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Reflections: Science Club for Girls Biochemistry Curriculum

This past year of writing and teaching my curriculum through Science Cub for Girls has been one of the most inspiring and meaningful experiences of my life. I initially set out to write this curriculum because I wanted to expand upon the wonderful experience I have had mentoring with Science Club for the past two semesters. Over this time, I have become deeply passionate about the mission of this organization to engage girls in science from a young age, to serve as mentors and role models, and to give them an environment in which they have the freedom to learn, explore, and experiment freely without fear of judgment. Over the previous two semesters, I gained valuable experience in learning how best to connect with and teach young girls, and I wanted to take the next step, to not only teach a pre-established curriculum, but to create and implement one myself.

Through this curriculum, I wanted to be able to explore in greater depth, a topic that fascinates me, and to share this sense of fascination with young children. I look back on my experience learning about biochemistry in some of my high school courses as a major factor which fueled my passion for science and inspired me to study science in college. This subject particularly is so rich, interesting, and increasingly important in modern science, and yet, is somewhat neglected in lower levels of education. I therefore wanted to use this curriculum to make the subject of biochemistry more accessible to young minds, and in doing so, to share the sense of enthusiasm and intellectual curiosity for science that I myself didn't find until later in my educational career.

Thinking about how to craft a biochemistry curriculum that would be comprehensible and interesting for fourth graders was also an exercise of great intellectual value for me. Often times in science classrooms, students, including myself, tend to get tied down in the details, in big words and tricky concepts. Designing this curriculum specifically for young people, however, forced me to think more deeply about what ideas lie at the core of what we call biochemistry. In researching and reading up on the subject in greater depth to prepare to write the curriculum, I was struck by a sense of new appreciation for just how central biochemistry is to an understanding of what makes up life. I was able to really focus in on themes, patterns, and core concepts central to the processes that take place around and within us, and used this as a starting point for the curriculum. In each of the lesson plans, I tried to capture common themes of structure and function, and to use the common human experience as a basis point, to help the girls to realize how these themes and principles already apply in their everyday lives. This aspect of the curriculum was in the end, something that I found to be one of the most successful. The girls consistently became more engaged and enthusiastic when I was able to bring the subject back to things that they already knew and could relate to. I believe that this process of creation that I was able to experience through writing this curriculum is so important to more deeply engage with science, and has benefitted me as much as I hope it has benefitted the girls.

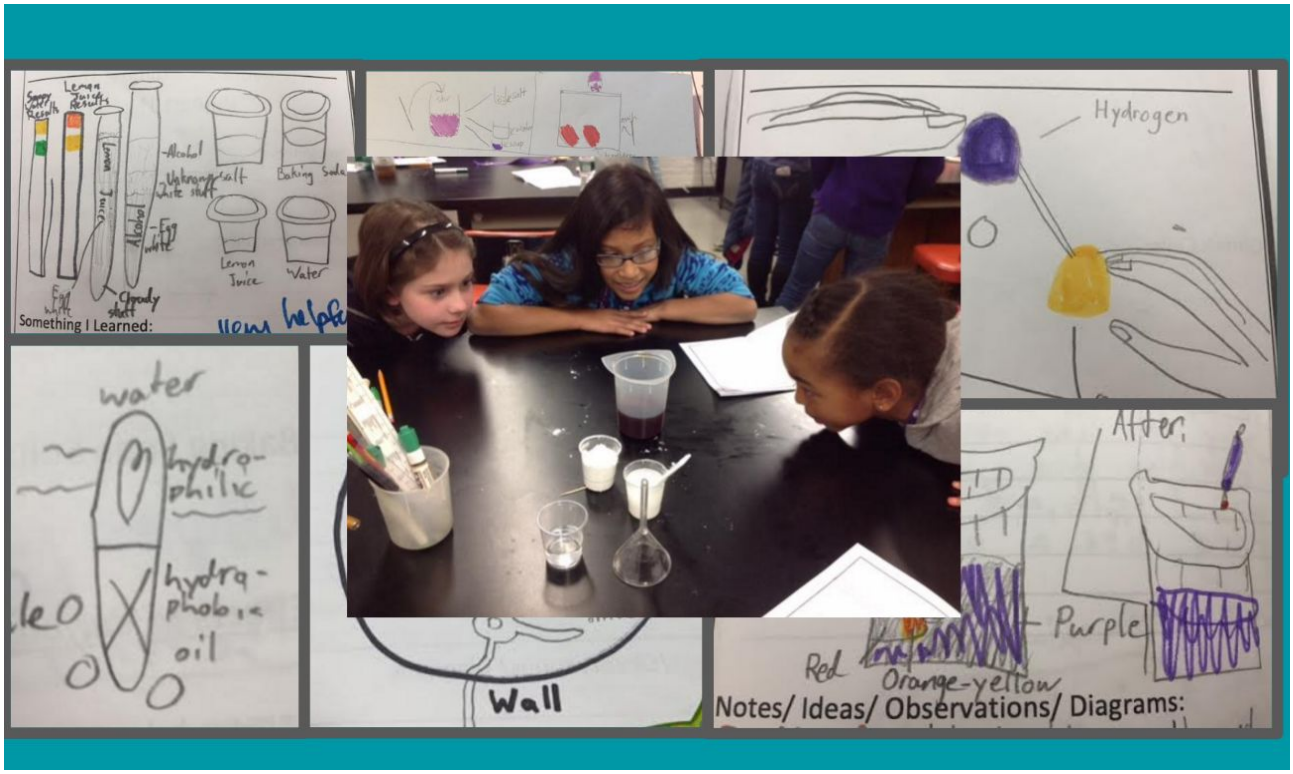
Getting to actually implement the curriculum this past semester was an equally incredible learning experience. I found it so fulfilling to see my ideas put into practice, to see the girls make

