

# Inquiry as both a Science and an Art

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## Introduction

Many students early on in their life come to a point where they devalue and disregard science and all other fields of study and therefore lose interest in continuing to get an education. How can we help students experience their own intellectual creativity and come to valuable understandings? In an attempt to weaken the polarization found between scientists and scholars, science educators and scholarly educators, the k-12 summer institute has been established to bring more awareness and action from teachers across the board. This summer I assisted in planning and running the summer 2008 institute for K-12 teachers and was responsible for evaluating it. In the following, I share a collection of my observations.

## Goals of the Summer Institutes

<http://serendip.brynmawr.edu/local/suminst/>

- Allowing teachers from different grades to work together with access to various resources to learn about science and its implications for education to better their teaching whether in their lessons, activities, behaviors, or understandings of the things that go on inside the classroom.

- Acquiring skills in and exploring productive use of information technology. <http://serendip.brynmawr.edu/local/suminst/>

- Bridging the disciplinary gap between science/mathematics and other areas of the curriculum as well as in the educational approach (lecture versus discovery based, etc.)



Courtesy of <http://serendip.brynmawr.edu/local/suminst/bb08/groupphoto.html>

## Valuable Educational Implications and Considerations

### Pre/Post Institutes:

- Schooling can be defined as a designated time and place to solidify and develop individual diversity, get concepts of life less wrong<sup>i</sup>, thereby expanding on ones repertoire of knowledge and awareness to successfully tackle challenges in the real world<sup>ii</sup> which is only as good as the participants that make it up.<sup>iii</sup>

- Getting understandings of life less wrong<sup>iv</sup> can be accomplished via multiplist pedagogy. This being one that provides, to the furthest extent possible, a potpourri of teaching methods to best accommodate the even wider range of learning styles in the classroom. <http://serendip.brynmawr.edu/exchange/node/2583#comment-66477>

- The use of language (word choice such as hypothesis, stories<sup>v</sup>, and metaphors<sup>vi</sup>; students' expectations versus teacher's inclinations<sup>vii</sup> etc.) is important on several levels, all of which need to be constantly considered in the teacher's mind when conducting the class.<sup>viii</sup>

- Students should not be forced to learn the minute details of a certain study unless the student is in an advanced course, deliberately taking it to specialize in that field. Instead, all students should be taught the most basic information as well as information relevant to other disciplines and life situations; learning how it functions for/in the rest of the world to better their ability to grapple<sup>iv</sup> with real-life challenges. <http://serendip.brynmawr.edu/exchange/node/2592#comment-67088>

- "...it's important to celebrate what makes us different so that we can integrate those differences into our ways of thinking." <http://serendip.brynmawr.edu/exchange/node/2019#comment-60904>

- Will eliminating all/most forms of testing be an effective approach to accurately evaluating each person's particular learning style? Is the real problem the way in which tests are used (i.e. SATs, IQs, etc.) or which tests/questions are being used in the classroom (i.e. true/false questions)?

- How effective is homeschooling and the variety found in the way that homeschooling can be conducted (i.e. professional tutors, parent-teachers, online education)? Does the fact that their establishments as well as the establishment of specialized institutions (single-sexed, African American schools, etc.) add to the diverse amount of methods in which education can be practiced suffice? <http://serendip.brynmawr.edu/exchange/node/2583#comment-66172>

### Computer Science Education Institute Haverford College

- Introduce non-conventional computer concepts and programs and provide several tools to experiment with and potentially utilize to make a positive difference in classrooms.

- Computational thinking involves the process of working with abstractions and is coupled well with inquiry based skills; as Computer Science requires thinking at multiple levels of abstractions, inquiry takes those abstractions and decomposes them through investigation, questioning, skepticism, and criticism.

- Dispelling or independently manipulating ones perception of an optical illusion demonstrates one's ability to come to various and completely different interpretations of things. And so it is important to consider when teaching a group of people the same thing, that the understanding of the situation can easily vary from person to person.

