The Vertically Integrated Projects (VIP) Program and Consortium: What Matters and Why?

By: The VIP Consortium
What Really Matters in VIP and Why?

1. Language
2. Marketing
3. Access
4. Infrastructure
5. Time
6. Scale
7. Fun
8. Collaboration
1.1. Language Matters: Be Inclusive!

Scholarship and Exploration

• **Scholarship**: Development of Deep Knowledge and Expertise in One or More Fields
• **Exploration**: Acts of Discovery, Design, Creativity, Innovation, Research in One or More Fields
• Present in all Academic Disciplines!
1.2. Language Matters: Be Inclusive!

All Disciplines Can Participate

• Every additional discipline makes your VIP teams and your VIP program stronger
• Transform campus from a “Catalogue of Disciplines” to Communities of Common Interest and Action – VIP teams
2.1. Marketing Matters: Make it Easy to Find

Advertise Teams by What they Do
  Sortable by Disciplines/Initiatives/Etc.
Easy for Students to Find
  Simple Intro to the Team
  Just Enough Detail to Decide
Easy for Companies/Organizations to Find
  Find Students Interested in What They Do
  Find Faculty Interested in What They Do

Good Example of VIP Team Listing
2.2. Marketing Matters: Make it Personal

**Recruiting Students:**
- Emails that Address Each Discipline:
  - “Dear CS Students, There are VIP Teams that are Seeking your Expertise!”
- Poster Sessions

**Recruiting Faculty**
- Go to Depts’ Faculty Meetings
  - “What Could You Do if You had a VIP Team?”

**Recruiting Disciplines**
- Learn Their Language OR
- Find Someone Who Knows It
3.1. Access Matters: Stop Useless Screening!

Only Enthusiasm Matters!

- GPA Does Not Matter
- Interviews Do Not Matter
- Prerequisites Do Not Matter
  - Don’t Lock Students Out of VIP!!

When You Screen with GPA/Interviews/etc
- Fewer Underrepresented Minorities
- Fewer Talented Students
- Wasting Your Time!!
3.2. Access Matters: Time and Scale

Students *Develop* While on Your Team

- Learning from You, Your Graduate Students, Their Teammates, Project Partners, etc.
- Time Together Smashes Disciplinary Barriers
  - Not More Courses!
- Prerequisites Do Not Matter!

There Will be Outstanding Students

- Even if You Picked Them Randomly
  - The Law of Large Numbers is a Friend
- Screen by Enthusiasm → More Great Students
4.1. Infrastructure Matters: Websites/Webtools

Website for Advertising and Applying for Teams

Easiest Way to Advertise Teams
Put a Link on It for them to Apply for Team of Their Choice
– Applications go in a Database for Admission Decisions –
Admit Using ONLY Year, Discipline, Credits and Enthusiasm

Web-Based Student Assessment (Grading) Tools

Grading and Peer Eval. Tools On-Line and Easy to Use
Making Grading Easy for Advisers Makes Better Advisers!
Other Possibilities Besides A, B, C,... Can Work
4.2. Infrastructure Matters: Databases

Database of All Student Assessments over Time
- Great for Seeing How Students Develop on Your Team
- Great for Education Research
- Good for ABET Visits!!

Team Health Assessment (Grading) Tools
- Peer Evaluations Used by Adviser
- Social Network Diagrams to see Team Structure
- Grades Over Multiple Semesters
- Shut Down Dysfunctional Teams
5.1. Time Matters: Deep Learning and Doing

Students Participate for 3 to 6 Semesters
- Develop Deep Expertise in Their Field
- Learn to Work with Other Disciplines
- Seniors Functioning at an MS Level

Teams Last Many Years/Decades
- Work Evolves with the Advisers Research
- Example: Can Create Complex Systems that Work!

Enable Research Opportunities; Raise Funds!
5.2. Time Matters: Taking Over Campus!!

