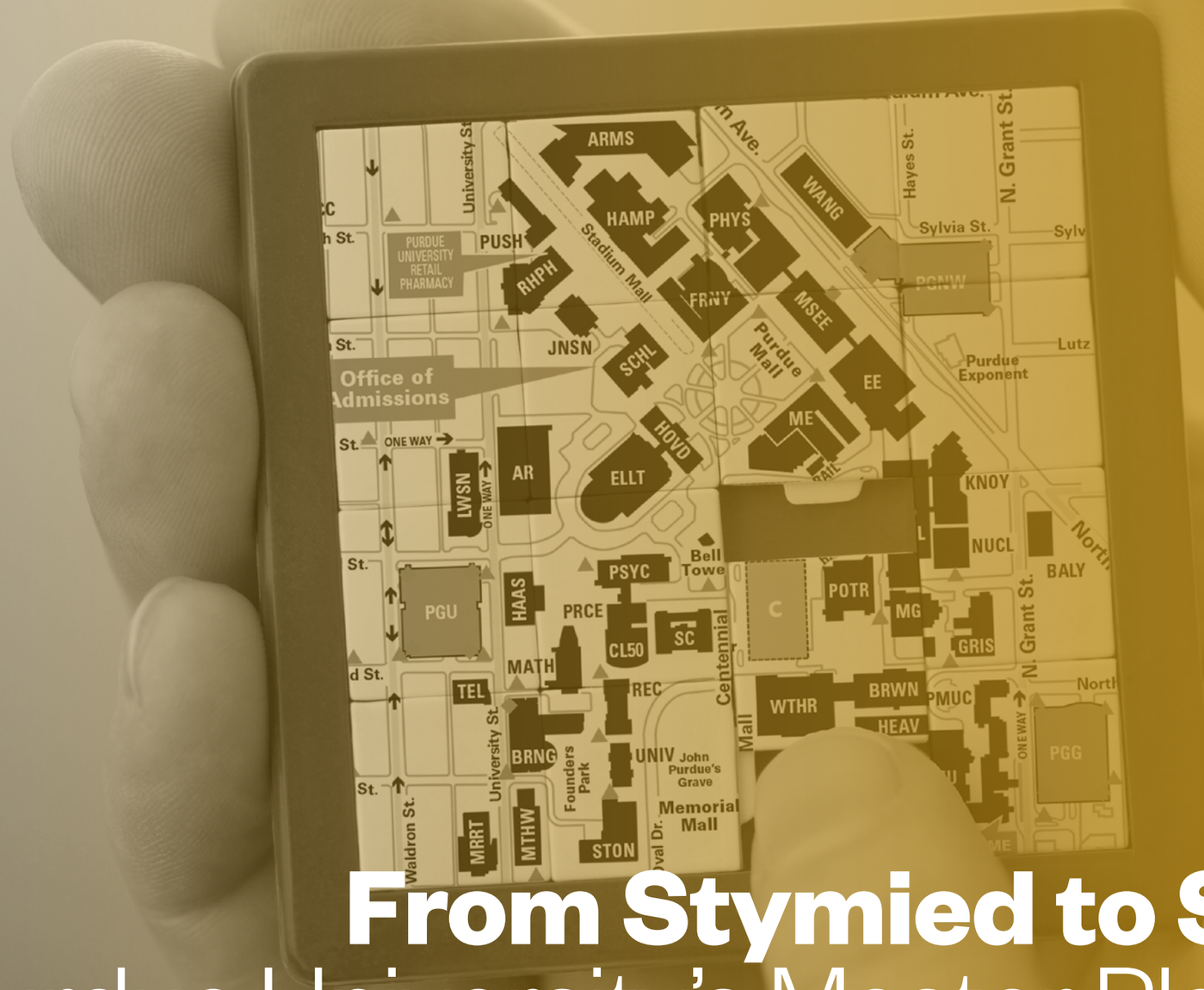
**Alex O'Briant**
Ennead Architects

**Michael Gulich**
Purdue University

**Christine Hrycyna**
Purdue University




# From Stymied to STEM Lab

## Purdue University's Master Plan Success

**Alex O’Briant**
Ennead Architects

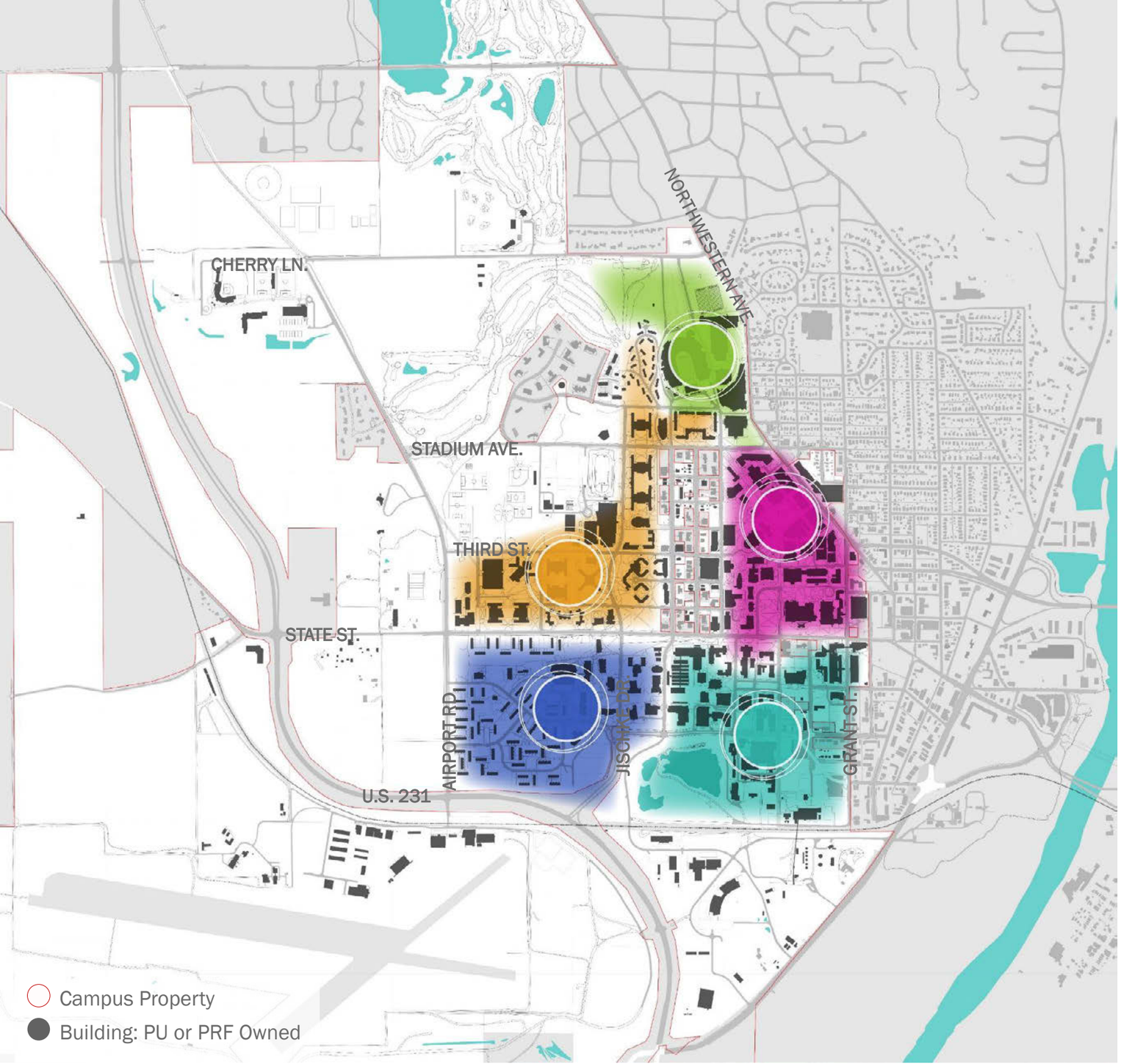
**Christine Hrycyna**
Purdue University

**Michael Gulich**
Purdue University

- Structure a data-driven college or precinct planning process for maximum effectiveness.
- Use a cluster-based approach to master planning in order to maximize flexibility.
- Build momentum among key constituencies to accelerate execution of master plan components and elevate awareness of the broad value of new interdisciplinary facilities.
- Using a College Master Plan as a guide, collaborate across departments to program and plan an interdisciplinary teaching lab environment.

## AIA Learning Objectives

# Campus Master Plan




# EXISTING CHALLENGES & OPPORTUNITIES

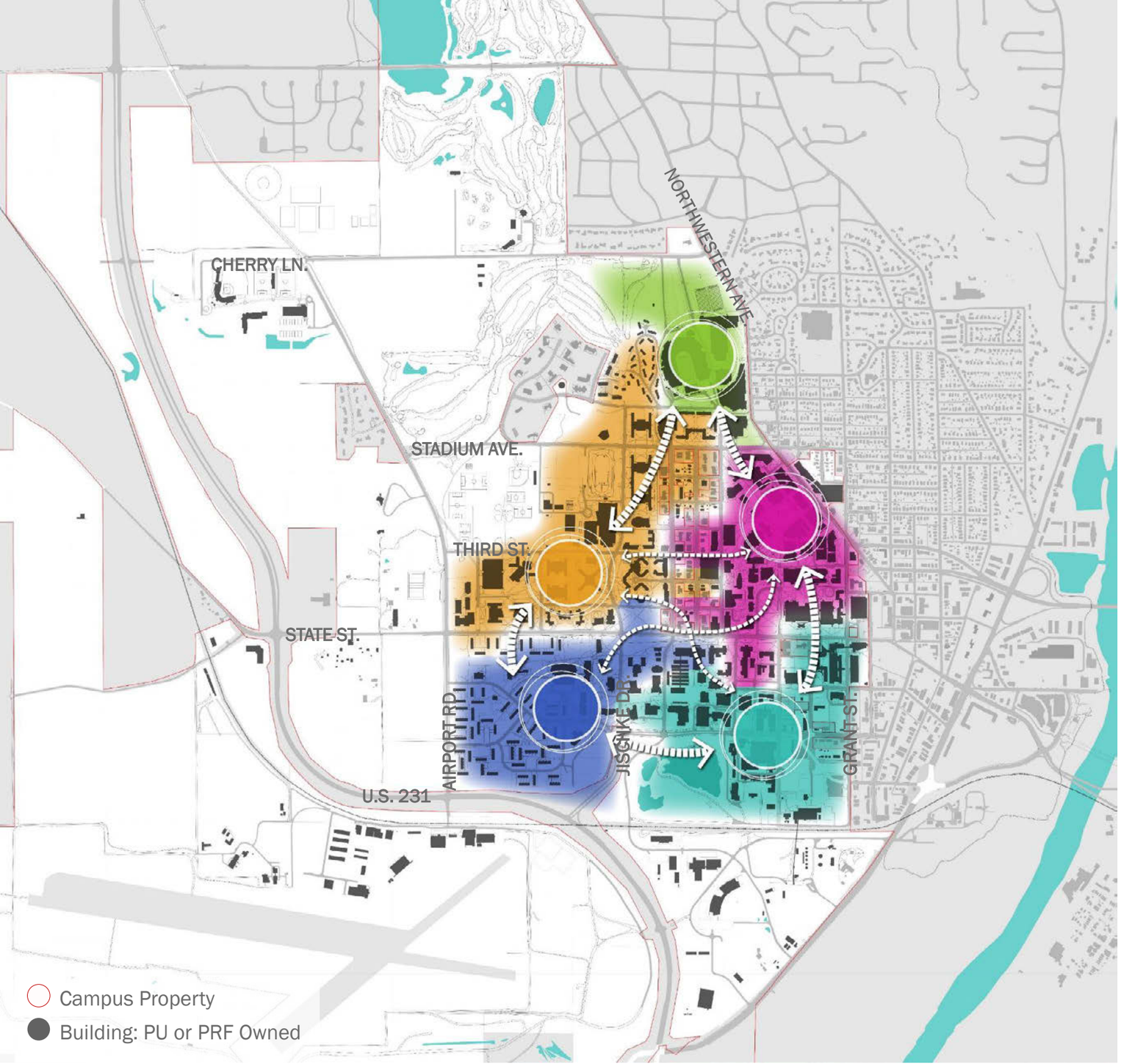
Currently the campus is disconnected and fragmented into five districts

## MAJOR CHALLENGES: *CONNECTIVITY & QUALITY*

- Open space lacks consistency and overall connectivity
- South Campus is vehicular dominant
- Some facilities do not meet current needs

## MAJOR OPPORTUNITIES: *INFILL, VIBRANCY, RENOVATION*

- Available infill sites for new development
- Ability to leverage recent project successes to enhance vibrancy at key campus crossroads
- Opportunity for renovation to increase quality and utilization




# PLANNING PRINCIPLES

## *Move from five districts to one campus*

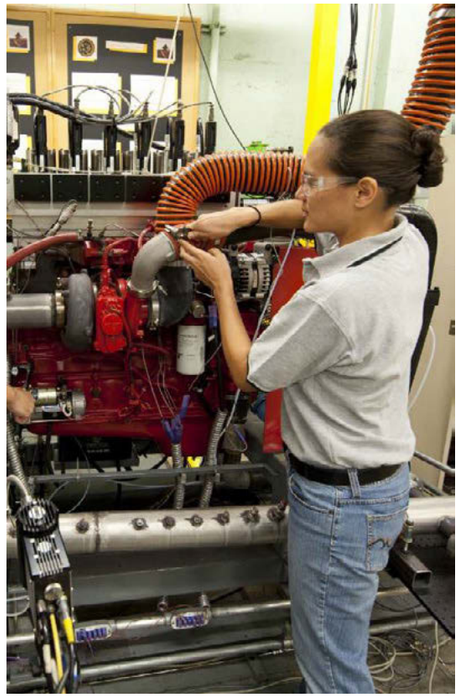
Improve campus identity by creating a more connected, vibrant, sustainable, and collaborative campus with robust utilization of our existing buildings and grounds.

- Strengthen Identity
- Enhance Connectivity
- Promote Vibrancy
- Foster Collaboration
- Nurture Sustainability
- Increase Utilization/Flexibility

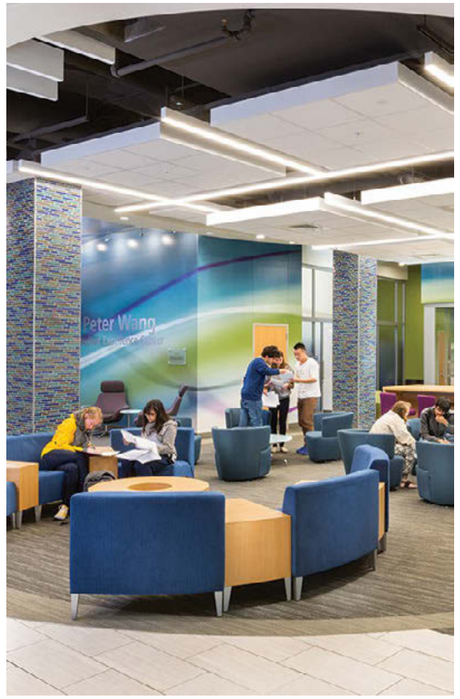
# MASTER PLAN GOALS

The master plan provides a 50-year vision that informs near-term decisions and actions and a framework for open space, circulation, and connectivity.

