An immersive research program for high school students

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Program Overview

Four high school students worked at Drexel for four weeks:

- Immersive research experience
- Capstone project
- Lab tours and lunch talks
- Workshops/lectures
- Presentations
Program Details

- Dates: August 1, 2016 - August 26, 2016 (four weeks total)
- Accepted 4 high school students out of 16 applicants
  - 3 rising seniors
  - 1 rising junior
  - 3 female students
  - 1 male students
- Program ran daily from 10am-3pm
- Location: primarily Drexel University with a few off site visits
Motivation

● For the high school students:
  ○ Exposure to university level research
  ○ Leads to major decisions such as career, major, etc. in an uninformed way

● For the research:
  ○ How effective are outreach programs?
Why IceCube?
The IceCube Collaboration

- International collaboration
  - Approx. 300 physicists from 48 institutions and 12 countries
- Drexel University IceCube research group
  - Undergraduate students
  - Graduate students
  - Postdoctoral fellow
  - Faculty

The IceCube Collaboration

Funding Agencies:
- Fonds de la Recherche Scientifique (FRS-FNRS)
- Fonds Wissenschaftlich Onderzoek-Vlaanderen (FWO-Vlaanderen)
- Federal Ministry of Education & Research (BMBF)
- German Research Foundation (DFG)
- Japan Society for the Promotion of Science (JSPS)
- Knut and Alice Wallenberg Foundation
- Swedish Polar Research Secretariat
- The Swedish Research Council (Vr)
- US National Science Foundation (NSF)
Immersive Program

- IceCube group meeting
- Work with each of Drexel’s research group members
- Worked in the IceCube office
- Workshops held by faculty and graduate students:
  - Particle physics
  - IceCube
  - Computer programming
  - Astrophysics
  - Electronics
  - Scientific presentation
Diverse Program

- Lab tours:
  - Drexel Implant Research Center
  - Nanomaterials Lab
  - Particle physics lab
  - BLAST Laboratory at UPenn
  - Academy of Natural Sciences

- Lunch series: 14 different Drexel researchers gave informal talks about their research
Capstone Project: A Model of IceCube

- **IceCube Array**: 86 strings including 8 DeepCore strings, 5160 optical sensors
- **Amanda II Array**: (precursor to IceCube)
- **DeepCore**: 8 strings-spacing optimized for lower energies, 480 optical sensors
- **IceTop**: 81 Stations, 324 optical sensors
- **Bedrock**: 2450 m, 2820 m, 1450 m, 50 m
What does IceCube look like?
Diversity of Capstone Project

- Planning and building a structure
- Electrical engineering
- Programming skills
Final Capstone Project

IceCube Lab

IceTop
- 81 Stations
- 324 optical sensors

IceCube Array
- 66 strings including 8 DeepCore strings
- 5160 optical sensors

Amanda II Array
(precursor to IceCube)

DeepCore
- 8 strings-spacing optimized for lower energy
- 480 optical sensors

Eiffel Tower
- 324 m

Bedrock
Presenting at the Franklin Institute: Cascading outreach effect
Formal Presentation:
Department of Physics
Assessment

● Two pre- and post- surveys:
  ○ Survey specifically designed in-house
  ○ Friday Institute Student Attitudes Toward STEM Survey (6-12th grade)

● Weekly blog posts:
  ○ Ex. How do you describe the work you have been doing this summer to your friends?

● Oral exit interview
  ○ Group interview held after the final presentation on the last day
“I really felt accomplished with myself after these four weeks in the program.”

“Some people might say that the last week is when things are supposed to wind down, but at the end of the day it felt as though we were wound up about programming, physics research, and all the possible careers that lay in our future and the scientific realm.”
Preliminary Results

Gauging Interest in Science
pre- mean = 4.28, pre- standard error = 0.11
post- mean = 4.62, post- standard error = 0.09

Gauging Interest in Engineering
pre- mean = 4.14, pre- standard error = 0.11
post- mean = 4.28, post- standard error = 0.11
Preliminary Results

Gauging Interest in STEM Career Options
pre- mean = 2.67, pre- standard error = 0.15
post- mean = 2.88, post- standard error = 0.14

Pre-Survey
Post-Survey
Summary

- We designed and assessed a summer program for high school students
- Curriculum was:
  - Immersive - exposure to university research
  - Diverse - coding to communication
- Formal assessment with preliminary results

Future Plans

- More analysis and publication
- Currently accepting applications for July 2017
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