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

By: The VIP Consortium

Georgia Tech Vertically Integrated Projects

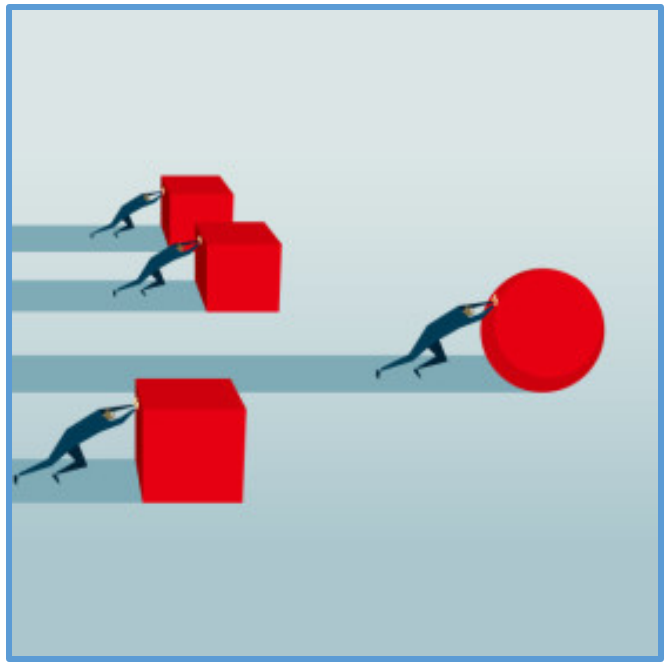
What Really Matters in VIP and Why?

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

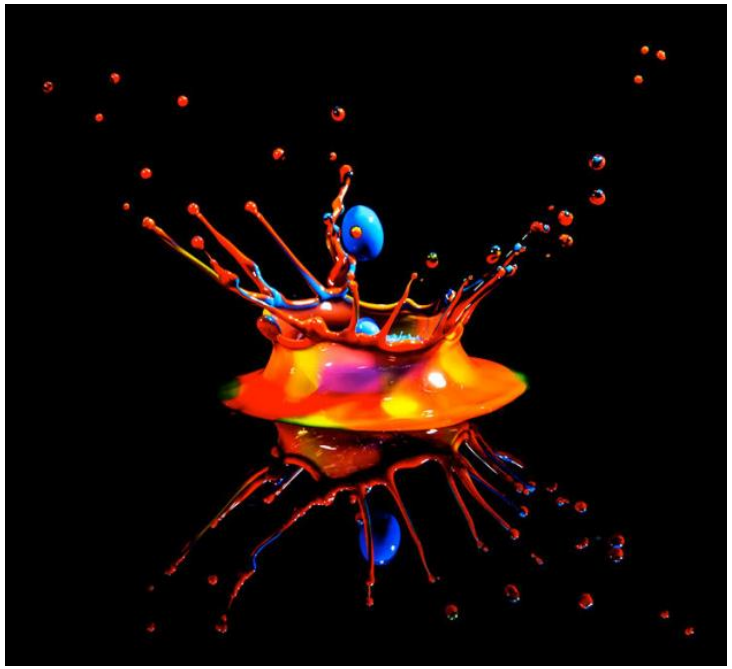
- Sortable by Disciplines/Initiatives/Etc.

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:

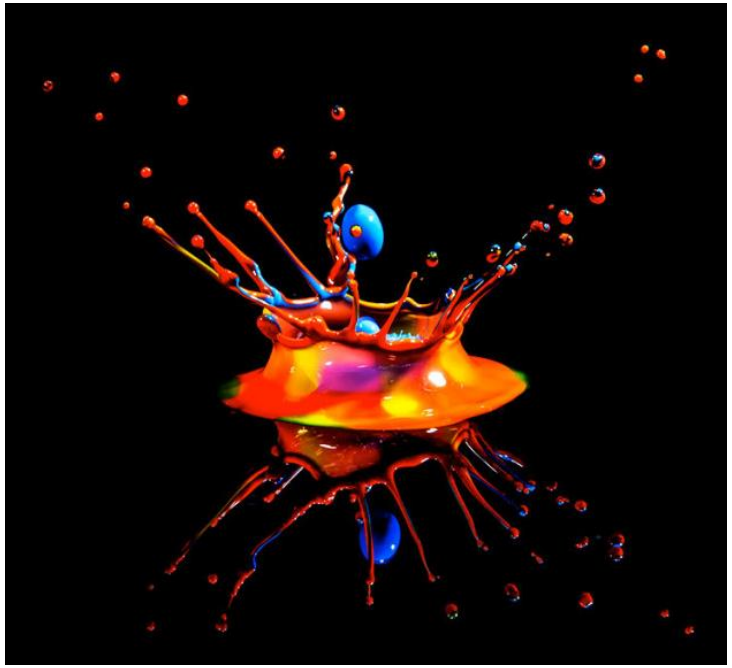
- Emails that Address Each Discipline:
  - "Dear CS Students, There are VIP Teams that are Seeking your Expertise!"
- Poster Sessions

