

# WPI

## Innovative Approaches to Tackling Complex Challenges

**Rick Vaz**

*Center for Project-Based Learning  
Worcester Polytechnic Institute*

Colloquium on Teaching and Learning Innovation

April 7, 2017

# OUR UNDERACHIEVING COLLEGES



A CANDID LOOK AT HOW MUCH  
STUDENTS LEARN AND  
WHY THEY SHOULD BE LEARNING MORE

**DEREK BOK**

# THE WAR ON LEARNING

GAINING GROUND IN THE DIGITAL UNIVERSITY

ELIZABETH LOSH



Copyrighted Material

# COLLEGE (UN)BOUND

THE FUTURE OF HIGHER EDUCATION  
AND WHAT IT MEANS FOR STUDENTS



**JEFFREY J. SELINGO**  
Editor at Large, *The Chronicle of Higher Education*

Editor at Large  
BEST-SELLING AUTHOR

**J. BENNETT**

WITH **DAVID WILEZOL**

# FAIL U. THE FALSE PROMISE OF HIGHER EDUCATION

**CHARLES J. SYKES**

# HIGHER EDUCATION?

HOW COLLEGES ARE WASTING OUR MONEY  
AND FAILING OUR KIDS  
AND WHAT WE CAN DO ABOUT IT

**ANDREW HACKER • CLAUDIA DREIFUS**

Copyrighted Material

# IS COLLEGE WORTH IT?

A FORMER UNITED STATES SECRETARY OF  
EDUCATION AND A LIBERAL ARTS GRADUATE EXPOSE  
THE BROKEN PROMISE OF HIGHER EDUCATION

Copyrighted Material

# Interesting Times for Higher Ed

---

- Increasing costs
- Decreasing public support
- Changing student profiles
- Changing faculty roles
- Emerging delivery models
- Rapid technological advance



Will your institution thrive?

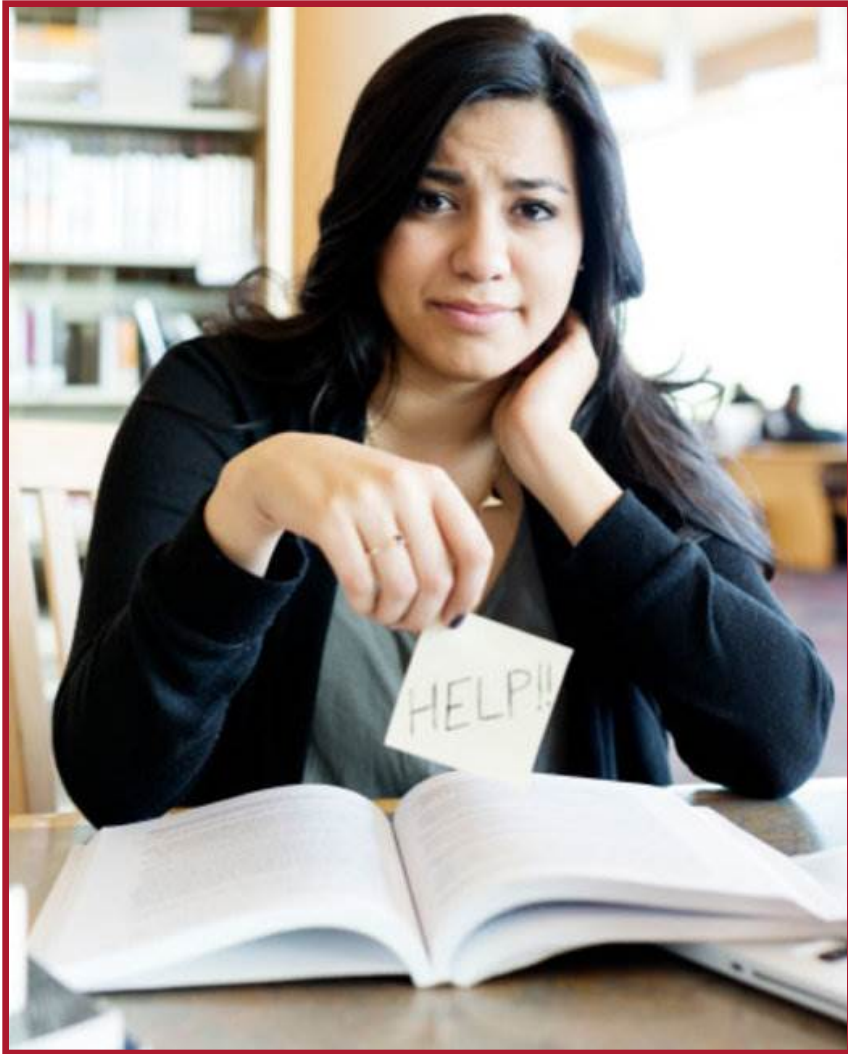
Will it survive?

