Bloomington Assessment and Research

# *Navigating COVID-19: Using Network Analysis To Guide Campus Course Offering Plans*

INDIANA UNIVERSITY BLOOMINGTON

# Overview

1. Background/Motivation
2. Network Analysis Overview
3. Results
   - Informing Fall 2020 Recommendations
   - Assessment After Fall 2020 Implementation
4. Q&A / Discussion: Other Applications of Network Analysis

SECTION 1

# Background/Motivation

# Indiana University  - Bloomington

1. Campus 43,000 students
2. FT Faculty 2,200
3. Course Enrollments 200,000+
4. 12,700 classes and 1,300 classrooms and 300+ general inventory
5. Previously approx 5% enrollments were online

# COVID-19 Challenges

- Planning for Fall 2020 in-person classes (exceedingly complex):
  - Conduct in-person instructions safely
  - To the extent possible:
    - All resident UGRD students enrolled in least 1 in-person class
    - Priority given to incoming beginning students
- State/Institutional guidelines continuously influx
- Space challenges
  - ~60 $ft^2$/room occupant
- Setting the Academic Calendar with many considerations

# Campus Committees

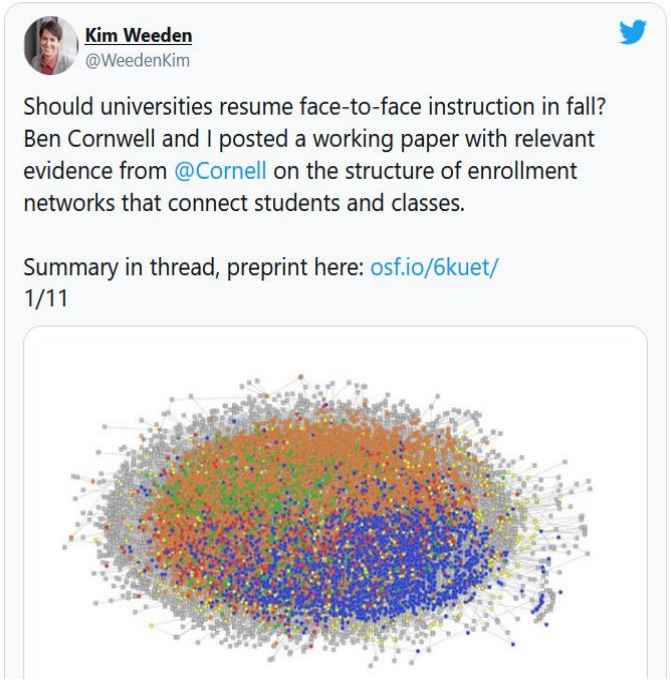
- Strategic Space Utilization Committee
  - Consider classrooms, classroom technology, academic calendaring, room scheduling practices, course delivery models and pedagogical modality to ensure instruction can be performed safely, flexibly and consistent with campus academic plans and objectives.
  - Attention of the committee focused on the “Hybrid: Return to in-person teaching with Online Offerings for Fall and/or Spring” scenario as it represented the model with the most unknowns.
  - Determined to use data to inform decision-making, especially related to planning course modality offerings
- Committee Membership
  - School Deans, Facilities Directors, Student Life, Residential Life, etc.

# Chronicle Article – Cornell University Study

- Cornell university researchers modeled course enrollment networks
- Nearly all students shared a common classmate – significant implications for higher ed in COVID-19!
- This analysis formed basis for work at Indiana University - Bloomington

‘A Very Small World’: How Data on Student Enrollment Could Help Colleges Stop Coronavirus’s Spread

