



## **A Study Referencing Advantages of a Seeds of Change Summer Project!**

St. George's School in Middletown, Rhode Island is a top level high school in the United States having formal relationships with the Harvard Graduate School of Education and the Curie Institute in Paris, France, where their students can do research. St. George's has taken groups through the Seeds of Change program for the past two years.

St. George's has produced a study (that we are treating as proprietary to St. George's) documenting their findings as to the project's advantages. The report was produced by Dr. Robert Wein, chair of St. George's Science department, a Lockheed Martin scientist, and a university physics professor prior to committing his life to high school education. Norm Augustine, former chairman of Lockheed and, for years, chair of the NASA panel to map out manned space programs for the United States, was an inspiration for our Seeds of Change program. Norm's contention is that 4 percent of our population are scientists/engineers and these are the people that create the jobs for the other 96 percent. Sadly, the 4 percent has been diminishing year after year. Accordingly, the Seeds of Change program is dedicated to creating a high school science program in cooperation with very committed high schools that propel students in bioscience far beyond today's secondary education systems.

The following excerpts from this study by Dr. Wein should be helpful for schools considering summer programs with Seeds of Change.

### **Excerpt # 1:**

Given the recent explosion in technology in society it is clear that the study and use of science is not only a societal need, but also beneficial to each student. In the many discussions of 21<sup>st</sup>-Century skills, problem solving and flexibility (*e.g.*, Kurshan), as well as the four Cs: critical thinking, communication, collaboration, and creativity (*e.g.*, NEA) are the most essential components.

### **Excerpt # 2:**

There is a growing sense in the science community that high school students can and should conduct original research (Scott and VanNoord, Sousa-Silva *et al*, and Elfman). In fact, there are a (very) few extant programs where that happens. However, each of these programs relies on non-school science "experts" to work with students in an artificial way (*e.g.*, weekends, once a week in the evening) over multiple semesters. Appendix A includes an extensive list of science programs for high school students that claim to be immersive or experiential.

Only one of the programs, out of nearly 300, allows the student to develop their own question and experiments. The uniqueness of the Seeds of Change (SOC) science experience rests on the students designing, executing, and presenting their own research experiments. This is something not typically approached by science students until they are advanced undergraduates, or more likely, in graduate school. Our experience with SOC has clearly demonstrated the positive results of tapping into the creative freedom of younger students.

**Excerpt # 3:**

A number of the finest tropical researchers in the world have already affiliated themselves with this SOC/University of Costa Rica team.

**Excerpt # 4:**

There is a primary school approximately one kilometer from the research site. In addition, a regional secondary school is being built approximately 5 kilometers away. Either of these can serve as potential sites to engage the young people of the area (with our students) as a meaningful service project. There is also a butterfly garden/research station being developed by Seeds of Change and the University of Costa Rica that is an excellent candidate for ongoing service work driven by our students, both by students who travel to Costa Rica and for classes back in the US.

**Excerpt # 5:**

Transformative teaching is a composite of many current pedagogical strategies, for example: design based, inquiry based, brain based, and student centered (Slavich and Zambardo).

**Excerpt # 6:**

A current listing of High School Science Immersion Programs (in Appendix A). While this is not truly complete, it is extensive. Of the programs that follow, only one was close to the presently proposed Seeds of Change program in terms of science content (MIT program, at the end), however none are as fully consistent with the Seeds of Change mission, in terms of science education, service influencing a community, and affecting the likelihood of creating a new scientist.

## Appendix A.

A review of 50 “top” programs

<https://www.bestcollegereviews.org/features/pre-college-summer-science-programs-high-school-students/> (July 28, 2018)

While very good, none of these programs appear to be centered on students developing their own research question and experiment.

Amazing list of 212 programs, coordinated through Johns Hopkins Center for Talented Youth.

[https://cty.jhu.edu/imagine/resources/summer\\_programs/science.html](https://cty.jhu.edu/imagine/resources/summer_programs/science.html)

These include camps for each major category of science as well as programs for underrepresented groups in the sciences. For example, an excellent physics camp at UPenn.

<http://www.physics.upenn.edu/~pssa/>

Students design a lab to determine speed of light, given the equipment, and lessons they have had, but still do not design their own question. Program is lecture and lab based but restricted.

Non-“cash cow” programs listed by collegetransitions.com

<https://www.collegetransitions.com/top-summer-programs-for-high-school-students/> (July 24, 2018)

Some of the programs listed talk about immersion during the class period (language, computer science/coding) but that is not the way students can be “immersed in science.” Experiments can take from many hours to many months.

Temple University cancer research

<https://www.foxchase.org/research-training/education/research/high-school/immersion-science-program> (July 24, 2018) develop science interest, cancer research

Choate Rosemary Hall

<https://www.choate.edu/academics/signature-programs/science-research-program> (July 24, 2018)

Students work with a university faculty member in the summer on the faculty member's research project.

Highlands University, New Mexico

<http://www.nmhu.edu/high-school-students-experience-hands-on-science-through-highlands-summer-immersion-program/> (July 24, 2018)

Observational, data taking in the desert southwest, under supervision of a college faculty member

Minnesota, Twin Cities, Duluth

<http://wolf-ridge.org/wp-content/uploads/2015/08/LH-Science-Immersion.pdf> (July 24, 2018)

The focus is on field work and observational biology, data taking, not original research.

Esperanza College/Eastern University

<https://esperanza.eastern.edu/academics/non-degree-programs/summer-camps/immersion-science> (July 24, 2018)

Trying to show students that science is fun

George Washington University Medical School

<https://smhs.gwu.edu/medical-laboratory-sciences/programs/summer-immersion-program-2018> (July 24, 2018)

The program teaches techniques and introduces instrumentation.

Science Education Partnership Award (SEPA) Seattle Biomedical Research Institute

<https://nihsepa.org/project/bioquest-academy-creating-an-innovative-immersion-program-for-teens/> (July 24, 2018)

Biomedical developments, delivered multiple ways, (some remotely) to grow interest in STEM

SEPA funding Urban Squash programs,

<https://nihsepa.org/project/citylab-and-urban-squash-a-new-pathway-to-achieve-stem-success/> (July 24, 2018)

Near-peer science tutoring, not genuine experience as a scientist

Ninth grade residential program at University of Florida

<https://www.cpet.ufl.edu/students/rise/> (July 24, 2018)

Tutorials, talks and lab tours. Also, participation in faculty/grad student experiments.

High school internships and courses in Science and Engineering at BU

<http://www.bu.edu/summer/high-school-programs/research/> (July 24, 2018)

Experiments in the internships are 40 hrs/week, but designed by grad students.

MIT Research Science Institute

<https://www.cee.org/research-science-institute> (July 24, 2018)

80 of the best students from around the world experience professors, lab work. Great placements. *Closest to this proposal (includes research, but not their own question with controls) includes presentations.*

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