1. Invest in teaching, research, and collaborative spaces

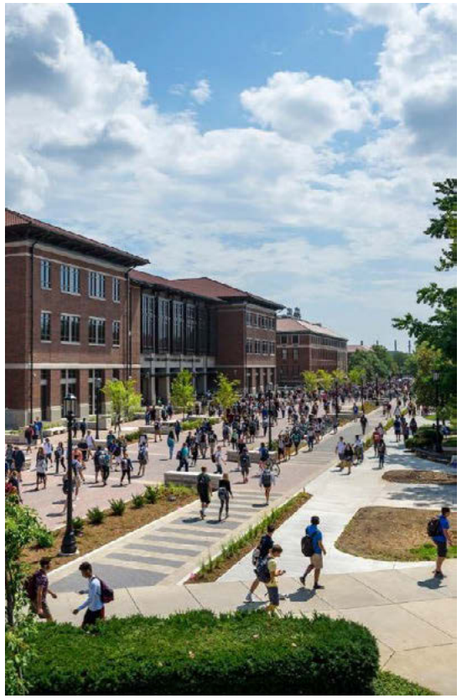


2. Prioritize strategic renovations

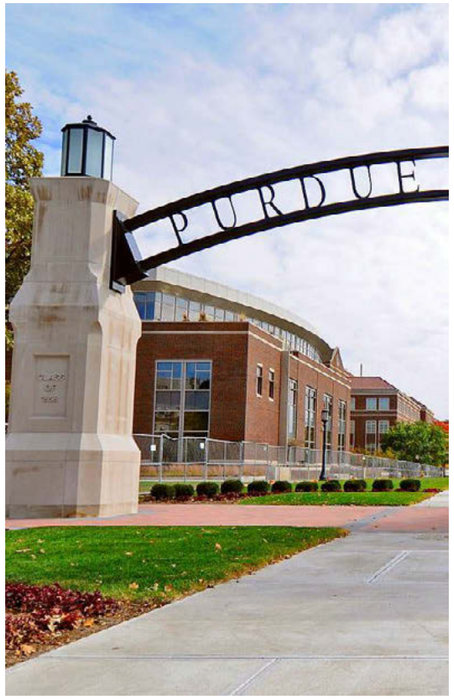



3. Focus housing and dining investments

4. Enhance open space connectivity and campus circulation



5. Strengthen campus identity and gateways



# College Master Plan


**745,943** ASF
**19** buildings

# **College of Science Master Plan** Scale and Scope

# Recruiting and Retention

**Quantitative Goals**

Efficiency -

Growth -

Safety -

Condition -

## Implementation

**Qualitative Goals**

- Community
- Collaboration
- Identity
- Character

**College of Science Master Plan** A Framework

# Cluster Approach


**Cluster B**

Physics, EAPS, PRIME Lab

**Cluster A.2**

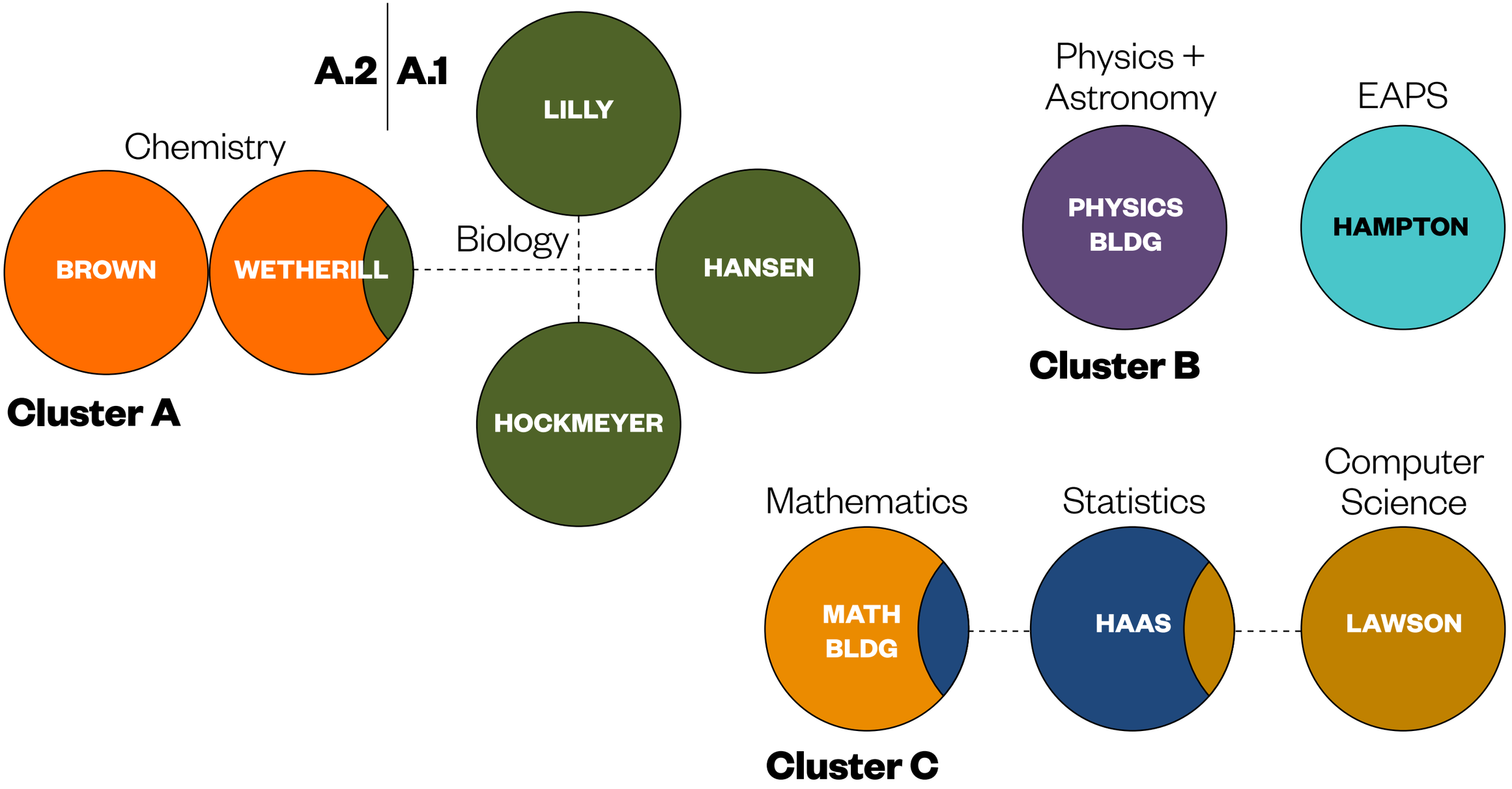
Chemistry

**Cluster C**

Computer Science, Math, Statistics, CERIAS, CoS Admin

**Cluster A.1**

Biological Sciences

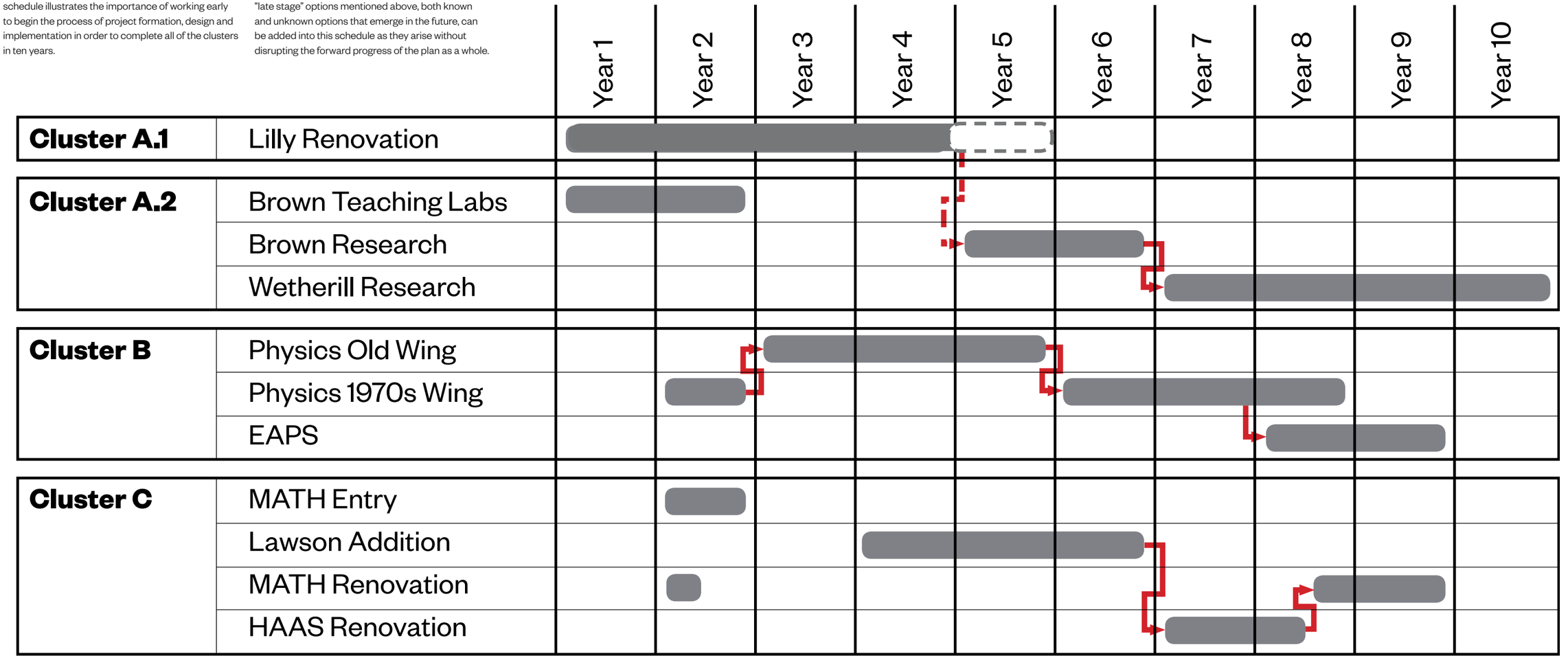



## Cluster Definitions

## Proposed Cluster Schedule

The proposed schedule below illustrates how the cluster approach can accommodate independent projects over a ten year period. The dashed arrow indicates interdependency between clusters, primarily to meet swing space requirements. This schedule illustrates the importance of working early to begin the process of project formation, design and implementation in order to complete all of the clusters in ten years.

Some projects, such as small renovations to MATH, could be undertaken outside of the primary Cluster C plan, offering greater flexibility in funding and schedule, and allowing opportunities for significant improvement to that building as soon as possible. In addition, the "late stage" options mentioned above, both known and unknown options that emerge in the future, can be added into this schedule as they arise without disrupting the forward progress of the plan as a whole.

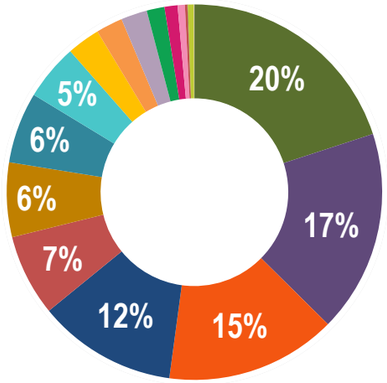



# Cluster Schedule Flexibilty

## College of Science

Summary

### Assignment



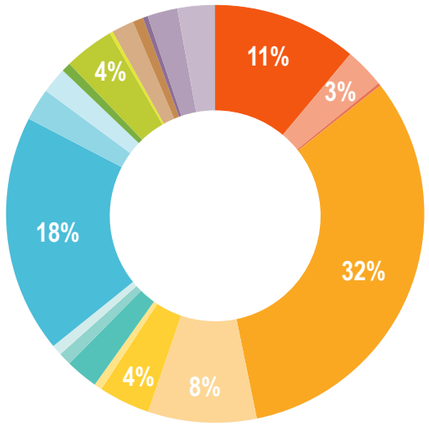

**Assignment** – This chart illustrates the amount of College of Science space in each building by square footage and the percentage of the overall College. The adjacent columns show the total square footage of each building and the percentage of the building being used by College of Science.

| | College of Science | | Building | |
|---|---|---|---|---|
| | Dept ASF | % of CoS | Bldg ASF | % of Bldg |
| PHYS | 149,049 | 20% | 190,194 | 78% |
| BRWN | 130,000 | 17% | 134,472 | 97% |
| WTHR | 109,888 | 15% | 138,029 | 80% |
| LILY | 89,339 | 12% | 228,888 | 39% |
| LWSN | 52,410 | 7% | 55,832 | 94% |
| MATH | 47,820 | 6% | 72,130 | 66% |
| HAMP | 45,638 | 6% | 177,852 | 26% |
| HOCK | 36,080 | 5% | 36,834 | 98% |
| HAAS | 21,226 | 3% | 27,926 | 76% |
| HANS | 17,185 | 2% | 62,705 | 27% |
| DRUG | 16,816 | 2% | 34,305 | 49% |
| BIND | 11,370 | 2% | 43,781 | 26% |
| LSR | 8,397 | 1% | 61,764 | 14% |
| REC | 4,709 | 1% | 20,590 | 23% |
| BRK | 1,559 | 0% | 105,571 | 1% |
| DLR | 288 | 0% | 55,840 | 1% |
| LSA | 3,829 | 1% | 27,424 | 14% |
| SSWA | 200 | 0% | 6,000 | 3% |
| BCHM | 140 | 0% | 61,029 | 0% |
| | 745,943 | 100% | 1,541,166 | |

| RESEARCH | | TEACHING | SUPPORT | | | Total ASF |
|---|---|---|---|---|---|---|
| Offices | Labs/Support | Teaching Labs | Collaboration / Commons | Administrative / Support | Departmental Support | |
| 170,545 | 338,827 | 107,081 | 35,717 | 32,484 | 60,227 | 744,881 |
| 23% | 45% | 14% | 5% | 4% | 8% | |
| 310 | 250 | 210 | 317 | 305 | 710 | |
| 315 | 255 | 215 | 350 | 306 | 720 | |
| 316 | 251 | 220 | 355 | 307 | 730 | |
| | 256 | | | | 760 | |
| | | | | | 500 | |
| | | | | | 600 | |

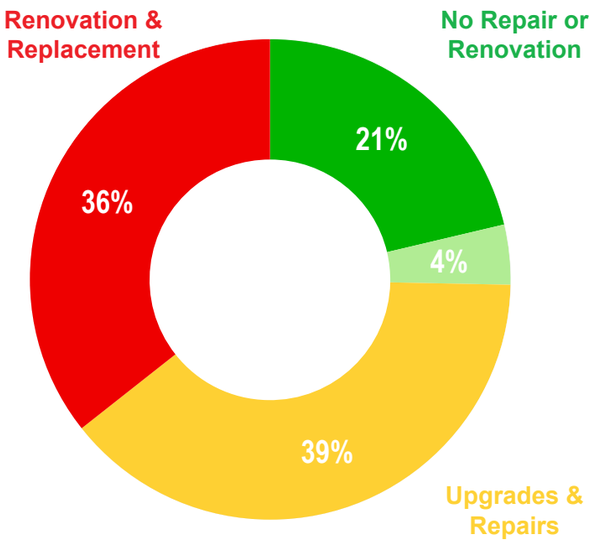
| | | | | | |
|---|---|---|---|---|---|
| 210 | Teaching Lab | 305 | Administrative Offices | 350 | Conference/Study |
| 215 | Teaching Lab Support | 306 | Office Support | 710 | Central Computer |
| 220 | Open Lab | 307 | Open Office | 720 | Shop |
| 250 | Experimental Lab | 310 | Faculty/Research Office | 730 | Central Storage |
| 255 | Experimental Lab Support | 315 | Research Office Support | 500 | Special Use |
| 251 | Computational Lab | 316 | Open Office/Grad Students | 600 | Building Commons |
| 256 | Computational Lab Support | 317 | Department Commons | 760 | Hazmat |

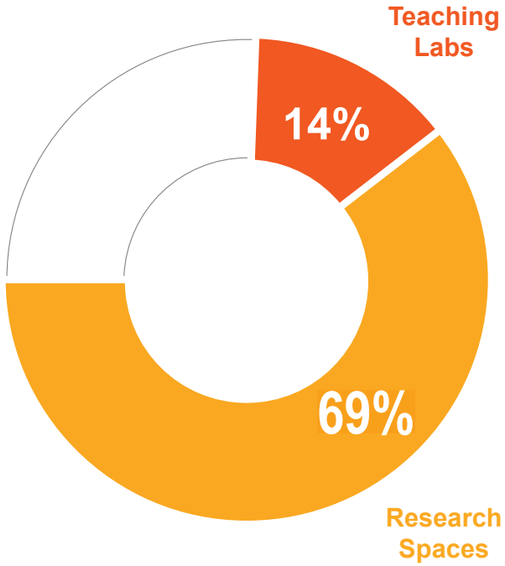
### Space Type

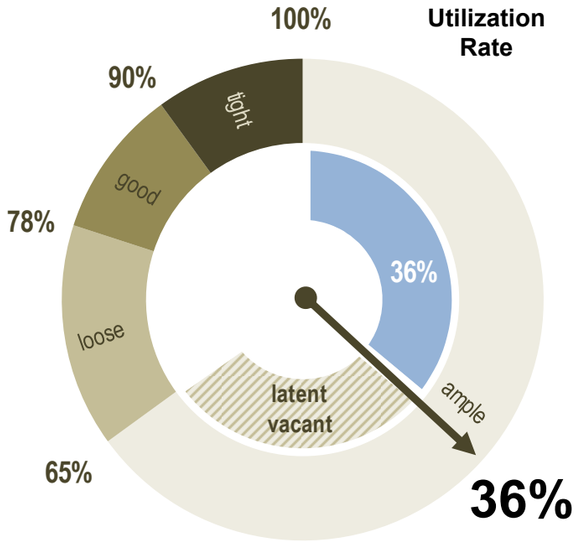



**Space Type** – The donut chart represents the percentage of each Space Type or Room Code (FICM) listed on the Master Inventory spreadsheet and confirmed during the Building Tours. The chart above shows the total square footage of Space Types within each category listed: Faculty / Research Offices, Lab / Support, Teaching Labs, Collaboration / Commons, Administration / Support and Departmental Support.

# Data Gathering

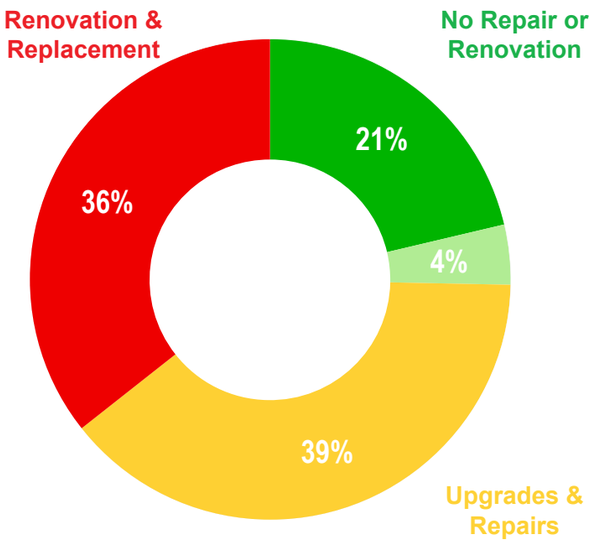


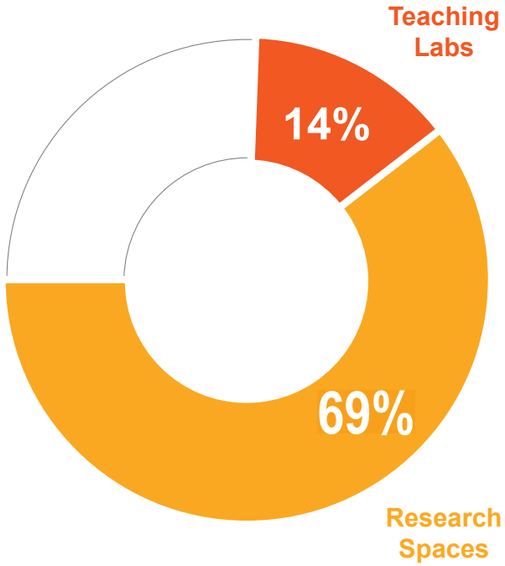




# Key Data Points

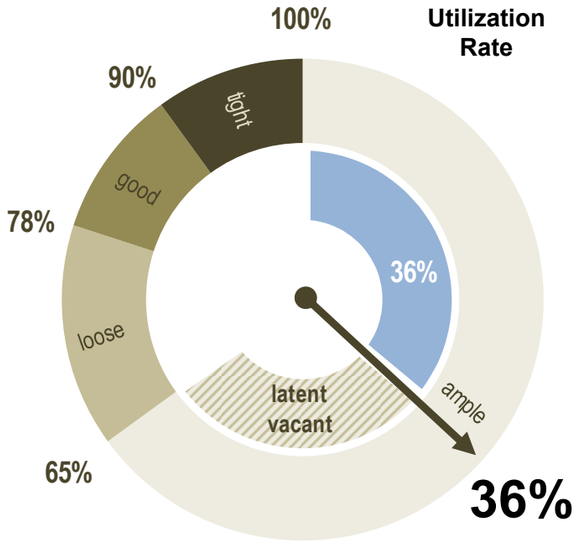
**75%** of College of Science Facilities Need Renovation or Replacement