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 –

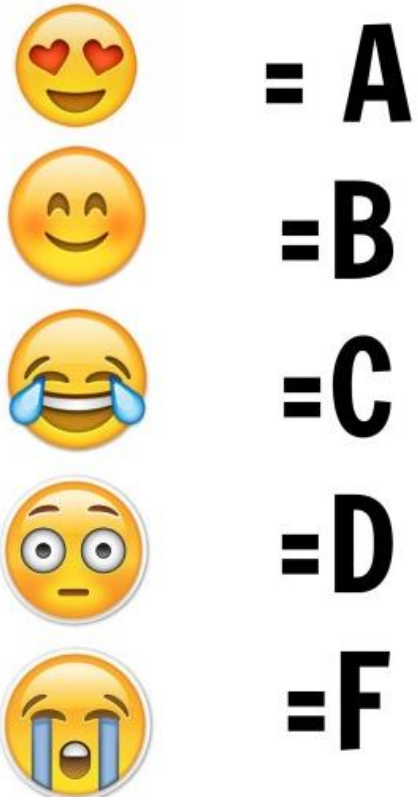
Admit Using ONLY Year, Discipline, Credits and Enthusiasm

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



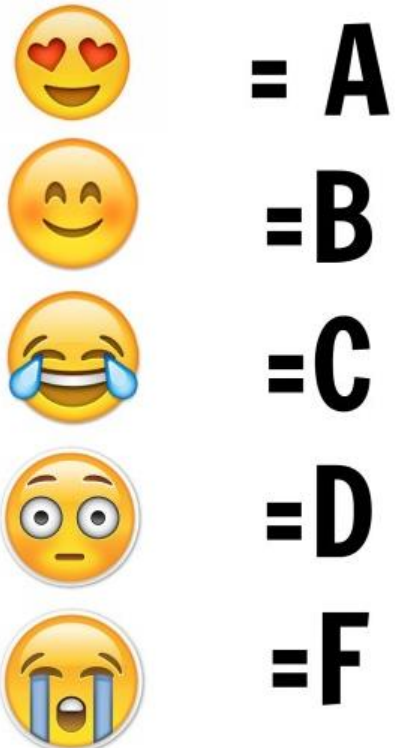
4.2. Infrastructure Matters: Databases

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



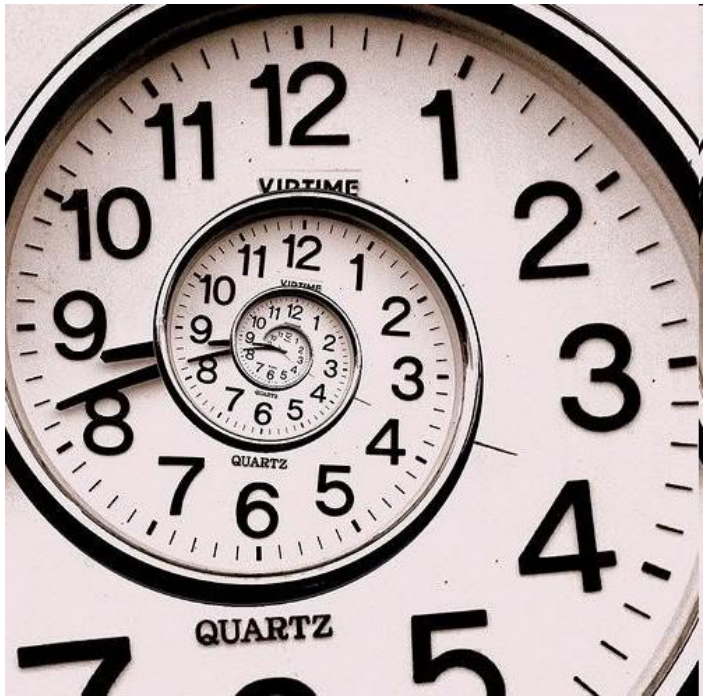
5.1. Time Matters: Deep Learning and Doing

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!



