

Impact of Close Reading Strategies in Chemistry

Introduction

My experience has shown that my college-prep chemistry students have difficulty learning by reading the textbook. Besides my own concern for my students' reading ability, the National Endowment for the Arts (2007, pp. 7-58) has recognized a decline in reading proficiency among American adolescents, and the Program for International Student Assessment (2016, p. 5) found U.S. fifteen-year olds ranked 25th among 70 countries in reading literacy.

This gap in reading ability prompted me to work to improve the reading ability of my students in chemistry. I hoped that by improving their reading skill in chemistry, my students would become better readers in general, and this crucial skill would serve them for the rest of high school and beyond.

Research Questions

This action research project examined the impact of close reading strategies in chemistry. Boyles (2013, p. 37) states that "close reading means reading to uncover layers of meaning that lead to deep comprehension." This is the definition of close reading used as I posed my research questions.

Primary Question:

- What is the impact of close reading techniques on student comprehension in chemistry?

Sub Questions:

- What is the impact of close reading on student attitudes and motivation toward reading in the content area?
- To what extent can students apply close reading techniques to other subjects?
- In what ways did this experience affect my own teaching practice?

Sample

St. Ignatius High School is an all boys Jesuit school with an enrollment of 1499 students. The majority of students identify as Caucasian; 16% of students identify as Black/African American, Hispanic, Asian, and American Indian. Ten percent receive free or reduced lunches, and 4% receive Title I services.

For this study on the impact of close reading strategies, I used two classes of sophomore college-prep chemistry with a total of 52 students.

Table 1. Treatment Matrix.

Phase	Strategy Type and Name	Topic
Nontreatment	None	Atomic Structure
Treatment 1	Pre-reading: Text and Visual Scanning (Scan It)	Periodic Properties
Treatment 2	During-reading: Annotation (Mark It Up)	Chemical Bonding
Treatment 3	Post-reading: Writing and Dialogue (Talk It Out)	Chemical Reactions
Treatment 4	Combined: All Three Strategies (Put It Together)	Chemical Quantities

Quotes

"I felt it was impossible to understand before learning strategies. It is now easier to understand the reading."

"I now know it is important to read the text, and it is easier to dissect what I am reading."

"I know how to determine what is relevant or not in the reading."

"I feel all of the strategies helped. Each showed an effective way to better understand the content."

"I've learned it is important to read the textbook, but my attitude hasn't changed."

"Ever since I learned Mark It Up, I've been using it in history, English, and when I'm doing bible study."

Treatment and Data Collection

Students were taught a comprehensive process for focused reading that addressed the pre-reading, during-reading and post-reading stages; one strategy was taught for each reading stage. Each treatment phase lasted three weeks. During each phase, students learned a new reading strategy, and were given three reading challenges with which to practice the strategy. A summary of this treatment plan is presented in Table 1.

Seven data collection instruments were used to assess reading comprehension, attitudes towards reading, motivation to read, usefulness of reading strategies learned, and student and teacher experiences. A summary of data collection instruments and timeframes is presented in Table 2.

Table 2. Data Collection Summary.

Instrument	Assesses	Timeframe
Qualitative Reading Inventory (QRI)	Comprehension	Pre and Posttreatment
Classroom Assessment Techniques (CATs)	Comprehension	Post reading challenges
Survey of Adolescent Reading Attitudes (SARA)	Attitudes	Pre and Posttreatment
Adolescent Motivation to Read Profile (AMRP)	Self-concept/Value	Pre and Posttreatment
Reading Strategy Usefulness Survey (RSUS)	Student Experiences	Posttreatment
Individual Student Interviews	Student Experiences	Pre and Posttreatment
Journal: Field Notes and Self-Reflections	Teacher Experiences	Throughout the Study

Results

Changes in Reading Comprehension

Student comprehension significantly improved as measured by the QRI reading assessment without look-backs (the ability to refer back to the text when answering questions). The class mean score increased from 3.7 to 5.6 correct out of 10 questions (Figure 1). Effect size was calculated to be 0.90, signifying a large gain in scores.

Posttreatment vs. Pretreatment QRI Scores – Without Look-Backs

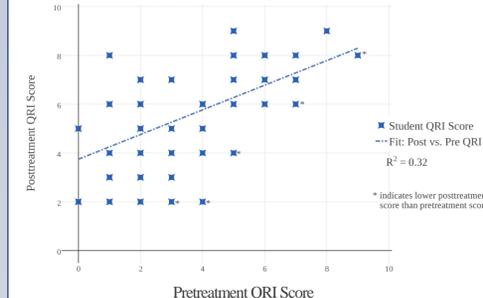


Figure 2. Student posttreatment vs. pretreatment QRI scores, without look-backs. (N=52).