Spread Throughout Campus
Everyone Knows About It
Partners Come Calling
Included in Research Proposals

Development Opportunities
Endowments!
Corporate Partnerships!
New Proposal Opportunities (OSP; NSF; etc.)
6.1. Scale Matters: Teams and Programs

**Bigger VIP Teams Can Do More**

≥ 10 Students Enables Continuity Across Semesters, Years
VIP Teams of 55, 70 Students Exist
**Can Include More Disciplines**

**Bigger VIP Programs can Do More**

Easier to Attract More Faculty
Easier to Attract New Disciplines
**Easier to Get Committee Approvals!!**
6.2. Scale Matters: 19 year old Stadium-IoPT Team
6.3. Scale Matters: Ignition at 10 ~ 20 Teams
### 6.4. Scale Matters: Campus-wide VIP Courses

<table>
<thead>
<tr>
<th></th>
<th>1 credit</th>
<th>2 credits</th>
<th>3 credits</th>
<th>For pay (0 credits)</th>
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<td><strong>2nd Year</strong></td>
<td>VIP 2601</td>
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<tr>
<td><strong>3rd Year</strong></td>
<td>VIP 3601</td>
<td>VIP 3602</td>
<td>VIP 3603 by dept. request</td>
<td>VIP 3600</td>
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<tr>
<td><strong>4th+ Year</strong></td>
<td>VIP 4601</td>
<td>VIP 4602</td>
<td>VIP 4603 by dept. request VIP 4813 capstone</td>
<td>VIP 4600</td>
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<td>VIP 6601</td>
<td>VIP 6602</td>
<td>VIP 6603</td>
<td>VIP 6600</td>
</tr>
</tbody>
</table>

- Each course can be taken multiple times
- Each *team* is one section of *every* course
- Available to all Disciplines
6.5. Scale Matters: Team Count, Size, Disciplines
7.1. Fun: Everyone is Interested

Faculty Start Teams Because they Want Them

- Ensures that Teams Last a Long Time
- Have Source of Funding Because its Their Research

The Team Produces Results for Faculty

Students Join the Teams of Interest to Them

- Enthusiasm Drives Them
- They Want to Make a Difference

Improves Their Job and Grad School Prospects
7.1. Fun: Make a Difference

work hard.

have fun.

make a difference.
8.1. Collaboration Matters: At All Levels

Within Teams

Across Disciplines

Between Universities

Around the World
8.2. Collaboration Matters: The Consortium, 2018
The VIP Program: Essential Characteristics

- VIP Program Led by Faculty
- Projects embedded in Professors’ Scholarship and Exploration Efforts
- Large-Scale Projects Lasting Years/Decades
- Multidisciplinary Teams Possible/Encouraged
- Program is Curricular; All Students Graded
- Incentives for Students to Participate for 2+ Years
- Classroom and Meeting Space Supporting Teams
- Learning Outcomes Include Disciplinary and Professional Skills
The VIP Consortium: Essential Characteristics

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• Program Must Have Essential Elements of VIP but Adapt as needed to Local Conditions
• Share Resources/Tools/Processes/etc.
• Everyone Contributes What They Can
• Participation in Evaluation and Dissemination
• Publish Papers and Write Proposals Together
What could you do if you had a VIP team?

http://www.vip.gatech.edu

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VIP Program Architecture: The Basics

Enable Long-Term, Large-Scale, Multidisciplinary Teams

- Project teams led by faculty; embedded in their S&E activities
- Large teams: 10-20+ undergraduates; 1-4 grad students
- 2\textsuperscript{nd} through final year undergraduates students on every team
- Long-term participation – up to 3 years per student
- New students replace those who graduate
- Students drawn from all disciplines needed by the project
- Teams continue for many years
- Academic credit and grades each semester
VIP Enrollment: By Major, Spr. 2019

- Computer Science: 387
- Mechanical Eng: 133
- Biomedical Eng: 83
- Electrical Eng: 76
- Industrial Eng: 63
- Aerospace Eng: 48
- Computer Eng: 39
- Chemical and Biomolecular Eng: 16
- Materials Science and Eng: 3
- International Affairs and Modern Languages: 2

Other majors have fewer enrollments.
Evaluating the Performance of VIP Students

• Grading Process: Middle and End of Each Semester
  • Every Student Graded A, B, C, D, F / Other Scales Possible
  • No P/F, No Auditing, No Volunteers

• Peer Evaluations – Specific to VIP (CATME not a good fit)

