

Concept Maps in Middle School Science

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began with

Background

School A serves approximately 1,000 students in grades seven and eight. School A's science department believes instructional practices should allow students to make connections and see relationships between ideas and concepts. Concept mapping was chosen to aide students in working towards this goal.

Research

- Metacognition plays an important role in the process of self-regulating one's own learning (Difrancesca, Nietfeld, Cao, 2015)
- Concept maps allow the learner to organize prior knowledge with new knowledge into a format that can highlight connections (Canas & Novak, 2006)



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Methodology

- Three eighth grade science sections participated in the study ($n=88$).
 - All three sections participated in one treatment unit and one nontreatment unit.
 - During treatment, concept mapping supported the content throughout the unit.
- Data collected from Pre and Posttreatment Unit Test, Pre and Posttreatment Student Survey, Pre and Posttreatment Student Interviews
- Each treatment consisted of a four-week unit that led students through a progression of concept map development to support science curriculum.

student work resulted in

Data Analysis

Table 2. Pre and Post Unit Test Normalized Gain

Unit	Treatment	<i>n</i>	Normalized Gain	Nontreatment	<i>n</i>	Normalized Gain
Heredity and Genetics	A (P1,3)	54	.499	A (P2)	32	.577
Biological Evolution	B (P2)	32	.680	B (P1,3)	56	.507
	Mean NG		.58	Mean NG		.54