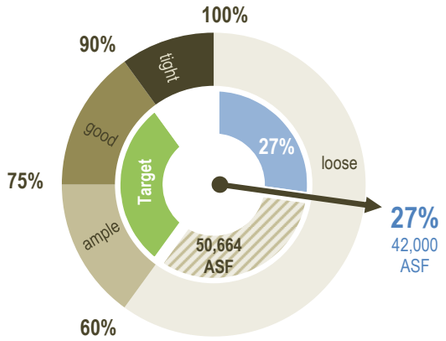

**83%** of Spaces in Need of Renvation or Replacement are Teaching or Research Spaces



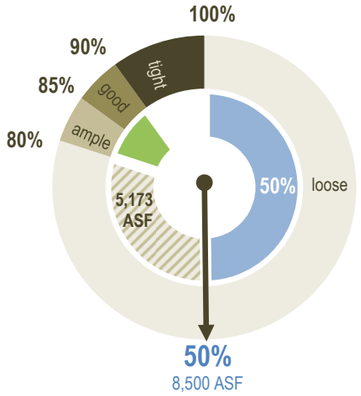

Teaching and Research Labs are Among the Lowest Efficiency Spaces at the College at **36%**



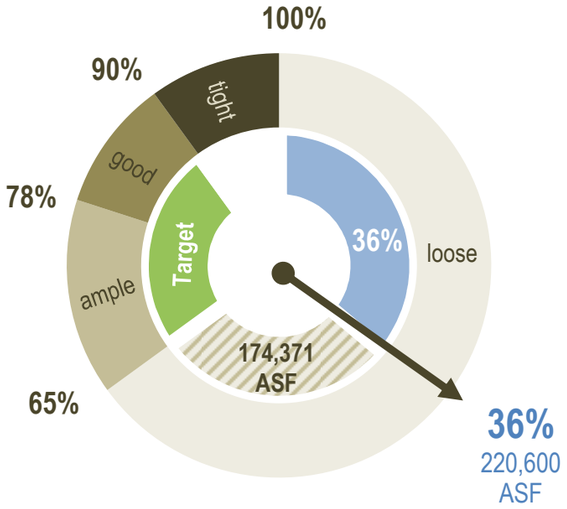

## Key Data Points




**Biological Sciences**




**Statistics**

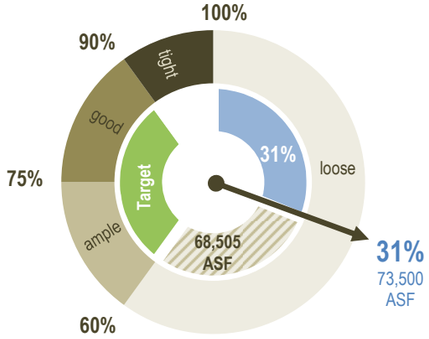



**College of Science**

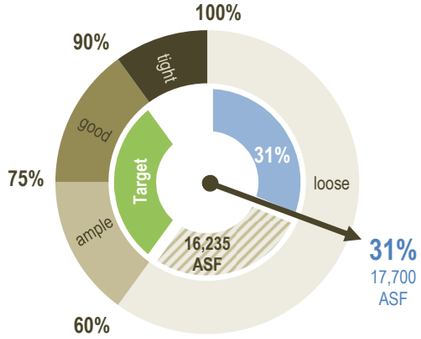
**Current Utilization** — The current utilization rate of the existing space as determined from information provided by campus.

**Latent Vacant** — Assignable square footage (ASF) that could be available for department growth or university reassignment, provided current research ASF was renovated to current national standards in technical accommodation and space assignment.

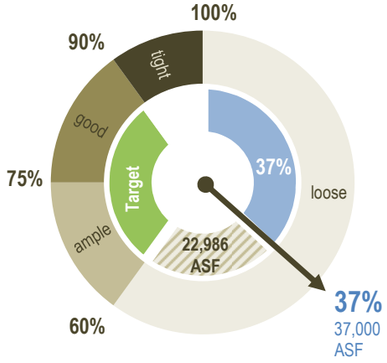
**Target Utilization** — Utilization target range which provides ample space for team at first occupancy and room for growth and collaboration over time.



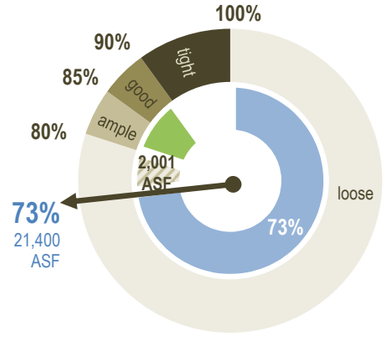

**Chemistry**



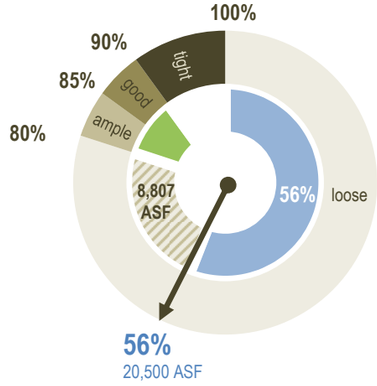

**EAPS**




**Physics & Astronomy**




**Mathematics**




**Computer Science**

# **Key Data Points** Research Lab Utilization

**COLLEGE OF SCIENCE TOTALS**

**EXISTING**

Existing "Assigned Research Ui

| PI | FTE | FTE / PI | ASF / PI | ASF / FTE | ROA $/ASF | Res Occupancy | | Supply ASF | Fit |
|---|---|---|---|---|---|---|---|---|---|
| 336 | 760 | 2.3 | 1,176 | 570 | $152 | 36% | | 432,968 | |
| EXP PI | CMP PI | | | | | | | | |
| 153 | 183 | | | | | | ***Offices*** *FICM 310* | *136,983* | |
| | | | | | | | ***Labs / Support*** *FICM 250, 255* | *306,451* | |
| | | | | | | | ***Deduct 310 (Non-Res)*** | *(10,466)* | |
| | | | | | | | ***Deduct ( Unassigned)*** *- Core & Highly Specialized Labs* | *(37,997)* | |
| | | | | | | | *Current Assigned PI Research Supply (ASF)* | **394,971** | **loose** |

**MODEL**

| GRANT $ / PI | ASF / PI | ASF / FTE | ROA $/SF | Res Occupancy | Latent Vacant | Res Demand ASF | Fit |
|---|---|---|---|---|---|---|---|
| | 657 | 290 | $271 | 65% | 174,371 | 220,600 | ample |
| $178,136 | 547 | 242 | $326 | 78% | 211,271 | 183,700 | good |
| | 424 | 188 | $420 | 100% | 252,471 | 142,500 | tight |

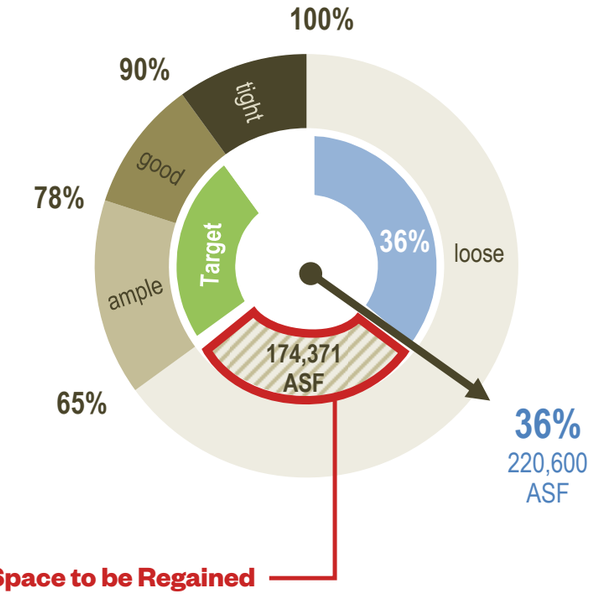
*Latent Vacant = (Supply ASF plus Core & Hi Spec ASF) less Research Demand ASF*

*Assigned SF (ASF) + Unassigned SF (USF) = Research Need ASF*

*100% model = 45 asf/ fte office; 120 asf/ exp lab; 38 asf/ cmp lab; 130 asf/ PI office*

*Research Occupancy Rate = Current Assigned PI Research Supply (ASF) / 100% Research Demand (ASF)*

Proposed "Assigned Research Unit"




**Current Utilization** — The current utilization rate of the existing space as determined from information provided by campus.

**Latent Vacant** — Assignable square footage (ASF) that could be available for department growth or university reassignment, provided current research ASF was renovated to current national standards in technical accommodation and space assignment.

**Target Utilization** — Utilization target range which provides ample space for team at first occupancy and room for growth and collaboration over time.

# **Key Data Points** Research Lab Utilization

**Legend:**

- Teaching Lab
- Teaching Lab Support
- Experimental Lab
- Experimental Lab Support
- Office Support
- Administrative Offices
- Conference / Study
- Open Office
- Faculty / Research Office
- Restrooms / Mechanical
- Classroom

