The Influence of the Science Stations Approach in a Sixth Grade Earth and Space Classroom

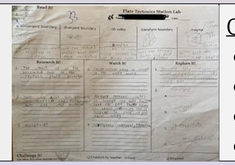
Introduction and Background

- Paola Middle School is located in Paola, Kansas. It is a farming community south of Kansas City.
- Research sample consisted of 28 sixth grade Earth/space science students.
- The treatment given was a variety of Kesler science stations in both tangible and digital form.
- Due to COVID-19, students were either in class or remote learners if put into quarantine.

The Stations

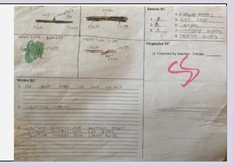
Input stations:

- Watch it!
- Explore it!
- Research it!
- Read it!



Output stations:

- Illustrate it!
- Organize it!
- Write it!
- Assess it!



What influence does the science stations approach have on student learning in a sixth grade Earth and space science classroom?

SQ1: How effective are stations in meeting Multiple Intelligences?

The theory of multiple intelligences was first introduced by Howard Gardner in 1983. They include naturalistic, mathematical/logical, linguistic/verbal, musical, visual/spatial, kinesthetic, interpersonal, and intrapersonal.

Instruments:

1. Likert survey: Getting to Know You
2. Focus group interview (*n*=4): Learning Preferences Interview
3. Checklist: Stations to MI congruity

Survey results: dominant intelligences that occurred the most in the sample were visual/spatial and kinesthetic. Linguistic did not appear as dominant at all, and appeared the most as weakest (*N*=28).

Each multiple intelligence, with the exception of musical, was present in at least one of the stations. Interpersonal and intrapersonal were dependent on the learning situation.

Intelligences:	Naturalistic	Math-logical	Linguistic Verbal	Musical	Visual-spatial	Kinesthetic	Inter-personal	Intra-personal
Station Name:	Watch Research	Research Explore	Read Write	N/A	Illustrate Organize	All stations Explore	All stations	Assess Write

Reference: Gardner, H. (1998). A multiplicity of intelligences. *Scientific American Presents*, 18–23. https://howardgardner01.files.wordpress.com/2012/06/a-multiplicity-of-intelligences1.pdf

SQ2: How do stations influence understanding of certain content under the NGSS standards?

The gravity unit stations were used as a count of NGSS standards present. Most of the SEP's and CC's were present except: Asking questions, Planning and carrying out an investigation, and Energy and matter: flows, cycles and conservation. This is not to say that these missing components were not present in other station units.

Instruments:

1. Pretests and posttests: plate tectonics, volcanoes, and the rock cycle
2. Formative assessment: stations lab sheets
3. Performance assessment: tectonic plates/volcanoes/earthquakes map

Implementing the 5-E instructional model is a great way to ensure NGSS standards are being met. The 5e's are: Engage, explore, explain, elaborate, and evaluate (Bybee et al. 2018).

Stations are often used in the explore stage.

Pre/post test normalized gains:

- Plate tectonics-medium at 0.68
- Volcanoes-low at 0.14
- Rock cycle-high at 0.74

Pearson Correlation: Stations lab sheets to performance map

Plate Tectonics Stations Score	1	0.285434057
Map Score	0.285434057	1
Volcanoes Stations Score	1	0.631357753
Map Score	0.631357753	1

Reference:
BSCS Science Learning – a 501(c)(3) organization. (2018). BSCS Science Learning. https://bscs.org/about/our-story/

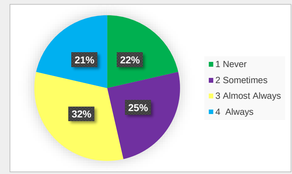
SQ3: Which station's delivery method (tangible vs. digital) optimized student engagment?

In August of 2020, Paola schools opted to preserve in-person learning amid the COVID-19 pandemic. Parents had the option to allow their kids to attend remotely as well. This increased the need for digital resources. Kesler Stations were available tangibly and digitally.

Instruments:

1. Likert survey: Science Stations Student Self-Assessment Survey
2. Teacher observations
3. Focus group interview (*n*=4): Learning Preferences Interview

To gauge general interest in science, a STEM question was added to the survey. Out of all 28 students in the sample, 15 said they would pursue a career in STEM.



Student Quote:
"I like in-person because I have to have something to do. But I think what happens is I could accidentally delete or the technology crashes, but on paper, as long as you keep track of it, it will always be there."

Survey results:

- Effort:17.3% believed they gave their best effort on digital stations and16.7% believed they gave their best effort on tangible stations.
- Understanding: Students had higher percentages of positive responses for questions regarding understanding both modes of stations. Tangible was higher with 74.1% as opposed to 62.5% positive responses.
- Specific station preference: Illustrate It! was found to be most interesting and easiest. Assess It! was hardest, and Write It! was least interesting.

Conclusion and Value

Once this study was concluded, I found that the science stations approach strengthens and supports the multiple intelligences, NGSS standards mastery, and student engagment. Tangible modes in particular are more engaging and had better quality outcomes, however, the digital stations were a very valuable resource when faced with providing curriculum to remote learners. Middle school teachers all over the United States use the Kesler stations, so this research could be valuable to anyone who uses them in particular, or the science stations approach in general.

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