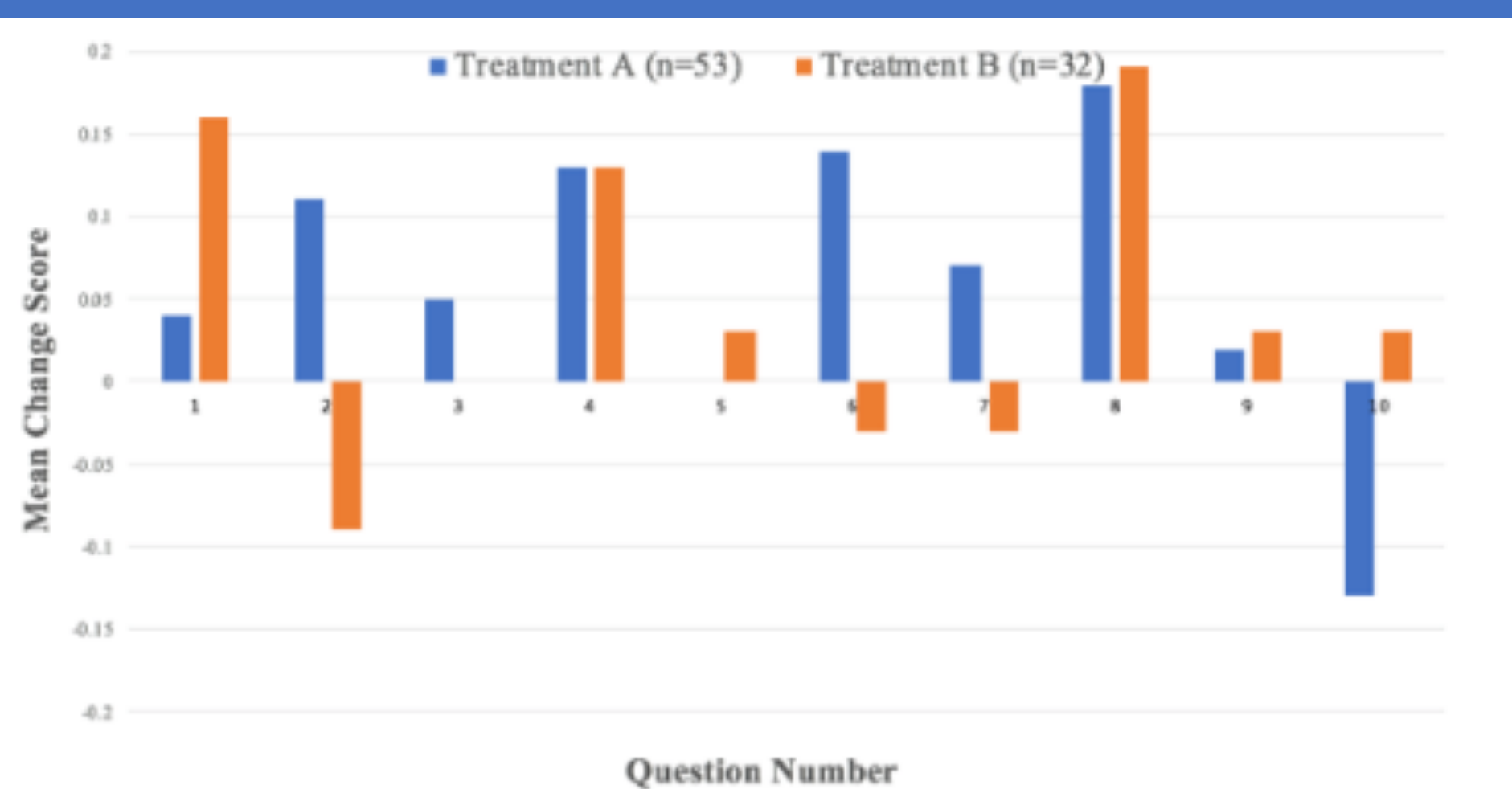


Figure 8. Change Score of Student Survey Questions from Pre to Post ($n=85$). Question 1: When learning, I use a strategy or multiple strategies to organize my learning. Question 2: After a lesson or lessons, I find myself thinking about what I just learned. Question 3: I rely on the teacher to organize the learning. Question 4: I learn best by the teacher telling me how to organize my learning. Question 5: Memorizing facts or information allows me to be successful. Question 6: I can recognize when I need support(help) to learn. Question 7: I enjoy learning new things. Question 8: Learning how to learn is something that you can practice. Question 9: I am comfortable with sharing my learning (i.e. work samples, solutions) with others. Question 10: Learning is a long process that involves mistakes.

Pre and Posttreatment Student Interview

Question: Do concept maps help you learn new science content?

"Yes, it helps me organize information about things. Also it helps me study about something on the test"

"Yes. They have helped me to organize my learning into the most important parts, then branch out."

Question: Is there anything else you would like to share with me?

"I would like to note, this new strategy to teaching of yours led me to get a 93% before corrections (which is pretty good)."

Question: Does it help you while learning to make connections to previous learning?

"Yes it helps me because I can understand how things we learn relate to each other."

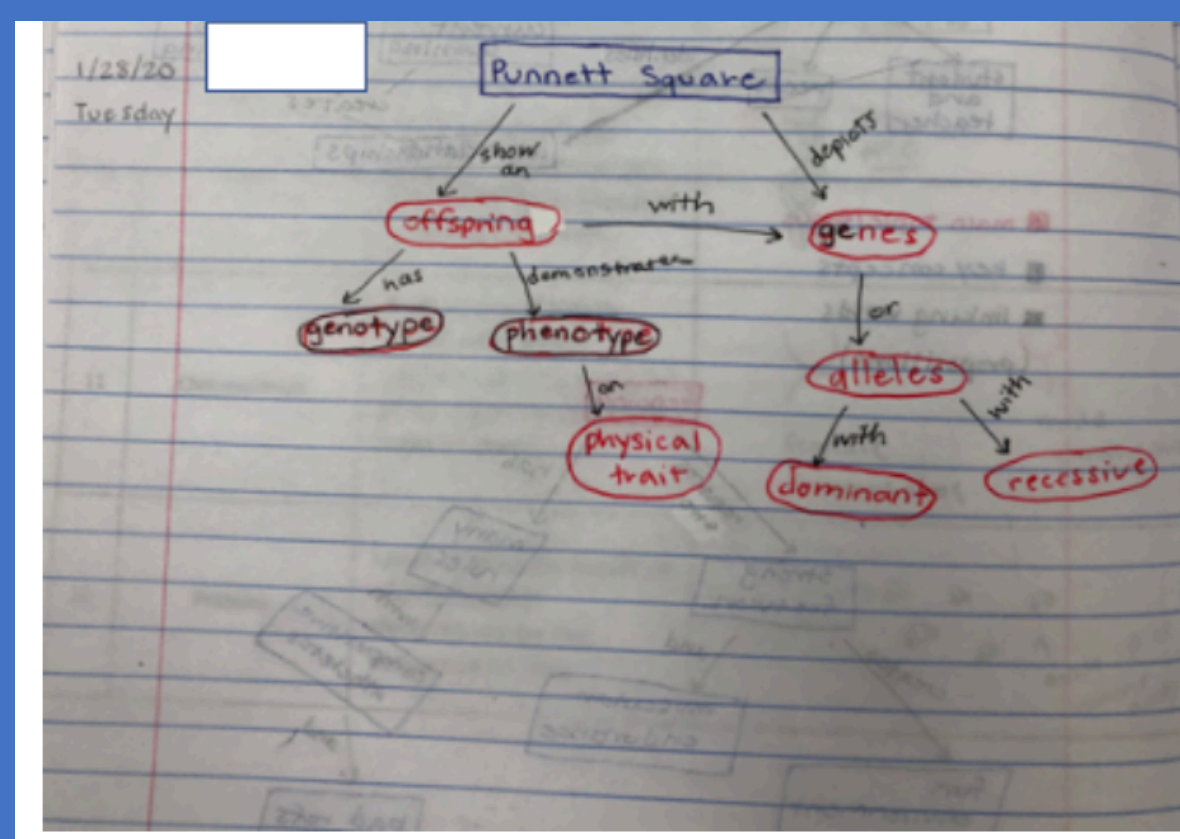


Figure 13. Week Three Individual Concept map Creation.