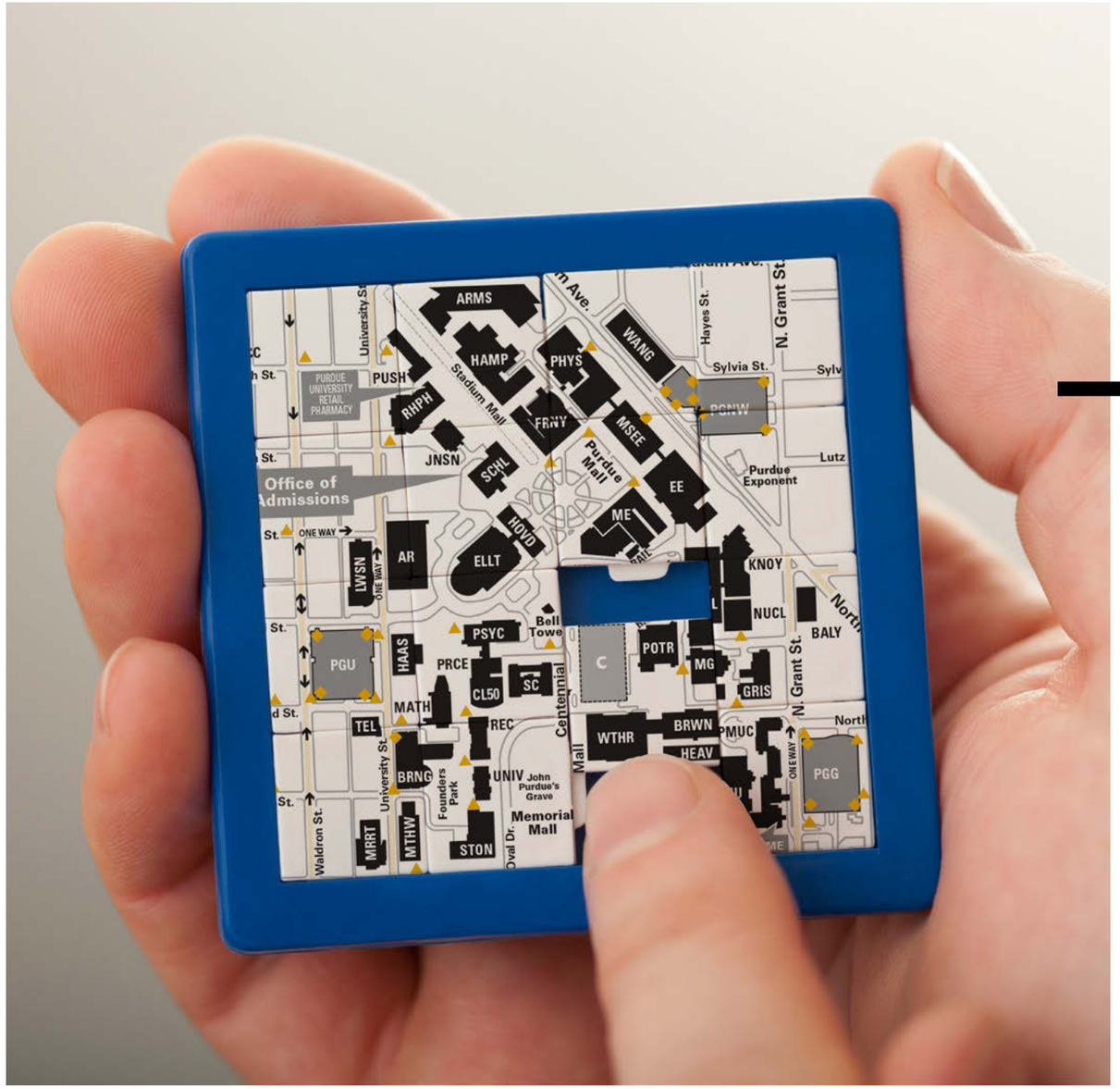
**Example Floor Plan - Existing**

Improve Building Entrance

De-fragment Space Planning to Enhance Identity and Increase Clarity

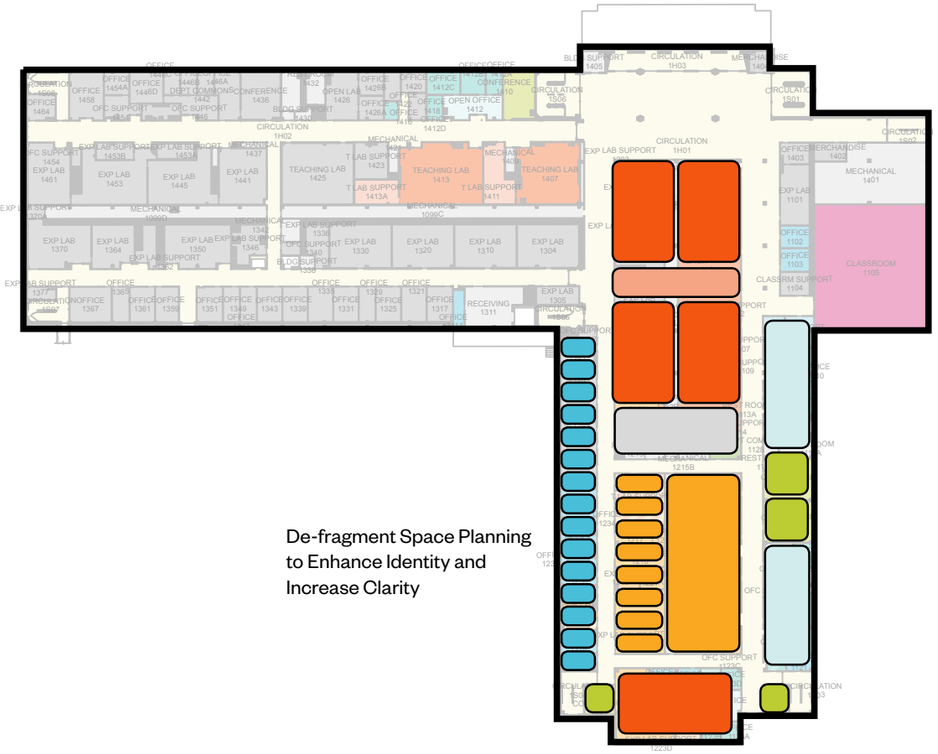
**Example Floor Plan - De-fragmented**

# “Defragging” to Improve Efficiency




Improve Building Entrance

De-fragment Space Planning to Enhance Identity and Increase Clarity



**Example Floor Plan - De-fragmented**

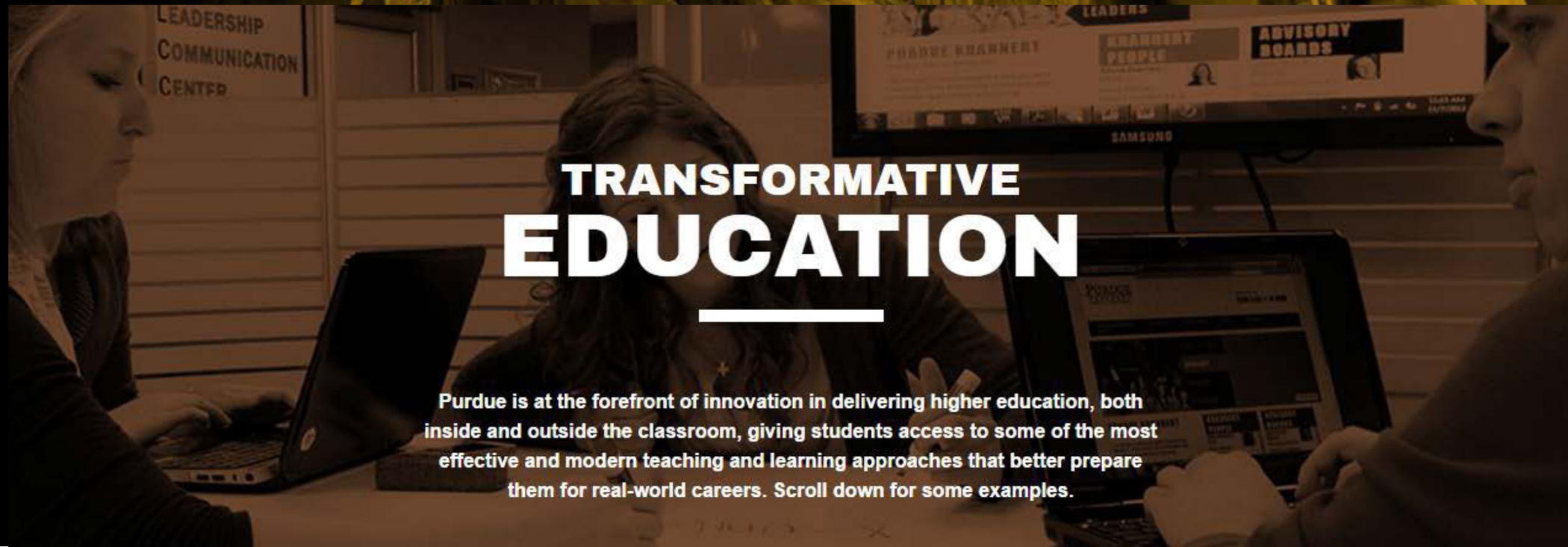
# Making the First Move

# STEM Teaching Lab

# Why this plan?
# Why now?

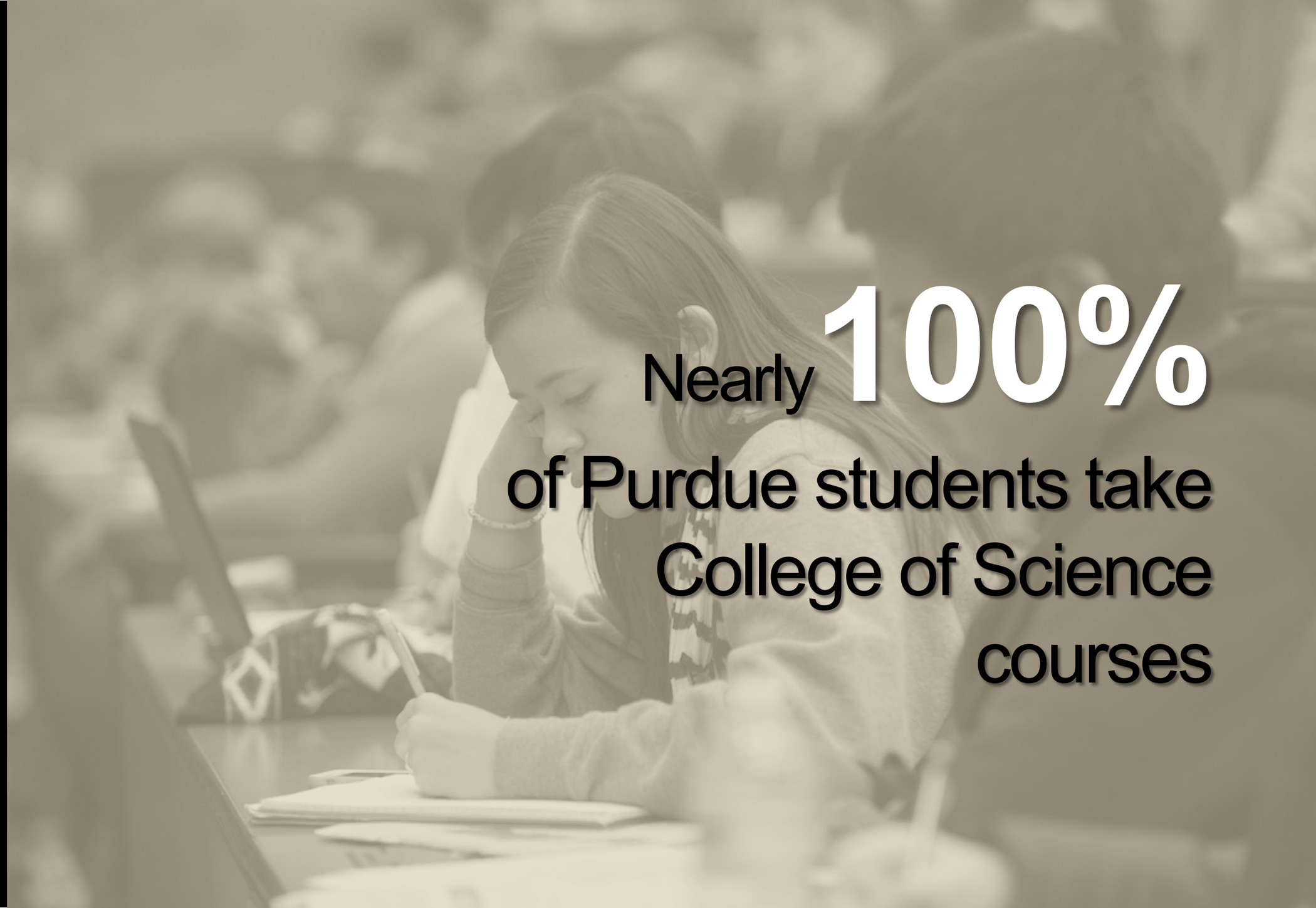
# STEM LEADERSHIP

By leveraging our historic strengths in science, technology, engineering and mathematics (STEM), Purdue is answering the national call to prepare a greater number of highly capable graduates in these disciplines. Scroll down to learn more.



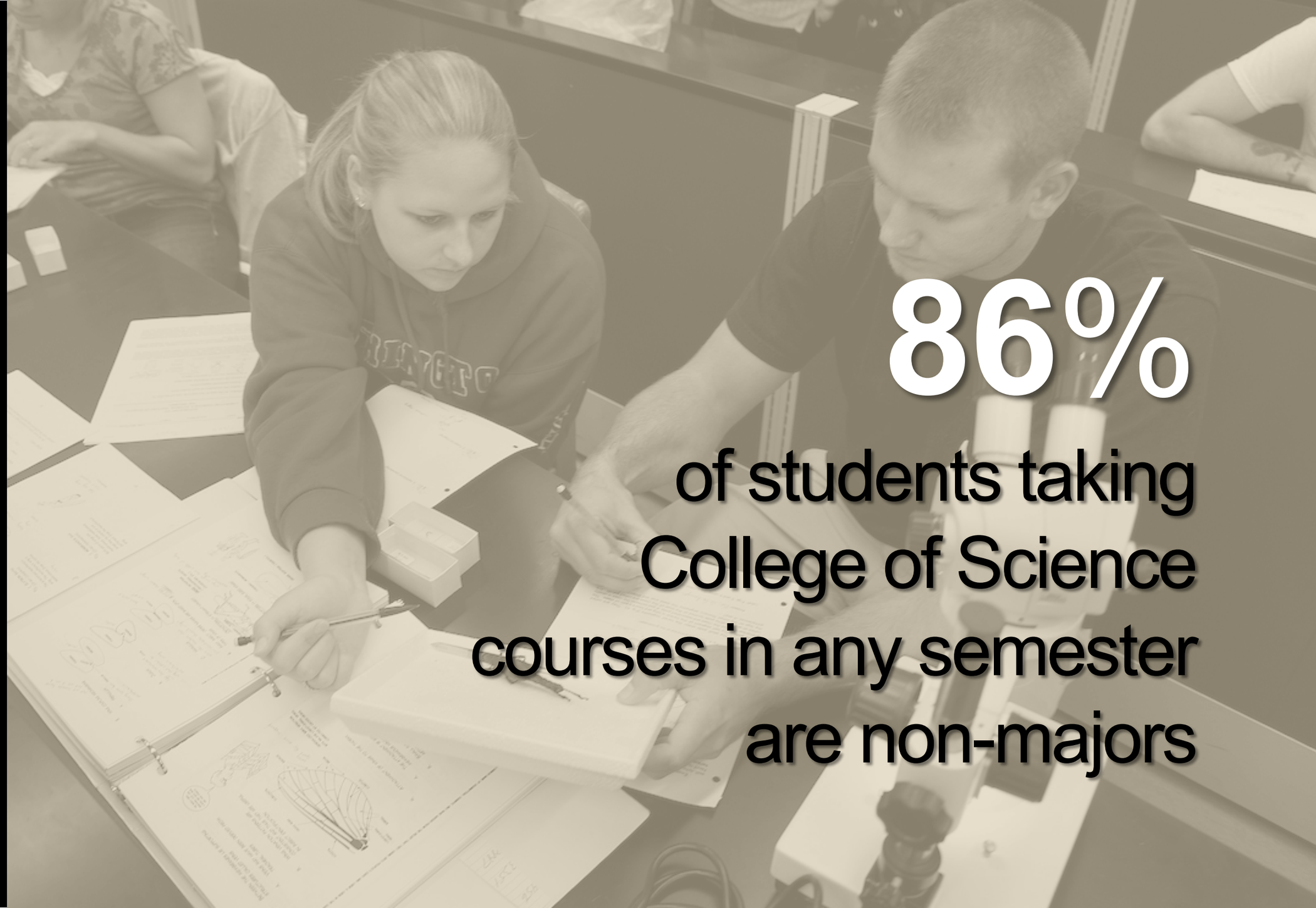

# TRANSFORMATIVE EDUCATION

Purdue is at the forefront of innovation in delivering higher education, both inside and outside the classroom, giving students access to some of the most effective and modern teaching and learning approaches that better prepare them for real-world careers. Scroll down for some examples.



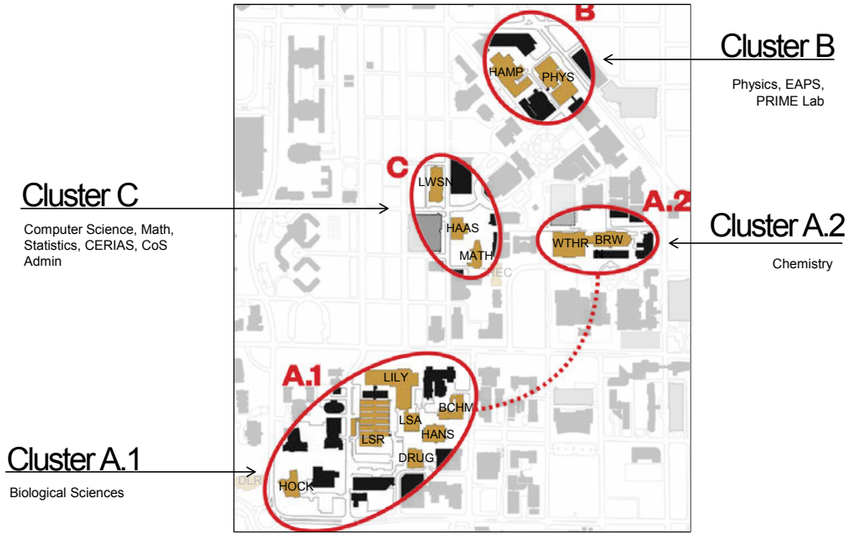
Nearly **100%**

of Purdue students take College of Science courses



# 86%

of students taking College of Science courses in any semester are non-majors



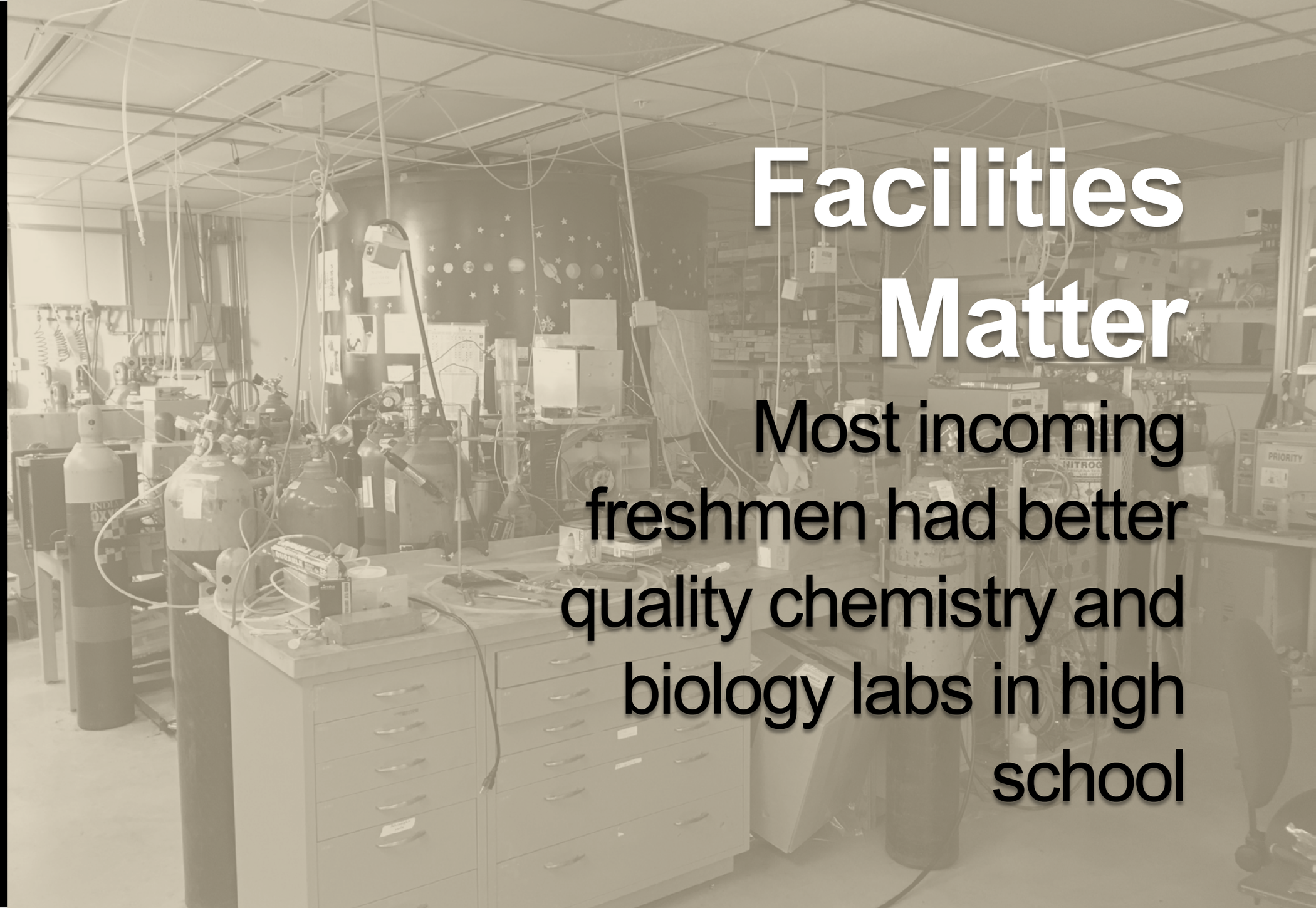

**4 CLUSTERS**


**745,943 ASF over 19 buildings**

# Estimated Cost of Construction by Cluster

| Cluster | Building | Description | Estimated Cost of Construction* | Total Project Budget* |
|---|---|---|---|---|
| **Cluster A.1** | | **Phases 1-5** | **$59.1 M** | **$83.4 M** |
| | LILY | 5 Floor Gut Renovation | | |
| **Cluster A.2** | | **Phases 1-5** | **$127.9 M** | **$170.8 M** |
| | BRWN | Phases 1-2: Gut Renovation<br>Teaching Labs & Research Labs | | |
| | WTHR | Phases 3-5: 6 Floor Gut Renovation | | |
| **Cluster B** | **PHYS** | **Phases 1-4 Renovation** | **$74.6 M** | **$104.36 M** |
| **Cluster C** | | **Phases 1-3** | **$35.5 M** | **$47.7 M** |
| | LWSN | New Addition | | |
| | HAAS | Renovation | | |
| | MATH | Reno/New | | |
| **Total Cost** | | | **$297 M** | **$406.2 M** |

**Cost shown do not include escalation.*

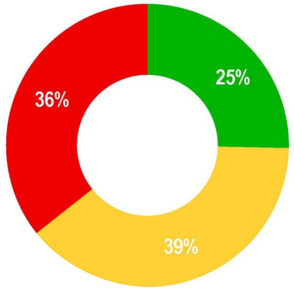


# Facilities Matter

Most incoming freshmen had better quality chemistry and biology labs in high school

# Space Quality

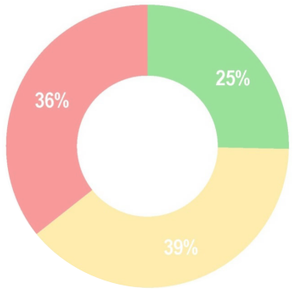
Current



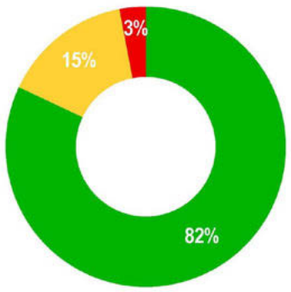

**75%** of College of Science space is in need of substantial renovation or repair.

A No Repair or Renovation
B Upgrades & Repairs
C Renovation & Replacement

Current




After

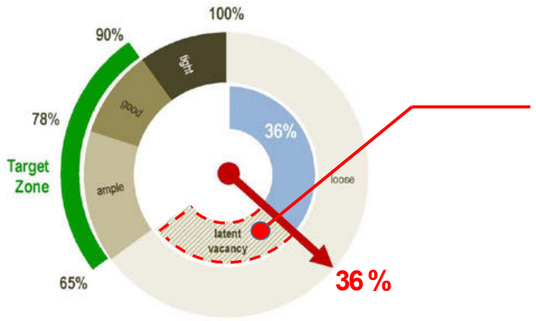



**82%** Good

A No Repair or Renovation
B Upgrades & Repairs
C Renovation & Replacement

# Utilization

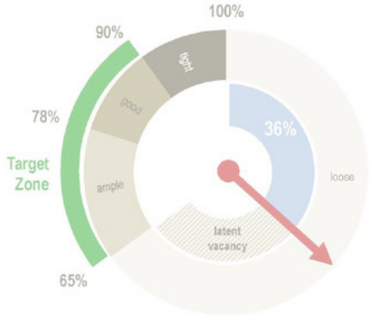
Current



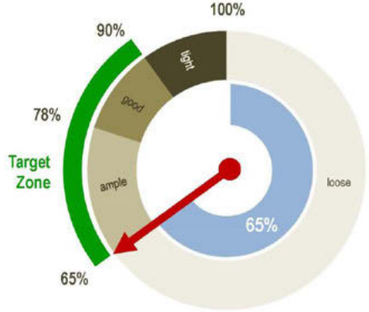

**Latent Vacancy**
**174,371 ASF** of Space to be Regained

***Target Zone –** Ideal Utilization Range: Matches national peer averages with spaces for collaboration and growth.

Current




After




***Target Zone –** Ideal Utilization Range: Matches national peer averages with spaces for collaboration and growth.

# Space Returned to University Reserves at Completion of Implementation of Master Plan

# 140,000 ASF

9,000 ASF in LILY or HOCK (renovated)
17,000 ASF in HANS (non-renovated)
69,000 ASF in WTHR (renovated)
45,000 ASF in Hampton (non-renovated)