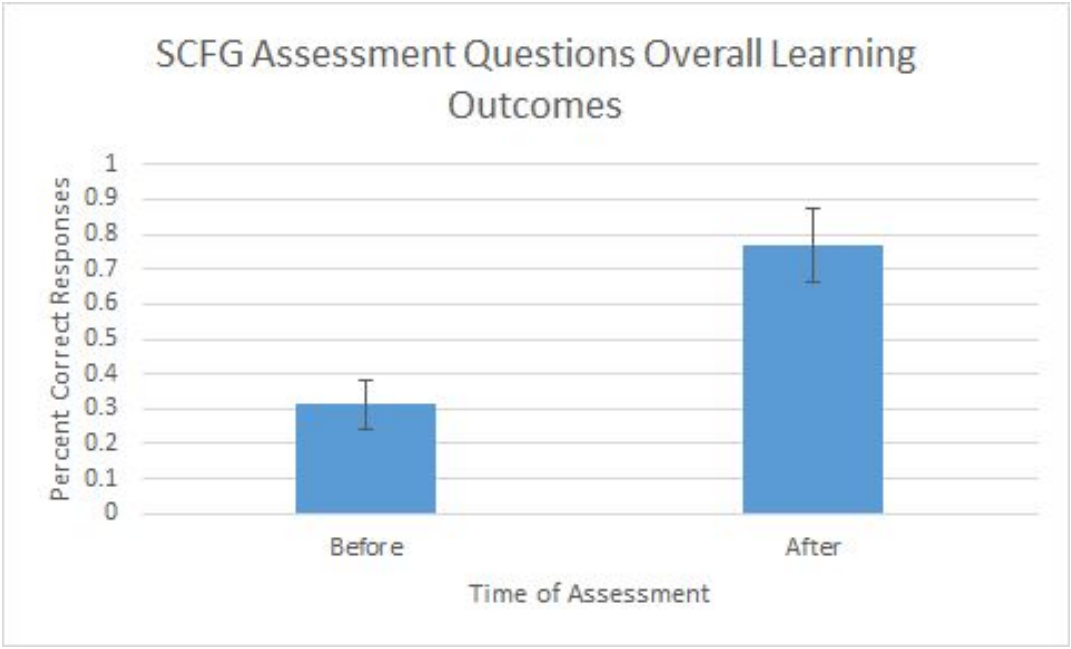
the connections that I hoped they would, and to generally witness a sense of enthusiasm about biochemistry! One thing that I didn't anticipate going into this semester was just how integral a part the girls themselves would play in shaping the curriculum. I went into the semester with many pre-established ideas of what the girls would know and what they would be willing to do, and was often pleasantly surprised to find that their curiosity and knowledge extended beyond what I had previously imagined. Extensions of lesson plans came to be based off of the girls' questions. When we did experiments, it was often the girls who proposed taking it further, testing new variables, and making new observations.

