How the Practice of Scientific Sketching Affects Qualitative Observations by High School Students

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CONTEXT & FOCUS QUESTION

- When students sketch an object, they are engaging in a more meaningful way than if they were just looking at a specimen, generating a deeper understanding and building recognition of minute details (Baldwin & Crawford, 2010).
- Scientific sketching helps students to develop their power of observation by enhancing their attention to detail and by developing their visualization acuity (Arias & Davis, 2016; Brew et al., 2012).
- For their observations to be accurate, students must be taught how to observe and be given guidance and time to practice sketching (Arias & Davis, 2016; Eberbach & Crowley, 2009).
- This leads to the focus question of "Does the teaching and practice of scientific sketching affect the quality of scientific observations by high school students?"

TREATMENT

- Two equivalent groups of students received different treatments. One group had teacher instruction on how to scientifically sketch, time to practice, and teacher feedback (Figures 8, 9, & 10). The other group of students were given no instruction and no time to practice scientific sketching.
- The students were asked to complete four surveys. The Qualitative Data Collection Survey assessed if they had any awareness of the concepts of qualitative observations and scientific sketching (Figure 1). The Student Opinion Regarding Sketching and Biology Questionnaire garnered student opinions on sketching and biology (Figure 2).
- The Oak Leaf Qualitative Observations Worksheet assessed the innate ability of students to make qualitative observations before the lessons (Figure 3). While the Linden Leaf Qualitative Observations Worksheet assessed if students had improved in their ability to make qualitative observations after the lessons, or lack thereof (Figure 4).

SURVEYS

Figure 1. The first survey given.

Figure 2. The second survey given.

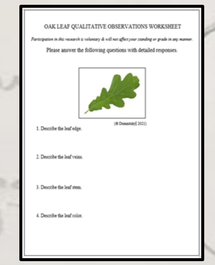


Figure 3. Observations pre-test.

Figure 4. Observations post-test.

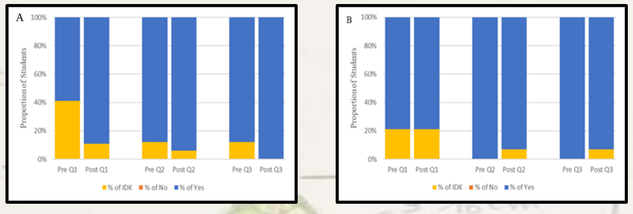
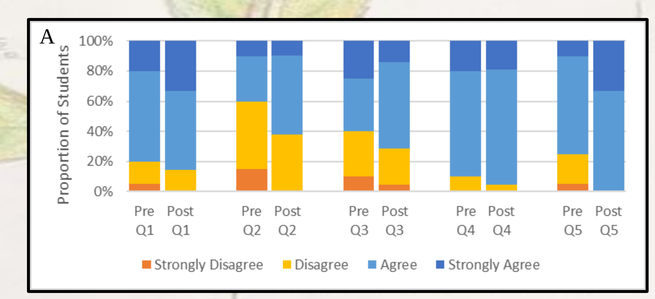


Figure 5. Change in Qualitative Data Collection Survey results for the sketching group (A), (*N*=18), and for the non-sketching group (B), (*N*=14). *Note*. Q1=Is there any utility in qualitative observations; Q2=Is there any role for art in science; Q3=Can anything be gained by scientific sketching in science (Figure 1).



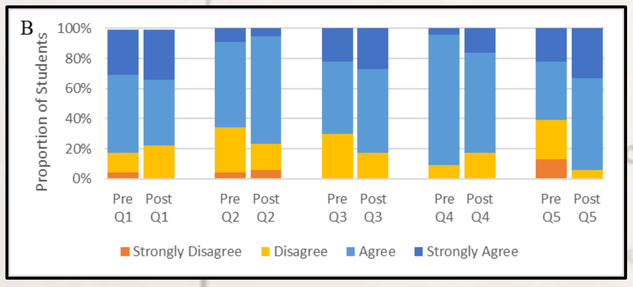


Figure 6. Change in Student Opinion Regarding Sketching and Biology Questionnaire for the sketching group (A), (*N*=21), and the non-sketching group (B), (*N*=18). Note. Q1=I like to draw; Q2=I am good at capturing detail in sketches; Q3=I like biology; Q4=I am good at observing details; Q5=I have been taught how to make scientifically accurate sketches (Figure 2).

Figure 7. Change in number of descriptors between the Oak Leaf Qualitative Observations Worksheet and the Linden Leaf Qualitative Observations Worksheet, (*N*=12). Note. Q1=Describe the leaf edge; Q2=Describe the leaf veins; Q3=Describe the leaf stem; Q4=Describe the leaf color (Figures 3 and 4).

STUDENT SKETCHES

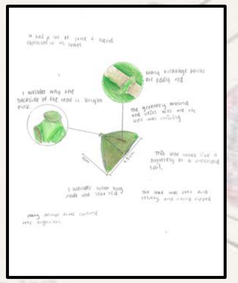


Figure 8. The first scientific sketch of a student in the treatment group.

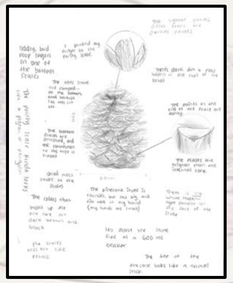


Figure 9. The second scientific sketch from the same student.

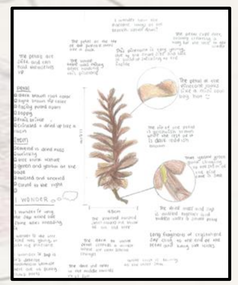


Figure 10. The third scientific sketch from the same student.

CONCLUSIONS

- The treatment group increased in self-confidence in being able to observe and capture details. They had a more favorable opinion of biology and they recorded that scientific sketching helped to build their observational skills (Figures 5 & 6).
- They also made improvements in their ability to record qualitative observations, with an average increase of one qualitative observation per leaf part. Whereas, the non-treatment group had an average decrease of 0.4 qualitative observations per leaf part (Figure 7).
- While the treatment group's results were expected, it was not expected that the students in the non-treatment group would decrease in their enjoyment and in their ability to make qualitative observations. More scientific sketching will be incorporated into my curriculum as an introduction to the joys of biology and to engage students in the process of qualitative observation collection.

CITATIONS

Arias, Anna Maria & Davis, Elizabeth A. (2016). Making and Recording Observations: When done well, observations can serve as evidence when engaging in science practices. *Science and Children*, *53*(8), 54-60.

Baldwin, Lyn & Crawford, Ila. (2010). Art Instruction in the Botany Lab: A Collaborative Approach. *Journal of College Science Teaching*, *40*(2), 26-31.

Brew, A., M. Fava, and A. Kantrowitz. 2012. Drawing Connections: New Directions in Drawing and Cognition Research. *Tracey journal: Drawing and Visualisation Research*, 2012. 77-99.

Eberbach, Catherine & Crowley, Kevin. (2009). From Everyday to Scientific Observation: How Children Learn to Observe the Biologist's World. *Review of Educational Research*, *79*(1), 39-68.

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HELLGATE KNIGHTS