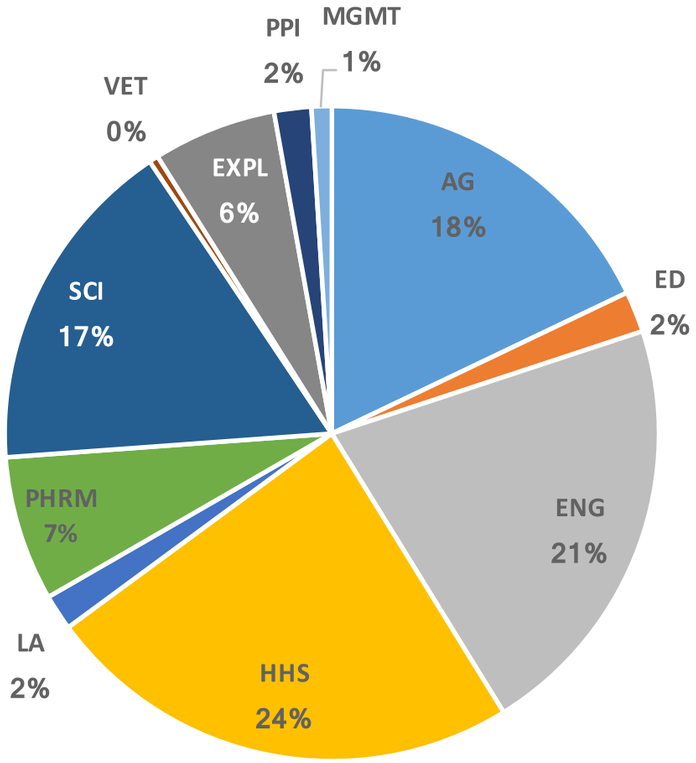
## Equivalent to Wetherill Lab Building

# Deferred Maintenance Addressed with Strategic Renovations

# $132 M

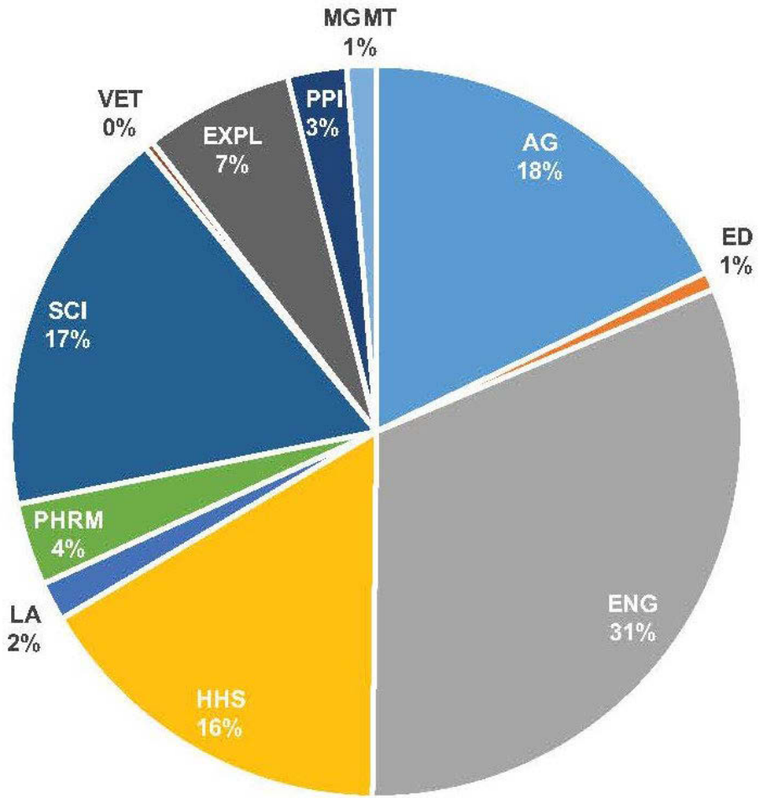
- 15k+ students per year
- 30%+ of incoming class

- ✓ State-of-the-art facilities for modern STEM fundamentals
- ✓ Focus on learning outside the classroom
- ✓ Vibrant hub of collaborative activity
- ✓ “Home away from home” for 1st and 2nd year students
- ✓ Flagship location at the epicenter of campus
- ✓ Interdisciplinary student research opportunities

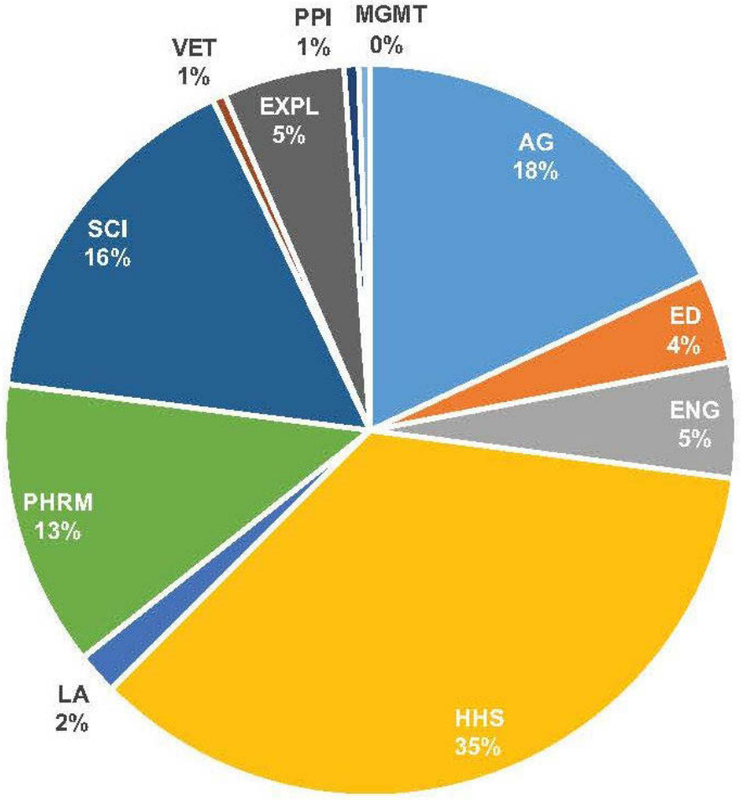



***15k+ Purdue students per year will take Chemistry & Biology in new STEM Teaching Lab***

**The Student Experience** STEM Lab Population




CHEMISTRY ANNUAL ENROLLMENT




BIOLOGY ANNUAL ENROLLMENT

**The Student Experience** CoS Population

**101%** Utilization
based on standard 5-day schedule

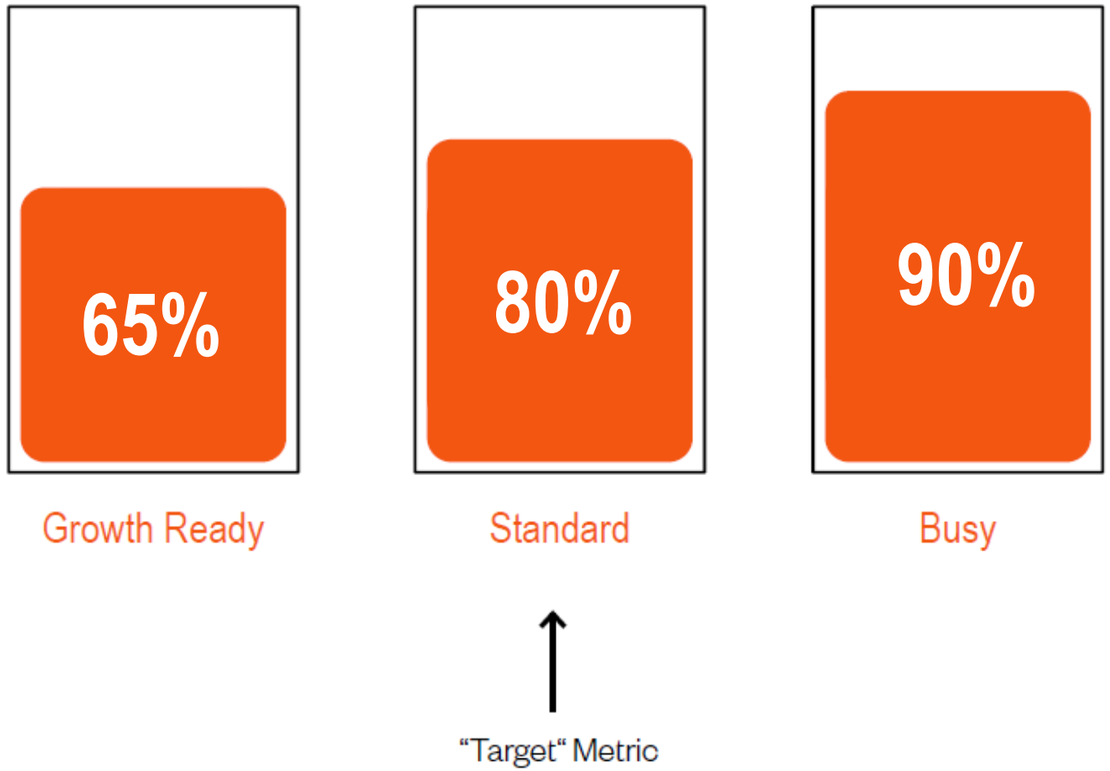
**95%** Utilization
based on extended 6-day schedule

13 General Chemistry Teaching Labs - Existing

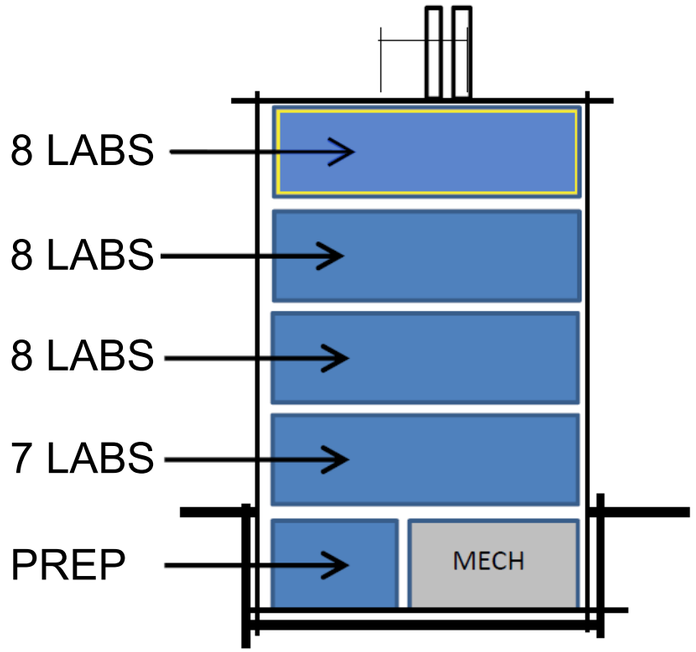
| | | Monday | | | Tuesday | | | Wednesday | | | Thursday | | | Friday | | | Sat | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7:30 | 11:30 | 2:50 | 7:30 | 11:30 | 2:50 | 7:30 | 11:30 | 2:50 | 7:30 | 11:30 | 2:50 | 7:30 | 11:30 | 2:50 | 8:30 | | |
| 1 | General Chemistry | 11100 | | 11100 | 12901 | 11100 | 12901 | | 11500 | 11500 | 12901 | 12901 | 12901 | 11500 | 11500 | 11500 | 12901 | 93% | 14 |
| 2 | General Chemistry | 11100 | | 11100 | 11100 | 11100 | 11600 | | 11500 | 11500 | 12901 | 12901 | 12901 | 11500 | 11500 | 11500 | 12901 | 93% | 14 |
| 3 | General Chemistry | 11100 | | 11100 | 12901 | 11100 | 12901 | 11500 | 11500 | 11500 | 12901 | 12901 | 12901 | 11500 | 11500 | 11500 | 12901 | 100% | 15 |
| 4 | General Chemistry | 11100 | | 11100 | 11100 | 11100 | 11600 | 11500 | 11500 | 11500 | 12901 | 12901 | 12901 | 11500 | 11500 | 11500 | 11500 | 100% | 15 |
| 5 | General Chemistry | 11100 | 11600 | 11100 | 11100 | 11100 | 11600 | 11500 | 11500 | 11500 | 12901 | 12901 | 12901 | 11500 | 11500 | 11500 | 11500 | 107% | 16 |
| 6 | General Chemistry | 11100 | 11100 | 11100 | 11100 | 11100 | | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 100% | 15 |
| 7 | General Chemistry | 11100 | 11600 | 11100 | 11100 | 11100 | 11600 | 11500 | 11500 | 11500 | 12901 | 12901 | 12901 | 11500 | 11500 | 11500 | 11500 | 107% | 16 |
| 8 | General Chemistry | 11100 | 11600 | 11100 | 11100 | 11100 | 11600 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 107% | 16 |
| 9 | General Chemistry | 11100 | 11600 | 20000 | 11100 | 11100 | | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 100% | 15 |
| 10 | General Chemistry | 11100 | 11600 | 11100 | 11100 | 11100 | 11600 | 11500 | 11500 | 12500 | 12500 | 11500 | 11500 | 11500 | 11500 | 11500 | | 100% | 15 |
| 11 | General Chemistry | 20000 | 11600 | 20000 | 11100 | 11100 | 11600 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 107% | 16 |
| 12 | General Chemistry | 11100 | 11600 | 11100 | 13600 | 13600 | 11600 | 11500 | 11500 | 12500 | 12500 | 11500 | 11500 | 11500 | 11500 | 11500 | | 100% | 15 |
| 13 | General Chemistry | 11100 | 11600 | 11100 | 11100 | 11100 | 11600 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | 11500 | | 100% | 15 |
| | | | | | | | | | | | | | | | | | Avg | 101% | 197 |
| 1 | Adv Organic Chem | | 25601 | 25601 | 25601 | | 25601 | | 25501 | 25501 | 25501 | | | | | | | 47% | 7 |
| 1 | Organic Chemistry | 26300 | | | 26300 | | 26300 | 26300 | | | 26300 | 26300 | 26300 | 26300 | | 26300 | | 60% | 9 |
| 2 | Organic Chemistry | | 25601 | 25601 | 25601 | 25601 | 25601 | 25701 | | 25701 | 25501 | | 25501 | | 25501 | 25501 | | 73% | 11 |
| 3 | Organic Chemistry | | | 26700 | 26500 | 26500 | 26500 | 26500 | | | 26500 | 26500 | 26500 | 26500 | | 25700 | | 67% | 10 |
| 4 | Organic Chemistry | | | 25601 | 25601 | 25601 | 25601 | 25701 | 25501 | 25501 | 25501 | | 25501 | | 25501 | | | 67% | 10 |
| | | | | | | | | | | | | | | | | | Avg | 67% | 40 |
| 1 | Analytical / Bio Chem | | | | 32300 | | | | | | 32100 | | 32100 | | | 32100 | | 27% | 4 |
| 2 | Analytical / Bio Chem | | | | 32100 | | | | | | 32100 | | | | | 32100 | | 20% | 3 |
| | | | | | | | | | | | | | | | | | | 23% | 7 |

General Chemistry Throughput per Semester

- 4,534 students @ 95% utilization (actual Fall 2017 enrollment)




# **Utilization** Targets for Gen Chem



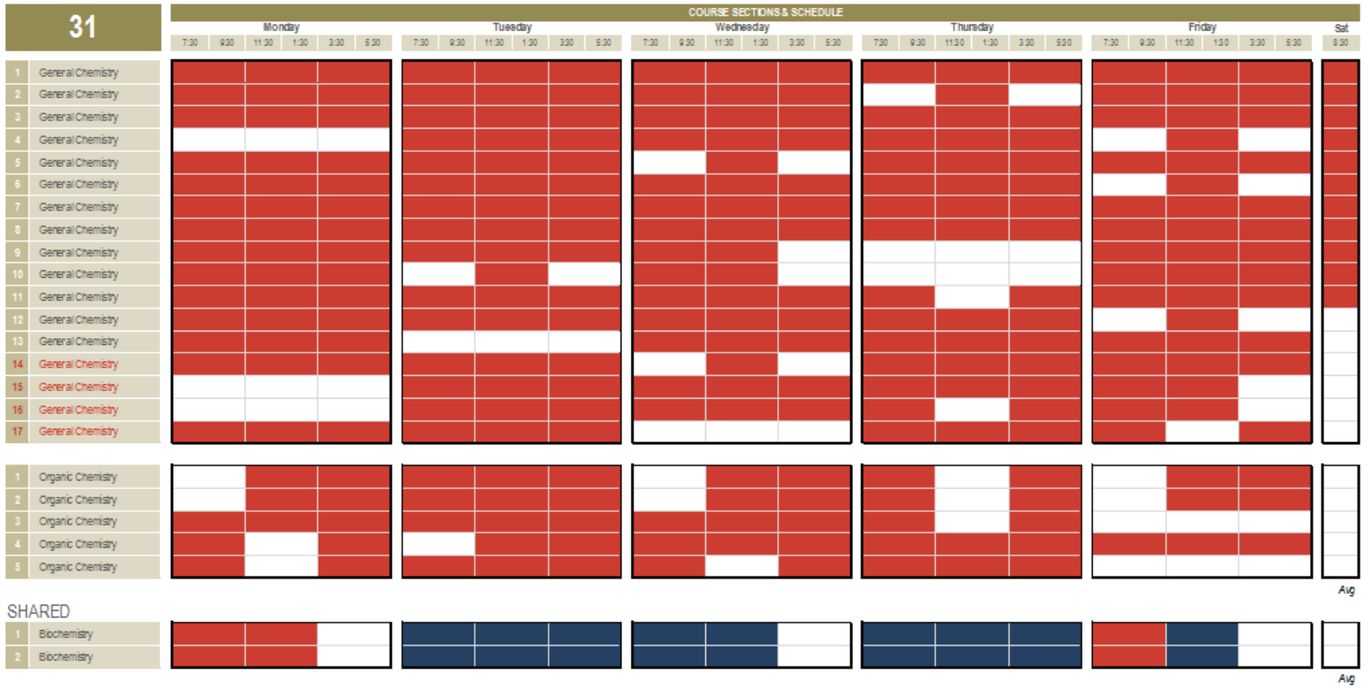

## 17 General Chemistry Teaching Labs - Proposed

- 104,000 GSF
- 4 Stories plus Basement
- 31 Labs (Chemistry/Biology)

