The Effects of the 5E Learning Cycle on High School Science Students

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Background

This study examined the effects of the 5E learning cycle on 53 high school Earth and Space Science students. The 5E learning cycle has been shown to increase student growth, content knowledge retention, engagement, and positive attitudes toward science (Beeth & Hewson, 1997; Ajaja, 2013). This is essential for my school since we have 57.9% of students scoring proficient or advanced on the Pennsylvania science exams, which is below the statewide goal of 83% by 2030 (PDE, 2018). This study took place while teaching four units. These units included geologic time, oceanography, and two units on meteorology.

Treatment

My four classes were divided into 2 groups. One group was taught using the 5E learning cycle and the other group was taught using traditional methods for one unit. After the completion of one unit the groups switched treatments. The treatment each group received was swapped between groups until four units were completed.

Focus Question	Data Source 1	Data Source 2
How does the 5E learning cycle affect student growth?	Pretests and Post-tests	Student Interviews
How does the 5E learning cycle affect student content knowledge retention?	Delayed Post-tests	Student Interviews
How does the 5E learning cycle affect student engagement?	Student engagement tally sheet	Student Interviews
How does the 5E learning cycle affect student attitude toward science?	Test of Science Related Attitudes (TORSA) Survey	Student Interviews

Student Normalized Gains

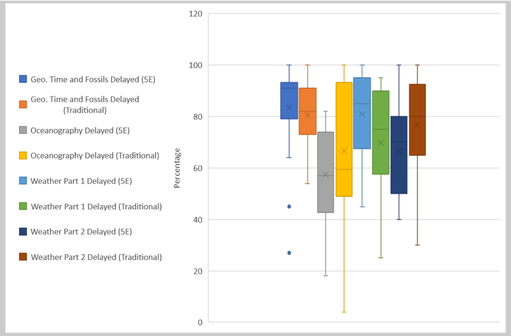

Figure 1. A comparison of student normalized gains between pretests and post-tests during each of the units, (Geo Time and Fossils N = 44, Oceanography N = 42, Weather Part 1 N = 42, Weather Part 2 N = 43).

Delayed Post-test Normalized Gains

Figure 2. A comparison of student normalized gains on their delayed post-tests after learning through the 5E learning cycle or through traditional learning, (Geo Time and Fossils N = 44, Oceanography N = 42, Weather Part 1 N = 42, Weather Part 2 N = 43).

Student Attitudes Toward Science

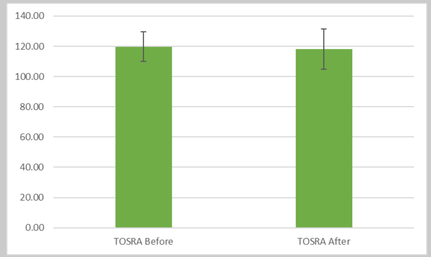

Figure 3. A comparison of the overall scores from the Test of Science Related Attitudes (TOSRA) survey before and after completion of a 5E unit. Error bars represent standard deviation, (N = 39).

TOSRA Categories

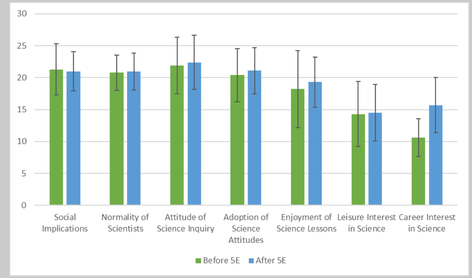

Figure 4. Average scores for each of the TORSA categories from before learning through the 5E learning cycle and after learning through the 5E learning cycle. Error bars represent standard deviation, (N = 39).

Student Engagement

53% of off task behaviors took place during 5E units while 47% took place during traditional learning units. The highest off task behaviors observed were off-task Chromebook use (27%) and talking to peers during instructional time (26%). The least frequent off-task behavior is sleeping during class (3%).

Student Quotes

- " I enjoyed the 5E learning style because it was more hands on, you are forced to be engaged, and you can't hide in the corner."
- "The 5E learning style allowed us more time to figure things out on our own."
- "During the 5E units we were doing different things everyday, so it switched things up and kept class interesting."
- "I believe I learned more during the 5E units because I do not like notes and the information goes in one ear and out the other during notes."
- "I prefer doing notes and worksheets, so I liked the traditional learning style."
- "I really enjoy science class because there is a lot you can learn."

Conclusions

- There was no statistically significant difference between student normalized gains while learning with either learning style.
- No statistically significant difference was found in student content knowledge retention between the two learning styles.
- Off task behaviors were not affected by the learning style. Chromebook use may have been a reason for a higher rate of off task behavior in the 5E group.
- The learning style did not affect student's overall attitudes toward science.
- The 5E learning style could have had an effect on students' interest in a science related career.

References

Ajaja, O. P. (2013). Which strategy best suits biology teaching? Lecturing, concept mapping, cooperative learning or learning cycle? *Electronic Journal of Science Education*, *17*(1). https://files.eric.ed.gov/fulltext/EJ1188391.pdf

Beeth, M. E., & Hewson, P. W. (1997). Learning To Learn Science: Instruction That Supports Conceptual Change. https://files.eric.ed.gov/fulltext/ED461489.pdf

Pennsylvania Department of Education. (2018). Keystone JSHS. Future Ready PA Index. https://futurereadypa.org/PerformanceDetail/163234050 04522 52062000870611512 061001621782 22093/0670522301562511970940441500271172352331620821 47/0561500311491482371951591591290 6157167004000026