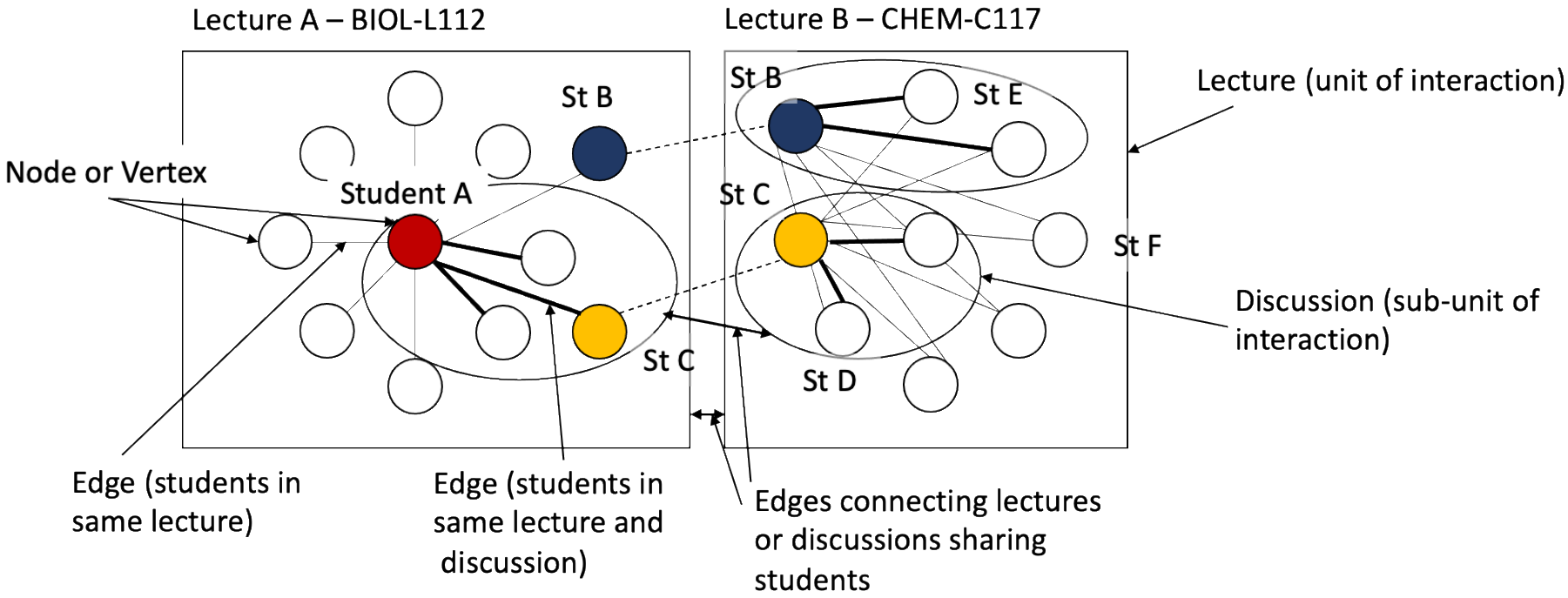
By Nell Gluckman | APRIL 17, 2020



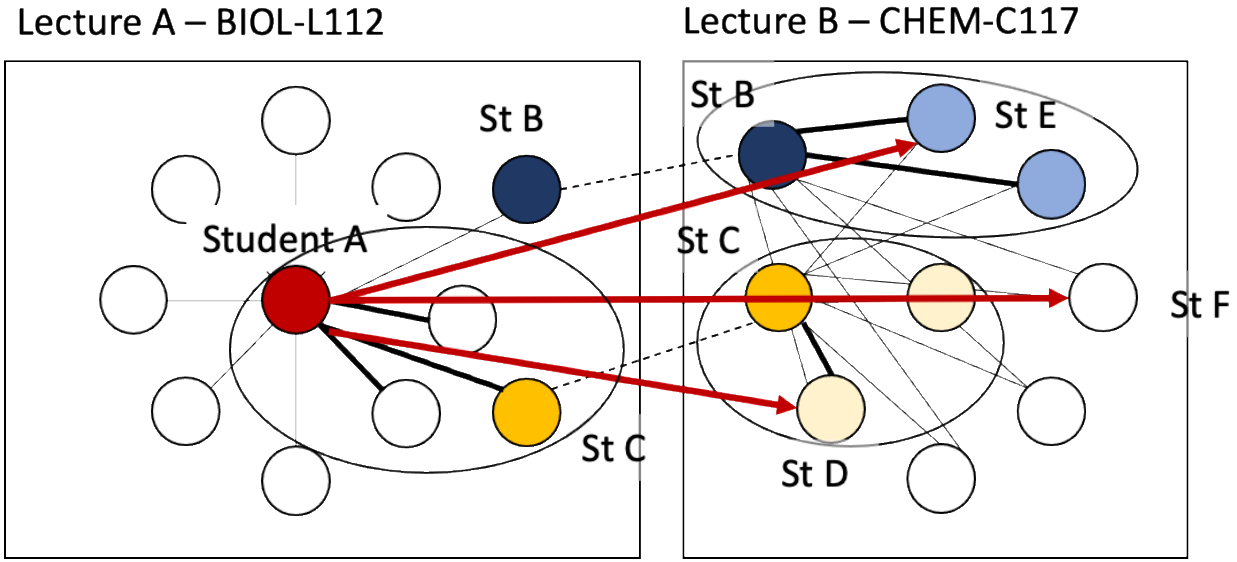
SECTION 2

# Network Analysis Overview

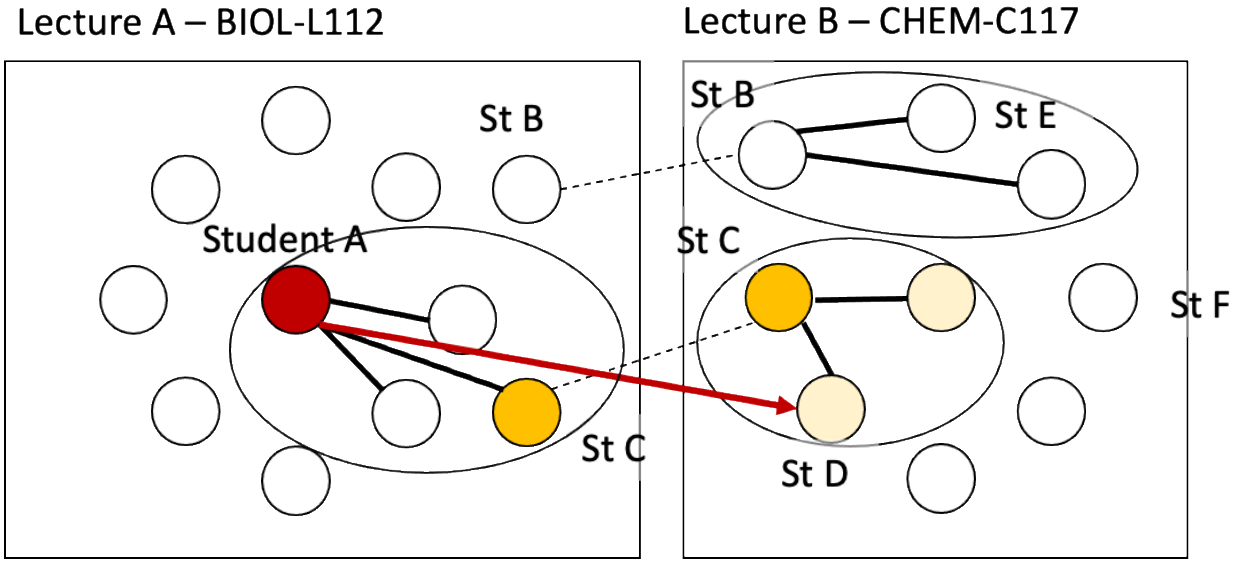
# Vertices and Edges



# Vertices and Edges



# Vertices and Edges



SECTION 3

# Results – Informing Fall 2020 Course Modality Recommendations

# Network Summary Statistics

| | NETWORK ANALYSIS METRICS | | GOAL DIRECTION |
|---|---|---|---|
| ** | Number of Edges | Number of student-to-student connections (enrollment pairs) from class activity. | ↓ |
| | Number of Vertices | Number of distinct students in the enrollment network. | ↓ |
| | Density | On average, the proportion of students who share one class activity, out of all the possible pairs. | ↓ |
| ** | Transitivity | Weighted average probability that any two adjacent vertices of a vertex are connected in the student enrollment network. This measures the clustering effect of student enrollments. Transitivity is also known as the clustering coefficient. | ↑ |
| | Average Path Length | Average shortest path from or to the vertices in the network. | ↑ |
| | Diameter | Longest path in the enrollment network between any two students. | ↑ |
| ** | Reach in 2 Steps | Average percentage of all students that can be reached within two steps through class enrollments. | ↓ |
| ** | Reach in 3 Steps | Average percentage of all students who can be reached within three steps through class enrollments. | ↓ |