General Chemistry Throughput per Semester*

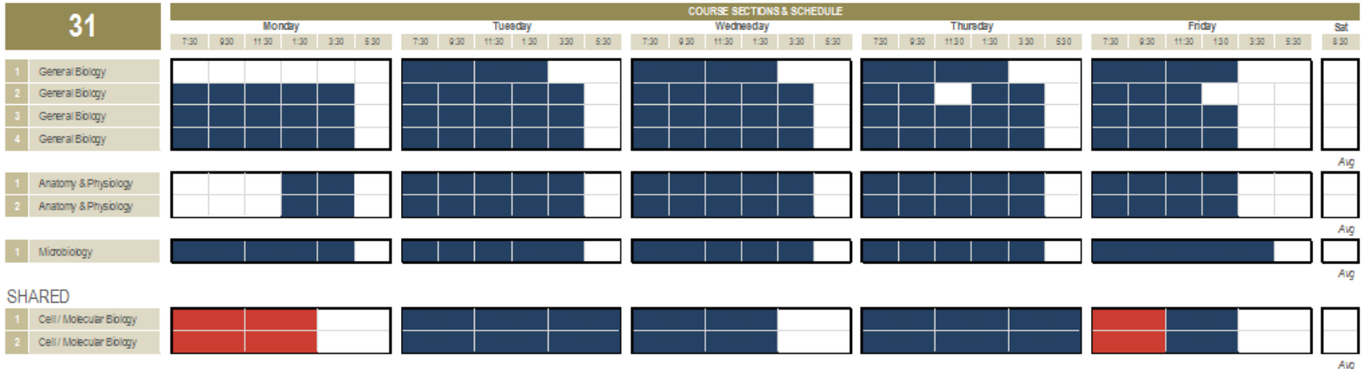
- 4,534 students @ 83% utilization (actual Fall 2017 enrollment)
- 2,850 students @ 50% utilization (projected Spring 2018 enrollment)
- Capacity for 5,000 students @ 88% utilization (allows for 10% growth over Fall 2017 peak)

* Utilizes 21 students per section as optimum for planning




## BIOLOGY

Teaching Lab Utilization - Fall 2017




# **Utilization** Proposed

| ARMORY LOT SITE | | |
|---|---|---|
| | **STEM Teaching Lab** (Proposed) | **STEM Teaching Lab** (Enhanced) |
| # of Teaching Labs | 31 | 33 |
| Chemistry Swing Space | Not Needed | Not Needed |
| Demolition | Parking Lot | Parking Lot |
| GSF | 104,000 | 111,000 |
| Total Project Cost | $60M | $64M |
| Occupancy Date (Assuming Dec. 2017 BOT Approval) | August 2020 | August 2020 |

Budget

# Teaching Lab of the Future


# Teaching Lab of Today

# Planning Metrics

## Open Lab Areas

Biology
- 20-24 Students / Lab
- 60 SF / Student

Chemistry
- 16-20 Students / Lab
- 70-75 SF / Student

## Lab Support Areas

12 SF / Student

## Team Support Areas

10 SF /Student

# Qualities

## Flexibility

Short term changeability
Long-term considerations

## Peer-to-Peer

Team-oriented furnishings and layouts

## Technology

Power and wi-fi
Display, interactivity, and distance learning

## Visibility

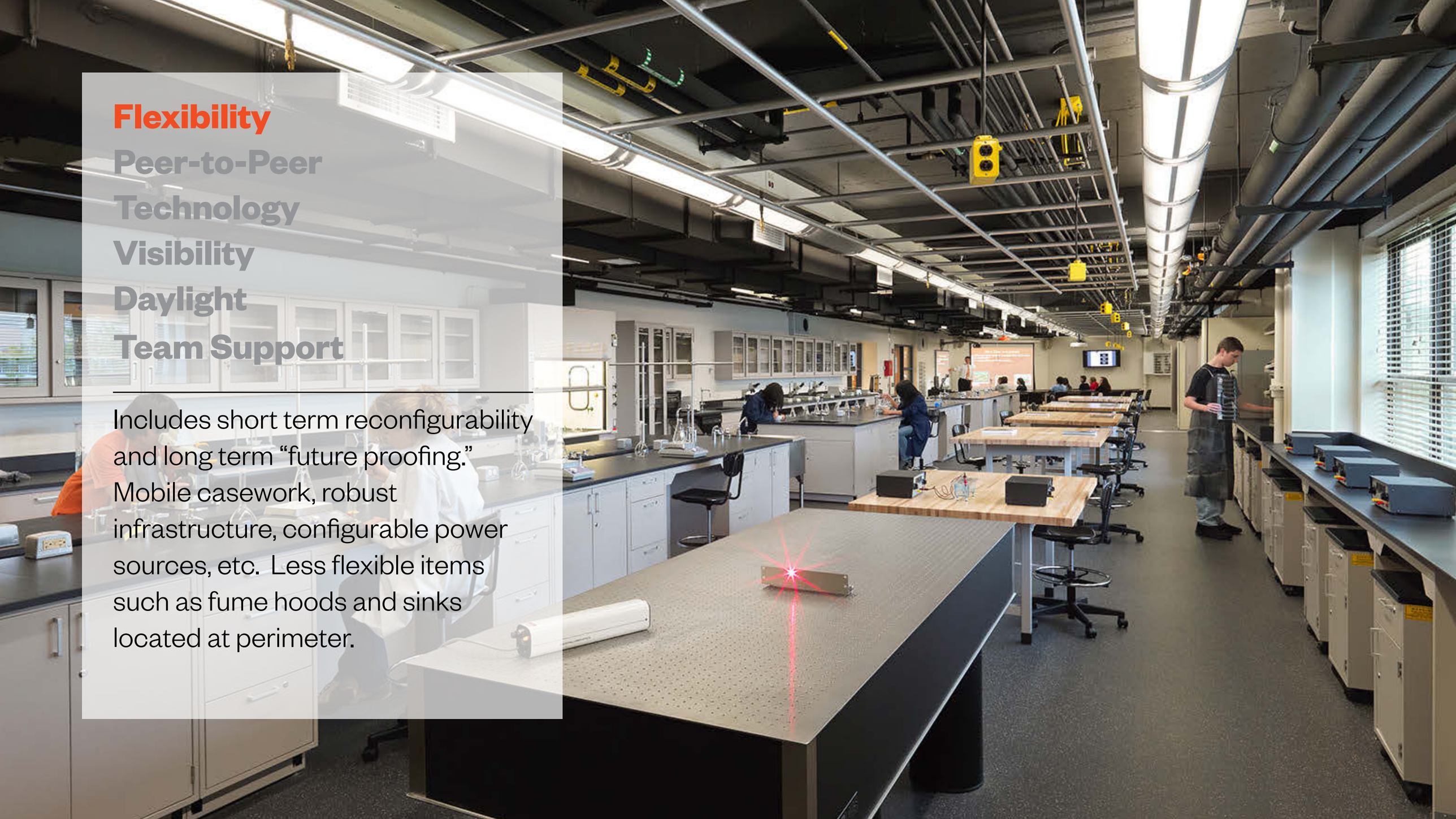
Science on display
Safety and security

## Daylight

Increased productivity
Better campus space

## Team Support

Collaboration beyond lab
Social space



## Flexibility

Peer-to-Peer

Technology

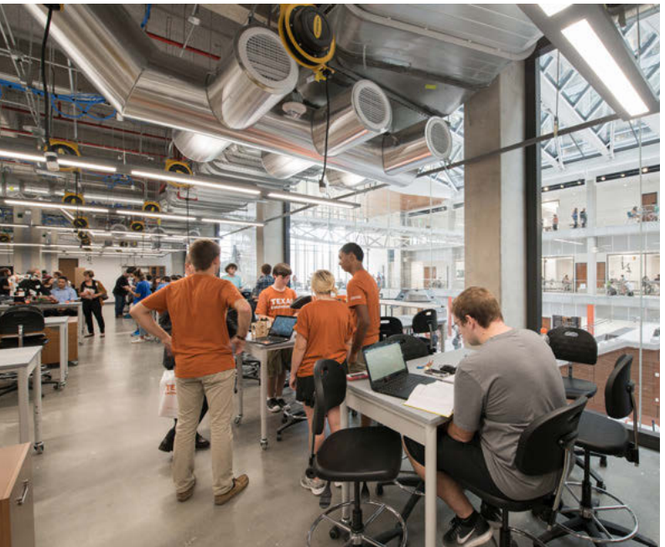
Visibility

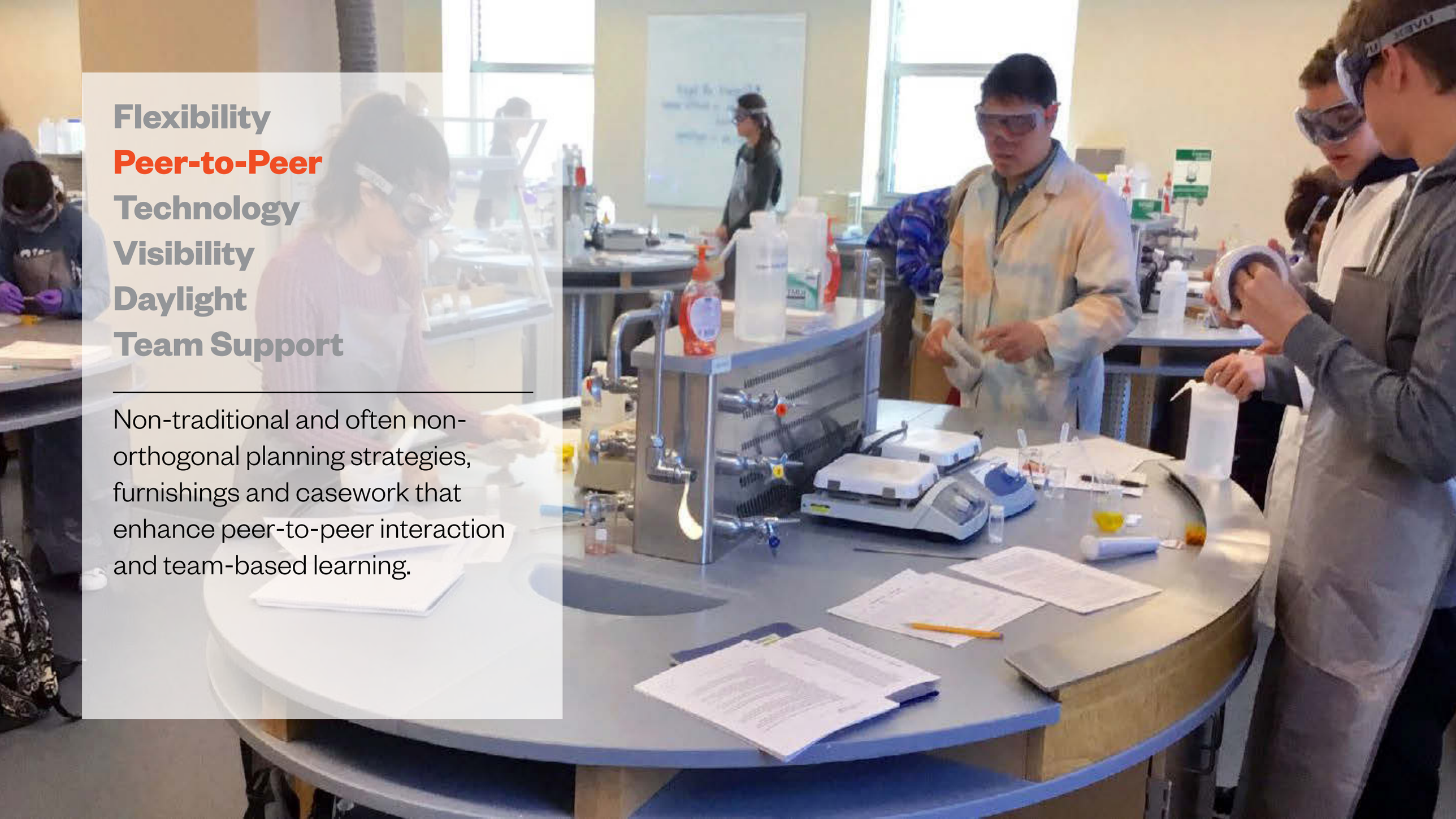
Daylight

Team Support

---

Includes short term reconfigurability and long term “future proofing.” Mobile casework, robust infrastructure, configurable power sources, etc.  Less flexible items such as fume hoods and sinks located at perimeter.





Flexibility

**Peer-to-Peer**

Technology

Visibility

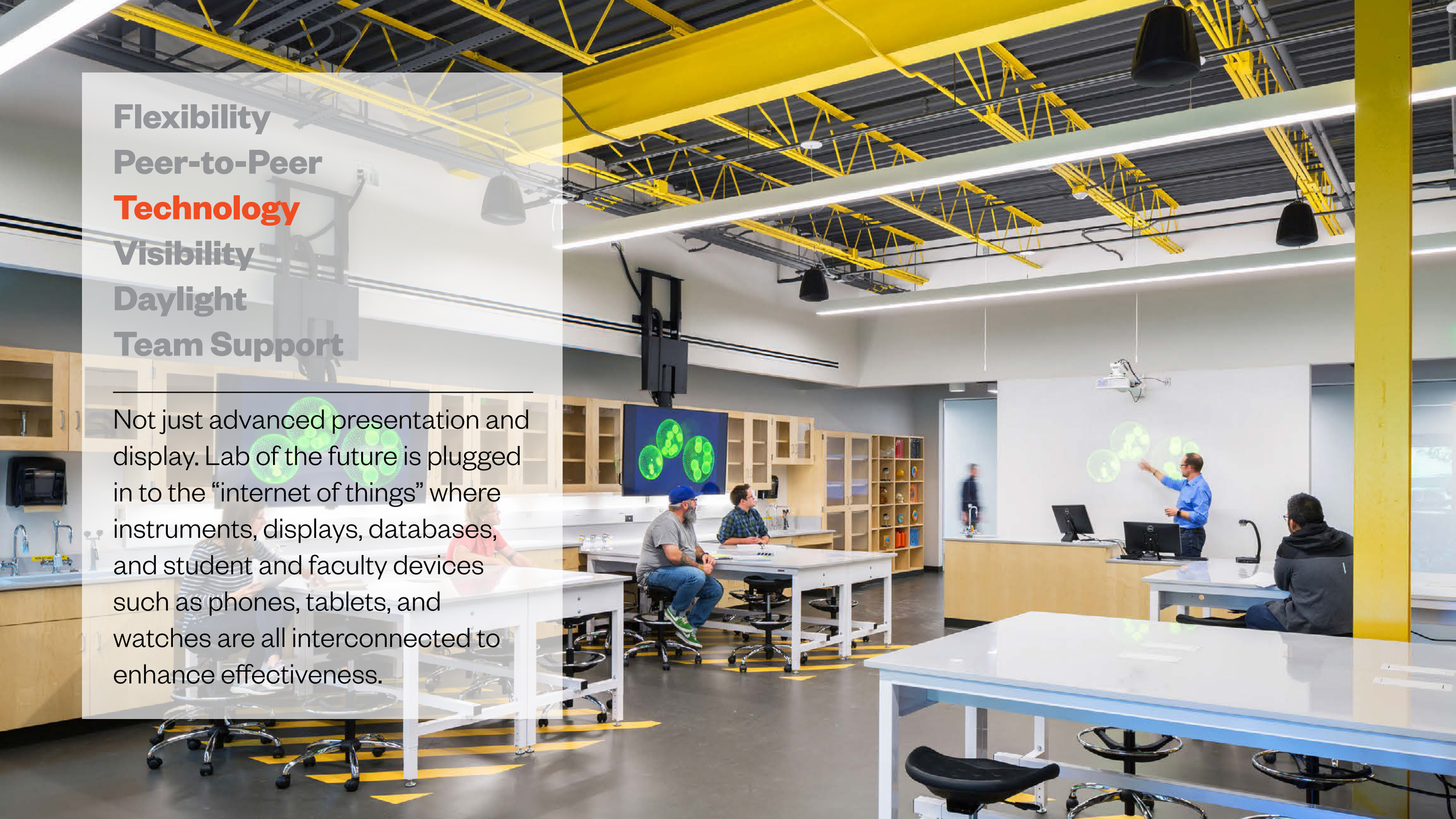
Daylight

Team Support

---

Non-traditional and often non-orthogonal planning strategies, furnishings and casework that enhance peer-to-peer interaction and team-based learning.