• Three Components in Grading:
  • Documentation: Journals, Wiki, GitHub, Presentations, Reports, ...
  • Individual Contributions: Judged by Team Advisers
  • Teamwork: Observations plus Peer Evaluations
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<tr>
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<th>Class</th>
<th>Major</th>
<th>Semesters</th>
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<td>EE</td>
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<tr>
<th>Midterm</th>
<th>Peer Eval</th>
<th>Enter Grades</th>
<th>Release Student Grade</th>
</tr>
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<tr>
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<td>Edit / View</td>
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<td>of / by</td>
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</tbody>
</table>

Grading Interface for Instructors
Grading Form:

Categories

Documentation
A- Notebook Maintenance
A- To Do Lists
A- Meeting Notes
A- Usability
A- Overall Design Notebook Evaluation
B- Wiki Content Quantity
A- Wiki Content Quality
  SVN code logged frequently
  Code Quality
A- Overall Documentation

Accomplishments and Effort
Tutorials and Learning Modules
Team and sub-team quizzes
Papers and Technical Articles
A- Pursues Independent Learning
A- Self Motivated
A- Independent Effort
B+ Quality of Effort (results)
A- Overall Effort

Teamwork and Interaction
Team meeting attendance
Team meeting participation
A- sub-team meeting attendance
A+ sub-team meeting involvement
A- Contributes useful ideas
A- Recognizes others ideas
B- Focuses effort on achieving goals
  Involves others in effort
A- Assists others with their efforts
  Manages time and tasks well
B- Leadership skills
  Final Presentation
  Peer Evaluations
A- Overall Teamwork Evaluation
<table>
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<tr>
<th>Question</th>
<th>Evaluation</th>
<th>Evaluation</th>
<th>Evaluation</th>
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<tbody>
<tr>
<td>1. How often do you interact with each person below?</td>
<td>5 / 5</td>
<td>5 / 5</td>
<td>5 / 5</td>
</tr>
<tr>
<td>2. How often do you get suggestions/advice from each person below?</td>
<td>4 / 4.7</td>
<td>5 / 4.7</td>
<td>4 / 4.7</td>
</tr>
<tr>
<td>3. How often do you give suggestions/advice to each person?</td>
<td>5 / 3.7</td>
<td>4 / 4</td>
<td>3 / 4</td>
</tr>
<tr>
<td>4. Participation in team meetings/class:</td>
<td>5 / 4</td>
<td>4 / 4</td>
<td>4 / 4</td>
</tr>
<tr>
<td>5. Participation in subteam meetings or breakout discussions:</td>
<td>5 / 4</td>
<td>4 / 4</td>
<td>3 / 4</td>
</tr>
<tr>
<td>7. Quality of work:</td>
<td>4 / 4.7</td>
<td>5 / 4.7</td>
<td>5 / 4.7</td>
</tr>
<tr>
<td>10. When encountering obstacles, how does each person react?</td>
<td>5 / 5</td>
<td>5 / 5</td>
<td>5 / 5</td>
</tr>
<tr>
<td>11. Independent Learning:</td>
<td>5 / 5</td>
<td>5 / 5</td>
<td>5 / 5</td>
</tr>
<tr>
<td>12. Team management ability:</td>
<td>5 / 4</td>
<td>4 / 4</td>
<td>3 / 4</td>
</tr>
<tr>
<td>13. Imagine your team is a company and you are the manager. VIP, Inc. has asked you to divide $10,000 in bonus money among the members of your team. EXCLUDING yourself, decide how the bonus should be divided.</td>
<td>4000 / 3333.3</td>
<td>4000 / 3333.3</td>
<td>2000 / 3333.3</td>
</tr>
</tbody>
</table>

14. Comments: Please leave comments on each person below for your instructor(s). Constructive criticism is especially helpful. 

