K-12 STEM Center: STEM Community outreach for 45 years

New Faculty Orientation – August 2023
Dr. Darin Gray

- Bachelor’s degrees in
  - Biomedical and Electrical Engineering
  - Mathematics
- Master’s degree – Teaching with an emphasis in math
- Master’s Degree - Cybersecurity
- Doctorate – Education Technology
- 15 years as an Electrical Engineer (Hughes Aircraft and QED Enterprises)
- 26 years as a high school and adult education teacher
- 26 years as a STEM Educator
- 10 years as Engineer (Communications, Cybersecurity, IT) - California State Guard
- DoD STEM Ambassador
- NSF Reviewer
- National Academies of Sciences, Engineering, and Medicine Workshop Proceedings Reviewer

2023 Recipient California Medal of Merit
2022 The Engineer’s Council Outstanding STEM Educator Award
2020 James E. Ballinger Engineer of the Year Award
Center’s Mission

The K-12 STEM Center is committed to providing equitable, culturally responsive opportunities for youth, families, and schools. Diversity, equity, and inclusion guide our work to actively address systemic inequities in STEM Education and build personally relevant knowledge and skills, self efficacy, and leadership within a community of learning and practice.
Center’s Vision

- Real-world STEM Experiences for students
- USC students & faculty STEM mentors
- STEM Pipelines and Pathways
Real World STEM Experiences
USC students & faculty STEM Mentors

viterbi impact

USC Viterbi School of Engineering
STEM Pipelines and Pathways

Inspiring Programs in STEM

INSIGHT highlights innovative higher education institutions and organizations working to recruit and retain underrepresented individuals in science, technology, engineering, mathematics, and beyond with our 2022 Inspiring Programs in STEM Award

CTE  LEARN  LEARNING

Ensuring ALL our students graduate READY FOR THE WORLD

STEM ECOSYSTEM
School Year 22-23 by the numbers

- ~5,000 K-12 students
- ~100 K-12 teachers
  - Impact: 12,000 additional K-12 students
- 160 Viterbi students
- 45 USC faculty members
Center’s Role in K-12 at USC

19 USC schools contribute to USC’s PreK-12 impact in LA

19 USC schools

500+ PreK-12 schools in LA across 5 school districts

100+ Unique programs

Reaching 500+ unique PreK-12 schools in LA\(^1\), including over 20\% of schools in the LA Unified School District, the 2\textsuperscript{nd}-largest district in the US

<table>
<thead>
<tr>
<th>Program</th>
<th># programs</th>
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<tbody>
<tr>
<td>Rossier School of Education</td>
<td>256</td>
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<tr>
<td>Viterbi School of Engineering</td>
<td>132</td>
</tr>
<tr>
<td>Dwork-Peck School of Social Work</td>
<td>68</td>
</tr>
<tr>
<td>Ostrow School of Dentistry</td>
<td>44</td>
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<tr>
<td>Dornsife College</td>
<td>27</td>
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<tr>
<td>Marshall School of Business</td>
<td>26</td>
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<tr>
<td>Cardinal Division of Occupational Science &amp; Therapy</td>
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</tr>
<tr>
<td>Keck School of Medicine</td>
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<tr>
<td>Biokinesiology &amp; Physical Therapy</td>
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<tr>
<td>Other schools</td>
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<tr>
<td>Other USC units</td>
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Priorities, Projects & Partnerships

The K-12 STEM Center has helped the NSF Early Career Award winners of the past few years with their Broader Impacts
Chem Ed Week: Teacher Training on Greenhouse Gases

Teachers will walk away from this interactive session with a proven lesson plan and the ability to engage students with the free 3D molecule modeling software, IQmol, to learn about greenhouse gases.

Free, full lesson plan and training in the software IQmol will be provided Meredith Brandon (Hawthorne Math and Science Academy), Kareesa Kron and Professor Shaama Sharada (both in USC Viterbi Chemical Engineering).

The free training is limited to 25 teachers, and the workshop will be filled on a first-come, first-served basis.

Learning MATLAB & Computational Physics with USC Electrical Engineering Professor

Saturday, October 24
9:30 - 11 AM PST
Register Today

Conozca una Ingeniera Aquí!

May 23, 2018

Mariahí music and jazz standards enlivened the multi-school fair last Saturday sponsored by Los Angeles Unified School District's Local District East. Families with students attending these schools stopped at many of the Festival’s over 80 booths. [Read more]
**Broader Impacts Pathway**

<table>
<thead>
<tr>
<th>Tap into STEM Center Event</th>
<th>Identify possible partner school for lab tour or speak/judge</th>
<th>Develop relationship with the partner school</th>
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<tbody>
<tr>
<td>Speak/Judge</td>
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<tr>
<td>Join SHINE or other programs</td>
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During the year you submit CAREER proposal:
Fall: brainstorm, STEM Center helps identify partner possibilities, meet Principal or Administrators
Spring: interaction with Partner (lab tour, meet faculty, etc.)
May: ask for a letter of collaboration from STEM Center & Partner Principal
L.A. County Racial-Behavioral COVID-19 Modeling
Joy Cheng (jcheng22@windwardschool.org)
Windward School, Class of 2022
USC Viterbi Department of Industrial and Systems Engineering, SHINE 2021

Introduction: ISE Lab Work

Work in the Industrial Systems and Engineering Lab spans topics such as chronic diseases, medical decision making, and telemedicine. Recently, Professors Shih-Yi Wu and Siu-chun Sun have been working together on a project that involves modeling COVID-19 in L.A. County to assist health policymakers.