new england lab
lab-tested furniture systems



Flexibility

Peer-to-Peer

**Technology**

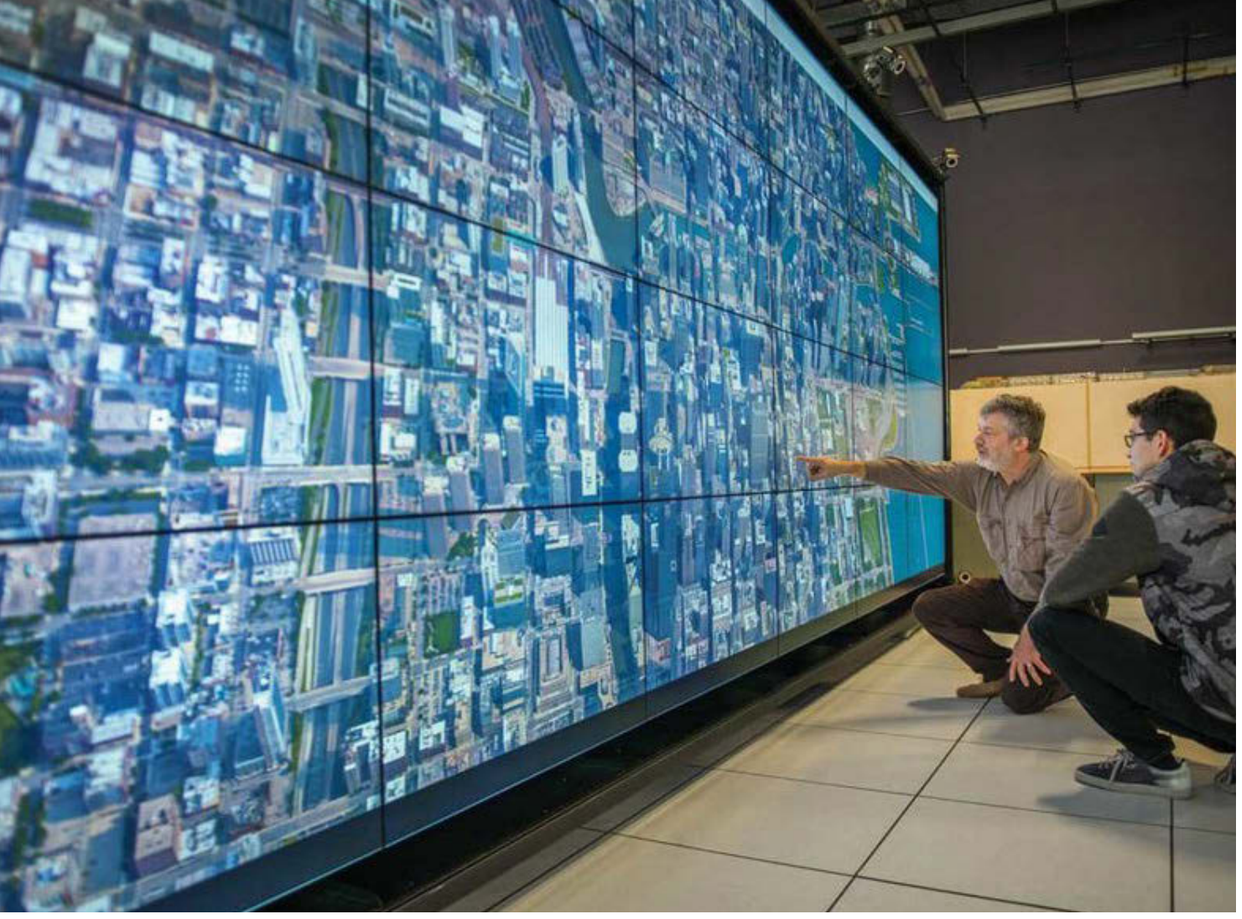
Visibility

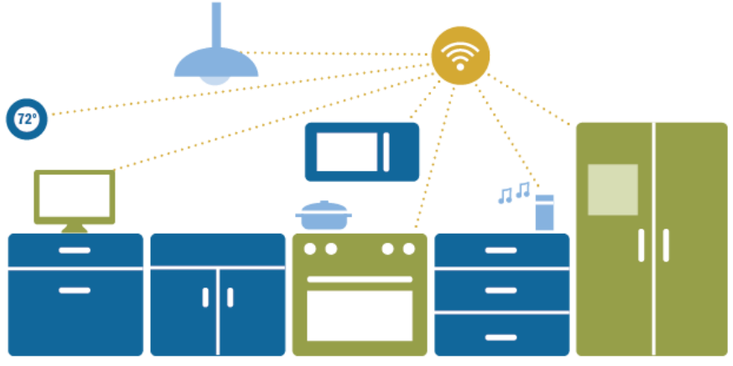
Daylight

Team Support

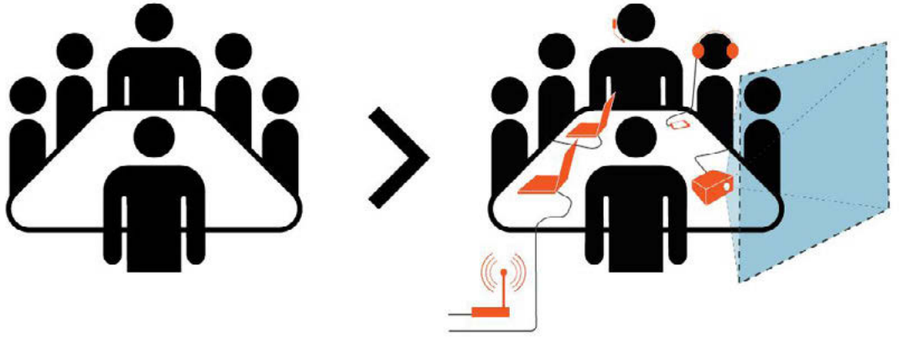
---

Not just advanced presentation and display. Lab of the future is plugged in to the “internet of things” where instruments, displays, databases, and student and faculty devices such as phones, tablets, and watches are all interconnected to enhance effectiveness.






**Internet of Things (IOT)**



**classroom** **classroom 2.0**


Flexibility

Peer-to-Peer

Technology

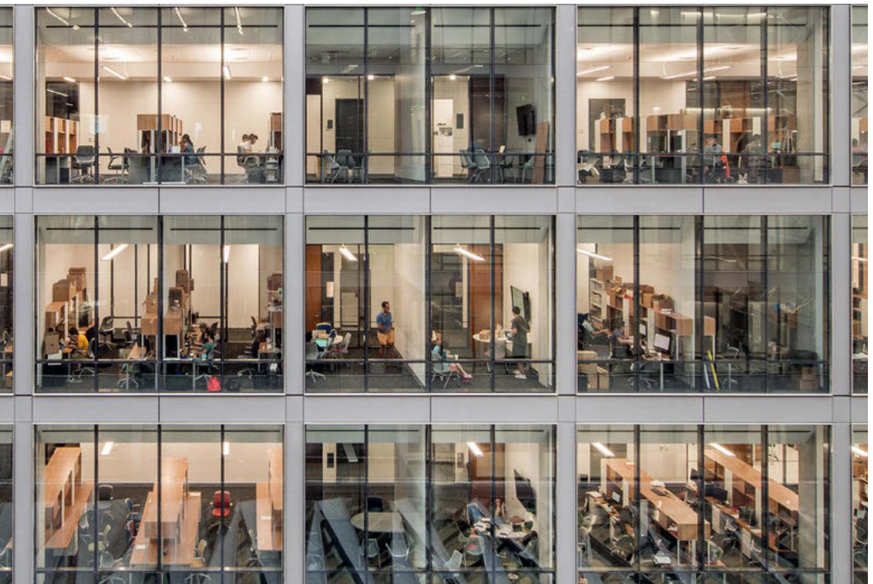
**Visibility**

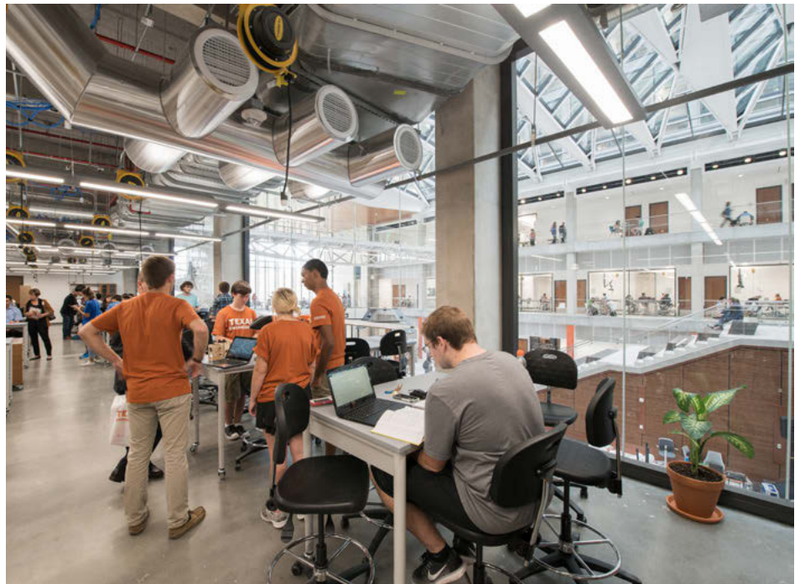
Daylight

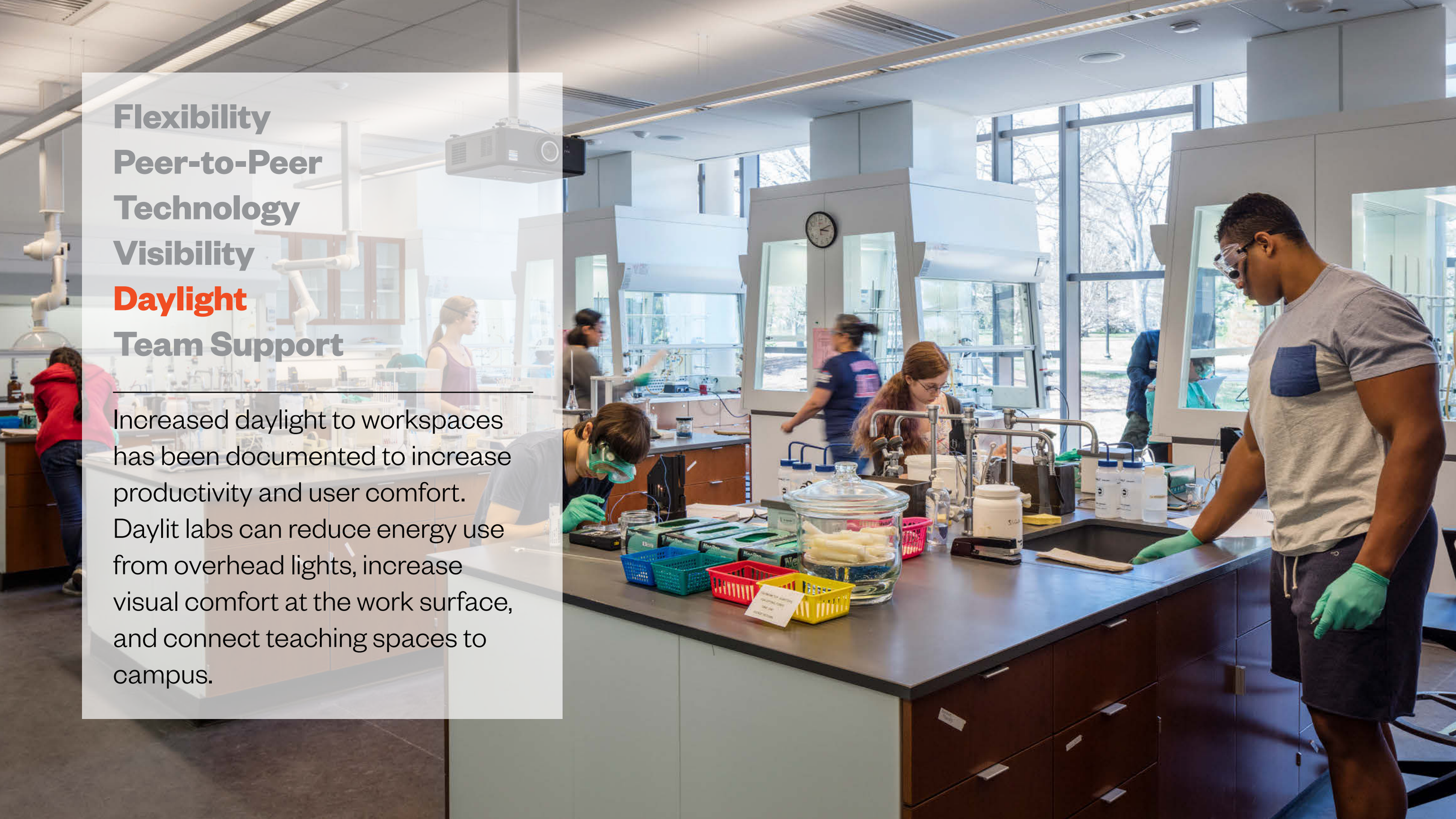
Team Support

---

Increased visibility of research activity builds excitment and a desire to learn while enhancing safety and security in the labs. Transparency between labs and other spaces enhances community and bolsters overall educational mission.





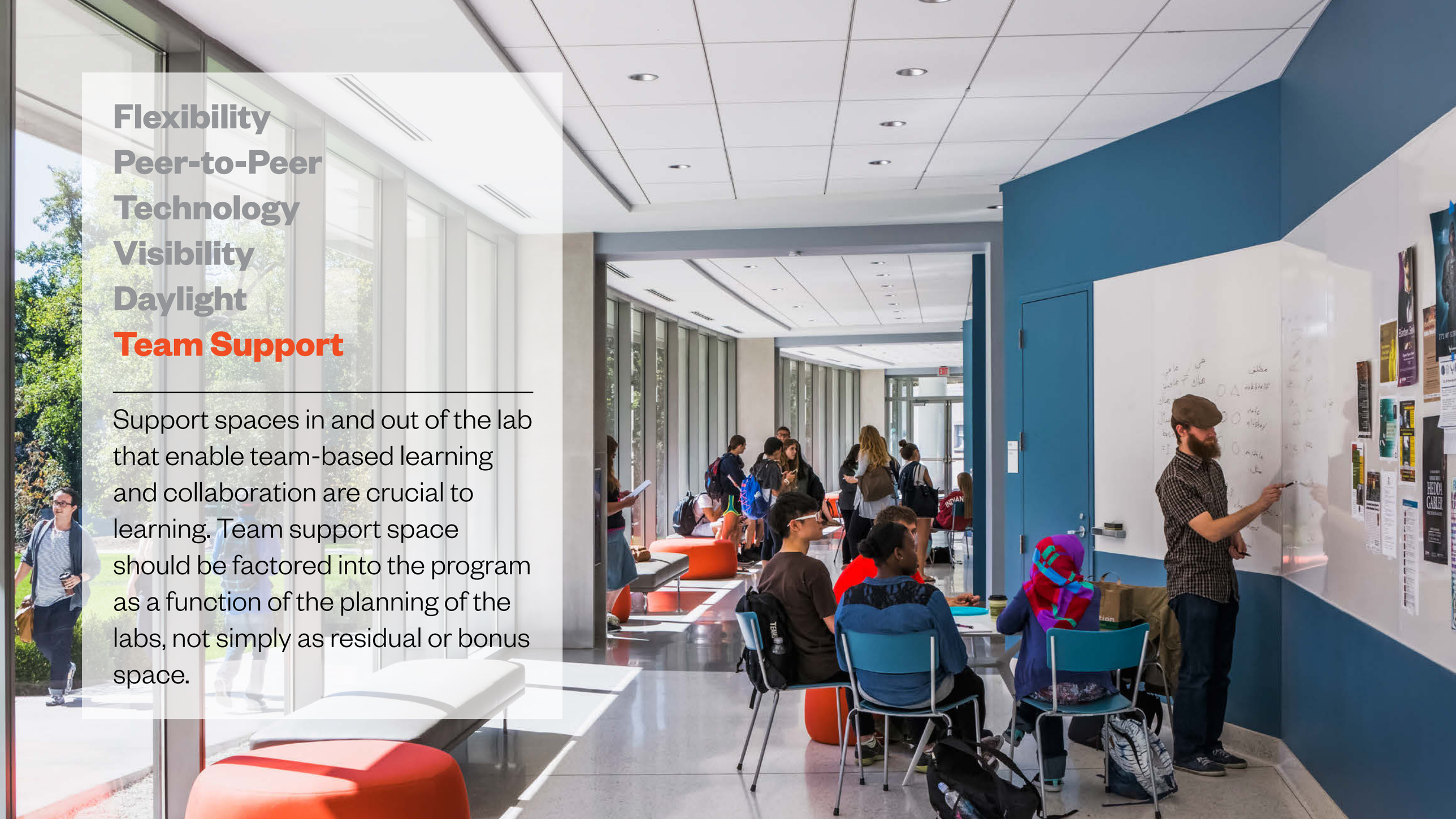


Flexibility
Peer-to-Peer
Technology
Visibility
**Daylight**
Team Support

---

Increased daylight to workspaces has been documented to increase productivity and user comfort. Daylit labs can reduce energy use from overhead lights, increase visual comfort at the work surface, and connect teaching spaces to campus.

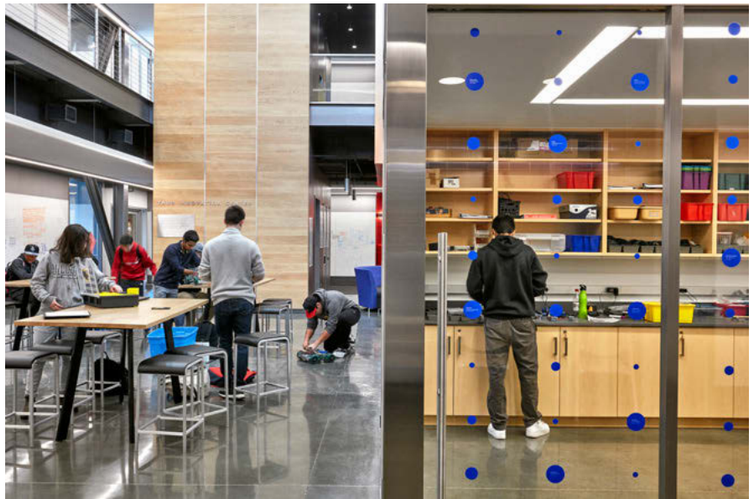

OBEY
Worldwide
PROPAGANDA

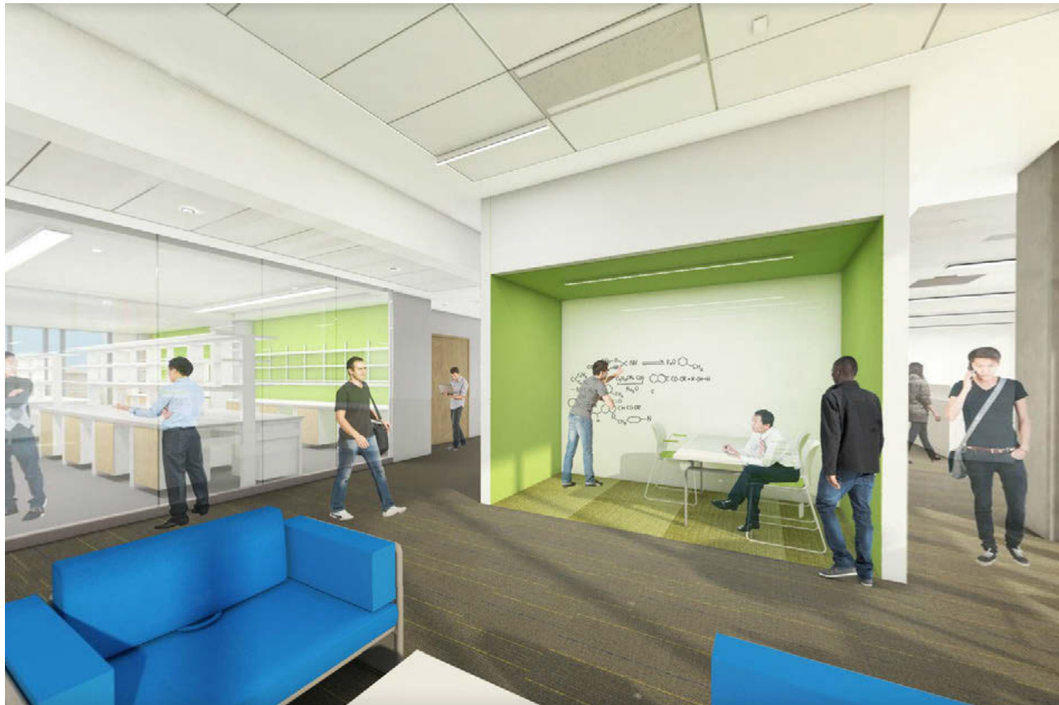


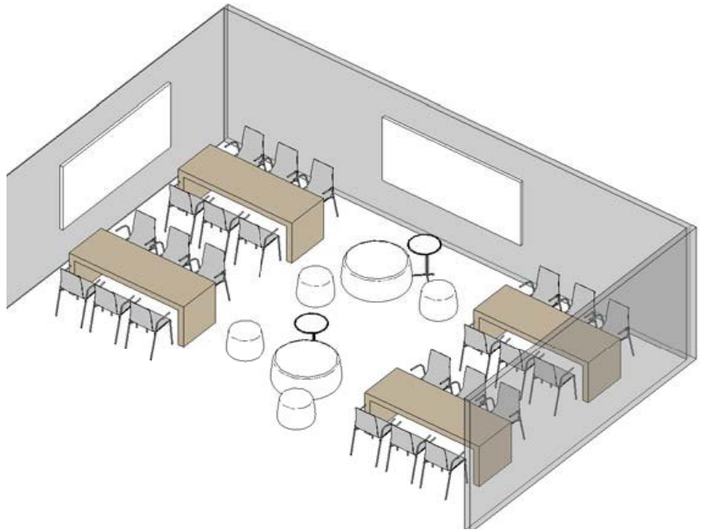
Flexibility
Peer-to-Peer
Technology
Visibility
Daylight
**Team Support**

---

Support spaces in and out of the lab that enable team-based learning and collaboration are crucial to learning. Team support space should be factored into the program as a function of the planning of the labs, not simply as residual or bonus space.