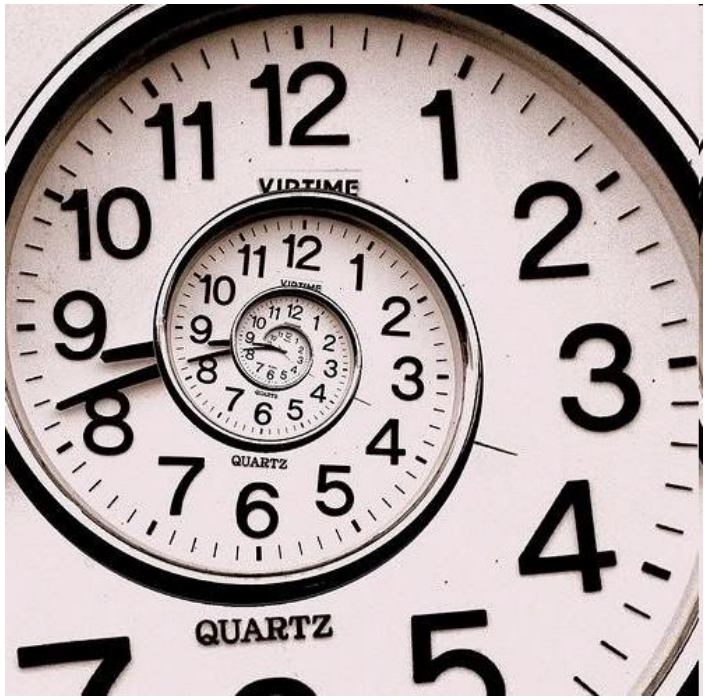
5.2. Time Matters: Taking Over Campus!!

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

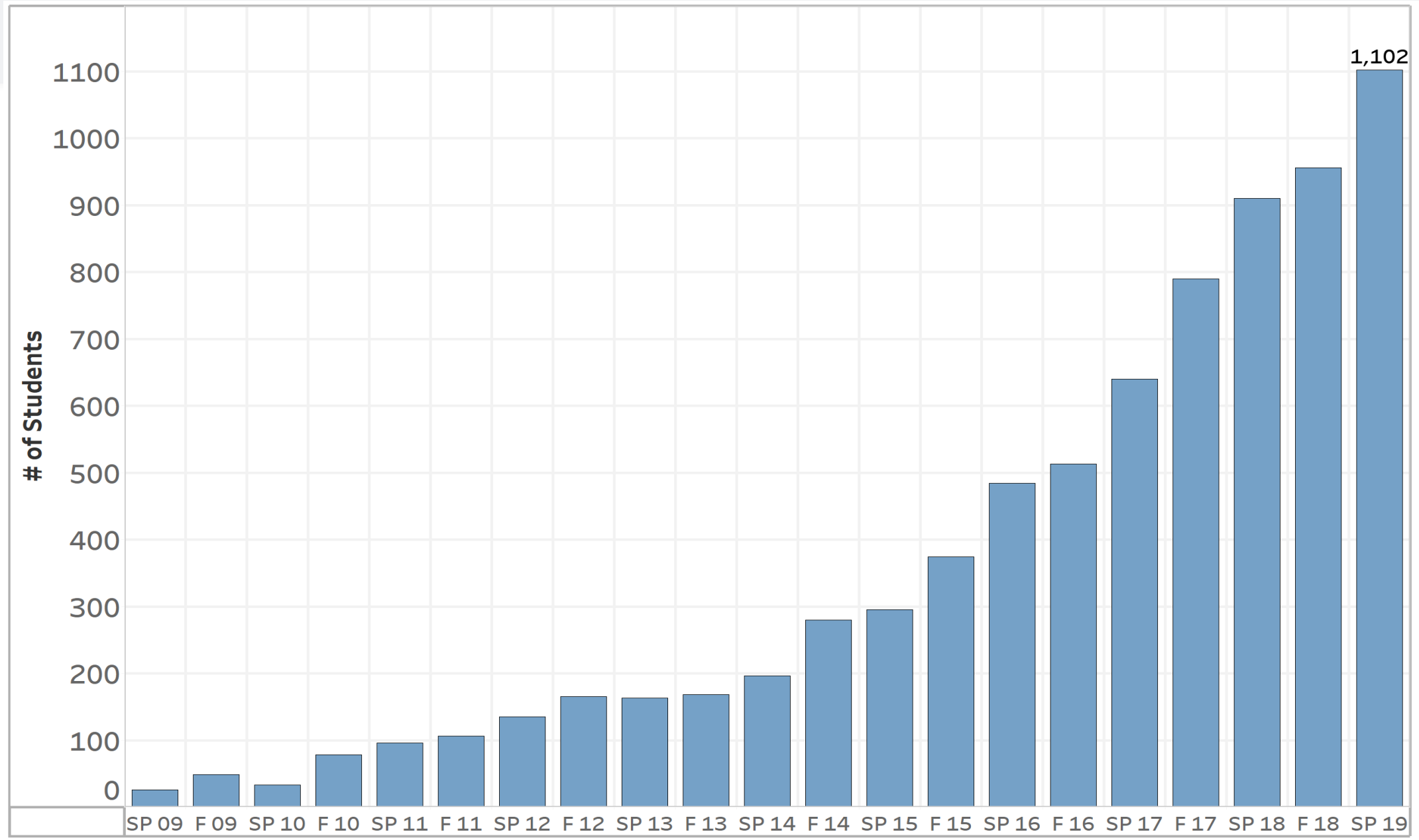
- ≥ 10 Students Enables Continuity Across Semesters, Years
- VIP Teams of 55, 70 Students Exist
- Can Include More Disciplines