- **Professor Wu** is building an innovative mathematical COVID-19 model for the county that considers traffic flow between geographic areas.
- **Professor Sun** runs focus group interviews with members of five L.A. communities to understand and quantify differences in behavior for the model.

Goals and Impact of Research

**Geographic and Racial Considerations**

In my research, I wanted to explore the relationships among race, behavior, and aspects of the pandemic in L.A. County and build a model schematic of COVID-19 for different parts of the county to incorporate these complexities. L.A. County is divided into eight service planning areas (SPAs): (1) Aitken Valley; (2) San Fernando Valley; (3) San Gabriel Valley; (4) Metro LA; (5) West L.A.; (6) South L.A.; (7) East L.A.; and (8) South Bay. I chose to view L.A. County at the SPA level because the county observed SPAs from a health standpoint and each SPA captures a unique set of communities in L.A. In addition, I chose to analyze trends for the five most prominent racial groups in the county: Asian (including Pacific Islander), Black, Hispanic, Native, and White (in alphabetical order).

Different SPAs have different racial breakdowns:

- **Research Question**

My goal was to figure out whether different racial groups have different pandemic-related situational or behavioral patterns that influence COVID-19 case/vaccination levels and what ultimately impact rates of flow between states in a disease compartment model. I sought to examine this question by using MATLAB to visualize data from the Understanding America Study (UAS) by USC Dornsife and the Vaccine and COVID-19 Surveillance Databases provided by the L.A. County Department of Public Health.

Behavior and Race

The data in Figures 2 and 3 were collected in the form of “Yes,” “No,” and “Unsure” answers.

Data Visualization

- **COVID-19 and Race**
  - Figure 4: Percent of each race vaccinated by age as of July 2021, PC JC
  - Figure 5: Percent of each race vaccinated by year as of July 2021, PC JC
  - Figure 6: 14-day case rate (number of cases per 10,000 people) by race from March 2020 to July 2021 and from May to July 2021, PC JC

Living Situation/Financial Insecurity and Race

Simple and Complex Modeling

To model the pandemic in a manageable way given time constraints, I built an uncalibrated susceptible-infected-recovered (SIR) model based on L.A. County COVID-19 parameters and probed the spread of the disease over 100 weeks using Insight Maker.

I designed a complex model schematic for COVID-19 in L.A. County that includes racial categories because of behavioral and situational differences among racial groups that affect rates of flow from box to box.

Conclusions and Predictions

- **Trends in Data**
  - There are behavioral and situational differences among racial groups that correlate with variations in case levels and vaccination rates. Trends may be caused by limited access to resources, free time, and/or vaccines for some races; a higher perceived risk of disease by Asians; a mistrust of vaccines because of historical atrocities; COVID-19-related misinformation, and more.
  - Potential biases in behavioral survey data include social desirability and the fact that there are only three responses options. These biases could explain why trends in mask-wearing data are not as clear as expected given information gleaned from focus groups.

- **Predicting SPA Behavior**
  - Because each SPA has a different racial breakdown, we hypothesize that the behaviors of each SPA reflect the behaviors of the racial groups that constitute the SPA. One way to predict the general behaviors of each SPA is to take the weighted average of the most recent data across racial groups for each behavior. We can use our findings to inform rates of flow in a COVID-19 model.

Reflections and Next Steps

Over the course of SHINE, I learned many useful skills including reading and searching for scholarly literature, using MATLAB to visualize data and solve problems, and properly following social and behavioral research best practices when handling data involving human subjects. Most of all, I valued learning about the modeling process from the professors and my mentor’s work and discovering pandemic-related trends in L.A. County. In the future, I would love to dive deeper into the mathematical aspect of model schematics and try calibrating and testing a model with different health policies. I would also like to conduct more research on why certain behavioral trends exist for different races.

Acknowledgements

Special thanks to Dr. Sutee Vatsalan and Brooke Bushey for their dedication in organizing SHINE, Professors Shih-Yi Wu and Siu-chun Sun for sharing their research and welcoming me into their lab, Anthony Nguyen for being an incredible and supportive mentor, Maya Novakovich for her help and brainstorming, Ashley Park for being an amazing lab partner and friend, and Center for Mentorship in Science for making us early to meet with me, and the rest of the SHINE team for making my summer so amazing.
Questions?

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