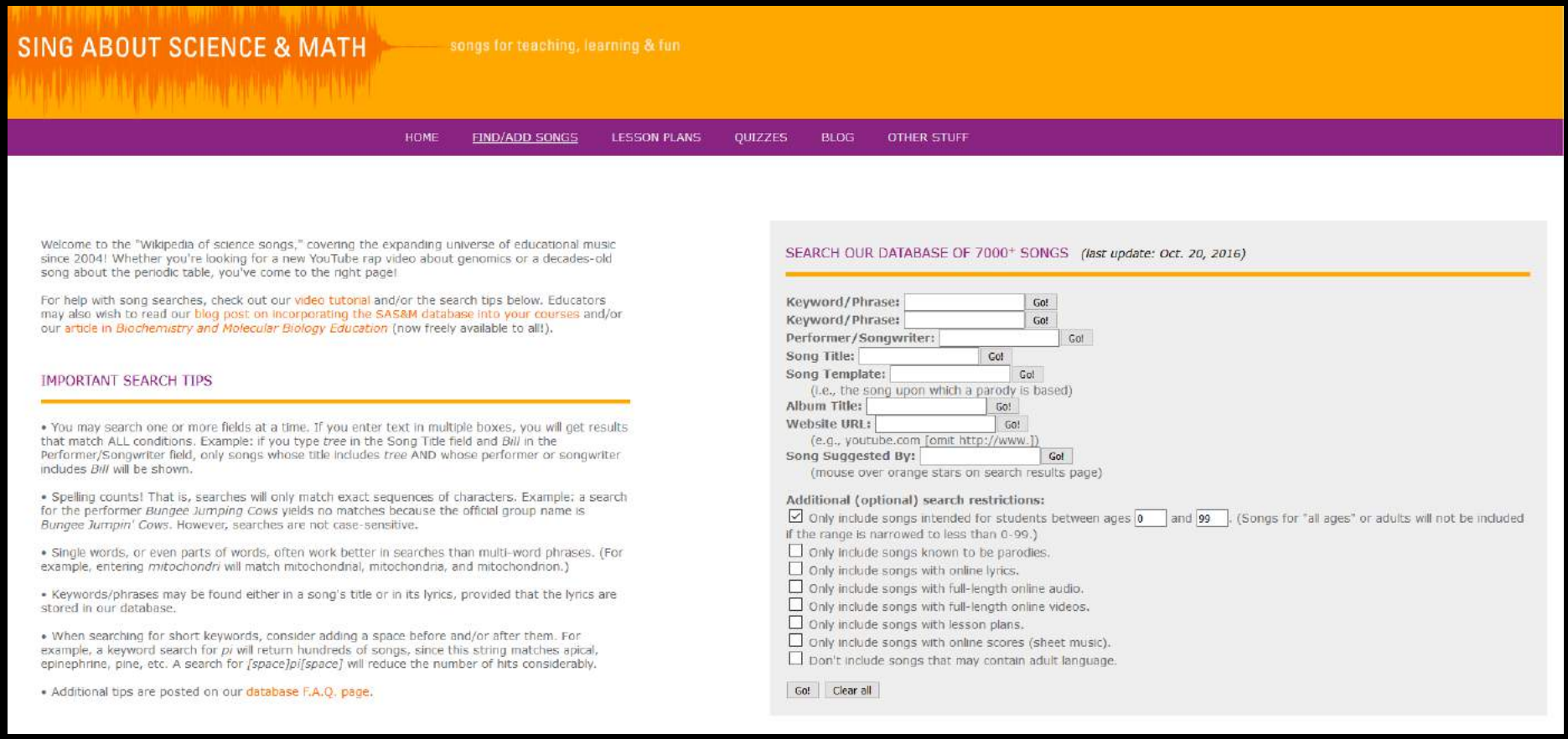
- Part of the VOICES “Digital Library” project
- Goals of the Digital Library:
  - Support instructors, administrators, professional songwriters, students, and scholars in creating, finding, and using materials relating to songs for STEM education
  - Develop and encourage best practices for use of songs in STEM classes

Proposed content for the digital library:

- **Enhanced, curated database**



Proposed content for the digital library:

- **Enhanced, curated database**
- **Flashcard summaries of the best scholarly articles about STEM songs**

closed questions was administered during class time. The design of the questionnaire began with a data analysis plan such as every question had a purpose and should produce the best possible data for the purpose of this action research. The questions had to be very clear such that there was no misinterpretation and to make it easy for students to provide valid, accurate, and reliable answers. In addition, the questions designed had to fulfil content validity to ensure that the sample questions was measuring what was intended to be measured [9].

Students were given approximately 5-10 minutes to complete the questionnaire and to add in any additional comments. They were not requested to write down their names in the forms, hence there was a level of anonymity and they were able to write down their opinions without fear. A frequency count was done for each question and figures were used to present the findings. The results of the questionnaire were analyzed and categorized.

Additional studies could be done to include a more

Equilibrium Song

A system at equilibrium is dynamic,
The concentration of products and reactants,
They'll always and forever be a constant,
Rate of forward, reverse reactions will be same.