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

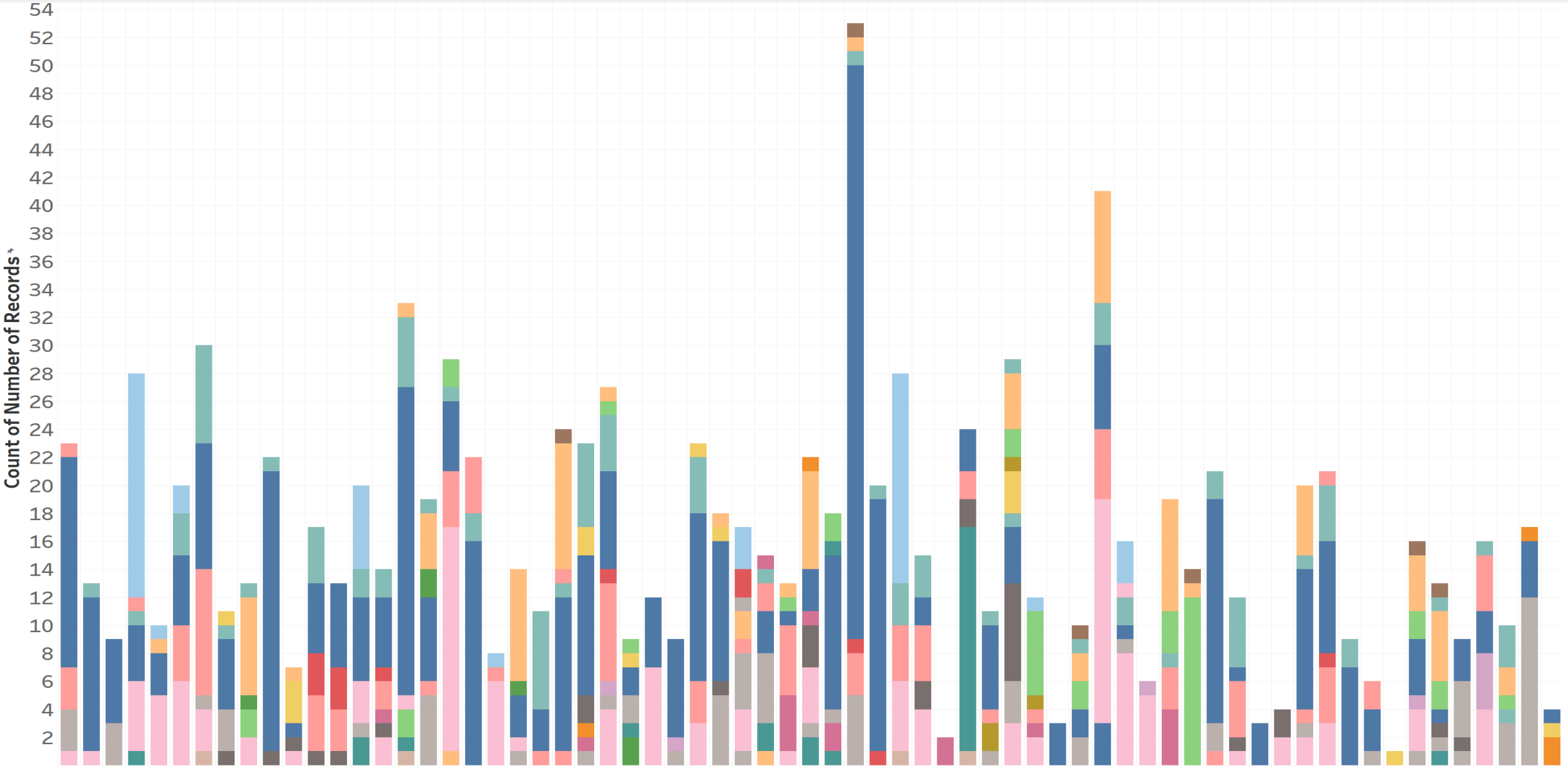


6.4. Scale Matters: Campus-wide VIP Courses

	1 credit	2 credits	3 credits	For pay (0 credits)
2nd Year	VIP 2601			
3rd Year	VIP 3601	VIP 3602	VIP 3603 by dept. request	VIP 3600
