Systemic Reform of STEM Education: The Vertically Integrated Projects (VIP) Consortium

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What is Innovation?

“The development of novel products, services, and processes for the benefit of society” (NSF)

(Too Narrow)

“Inspiration plus Execution”

(Works in all Disciplines)
The Barrier: 3 Forms of Fragmentation

– By Mission
  • *Research*: Exploration, Idea Generation
  • *Education*: Knowledge, Skills
  • *Service*: Partnerships, Economic Development

– By Time
  • Semesters, Academic Years

– By Discipline

Must Overcome These

– So Everyone can Participate
– To Create a True “University-Deep” Community
Vertically-Integrated Projects Program

The VIP Approach: Foster Innovation by Involving Students in Challenging Projects Embedded in Faculty Research.

Ensure Success by Providing the Necessary:

TIME  CONTEXT  MENTORING
Vertically-Integrated Projects Program

Bringing People Together

Undergraduate Students
Faculty Research

Students need Real Projects in which they Experience the Innovation Process
Faculty can Benefit from Help at all Levels of The Innovation Process
VIP Program Architecture

- **Long-term, Large-scale Projects:**
  - Faculty Led Projects
  - Large teams: 10-20 undergraduates; 1-4 grad students
  - Sophomores through seniors on each team
  - Long-term participation – up to 3 years per student
  - New students replace those who graduate
  - Teams continue for years, decades
  - Academic credit each semester

- **Challenging, Real-World Projects**
Vertically-Integrated Projects Program

Large Teams: The eStadium VIP Team (F’10)
VIP Course Structure

VIP-X00Y

- **X** = Year:  2=Soph;  3=Junior;  4=Senior
- **Y** = Credits:  1, 2, or 3

Each course can be taken multiple times

Currently: 2811 -- 3811, 3812 -- 4811, 4812, 4813

4813 for Senior Design, Project, Thesis, or Equivalent

Each *team* is one section of *every* course

Available to all Disciplines
Model for How VIP Credits Count

Incentive to Participate Multiple Years

Take 5 or fewer credits:
- All are Approved-Elective (Free-Elective) Credits

Take 6+ credits:
- 3 to 6 Technical Elective Credits
- Rest are Approved-Elective (Free-Elective) Credits

VIP + VIP Senior Design: 8+ Credits
- 3+ Credits as a Junior
- 2 Credits (4812) 1st-Semester Senior Year
- 3 Credits of VIP Senior Design (4813)
Vertically-Integrated Projects Program

Multidisciplinary: Enrollment by Team/Major

Count

Major
- AE
- BA
- BCHM
- BMED
- CE
- CHBE
- CM
- CMPE
- CS
- DMTH
- EE
- ENVE
- ID
- IE
- MATH
- ME
- MSE
- PHBC
- PHYS
- SPEC
Vertically-Integrated Projects Program

Essential Characteristics of VIP

• VIP Program Led by Faculty
• Projects Homed in Faculty Research
• Large-Scale Projects Lasting Years/Decades
• Multidisciplinary Teams Encouraged
• Program is Curricular – Identifiable VIP Courses
• Incentives for Students to Participate for 2+ Years
• Classroom and Meeting Space Supporting Teams
• Learning Outcomes Include Development of both Disciplinary and Professional Skills
Vertically-Integrated Projects Program

VIP: Benefits to Students

- Realistic Team Experience
- Opportunity to Learn/Master different Roles/Skills
- In-Depth Experience in their Field
- Authentic Multi-Disciplinary Experience
- Knowledge Exchange across many Boundaries
- Provide a Compelling Reason to be on Campus
- Preparation for the Work / Grad School
- Understanding of the Innovation Process
- Fun!
Vertically-Integrated Projects Program

VIP: Benefits to Universities

• Enhances Student Learning
• Enhances Faculty Research
• Enables New Partnerships
• Creates Multidisciplinary Opportunities
• Compelling Reason to have a Campus
• **Everyone** Participates in the Innovation
• **Deepens/Broadens the University Community**
The VIP Consortium …. So Far:

- Boise State
- Colorado State
- Florida International
- Georgia Tech
- Howard Univ
- Morehouse College
- National Ilan Univ
- Purdue Univ
- Rice Univ
- Texas A&M Univ
- Univ of Hawaii
- Univ of Michigan
- Univ of Strathclyde
- Univ of Washington
- VA Commonwealth
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The VIP Consortium …. Additions?

- HBCU ECE Network
- Northeastern Univ
- NYU-Polytechnic
- Ohio State
- Univ. of Delaware
- UC Berkeley
- UC Davis
- ??

How to Join

- Application Process for Remaining Funded Slot
- Anyone Else Can Join
- We Can All Work on Funding
- Institutionalization is the Goal
VIP Consortium Characteristics

• All Institutions Field a Faculty-Led VIP Program
• Program Must Have Essential Elements of VIP
• Shared Logo and Branding Effort
• Share Resources/Tools/Processes/etc.
• Everyone Contributes What They Can
• Participate in Evaluation and Dissemination
• Publish Papers and Write Proposals Together
• Work Toward Systemic Reform of Higher Education
• Create VIP Consortium Entity
The Next Two Days!

• Building Our Network
• Guidance for Starting-Up and Scaling-Up VIP
  • Lessons Learned and Tools Developed
• Adapting VIP to Your Institution
• Setting Your VIP Program’s Goals
  • Number of Teams and Students
  • Evaluation
  • Diversity
  • Reporting Requirements
• Our Consortium’s Goals and How to Reach Them
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What could you do if you had a VIP team?

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