- The recognition of spatial regularities<sup>x</sup> in the brain is analogous to human thinking and computers working computationally to search through large amounts of sequenced data for patterns (to then utilize recursive techniques, binary information, parallel processing, etc.). <http://serendip.brynmawr.edu/exchange/chance>



Courtesy of <http://www.fertanish.com/blogimages/scratch.jpg>

### Brain and Behavior Institute Bryn Mawr College

- The wide range of diversity found in individuals is not a small one and greatly affects how s/he will learn. One that consistently goes unnoticed is neurodiversity-the slight differences in each individual's nervous system, providing the basis for their perception, recognition, unconsciousness, sub-consciousness, consciousness, etc. are forever present. These differences than in learning, before anything else, needs to be acknowledged and addressed in a manner that best supports pro-social behavior and civic engagement.

- Teachers need to be more conscious of their students' behaviors so as to not confuse that which inhibits learning and that which prevents learning from being exciting.

- There is more value in learning from the process than the product. This is true more so when the product is considered absolutely correct; absolute conclusions are in fact susceptible to change and therefore should not be regarded with such permanency. <http://serendip.brynmawr.edu/exchange/hbi08/session1#comment-68090>

- Familiarity with the brain and the rest of the nervous system is lacking in lower level education.

- "Commonalities in understandings and skills should to the extent possible be allowed to evolve from the interactions of different inquirers rather than being as a needed foundation without which individual inquiry can't proceed." <http://serendip.brynmawr.edu/exchange/node/2583#comment-66475>

### Science as Interactive, Interdisciplinary Inquiry Bryn Mawr College

- "...explore the beneficial balance/threshold, for any given science concept, between unstructured (totally self-generated exploration) activities.

<http://serendip.brynmawr.edu/exchange/suminst/iii2008/inquiry#comment-69536>

- Open-ended inquiry<sup>xi</sup> allows an individual to freely investigate their natural curiosity and actively question and consider and reconsider observations about the world.

- Incorporating interactive interdisciplinary-based learning to improve a student's inquiry skills is a valuable tool<sup>xiii</sup> for people at any and every point of his/her life. <http://serendip.brynmawr.edu/exchange/node/2592#comment-66573>



Courtesy of <http://serendip.brynmawr.edu/local/suminst/iii08/group.html>

## Current Conclusions

The three K-12 summer institutes collectively produce a spectrum<sup>xiii</sup> for educating science that travels from a traditional, lecture-based form to one that is more contingent on open-ended, inquiry-based discussions and finally based primarily on the students' participation. Looking at this progression, it is possible to vision the evolutionary change of science education has had over the years. The way in which science education can be taught nowadays has reached a point that is unbelievably similar to the way humanity courses are structured and executed. Awareness of these differences and similarities found

in the different fields of education and within the participants themselves will potentially help bring about positive change to the educational system. <http://serendip.brynmawr.edu/exchange/node/2872>

## Future Plans

Within this current academic year, I want to encourage and support developing a monthly week night session that expands on the Brain and Behavior Summer Institute for K-12 teachers with 12-16 professors and college students. This would be similar to the monthly night discussions Professor Grobstein has held on education in the past and I am compelled to say that the two can merge and bring even more experience to the usual summer Brain and Behavior Institute in the future. In addition to that, this will maintain the relationships made with participants from past Howard Hughes Medical Institute summer institutes and help make it stronger.

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i. [http://serendip.brynmawr.edu/sci\\_edu/less\\_wrong.html](http://serendip.brynmawr.edu/sci_edu/less_wrong.html)  
ii. <http://serendip.brynmawr.edu/exchange/node/2583#comment-66171>  
iii. <http://serendip.brynmawr.edu/exchange/node/2592#comment-66684>  
iv. [http://serendip.brynmawr.edu/sci\\_edu/less\\_wrong.html](http://serendip.brynmawr.edu/sci_edu/less_wrong.html)  
v. <http://irp.icaap.org/index.php/irp/article/view/9/18>  
vi. <http://serendip.brynmawr.edu/exchange/node/2602#comment-66776>  
vii. <http://serendip.brynmawr.edu/exchange/node/2699#comment-68836>  
viii. <http://serendip.brynmawr.edu/exchange/node/2699#comment-68270>  
ix. <http://serendip.brynmawr.edu/exchange/node/2583#comment-66171>  
x. <http://serendip.brynmawr.edu/exchange/chance>  
xi. <http://serendip.brynmawr.edu/exchange/franklingrobstein08>  
xii. <http://serendip.brynmawr.edu/exchange/node/2583#comment-66171>  
xiii. <http://serendip.brynmawr.edu/exchange/node/2872>