4th+ Year	VIP 4601	VIP 4602	VIP 4603 by dept. request VIP 4813 capstone	VIP 4600
Graduate	VIP 6601	VIP 6602	VIP 6603	VIP 6600

- 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

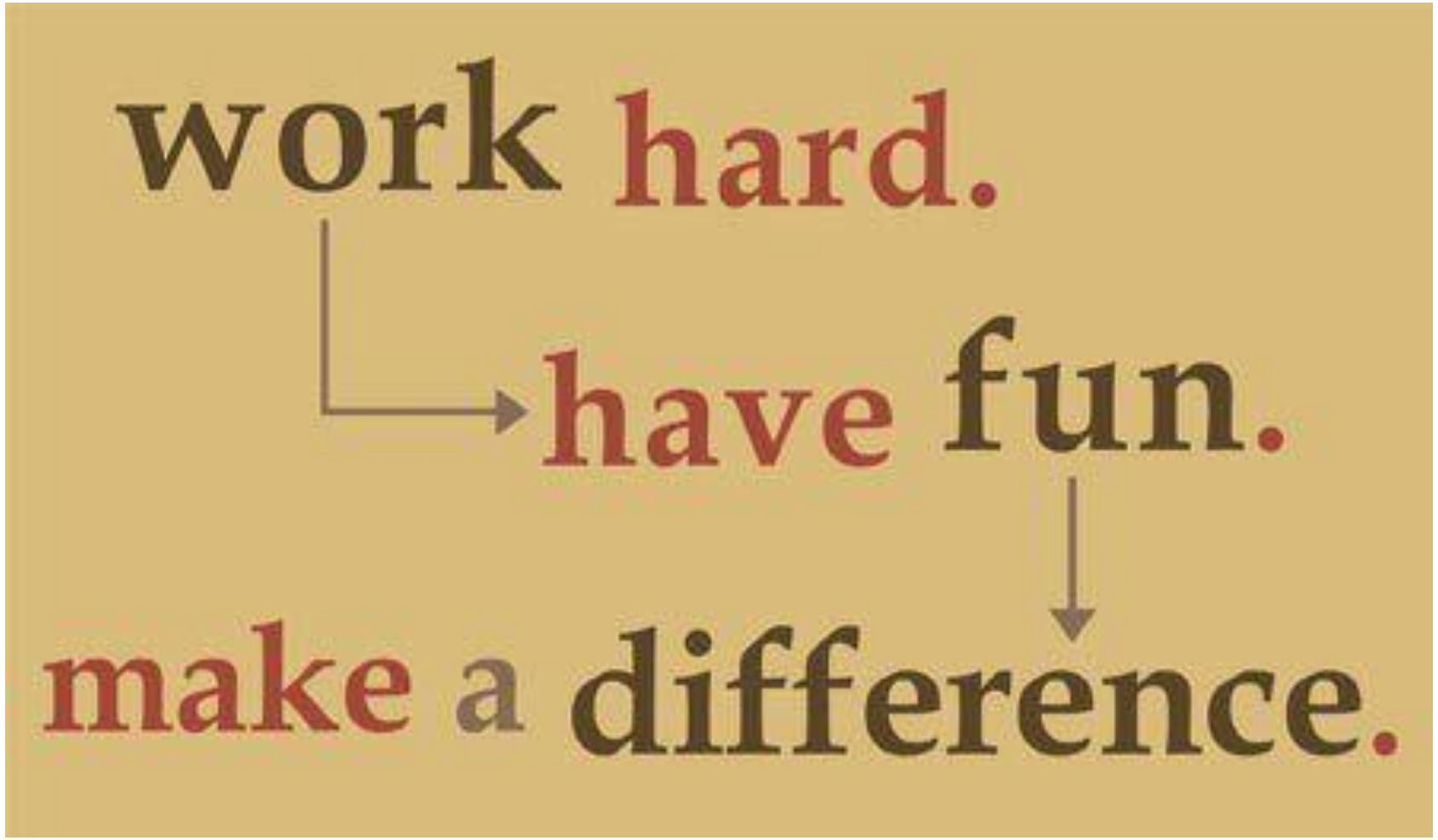
Faculty Start Teams Because they Want Them