Reduce Student-to-Student Contact Points : Goal Direction ↓

Increase Distance Between Students : Goal Direction ↑

# Ad hoc network simulations (Fall 2019 Data)

| Network Metrics | Scenario 1: All Course/Sections In-Person | Scenario 2: Computer Labs Online | Scenario 3: Class Size >49 Online* | Scenario 4: Multicomponent Lectures Online | Scenario 5: Non-multicomponent General Education Courses Online | Scenario 6: Scenarios 2-5 Combined | Direction Scenario 6 vs Scenario 1 |
|---|---|---|---|---|---|---|---|
| # of Edges ** | 7,458,408 | 7,367,098 | 1,483,914 | 4,868,250 | 5,407,434 | 1,119,036 | ↓ |
| #of Vertices | 38,386 | 38,362 | 37,512 | 38,374 | 38,009 | 35,919 | ↓ |
| Density | 1.0% | 1.0% | 0.2% | 0.7% | 0.7% | 0.2% | ↓ |
| Transitivity ** | 47.6% | 48.4% | 47.6% | 45.8% | 56.6% | 58.3% | ↑ |
| Average Path Length | 2.74 | 2.75 | 3.35 | 2.88 | 2.94 | 3.57 | ↑ |
| Diameter | 16 | 16 | 16 | 16 | 16 | 16 | – |
| 2 Step Reach ** | 45.1% | 44.6% | 9.1% | 34.9% | 29.9% | 5.4% | ↓ |
| 3 Step Reach ** | 78.7% | 78.6% | 65.8% | 77.0% | 76.4% | 52.4% | ↓ |

*Class size > 49 was found to be optimal; other class size cutoffs were simulated but are not shown.

SECTION 4

# Results – Assessment After Fall 2020 Implementation

# IUB Fall 2020 Class and Student Modality Summary

## Classes

- **All Classes:** 30% In-person, 45% Online (25% Research (RES) or Independent Study (IND))
- **Undergraduate:** 38% In-person, 62% Online (*not including RES/IND*)
- **Graduate:** 49% In-person, 51% Online (*not including RES/IND*)

## Student Enrollments

- **All Student Enrollments:** 58.6% In-person, 35.3% Online, 6.1% RES/IND
- **Undergraduate: 65.1% In-person**, 33.9% Online, 1% RES/IND
- *2 or more classes in-person: 35.6% of UGRDs*
- **UGRD Beginners: 72.7% In-person,** 27.3% Online, .1% RES/IND
- **Graduate:** 33.5% In-person, 42.7% Online, 23.7% RES/IND

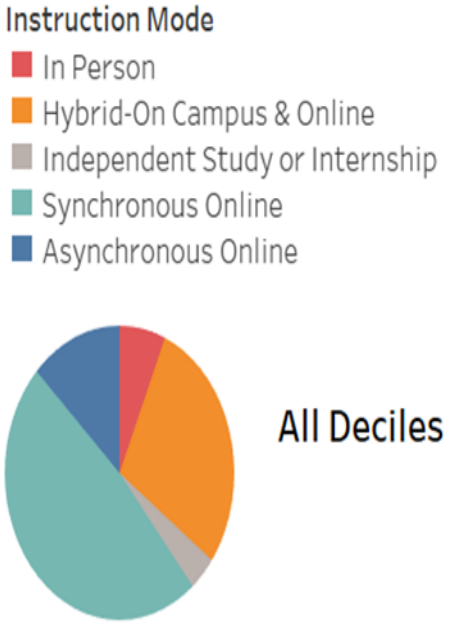
*"In-person" reflects enrollment in at least one class with an in-person class component.*

