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Applying Engineering Principles in an Interdisciplinary Virtual Summer Camp for Underrepresented 9th - 12th Graders in Rural Louisiana

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Ahmad Fayed is an Assistant Professor of Engineering Technology, a former member of the Experiential Learning team, and the Teaching Excellence Team at Southeastern Louisiana University. Ahmad holds a Ph.D. in Mechanical Engineering from the University of Nevada Las Vegas (UNLV) and taught several engineering classes at multiple schools including University of Nevada Las Vegas (UNLV), University of Nevada Reno (UNR) and Purdue University Northwest (PNW). His research interests include Engineering Education, Computer Vision, Robotics, Active Vibration Control and Optimization.

Dr. Deborah Athas Dardis, Southeastern Louisiana University
Dr. Bonnie Achee, Southeastern Louisiana University

In addition to her primary roles of undergraduate coordinator and instructor for the Department of Computer Science at Southeastern Louisiana, Dr. Achee also serves as faculty advisor for the student chapter of ACM-W, Women in Computing. She founded the Lion's Code Coding Camp to provide a summer program for pre-college students and recruit students to the discipline and university. Her research focus is computer science education.

Dr. Wendy J. Conarro, Southeastern Louisiana University
Dr. Mehmet Emre Bahadir, Southeastern Louisiana University

Mehmet Emre Bahadir is an Assistant Professor of Industrial Technology at Southeastern Louisiana University. His teaching and research interests are in the field of product design, industrial ecology, sustainable manufacturing, and additive manufacturing.

Dr. Troy Williams, Southeastern Louisiana University

Troy Williams is an Instructor of Physics in the Department of Chemistry and Physics at Southeastern Louisiana University. In his capacity at Southeastern, Dr. Williams has designed and led multiple STEM Educator professional development institutes focused on facilitating improving educator content knowledge and communication amongst STEM disciplines. His research interests in physics focuses on student-centered collaborative problem solving. Dr. Williams also serves as Co-Lead of the Northshore STEM Coalition, a member of the national STEM Learning Ecosystem network. As part of the Northshore STEM Coalition, Dr. Williams has helped to organize, develop, and deliver STEM programming to underserved communities. Troy holds a B.S. and M.S. in Physics and a Ph.D. in Science and Mathematics Education from Southern University and A&M College.

Dr. Mohammad Saadeh, Southeastern Louisiana University

I am the Department Head of Industrial and Engineering Technology at Southeastern Louisiana University. I received my first two degrees in Mechatronics Engineering in Jordan and Malaysia, respectively. In 2012 I graduated from UNLV with Ph.D. in Mechanical Engineering and immediately joined Southeastern as an Assistant Professor. I work in the area where Mechanical meets with Electronics to produce a nice mix called Mechatronics. I enjoy working with students while teaching in classroom, or in the lab doing research.

Tireka Cobb Ph.D., Louisiana Office of Student Financial Assistance

Dr. Tireka Cobb serves as the Director of LOSFA Field Outreach Services and Project Director for Louisiana GEAR UP. She and her team work to remove barriers and to promote, provide, and prepare students for their future post-secondary journey. Dr. Cobb has a Bachelor of Arts degree in English and Sociology, a Master of Business Administration, and a Doctor of Philosophy (Ph.D.) degree in Educational Leadership and Research, specializing in Educational Technology.

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Experience of delivering a virtual STEM focused summer program to pre-college students in the midst of the COVID-19 pandemic is presented. The program was offered to a diverse underrepresented population of 9 - 12th graders in rural Louisiana with a great opportunity to reach an otherwise underserved segment of the population.

SETTING

- Two weeks (Ten-day) summer program
- Applications of engineering principles across disciplines in a virtual setting
- Eight different modules (minicamps)
- One segment of a comprehensive on-going initiative to serve students and educators from underrepresented communities

DELIVERY METHODS/TOOLS

- Moodle was the delivery platform
- Kahoot, TinkerCAD, YouTube were used
- Supply kits were mailed to each student
  - 3D printed parts, Microcontroller boards, ...
- Groups of 8 – 10 students rotate through a different mini camp each day
- Continuous, virtual mentoring from faculty and near-peers (undergrad) using Google Meet
- Group discussions on content materials
- Hands-on, active learning with virtual guidance