Kc calculations are popularly tested,
Kc tells us how far a reaction occurs,
If Kc is much smaller than the value of 1,
This means there is very little product formed.

Chorus

Le Chatelier's Principle is so important,
When Temperature of the system increases,
The equilibrium, it will shift to endothermic.

3. Results

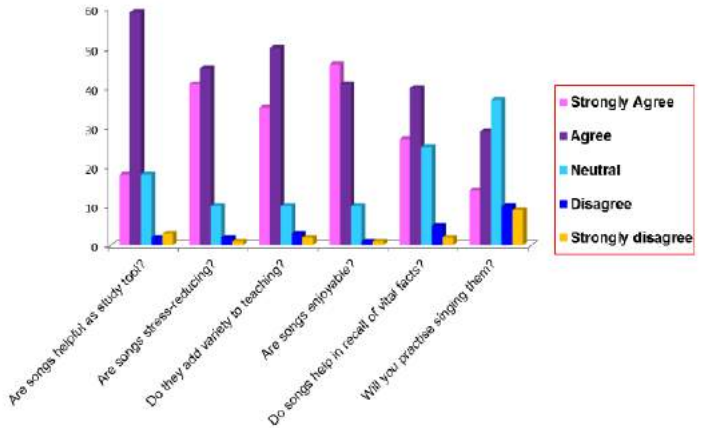


Figure 1. Analysis of questionnaire results based on action research conducted on ninety five Monash University Foundation Year (Science) students. A questionnaire, consisting of six closed questions was administered: 1) Are songs helpful as a study tool? 2) Do you find songs stress-reducing? 3) Do

Proposed content for the digital library:

- **Enhanced, curated database**
- **Flashcard summaries of the best scholarly articles about STEM songs**
- **Templates for learning guides**

Needed for full implementation:

- **substantial investment of time and money**
- **grant support**

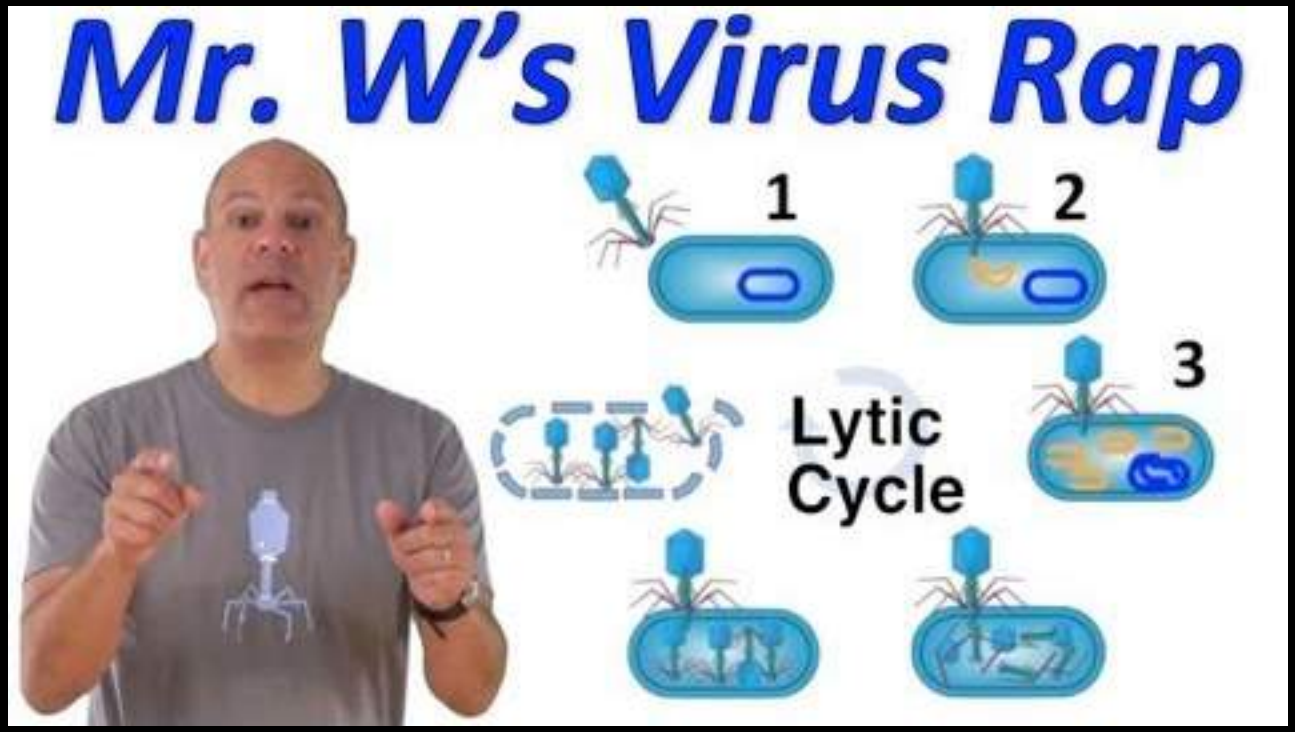
A start: The Quick Twenty Project

- **20 pretty good songs from each STEM field, showing the power of STEM songs for teaching, and the range of approaches to using them**
- **Relatively easy to assemble**
- **Approachable: quick, fun**