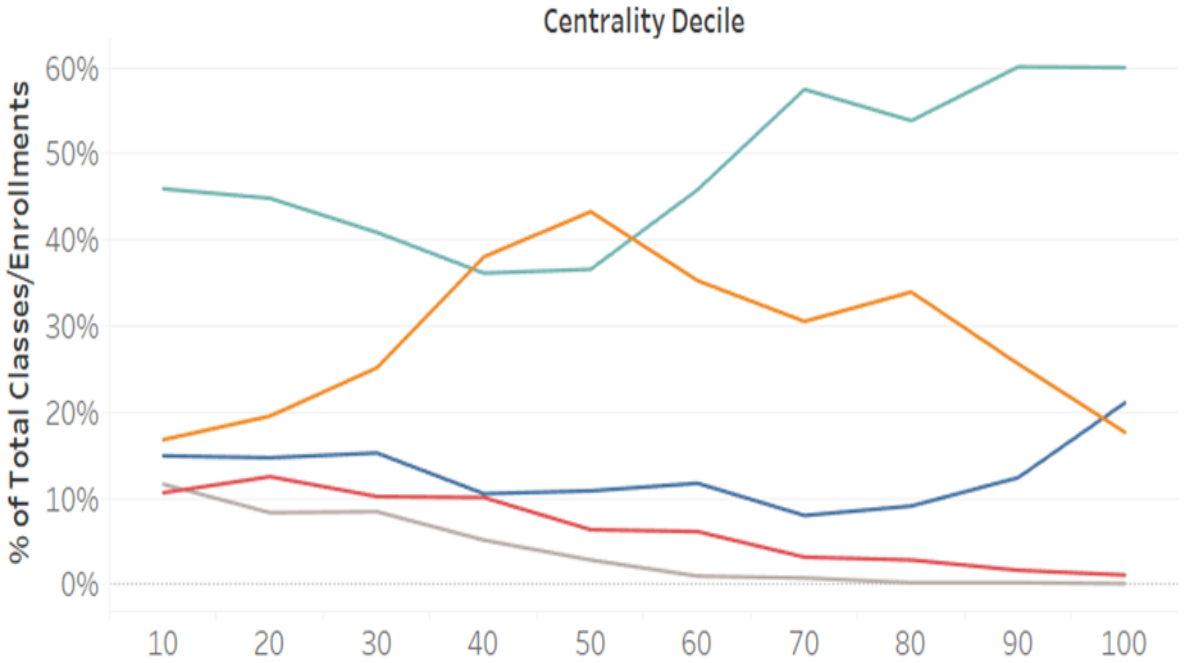
# Monitor Fall 2020 and Spring 2021 Statistics Against Simulated Recommendation

| Metric | Fall 2019 | | Fall 2020 | Spring 2021 |
|---|---|---|---|---|
| | In Person (Traditional Semester) | Simulated Committee Recommendation | In Person | In Person |
| Number of Edges | 7,458,408.00 | 1,119,036.00 | 736,095.00 | 482,823.00 |
| Number of Vertices | 38,386.00 | 35,919.00 | 24,436.00 | 20,161.00 |
| Density | 0.01 | 0.00 | 0.00 | 0.00 |
| Transitivity | 0.48 | 0.58 | 0.78 | 0.80 |
| Average Path Length | 2.74 | 3.57 | 3.97 | 4.70 |
| Diameter | 16.00 | 16.00 | 18.00 | 27.00 |
| Reach in 2 Steps | 0.45 | 0.05 | 0.04 | 0.03 |
| Reach in 3 Steps | 0.79 | 0.52 | 0.31 | 0.24 |

# Use Class-Level Network Statistics to Assess Impact (Fall 2020)

- **Localized Network Statistics:** compute network statistics for each class and rank classes from lowest to highest decile
- **Key Takeaway:** the most central classes (classes in highest centrality deciles) had smallest likelihood of meeting in person



SECTION 5

# Conclusion

# Conclusion

- Network analysis provided a structure to facilitate difficult campus-wide discussions and decisions about course delivery.
- Well received on campus
- Network analysis can be used in other higher education applications

# Brainstorm Other Ideas for Applications of Network Analysis

- Question 1: Have your campus applied network analysis in the past? To address what questions?
- Question 2: Where do you think are the potentials for this type of analysis?
- Question 3: What do you think are the limitations of this type of analysis?

Thank you!

Special Acknowledgement to Indiana University Network Science Institute: https://iuni.iu.edu/

Contact Us:

Bloomington Assessment & Research – vpuebar@indiana.edu

INDIANA UNIVERSITY BLOOMINGTON