Lessons learned from the first implementation year at the University of Memphis

Chrysanthe Preza
Kanuri Professor and Chair
*Electrical & Computer Engineering Department*
VIP Program Director
*Herff College of Engineering*
*the University of Memphis*
NSF IUSE Award 2021-2024

Chrysanthe Preza (PI)
Stephanie Ivey (co-PI)
Craig Stewart (co-PI)

Understanding the Role of Undergraduate Research and Mentoring in the Self-Efficacy, Identity, and Success of Engineering Undergraduate Students

Research training sessions
Industry speakers
VIP Summer Summit
Project assessment

https://www.memphis.edu/vip

Vertically Integrated Projects Program
The University of Memphis
VIP Course Sequence

Students enroll in progressive VIP courses for *three consecutive semesters* and participate at the appropriate level of experience to earn 3.0 hours of credit.

**ENGR 1211 - Exploration**
This course is intended for freshmen in the Honors program; students are expected to maintain involvement with the same project team for multiple terms. This course satisfies the Honors Forum UNHP 1100.

**ENGR 2211 - Introductory**
This course is intended for introductory team members; students are expected to maintain involvement with the same project team for multiple terms.

**ENGR 3211 - Intermediate**
This course is intended for intermediate team members or students who have working knowledge of the project topic.

**ENGR 4211 - Advanced**
This course is intended for advanced team members with two or more semesters of experience on the same project.
Pilot: Two VIP teams in Fall 2022

• Making the invisible visible: Engineering microscopes with deep learning
  Faculty: Dr. C. Preza, Elec. & Comp. Eng.

• Integrating Social Media, Big Data, and other Innovations to Assess Community Livability
  Faculty: Dr. S. Ivey, Civil Eng.

• Our first cohort: N = 12; 7 women; 4 Black/African American; 2 Hispanic
• 5 graduate student mentors
VIP Team expansion to include faculty from all engineering departments

3rd team added in spring 2023
- Making Sense of a Big World: Autonomous Sensing for Large Area Situational Awareness
  Faculty: Dr. Eddie Jacobs, Elec. & Comp. Eng.

Two New VIP teams available in Fall 2023!
- Winning the War on Bugs: Design of Antimicrobial Materials for Biomedical Applications
  Faculty: Dr. Jessica Amber Jennings, Biomedical Eng.
- Organizing chaos: Understanding turbulence in large-scale applications
  Faculty: Dr. Daniel Foti, Mechanical Eng.
First Year Outcomes & Observations

• Overall positive impact of the program for the students
  ▪ building community with their peers
  ▪ developing deeper understanding in the team’s technical focus area
  ▪ Improving technical writing and presentation skills
  ▪ graduate students developed leadership and mentoring skills

• Address Concerns/Challenges
  ❑ Student retention
    5 out of 12 did not continue to 2nd semester
  ❑ Clearer communication regarding how course activities scaffolded and supported the research project
  ❑ Clarify value of self-reflection in weekly journals
  ❑ Department buy in
  ❑ Approval of permanent VIP courses
  ❑ VIP course Meeting time
  ❑ Balance course work and VIP research
2nd Semester Deliverables
VIP Poster Presentations at
The UoM Student Research Forum, March 2023
The EECE Dept. Annual Competition, April 2023

Published paper in QuasesitUM - Undergraduate research journal at the UoM

2nd place winners in EECE competition
VIP Post-survey Results Spring 2023
(N=10, 4 women, 3 Black/African American; 1 Hispanic)
VIP Post-survey Results Spring 2023

To What Extent Did the VIP Program Help You Develop This Skill

- Communicate technical concepts and designs to others
- Manage a project team
- Collaborate on project team solutions
- Design systems, components or processes
- Understand computer hardware and systems

- Not at all
- Somewhat
- A great Deal
VIP Post-survey Results Spring 2023

To What Extent Did the VIP Program Help You Develop This Skill

- Work on a multidisciplinary team
- Computer programming
- Use the techniques and tools necessary for engineering practice
- Work on a project team within my discipline
- Make professional presentations

Options:
- Not at all
- Somewhat
- A great Deal
To What Extent Did the VIP Program Help You Develop This Skill

- Write professionally
- Resolve team conflicts or disagreements
- Design/conduct experiments
- Design computing algorithms
- Analyze or interpret data

VIP Post-survey Results Spring 2023
VIP Post-survey Results Spring 2023

To What Extent Did the VIP Program Help You Develop This Skill

- Peer mentoring
- Ethical decision making in engineering/research

- Not at all
- Somewhat
- A great Deal
Questions?

Partial support for this work was provided by the National Science Foundation Improving Undergraduate STEM Education (I-USE) program under Award No. 2120819. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
VIP impact on engineering identity, self-efficacy, growth mindset, persistence (student)

VIP impact on culture of inclusion (organization)

Determinants for scalable and sustainable model at UofM
<table>
<thead>
<tr>
<th><strong>Inputs and Investments</strong></th>
<th><strong>Activities</strong></th>
<th><strong>Outputs</strong></th>
<th><strong>Outcomes - Short term</strong></th>
<th><strong>Outcomes - Long term</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>University leaders</td>
<td>Development of VIP curriculum</td>
<td>Research project-based curriculum</td>
<td>Higher retention rate in STEM disciplines</td>
<td>Inclusive culture in Engineering</td>
</tr>
<tr>
<td>Participating Faculty conducting interdisciplinary research</td>
<td>Development of training units</td>
<td>Undergraduate students earn credit doing research</td>
<td>More diverse student body (gender, ethnicity, socio-economic, academic preparation)</td>
<td>Positive impact on post-graduate achievement</td>
</tr>
<tr>
<td>Diverse student body</td>
<td>Student recruitment</td>
<td>Improved undergraduate academic performance</td>
<td>Increased student engagement</td>
<td>Create STEM majors awareness in high school students</td>
</tr>
<tr>
<td>Physical meeting space conducive to teamwork</td>
<td>Development of team projects</td>
<td>Undergraduate students acquire skillset for real-world problem solving</td>
<td>Enhanced STEM identity</td>
<td>Facilitate TLSAMP student transfer to the UofM</td>
</tr>
<tr>
<td>Industry partners</td>
<td>VIP team formation</td>
<td>Improved undergraduate experience through mentoring and networking</td>
<td>Increased understanding of importance of diversity and STEM identity</td>
<td></td>
</tr>
</tbody>
</table>
How I learned about the VIP program

From May 2020 virtual graduation
UofM Vertically Integrated Projects Program

www.memphis.edu/vip