

Towards a Greater Understanding of Science through Music

Jennifer Mangan, Interdisciplinary Liberal Studies, University Studies
and David Newman, Department of Music, College of Visual and
Performing Arts
James Madison University
Harrisonburg, VA

A Project is Born!

- In 2013, directors of a summer space camp noticed kids left camp still not knowing order of the planets.
- David Newman composed his song, “The Planets” for camp the following year.



Original Music

- Presented lyric videos at first all-camp meeting of the week with counselors demonstrating moves
- Kids love singing original songs written for camp and each year request to do them throughout the week.
- Culminates in final performance for parents on last day.



Our Study

- Focused on two songs:
 - The Planets (Planet Rock)
 - Lunar Phases
- Other songs written specifically for camp by David Newman are, “The Reason for the Seasons” and “Earthquakes”



We focused on middle schoolers for this study

- Original camp only had grades 5 to 8.
- Age group is old enough to read and answer surveys.



Survey Questions

Pre/Post Tests Planets

- Planetary order and characteristics
- 1. List all planets in order of increasing distance from the Sun.
- 2. What are the terrestrial planets?
- 3. What are the terrestrial planets made of?
- 4. Which planets are gaseous?
- 5. Which planet has ice rings?
- 6. Which planets are blue?
- 7. Which gaseous planets are approximately the same size?
- 8. Between which two planets is the asteroid belt?
- 9. What two major characteristics make a body qualify as a planet?

Pre/Post Tests Lunar Phases

- 1. List all the phases of the moon.
- 2. What phase of the moon rises around noon?
- 3. What phase of the moon rises around midnight?
- 4. What phase of the moon rises around sunset?
- 5. What phase of the moon rises around dawn?
- 6. Does a waxing moon rise during the day or at night?
- 7. Does a waning moon rise during the day or at night?

Planet Rock

- <https://www.youtube.com/watch?v=Bsk6Dt-MV6o>



Planet Order Survey Data

Year	Pre-test % correct	Post-test % correct	Difference	Pooled Standard Deviation	Effect Size	Question: List the planets in the correct order
2013	71.83	64.62	-7.21	0.2169	-0.34	
2014 *	68.18	89.06	20.88	0.2052	1.02	
2015	67.31	92.42	25.12	0.1870	1.34	
2016	89.06	100	10.93	0.1856	0.59	

Lunar Phases

- <https://www.youtube.com/watch?v=djZTTPczN70>

Lunar Phases Survey Data

Year	Pre-test % correct	Post-test % correct	Difference	Pooled Standard Deviation	Effect size	Question: List moon phases in the correct order
2014	24.24	54.69	30.45	0.2052	1.48	
2015	30.77	57.58	26.81	0.1870	1.43	
2016 *	35.94	67.69	19.25	0.1856	2.04	

The Repetition Factor

- “Planet Rock” repeats the line, “Mercury, Venus, Earth and Mars are made of rock, rock, rock” 8 times.
- The lines about Jupiter, Saturn, Uranus, and Neptune are repeated twice.

Planet Rock (Lysip-video)
Chorus.

Mercury, Venus, Earth and Mars
are made of rock, rock, rock! (x2)

Jupiter is a giant ball of gas,
So is Saturn with its rings made of ice.
Uranus and Neptune are gassy and they're blue,
And they're also about the same size.

But Mercury, Venus, Earth and Mars
are made of rock, rock, rock! (x2)

The Repetition Factor

- Repetition is critical for moving new information from short-term to longer-term memory.
- Plus we sang this song many times over the course of the camp week.
- Camper parents informed us somewhat less jubilantly that their kids sang this song repeatedly at home.



Repetition of partial terms

- “Lunar Phases” repeats the chorus twice
 - Waxing, waning, crescent, gibbous are words that need to be combined to indicate a moon phase.
- Repetition likely helped for this song, but other factors must have been at play.

CHORUS:

I can tell the time from the phase of the moon
and its angle in the sky
Whether waxing or waning, crescent or gibbous
I know the reason why
'cause the light of the sun
on the face that we see
is what makes that part so bright
and we call these changes
the lunar phases.

Rhyming

- “Lunar Phases” has a much stronger rhyming scheme than “Planet Rock”
- The opening line is catchy and easy to remember: “The first quarter moon rises at noon”



Rhyming

- Unpublished data: James Madison University students in an introductory planetary science course did better with retaining lunar phase rising and setting times when they learned the song, “Lunar Phases”

Movement

- Both songs have choreographed moves to complement the lyrics.
- Movement provides more engagement with the song.
- Choreography also allows another avenue for retention of the concepts presented in the song.



Humor

- Puns
- Double Entendre
- Movement jokes
- Situational drama

Earthquakes

Song is extremely popular with campers.

Even kids not into the songs get up to move for this one.

Contains some more advanced vocabulary

No study yet on if the song helps with this vocabulary – future work!

<https://youtu.be/HrvEJruzNCE>

In Conclusion

- Music has the capacity to help kids learn and retain science vocabulary
- Adding choreography keeps it fun, but it needs to be simple
- Original music and songs are fun to learn and people quickly remember a catchy tune
- Science educators collaborating with musicians is an effective way to create educational musical tools for learning science.