<table>
<thead>
<tr>
<th>Comment</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very passionate about the team.</td>
<td>3</td>
</tr>
<tr>
<td>Very dedicated to learning what is needed for the team.</td>
<td>3</td>
</tr>
<tr>
<td>Could participate in discussion more.</td>
<td>3</td>
</tr>
<tr>
<td>Very knowledgable on the material related to the team. Needs to be more committed.</td>
<td>3</td>
</tr>
</tbody>
</table>
Social Network Analysis

Arrows Show Direction of Advice/help

Weight of Arrows Shows Frequency of Advice

Size of Circles ~ Sum of Incoming Ratings
How VIP@GT Credits Count: ECE/BME Example

Provide Incentive to Participate Multiple Years

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

● Take 6+ credits:
  ● 3 or 6 of them Become Technical Elective Credits
  ● Rest are Approved-Elective (Free-Elective) Credits

● VIP + VIP Senior Capstone: 8+ Credits
  ● 3+ Credits as a Junior (VIP-3601/2 then VIP-3602)
  ● 2 Credits (VIP-4602) 1st-Semester Senior Year
  ● 3 Credits of VIP Senior Design (VIP-4813)
Faculty Credit Options (Current Curriculum):

No Course Release for Adviser(s)
- Works in Depts with Low Teaching “Loads”
- Faculty will do VIP because it helps their research

One Course/Year *every year* for Primary VIP Adviser
- ½ Course/Semester matches actual time commitment
- 24+ distinct students/year for each year team operates
- Works if VIP counts as dept elective(s)/capstone

One Course/Year for *first 2 Years* for Primary VIP Adviser
- Gives credit when educating team falls on adviser
- Team is providing research benefits by year 2
- Allows dept to launch a specified # of new teams each year
Assessment: Many Aspects

Ongoing Study of Learning Outcomes + Impacts on Faculty, Departments, and Institutions

• Evaluation Teams at Boise State, Georgia Tech, Michigan

Exit Surveys: 233 VIP Students; 1781 non-VIP Students:

• Ability to work in a Multidisciplinary team:
  \[ t(1981)=4.437, p<0.001, d=0.313 \]

• Ability to work with Individuals from diverse backgrounds:
  \[ t(1987)=3.271, p=0.001, d=0.231 \]

• Understanding of technology applications relevant to your field of study:
  \[ t(2002)=3.19, p=0.001, d=0.224 \]
VIP: Benefits for Students

• Realistic Team Experience
• Opportunity to Learn/Master different Roles/Skills
• In-Depth Experience in their Field
• Long-term Multi-Disciplinary Experience
• Knowledge Exchange across many Boundaries
• Provide a Compelling Reason to be on Campus
• Preparation for Work / Grad School
• Understanding of the Innovation Process
VIP: Benefits for Faculty

- Better Organized, More Effective UG Research
- Continuity of Knowledge and Experience on Team
- Enthusiastic Minds and Hands
- Beneficial Education & Broader Impact for Grants
- Recruiting for Graduate School
- Adds New Dimension to Research Capability
- Peer Leadership and Management Reduces Workload
VIP: Benefits for Universities

• Enhances Student Learning
• Enhances Faculty Research
• Enables New Partnerships
• Creates Multidisciplinary Opportunities
• Compelling Reason to have a Campus
• Everyone Participates in Innovation
• Deepens/Broadens the University Community
The VIP Consortium: 35 Members So Far....

**United States (24)**
- Arizona State University
- Boise State University
- Colorado State University
- Drexel University
- Florida International University
- **Georgia Tech**
- Howard University
- Iowa State University
- **Morehouse College**
- New York University
- Notre Dame
- Polytechnic Univ of Puerto Rico
- Purdue University
- Rice University
- Stony Brook University
- Texas A&M University
- UC Davis
- University of Delaware
- **University of Georgia**
- University of Hawaii
- University of Michigan
- University of Washington
- VA Commonwealth University
- Virginia Tech

**International (11)**
- Inha University (Korea)
- Malmö University (Sweden)
- Natn’l Dong Hwa University (Taiwan)
- Natn’l Ilan University (Taiwan)
- Riga Technical University (Latvia)
- Universidad del Norte (Colombia)
- Universidad ICESI (Colombia)
- Universidad Mayor (Chile)
- Univ. of New South Wales (Australia)
- University of Pretoria (South Africa)
- University of Strathclyde ¹ (Scotland)

**Pending (6)**
- Georgia State University
- NCA&T University
- Reykjavik University
- Tuskegee University
- UNICAMP
- Universidad de Chile

**Legend:**
- **AAU**: Member Institution (10)
- **URM**: Underrepresented Minority Institution (7)
- ¹: Program in place prior to Consortium establishment (6)
- **Bold**: State of Georgia Institutions (3)
The VIP Consortium: 2018 Annual Meeting
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