- 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



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

- All Institutions Have a Professor-Led VIP Program
- 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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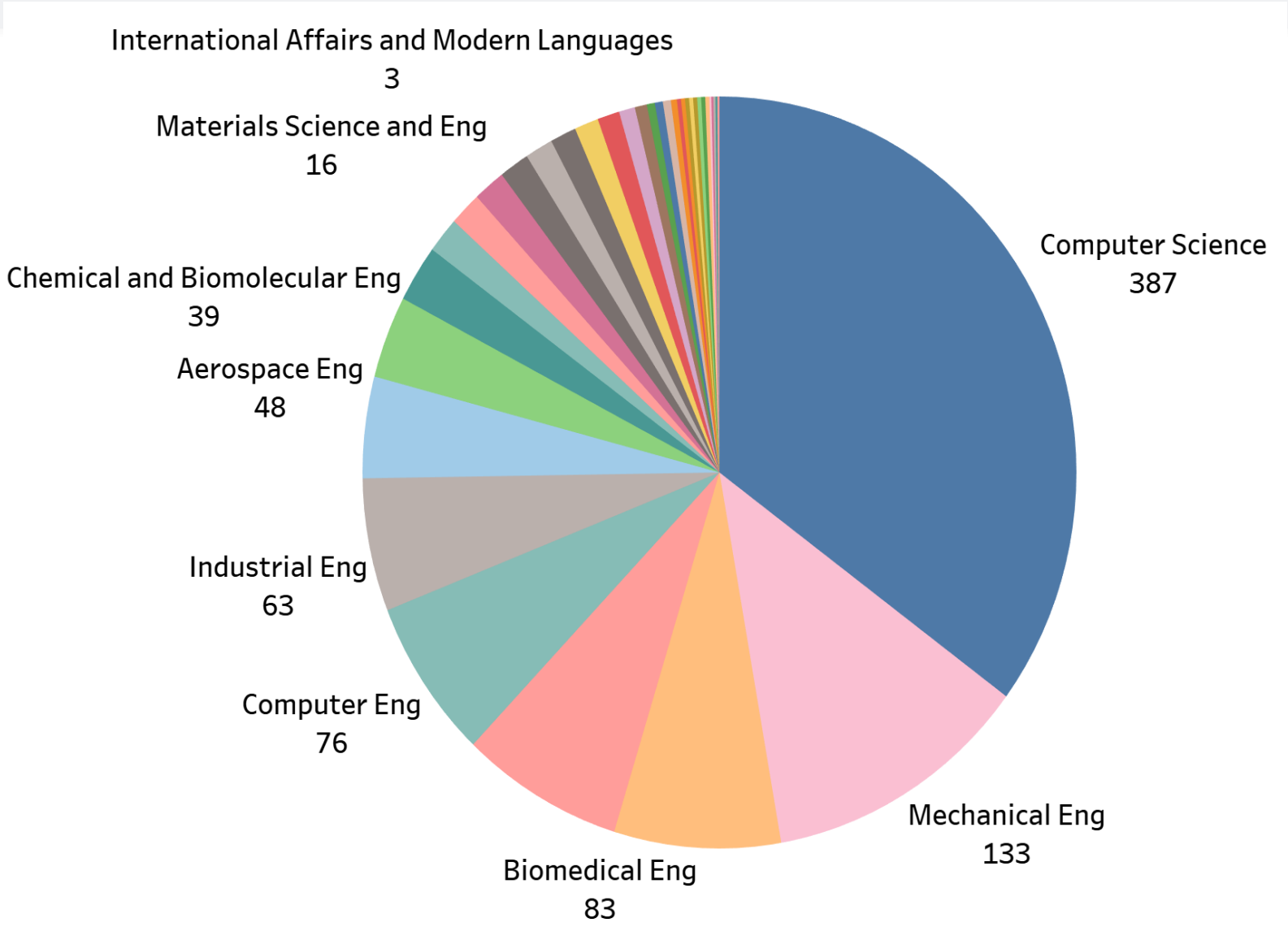
VIP Program Architecture: The Basics

