SRI Experiences

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I have been a member of the Science Department at New Castle Chrysler High School for 13 years. In any given year, I may teach some combination of the following: Earth & Space Science, Regular Biology, Honors Biology, Anatomy & Physiology, and Genetics. I also teach an evening Ivy Tech course in Anatomy & Physiology. My bachelor's degree, from Ball State University is in secondary education with a primary area of Biology and a secondary area of Earth and Space Science. My Master's degree, from Miami University, Oxford, is in Biology Education. I heard about Indiana University's Summer Research Institute through a colleague who encouraged me to apply with her. It was with mixed emotions that I shared my letter of acceptance with her as she shared her letter of rejection with me. Not only was I accepted for the two week course, but for the extended (6 additional week) research as well.

It was obvious from the beginning that SRI was to be different from any workshop that I had experienced before. The setting was a conference room where 23 secondary teachers gathered around a large table. Rather than being treated as students, we were treated as professionals, each of whom possessed a level of expertise to contribute. Rather than being presented in a typical lecture forum, the SRI workshop was presented in an inquiry-based fashion wherein the teacher became a researcher.

Dr. Bonner modeled the desired outcome for our classes, emphasizing science process skills, while de-emphasizing lecture. The inquiry-based classroom should be student-centered, with experimental design and increased time for investigation of paramount importance. Creating a more student-centered environment produces a climate where students become more accountable for their own learning. Students perform at a higher cognitive level when they are engaged, when they are self-motivated and when they are responsible for their own learning. Universities want students who can think, not simply memorize. Students need to know now more than ever how to research, how to distinguish between reliable and unreliable sources, how to discriminate between science and pseudoscience, how to analyze, and most fundamentally, how to think. In this scenario, the teacher must act as a facilitator and as a resource for students, not merely as a disseminator of rote facts.

I learned several new strategies for use in my classroom. Formative assessment techniques, some of which I already incorporate and some of which were novel to me, will play a larger role in my classroom. I have been frustrated with student performance on end of chapter/unit tests. With use of these formative assessment techniques, I will be able to detect and contend with the stumbling blocks that my students are tripping over before the test. Everyone has ingrained misconceptions. My students are no exception. I have discovered methods to discern and to address some of my students' common misconceptions. Assuming the attitude of a researcher has allowed me the opportunity to model scientific thought processes to my students. I have ascertained that it is necessary to express these thought processes verbally so that my students will begin to get the idea of how a scientist thinks. If I model these thought processes to my students consistently,

they will begin to make them part of their scientific repertoire. The most important aspect of this modeling must be continuous questioning. To ask questions is the central hub upon which the wheel of science turns. I aspire to model to my students that to a scientist, the phrase, “I don’t know” is the beginning of a journey, not an end, as they so often presume. I also wish to model to them that a scientific method is not necessarily a linear progression, that one “Scientific Method” does not exist, rather many non-linear methods of confronting a question.

I was assigned to Emilia Martins’ lab which investigates behavioral genetics and evolution. Here, I assumed the role of researcher. During the first two weeks, working with my partners, I was expected to research the scientific literature in order to become acquainted with the model organism with which we would be working, the zebrafish. We were expected to devise our own question, regarding zebrafish behavior and to formulate a hypothesis based on our research. We wrote the protocol for our experiment, ran a pilot, collected and analyzed our data and wrote a paper summarizing our findings. Dr. Martins guided us through this process and made suggestions for revisions as we proceeded.

During my extended research, I acquired a renewed and refined appreciation of research and of researchers. Most lay people, my students and I included, tend to think of researchers as continuously performing experiments. I found, to the contrary that much of the researcher’s time is spent in, well…research. While this may appear intuitively obvious, it was not until I was entrenched in the lab that I internalized this concept. An appreciable amount of the researcher’s time and effort is spent in analyzing the data that was collected during experimentation. To this end, Dr. Martins’ lab is designing and programming EthoBank which is part of a global on-line store compilation of information describing the behavior of animals. Another aspect of research which I had given little consideration is that of peer review. A significant amount of time is invested in reviewing and contributing to the work of others. Yet another often disregarded aspect of research is presentation. “Publish or perish” is the motto. Much time and effort is spent in preparing papers, talks, and presentations. An additional area that I had not given consideration was the amount of time and effort spent on grant writing. This summer, Dr. Martins’ lab was in the throes of writing a grant that would allow for studying the zebrafish in its natural habitat in India.

I found that the concept of time is different to a researcher than to a classroom teacher. Teachers are so used to changing gears every 50 minutes in Pavlovian response to the passing bell. A researcher may not move from one spot the entire day, does not clock out at the end of the day and works whenever their investigation requires them to do so. This allows the researcher adequate time for lengthy and comprehensive analysis. The mind of the researcher is very detailed and thorough, organized and focused, absorbed and intent, exhaustive and meticulous.

During my extended research, I spent a good deal of creative energy developing a four stage lesson plan that is progressively inquiry-based. These investigations will span the entire year with content interspersed between them and will run concurrently with other academic pursuits. I am aware that I must abandon my current pedagogical

philosophies, but dismissing that which is familiar is an arduous and daunting task. My utmost concern for implementation of inquiry into the classroom is the time restraint. Currently, it is challenging to cover all of the content in Biology H, and now I am considering adding a significant amount of new material and taking the time to teach science process skills. In addition, I will be teaching a course I have not taught in several years, using a new textbook from a different publisher. I must however, take into account the reduction of the amount of time spent on traditional methods. Nevertheless, I maintain serious concerns regarding the implementation of scientific inquiry while incorporating all of the content that is likely show up on standardized tests.

In consideration of the dissemination of the information that I have gained from the Summer Research Institute, I have several opportunities. Dr. Bonner proposed conducting an inquiry-based workshop for my high school colleagues, possibly in association with SRI teachers in my area. This is an opportunity that I would like to further explore. In addition, I have submitted my contribution to a collaborative article that will be published in the HASTI newsletter. Further, I plan to work with other SRI teachers to present a "Quick Hits of SRI" at HASTI in the winter, presenting our classroom bottlenecks and methods of addressing them. Also, Dr. Martins' created a new web site, "Zebrafish in Inquiry-Based High School Biology" as a collaborative effort between IU's SRI and secondary educators to which I have contributed content. Finally, I have added a new zebrafish web page and a teacher resource web page to my own web site. In these ways, the growth that I have achieved this summer may be shared with other secondary teachers and with students.

Even though I innately possess a questioning sense of wonder about everything around me, I refined that skill here. I found that in research mode, I started with a couple of questions and ended with a couple of hundred. That sense of wonder, of awe at the magnificence of the universe, of all the unanswered questions and of all of the questions that would emerge from attempting to answer *those* questions, became my constant companion this summer. It instills in me a thirst for knowledge, a thirst that grows deeper even as I attempt to quench it. That is the state of mind of the researcher, a paradigm in which answers lead to questions, not inevitably the converse. That is the state of mind that I most diligently wish to convey to my students.

As a result of this summer's experience my pedagogical philosophies have been drastically altered. My future classroom will be much more inquiry-based and student-centered. While I have always been aware, on an academic level, of the significance of the incorporation of a science-process approach in the classroom, I now possess the tools and the motivation to achieve that goal.

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