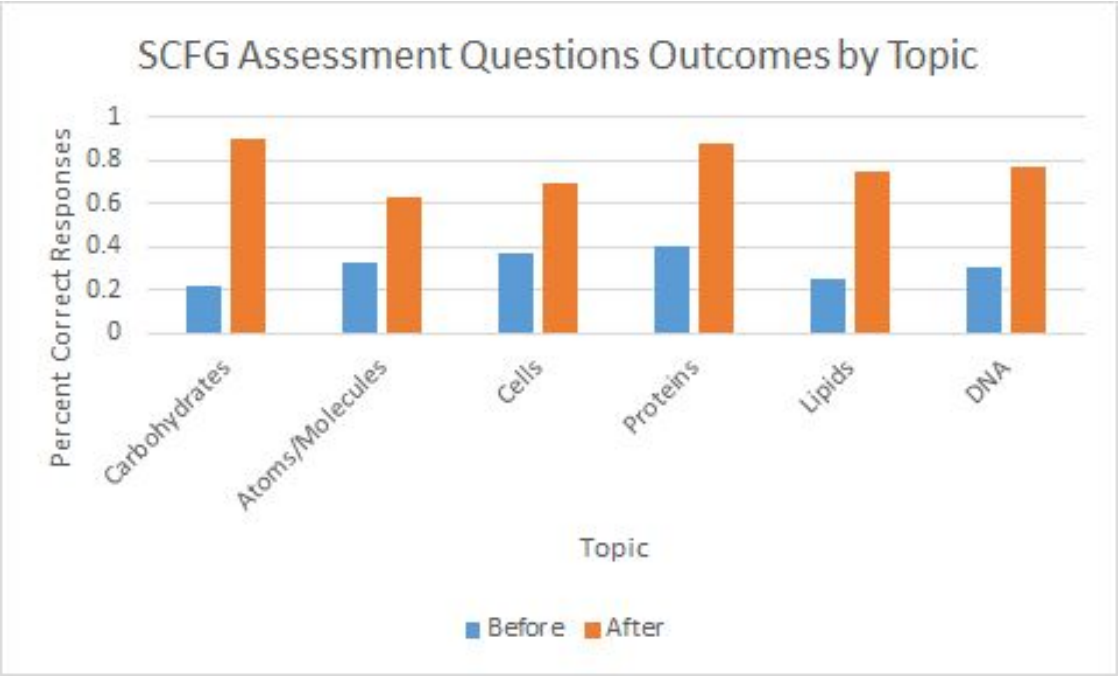
I also learned a lot about patience in working with these girls. Going in with so much foresight about how I expected the lessons to go initially blinded me to the obvious fact that the girls really do have lives outside of clubs. Sometimes girls would show up tired, or wild with energy. In the classroom, we had a mix of girls who seemed withdrawn, and those who wanted to shout out an answer to every question. Over the course of the semester, an important step for me was learning how to deal with so many divergent personalities, and to integrate the classroom around one topic. By the end of the semester, and after adjustments to everything from curriculum format to seating, I think we made real progress, and by the last week, everyone wanted to experiment with and write about their DNA extraction.

From a purely educational viewpoint, the girls also learned a lot about Biochemistry. They were able to make connections between lessons, and their answers to the questions of the day became more insightful each week. Before each lesson, our teaching team gave the girls a few multiple-choice assessment questions to test their knowledge of the material going into the session, without explicitly revealing the answers. On the last day of clubs, we repeated these same questions and again recorded the girls' responses. Overall, we found a 146% increase in the percentage of correct responses from initial testing to final testing(shown below). This data, combined with the insightful journal entries the girls made each week(also below) and their escalating level of enthusiasm with each lesson demonstrates that this student mentor-led, experiment-based approach to science learning really works, and will hopefully have positive consequences for these girls' futures.

Overall, engaging with young minds through writing and implementing this curriculum has been of great value to me. It was an opportunity for me personally to take a step back, beyond all the requirements and exams that studying science in college entails, and realize that what I love best about science is that you can be curious and ask questions and find answers through your own work. This process and these girls have reminded me that the point of science is largely to be wrong, is not always knowing the answer. This state of making guesses and trying to grapple with the world through experiment after experiment is the incentive behind almost all great work that has been done in science, and I hope that I will have played a part in engaging these girls in this lifelong mission.


Something I Learned:
Hydrogen
water
hydro-
philic
hydro-
phobic
oil
Wall
After
Purple
Red
Orange-yellow
Notes/ Ideas/ Observations/ Diagrams:


SCFG Assessment Questions Overall Learning Outcomes
Percent Correct Responses
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Before
After
Time of Assessment


SCFG Assessment Questions Outcomes by Topic
Percent Correct Responses
1
0.8
0.6
0.4
0.2
0
Carbohydrates
Atoms/Molecules
Cells
Proteins
Lipids
DNA
Topic
Before
After