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
- *2nd* 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
- Mechanical Eng
- Biomedical Eng
- Electrical Eng
- Computer Eng
- Industrial Eng
- Aerospace Eng
- Chemical and Biomolecular Eng
- Physics
- Biology
- Computational Media
- Materials Science and Eng
- Mathematics
- Neuroscience
- Environmental Eng
- Civil Eng
- Electrical and Computer Eng
- Industrial Design
- Biochemistry
- Business Admin
- Robotics
- Special Non-Degree
- International Affairs and Modern Lang
- Architectural Technology
- Bio Eng
- Chemical Eng
- History and Sociology
- Human-Computer Interaction
- Music Technology
- Psychology
- Undeclared College of Engineering
- Applied Physics
- Applied Physiology
- Architecture
- Computational Science Eng
- Machine Learning

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

Grading Interface for Instructors

Credits	Class	Major	Semesters	Email	wiki	Midterm		
						Peer Eval	Enter Grades	Release Student Grade
1	JR	CMPE	1		Wiki	of / by	Edit / View	☑
1	SR	CS	2		Wiki	of / by	Edit / View	☑
1	JR	CS	1		Wiki	of / by	Edit / View	☑
2	SR	CMPE	3		Wiki	of / by	Edit / View	☑
2	JR	EE	2		Wiki	of / by	Edit / View	☑
2	SR	CMPE	3		Wiki	of / by	Edit / View	☑
2	JR	CS	2		Wiki	of / by	Edit / View	☑
1	SR	EE	5		Wiki	of / by	Edit / View	☑
1	SO	CMPE	2		Wiki	of / by	Edit / View	☑
2	SR	EE	2		Wiki	of / by	Edit / View	☑

Grading Form: Categories

Credits: 2 **Class:** SR
Major: CMPE
Evaluation: Mid-term
Total semesters registered : 3