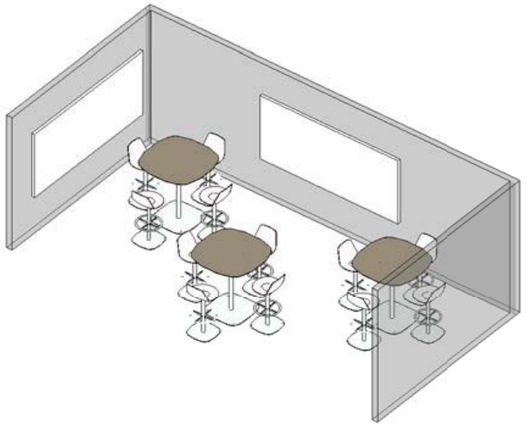






**3 SF / Student** +

Tutoring support
Study hall
Gallery / exhibition

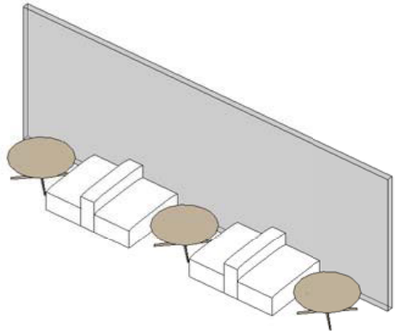


**5 SF / Student** +

Large team meeting
Multiple work groups

**1 SF / Student** +

Small team meeting
Study space
Casual Interaction



**1 SF / Student**

Casual interaction
One-on-one

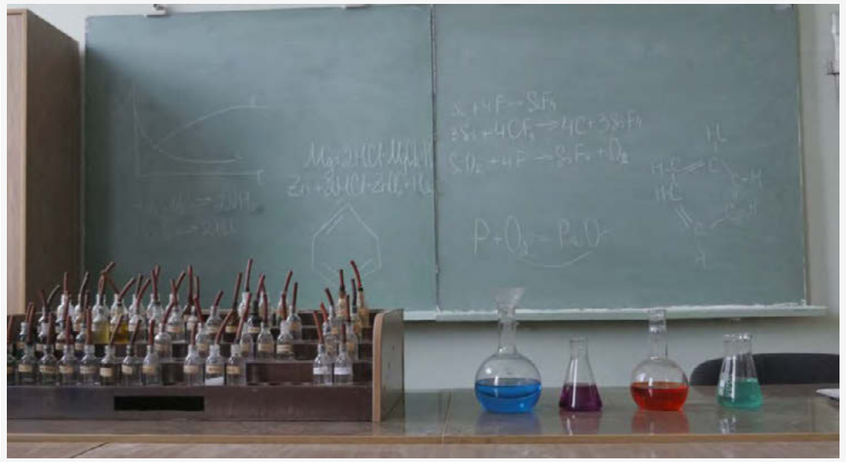
**10 SF / Student** Varied Team Support Space Sizes

# CURRENT CHEMISTRY TEACHING

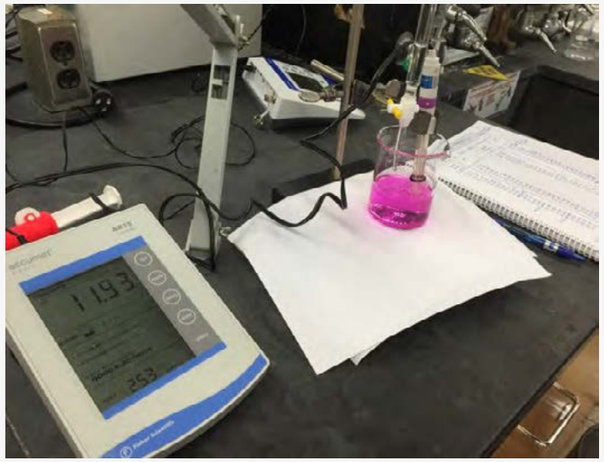
@

PURDUE UNIVERSITY

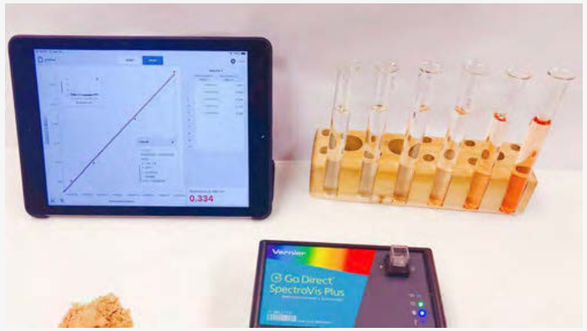
PEN AND PAPER LECTURE NOTES



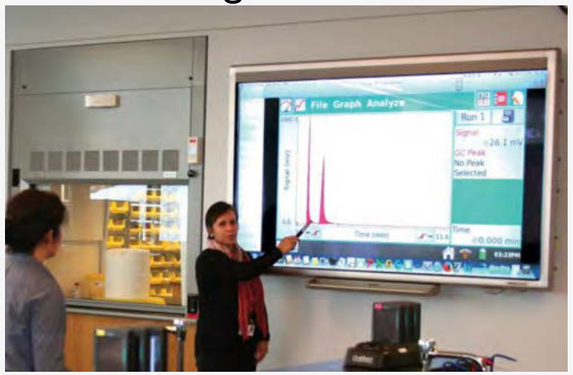
CHALKBOARDS IN LAB



WIRED PROBES AND SENSORS




Wireless, digital data collection




Real-time, in-lab teaching presentations

Live, interactive lecture notes

# NGDLEC

@

PURDUE UNIVERSITY

Replace traditional teaching methods with connected digital technologies!

- Live, interactive lecture notes
- Digital lab manual
- Real-time lab presentation
- Digital data collection
- Electronic Laboratory Notebook (ELN)
- On-line grading/LMS integration

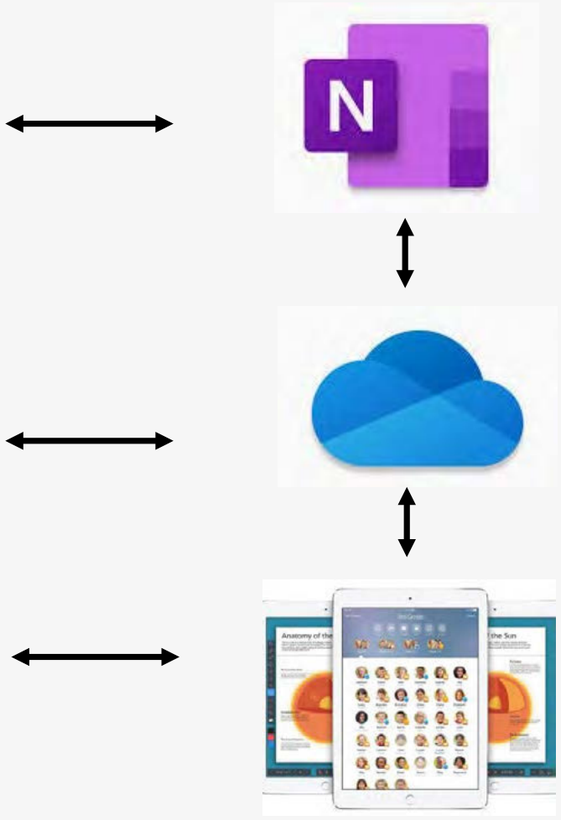
# NGDLEC

@

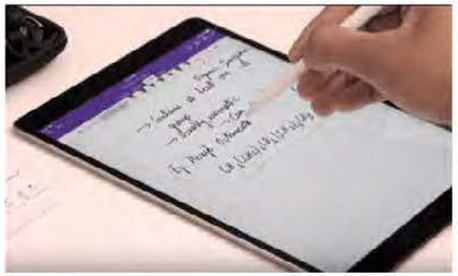
PURDUE UNIVERSITY

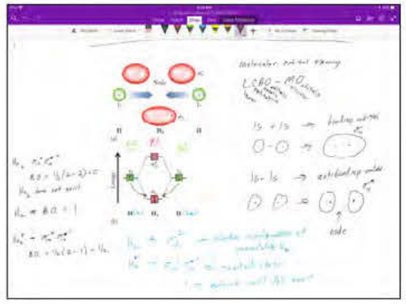
- Connected Digital Technologies:
  - OneNote Class Notebook (w/Microsoft O365)
  - OneDrive (w/Microsoft O365)
  - Vernier wireless probeware
  - Apple iPads with Apple Pencil
  - D2L
  - Apple Classroom

# IPADS FACILITATE THE USE OF:
ONENOTE
ONEDRIVE
APPLE CLASSROOM



# Real-time Digital Lecture Notes





**Lecture Materials:**

- Available anytime, anywhere
- Use Apple Pencil to write notes
- Insert pictures (pre-loaded or insert as needed)
- Include links, distribute activities or quizzes

**Advantages:**

- Lecture materials appear on student devices in real time and students follow on their devices
- No need to post lecture notes on LMS
- Paperless in-class activities

# Wireless, Digital Data Collection

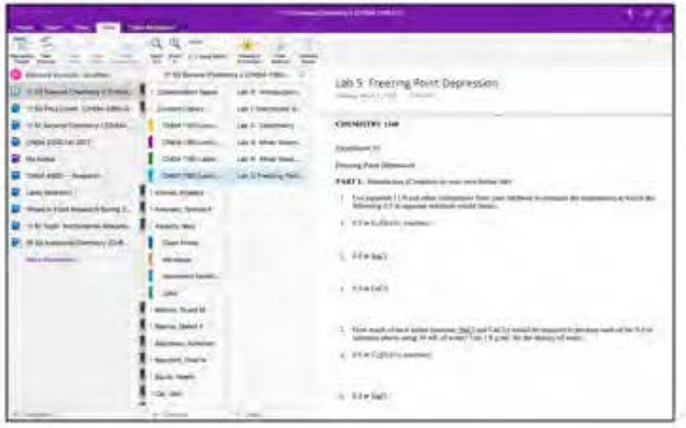
**Advantages:**

- Data collected direct to student device
- Data accessible outside of lab
- Easily input into Lab Notebook
- Data sharing done quickly

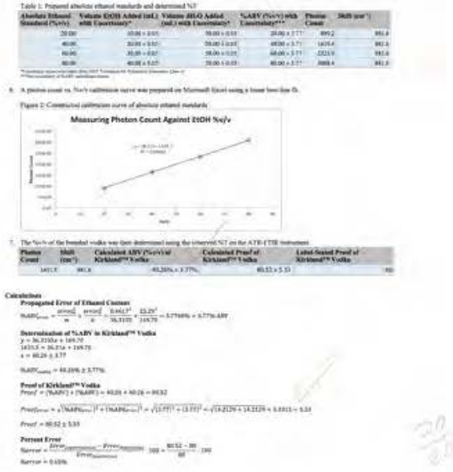
# Digital Lab Manual

**Advantages:**

- Electronically distribute lab materials to students
- Provide color pictures and videos for instruction
- Free to students
- Able to be easily updated



# Electronic Lab Notebook

**ELN:**

- Accessible across multiple platforms
- Numerous input methods: Typing, stylus, photographs, data graphs, video

**Advantages:**

- Student work is secure, available
- Input is time stamped
- Paperless labs

# Digital Instruction and Grading

**Advantages:**

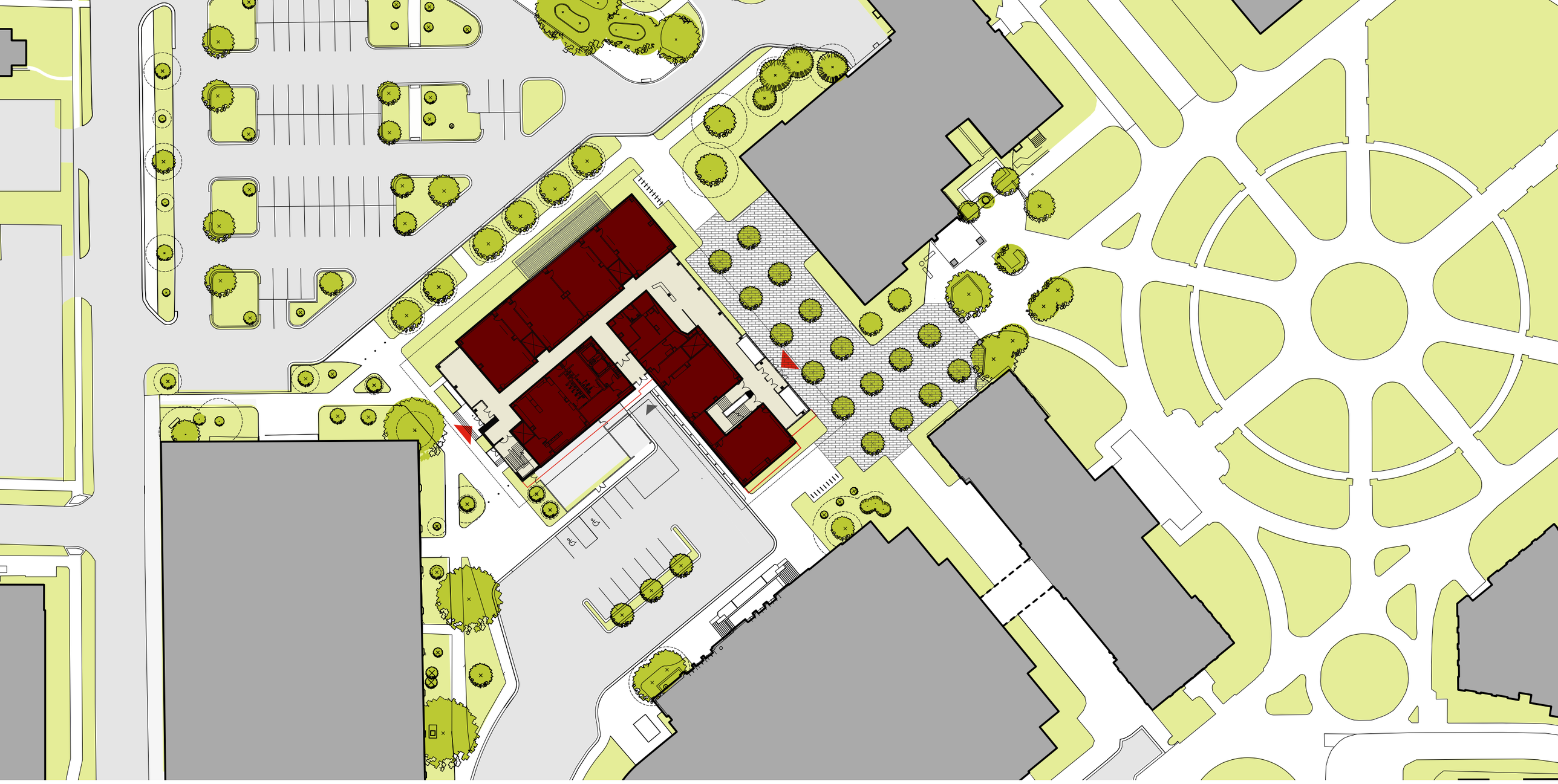
- Present any student's work on HDTV in lab
- Use iPad camera for live demonstrations
- Grading synced to student ELN
- Paperless


**Purdue University** From Master Plan to New Construction

**STEM Lab Building** Connecting to Campus


“The Billboard”

**STEM Teaching Lab** Building Sections



# Site Plan

**Biology Labs**

**Chemistry Labs**

**Team Support & Collaboration**

**Staff Support**


**STEM Teaching Lab** Typical Floor Plan

**STEM Lab Building** Floor Plans



# **STEM Lab Building** Floor Plans

# **STEM Lab Building** Floor Plans

# **STEM Lab Building** Floor Plans

# **STEM Lab Building** Floor Plans


ARMS
HAMP
PHYS
WANG
PUSH
RHPH
FRNY
MSEE
JNSN
SCHL
EE
ME
HOVD
PGNW
PSYC
PRCE
CL50
SC
HAAS
PGU
MATH
REC
TEL
BRNG
UNIV
MRRT
MTHW
STON
WTHR
BRWN
HEAV
POTR
MG
GRIS
KNOY
NUCL
BALY
PGG
PMUC
Office of Admissions
PURDUE UNIVERSITY RETAIL PHARMACY
Stadium Mall
Purdue Mall
Centennial Mall
Memorial Mall
Founders Park
John Purdue's Grave
Bell Towe
Purdue Exponent
Sylvia St.
Hayes St.
N. Grant St.
University St.
Waldron St.
Oval Dr.
Lutz
ONE WAY
Thank You