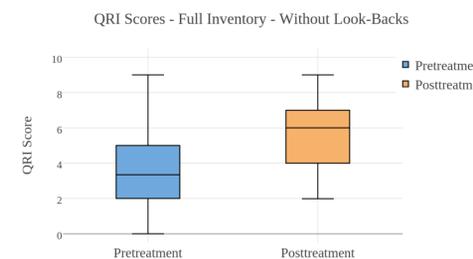


Figure 1. Box plot of pretreatment and posttreatment QRI comprehension scores, without look-backs. (N=52).

A review of individual student QRI scores without look-backs showed that 40/52 (77%) students scored higher, 7/52 (13%) students scored the same, and only 5/52 (10%) students scored lower on the posttreatment QRI; 4 of 5 students who scored lower dropped by only 1 point. This data is illustrated in Figure 2.

Table 3. Most Recommended Strategy (N=52).

Strategy	Number of Students (%)
Scan It	11 (21%)
Mark It Up	16 (31%)
Talk It Out	15 (29%)
Put It Together	10 (19%)

Results

Analysis of student scores on CATs given the day following each reading challenge tracked comprehension and allowed evaluation of the efficacy of each reading strategy. The Talk It Out strategy, which asked students to write and dialogue about what they read, resulted in a significant increase in average CAT scores from 4.5/10 nontreatment to 5.3/10 with strategy.

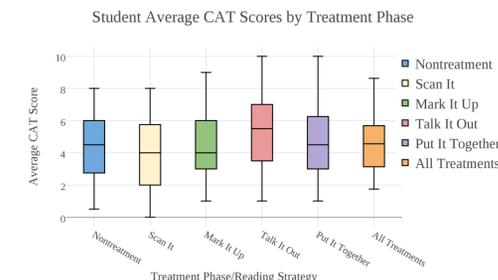


Figure 3. Student average CAT score by treatment phase. (N=52).

Changes in Attitude and Motivation

Student attitude towards reading print texts was unaffected (Figure 4). In response to a specific question about textbooks, 15% said they felt bad about reading a textbook both pre and post-treatment; 27% and 25% said they felt good about reading a textbook pre and posttreatment, respectively. In interviews posttreatment, 9/15 students said their attitude was the same, 5/15 said their attitude improved, and 1/15 felt worse.

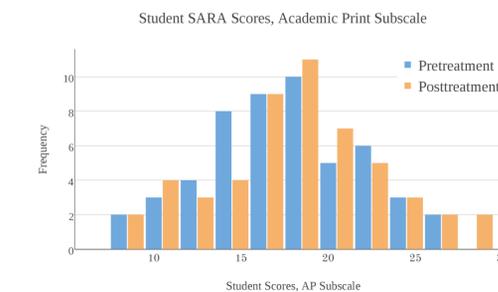


Figure 4. Histogram: Attitudes toward reading academic print (text), pre and posttreatment. (N=52).

Both facets of motivation measured by the AMRP survey – student's self-concept as a reader and student's value of reading – increased significantly from pre to posttreatment, with a small effect size of 0.30. Two AMRP prompts, "when I am in a group talking about what we are reading I feel comfortable" and "I think reading is a good way to spend time" showed effect sizes in the medium range.

Application of Reading Strategies

Over 90% of students agreed/were neutral that all 4 strategies helped them "read the textbook more carefully" and "understand the chemistry textbook better". Asked which strategy they would most recommend, students did not favor one strategy over another (Table 3). A plurality of students agreed/strongly agreed that strategies learned could be applied to English and social studies (Table 4) and 9/15 students interviewed had already applied a strategy to another subject.

Table 4. Usefulness of Reading Strategies to English and Social Studies (N=52).

Strategy	Number of Students Selecting Agree/Strongly Agree (%)	
	English	Social Studies
Scan It	21 (40%)	32 (62%)
Mark It Up	29 (56%)	39 (75%)
Talk It Out	28 (54%)	31 (60%)
Put It Together	24 (46%)	31 (60%)

Conclusions

After learning and practicing the reading strategies taught in this study:

- ❖ Students' reading comprehension significantly increased
- ❖ The Talk It Out strategy was shown to raise reading quiz scores significantly
- ❖ Students' attitude toward reading appeared to be unaffected
- ❖ Students' self-concept as a reader improved as did their value of reading
- ❖ Students showed an evenly distributed preference for reading strategy
- ❖ Students were willing to apply and did apply strategies to other subjects