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**

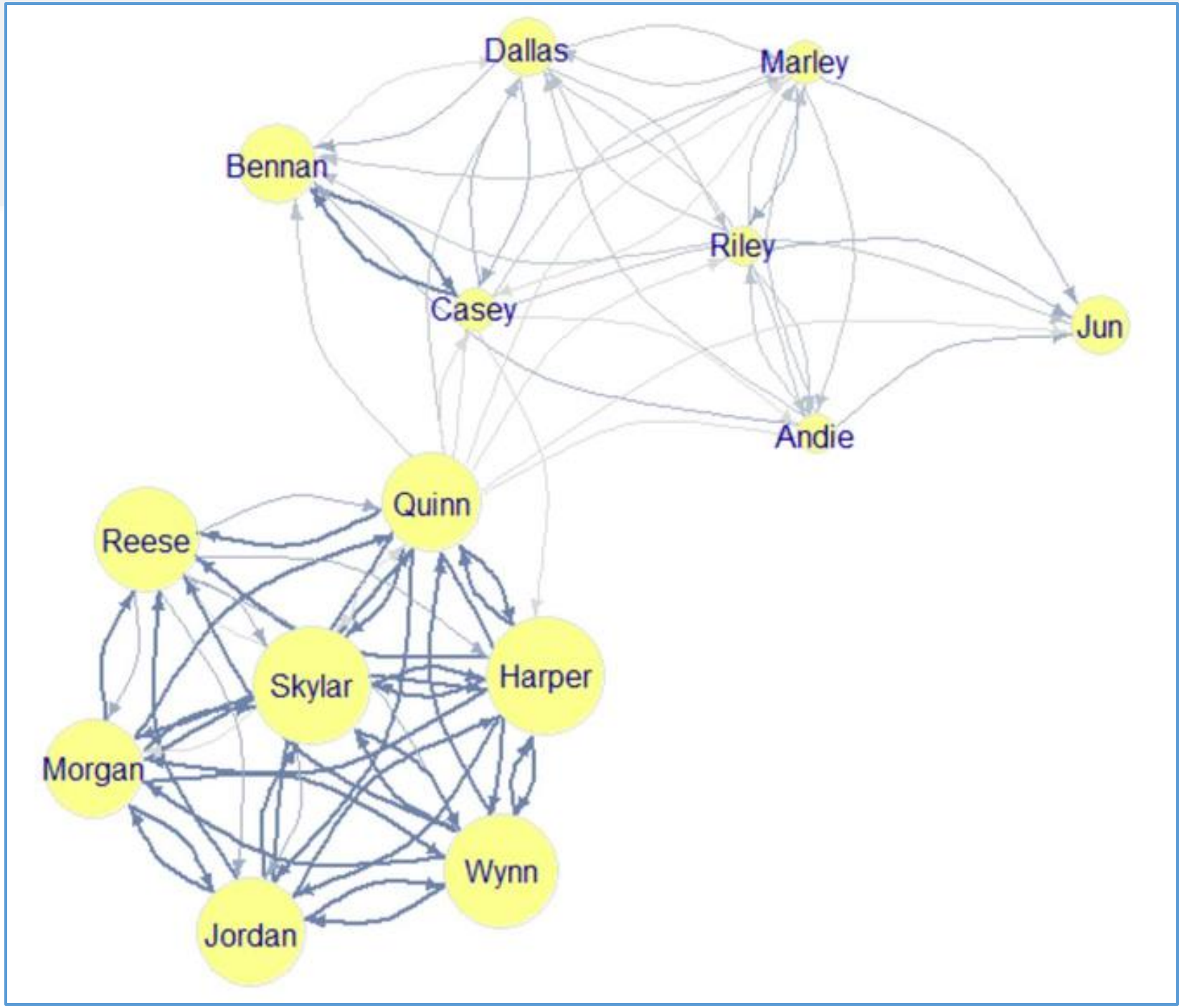
1. How often do you interact with each person below?	5 / 5	5 / 5	5 / 5
2. How often do you get suggestions/advice from each person below?	5 / 4.7	5 / 4.7	4 / 4.7
3. How often do you give suggestions/advice to each person?	4 / 4.7	5 / 4.7	5 / 4.7
4. Participation in team meetings/class:	5 / 3.7	4 / 3.7	2 / 3.7
5. Participation in subteam meetings or breakout discussions:	5 / 4	4 / 4	3 / 4
6. Documentation:	4 / 4	4 / 4	4 / 4
7. Quality of work:	4 / 4.7	5 / 4.7	5 / 4.7
8. Communication:	5 / 4	5 / 4	2 / 4
9. Dependability:	5 / 4.3	4 / 4.3	4 / 4.3
10. When encountering obstacles, how does each person react?	5 / 5	5 / 5	5 / 5
11. Independent Learning:	5 / 5	5 / 5	5 / 5
12. Team management ability:	5 / 4	4 / 4	3 / 4
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.	4000 / 3333.3	4000 / 3333.3	2000 / 3333.3
14. Comments: Please leave comments on each person below for your instructor(s). Constructive criticism is especially helpful.	Very passionate about the team.	Very dedicated to learning what is needed for the team. Could participate in discussion more.	Very knowledgable on the material related to the team. Needs to be more committed.

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 URM
- **Georgia Tech** AAU,1
- Howard University URM
- Iowa State University AAU
- **Morehouse College** URM,1
- New York University AAU
- Notre Dame
- Polytechnic Univ of Puerto Rico URM
- Purdue University AAU,1
- Rice University AAU
- Stony Brook University AAU
- Texas A&M University AAU,URM, 1
- UC Davis AAU,URM
- University of Delaware
- **University of Georgia**
- University of Hawaii URM
- University of Michigan AAU, 1
- University of Washington AAU
- 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 URM
- Reykjavik University
- Tuskegee University URM
- 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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