8 MINI CAMPS

1. 3D Design and Printing - Students designed and built a medical face shield
2. Physics Roller Coaster- Student completed simulations and then designed and built roller coasters and catapults
3. Mechatronics - Students assembled simple mechanical robots called brush bots and used TinkerCAD's Circuit to construct LED Light Shows using an Arduino and electronic components.
4. Cosmetic Chemistry- Students made bath bombs, sugar scrub exfoliants, and natural toothpaste
5. Battle of the Bug- Students built a model virus, performed 'transmission' experiments using Glo-Germ powder, determined the sugar content of food, and collected data on heart and respiratory rates at rest and during exercise
6. Aquaponics- Students assembled a pre-designed aquaponics system in their home and designed and drew a complete aquaponics system
7. HomeLion CyberSecurity- Students acted as investigators and collected evidence in a real-world, gaming experience to identify the cyber criminal
8. Architecture- Students cut out and assembled cardstock structures and built 3-D model homes on TinkerCAD

CHALLENGES

- Access to equipment
- Internet connection reliability
- Microphone or camera did not work
- Devices and software incompatibility
- Unfamiliar with delivery platform (Google Meet and Moodle)
- "Down-time" for students who finished projects quickly

LESSON LEARNED

- Chromebooks loaned out
- Supply boxes and minicamp instructions must be stand-alone
- Must ensure software compatibility
- Short tutor session on how to use delivery platforms
- Provide short, interesting activities to 'fill in' the gaps

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STATISTICS

- 76 students from 35 schools registered
- 63 students from 30 schools attended
- Project Completion:
  - Aquaponics 57%
  - HomeLion Security 69%
  - Mechatronics 66%
  - Battle of the Bug 51%
  - 3D Design 36%
- 76% reported experience was better than expected
- Battle of the Bug had the highest post-camp experience rating
- Scores increased slightly in pre-post knowledge challenges in Battle of Bug; post camp survey showed that over 65% desired to live healthy lifestyle
- Modest, but not significant increases in pre-post challenge in Roller Coaster minicamp
- Most enjoyed: hands on activities (29%), learning new things (25%), using the stuff in my box (23%)
- Enjoyment matched projected interest (A.3 and A.4)
- Most concerns: not keeping up, not knowing how to use technology and having technology work (A.5)
- Over half of students had no negative feelings towards any elements of the minicamps (A.6)

Fig. A.3. Future Fest 2020 Morning Poll Item 2 - Participant Interest

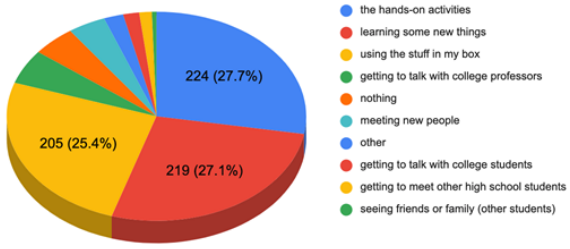


Fig. A.4. Future Fest 2020 Afternoon Poll Item 2 - Participant Enjoyment

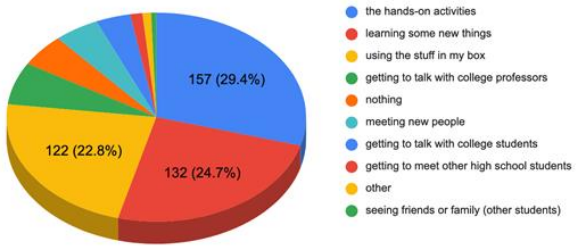


Fig. A.5. Future Fest 2020 Morning Poll Item 3 - Student Concerns

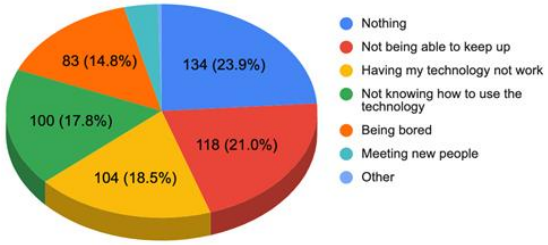
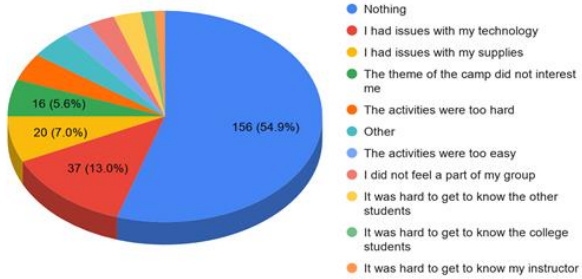
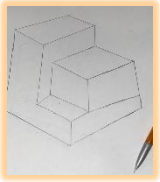


Fig. A.6. Future Fest 2020 Afternoon Poll Item 3 - Elements Students Did Not Care For





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SOUTHEASTERN LOUISIANA UNIVERSITY

Kahoot!

TINKERCAD AUTODESK TINKERCAD From mind to design in minutes

moodle

http://www.southeastern.edu/acad_research/programs/stile/stemsummer/futurefest/index.html