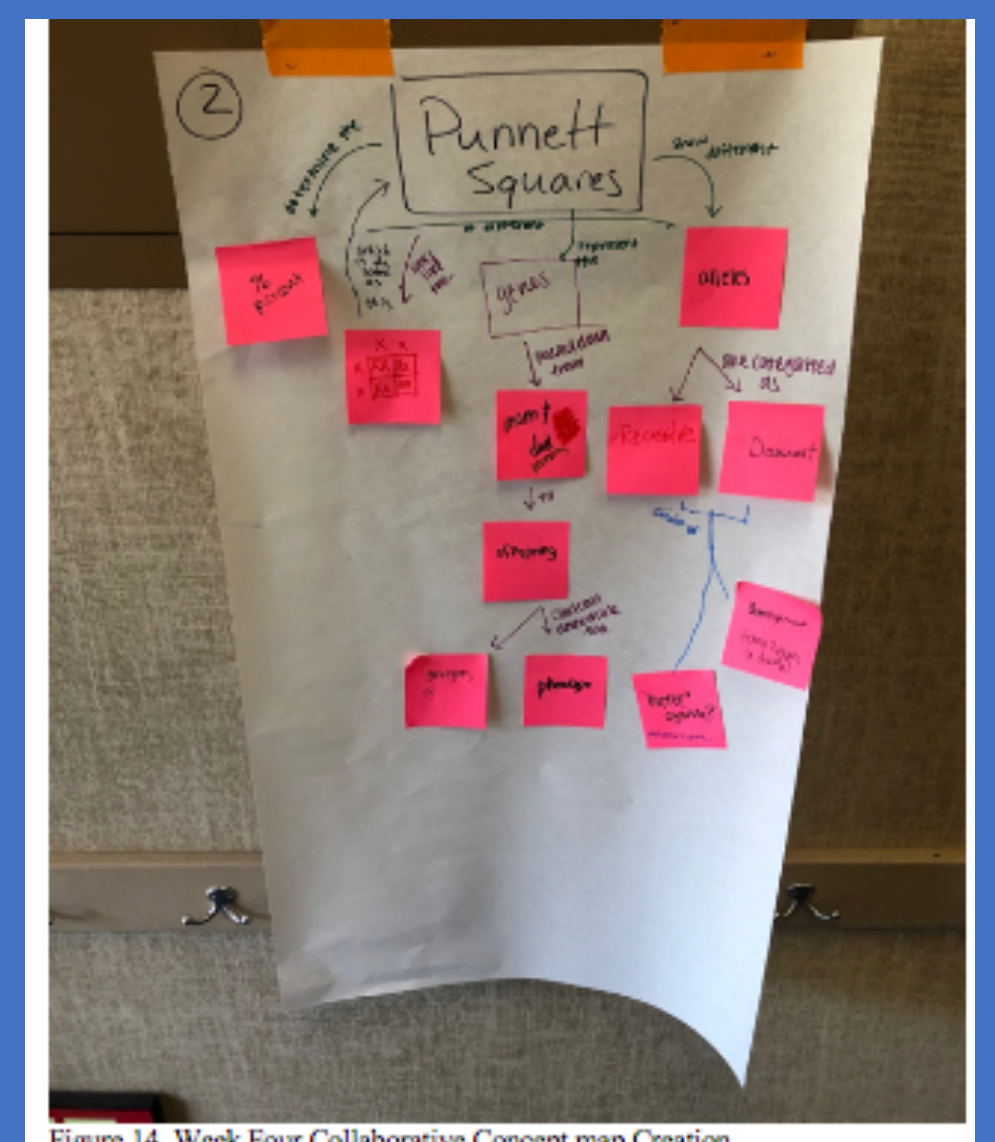


Figure 14. Week Four Collaborative Concept map Creation.

data demonstrated

Claim, Evidence and Reasoning

- Results suggested that concept maps increased students' unit test scores, with an average normalized gain of .56 across all treatment groups.
- Survey questions showed mixed results, with increases and decreases for selected question groups.
- Concept maps were seen by students to be beneficial to learning science content.
- Students were using concept maps beyond treatment units and the science classroom, showing interest and value in the use of concept maps.

References

Cañas AJ & Novak JD., (2006). The theory underlying concept maps and how to construct them. Florida Institute for Human and Machine Cognition. Retrieved February 13, 2019 from <http://cmap.ihmc.us/Publications/ResearchPapers/TheoryUnderlyingConceptMaps.pdf>

Difrancesca, D. & Nietfeld, J & Cao, L. (2015). A comparison of high and low achieving students on self-regulated learning variables. Learning and Individual Differences. 45. 10.1016/j.lindif.2015.11.010.