Expectations for each song:

- **Usefulness for teaching**
- **Lyrics & recording freely available online**
- **Ideas for use in a course, specific to the song**

Example from a semi-professional STEM songs person:
I'm a Virus, by Glenn Wolkenfeld



https://youtu.be/kYf_S18W3qY

I'm a Virus (Lyrics)

Virus Interactive Lyrics

Mode: Learn

Q #1/8; Correctly labeled 0 out of 4 items

Move each item to its correct place

- **cell**
- **infectious**
- **metabolism**
- **reproduce**

I'm a virus, an _____ particle,
a nano-thug, a pirate, the genuine article
Ebola, chickenpox, west Nile, influenza,
Yellow fever, AIDS, herpes, SARS, I'm comin' right at ya

I'm not a _____, not an independent organism,
I don't even have my own _____,
I only _____ myself by taking over cells,
Then I bust 'em apart, no wonder you don't feel well!

Q

I'm a Virus (Lyrics)

Virus Interactive Lyrics

Mode: Learn

8 questions, 1 response, 1 correct, 0 incorrect, 7 to go

Move each item to its correct place

- cell
- infectious
- metabolism
- reproduce

I'm a virus, an **infectious** particle,
a nano-thug, a pirate, the genuine article
Ebola, chickenpox, west Nile, influenza,
Yellow fever, AIDS, herpes, SARS, I'm comin' right at ya

I'm not a **cell**, not an independent organism,
I don't even have my own **metabolism**,
I only **reproduce** myself by taking over cells,
Then I bust 'em apart, no wonder you don't feel well!

Good!

You placed all of the items correctly on the first try!

Next question

Example from a professor:
Poiseuille's Law, by Greg Crowther

$$\text{Blood flow } (\dot{Q}) = \frac{r^4 \cdot \Delta P}{\frac{8}{\pi} \cdot L \cdot \eta}$$

r	radius of vessel
ΔP	pressure gradient along vessel
L	length of vessel
η	viscosity of fluid

https://youtu.be/9lnznkgQ-NQ

Lesson Plan

Songs like this one can be used during class meetings and/or in homework assignments. Either way, the song will be most impactful if students DO something with it, as opposed to just listening.

An initial, simple follow-up activity could be to answer the study questions below. A more extensive interaction with the song might entail (A) learning to sing it, using an audio file and/or sheet music as a guide, and/or (B) designing kinesthetic movements ("dance moves") to embody it. The latter activity could begin with students identifying the most important or most challenging content of the song, and deciding how to illustrate that particular content.

Study Questions

(1) What is Poiseuille's Law used for? That is, what does it calculate? In what units should be answer be reported?

(2) What does the "r" in the song stand for?

(3) The song states, "The blood flows around and around and around." Is this true?

(4) How does vessel radius relate to resistance to blood flow?

(5) What is delta P here? Is this the same delta P that is in Fick's Law of Diffusion?

(6) Of all the terms included in the equation, which one has the strongest influence on blood flow?

(7) Your classmate claims that blood flow is dependent on vessel DIAMETER raised to the fourth power. Is this true?

Poiseuille's Law of Laminar Flow	(1) Poiseuille's Law calculates the rate of blood flow through a single blood vessel of the circulatory system. Units should be volume of blood per unit time, e.g., milliliters per second. (2) "r" stands for radius -- the radius of the blood vessel. (3) Blood does flow in a circuit: from the left heart to the various tissues of the body, back to the right heart, to the lungs, to the left heart, out to the various tissues again, and so on. (4) Resistance to flow (often abbreviated with a capital R) is inversely proportional to radius to the 4th power (r^4). As radius increases, resistance decreases. (5) Here delta P refers to a difference in hydrostatic pressure over the length of the vessel. It is not the same as the delta P in Fick's Law of Diffusion. That delta P refers to a concentration difference of dissolved gases (whose concentrations are reported as partial pressures).

Expectations for the list:

- **Examples from each educational level**
- **Reasonable gender balance of song authors and performers**
- **Each song labelled with its general area (e.g. “electricity”) and topic (e.g. “Ohm’s Law”)**
- **The list should include at least 3 general areas.**

High priorities for the list:

- **Some songs set to well-known tunes written in the last 10 years.**
- **Some songs set to original tunes.**
- **Variety of song genres (e.g. folk, rap, rock, country).**
- **Songs by professional songwriters and by non-professionals.**
- **Some songs with polished recordings/videos, and some with rather unpolished recordings. (Setting the bar too high may discourage some.)**

- **Have subject coordinators for physics, biology, and statistics.**
- **You to develop a Quick Twenty list for another STEM field?**
- **astronomy, chemistry, computer science, engineering, geology, math, psychology, …**

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