*How can we best serve our  
students?*



# Interesting Times for Students, Too

---



- Equity and access challenges
- High levels of debt
- Changing workforce
- Evolving technologies

Knowledge is becoming a  
commodity

Credentialing schemes will  
follow

*How do we provide value?*

# Most Important College Learning Outcomes, According to US Employers

---

1. Ability to communicate orally
2. Ability to work effectively with others
3. Ability to communicate in writing
4. Ethical judgment and decision-making
5. Critical thinking and analytical reasoning
6. Ability to apply knowledge and skills to real-world settings

**91% of employers agree that these abilities are more important than the student's major area of study to achieve success in their careers**

*Source: Hart Research Associates, 2015*

# Evidence-Based, High Impact Practices

*(Kuh, AAC&U, et al.)*

---

- First-Year Seminars and Experiences
- Common Intellectual Experiences
- Learning Communities
- Writing-Intensive Courses
- Collaborative Assignments and Projects
- Undergraduate Research
- Diversity/Global Learning
- Service Learning/Community-Based Learning
- Internships
- Capstone Courses and Projects

# Project-Based Learning

- Applying knowledge to address complex, authentic problems
- Learning new topics independently
- Communicating effectively in written, oral, and visual forms
- Interacting productively with others





# Project Based Learning vs. Problem Based Learning

## Similarities

- Focus on an open-ended question or problem
- Provide authentic applications of content and skills
- Emphasize student independence and inquiry
- Are longer and more multifaceted than traditional assignments

## Differences

### ***Project Based Learning***

Often multi-disciplinary

May be lengthy (weeks, months)

Includes the creation of a product or performance for a relevant audience

Often involves real-world, fully authentic tasks and settings

May be almost entirely student-directed

### ***Problem Based Learning***

More often single subject

Tend to be shorter

Product may simply be a proposed solution, expressed in writing or in an oral presentation

More often uses case studies or fictitious scenarios as ill-structured problems

Often includes pre-planned, staged instruction

# High Impact Practices *(Kuh, AAC&U, et al.)*

---

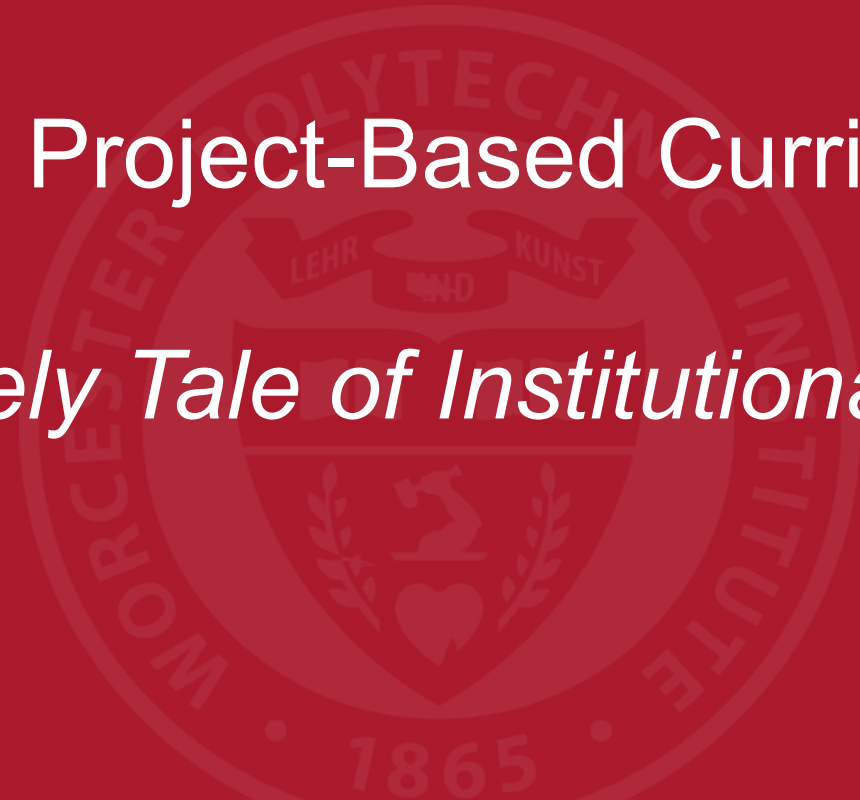
- ✓ First-Year Seminars and Experiences
- ✓ Common Intellectual Experiences
- ✓ Learning Communities
- ✓ Writing-Intensive Courses
- ✓ Collaborative Assignments and Projects
- ✓ Undergraduate Research
- ✓ Diversity/Global Learning
- ✓ Service Learning/Community-Based Learning
- ✓ Internships
- ✓ Capstone Courses and Projects

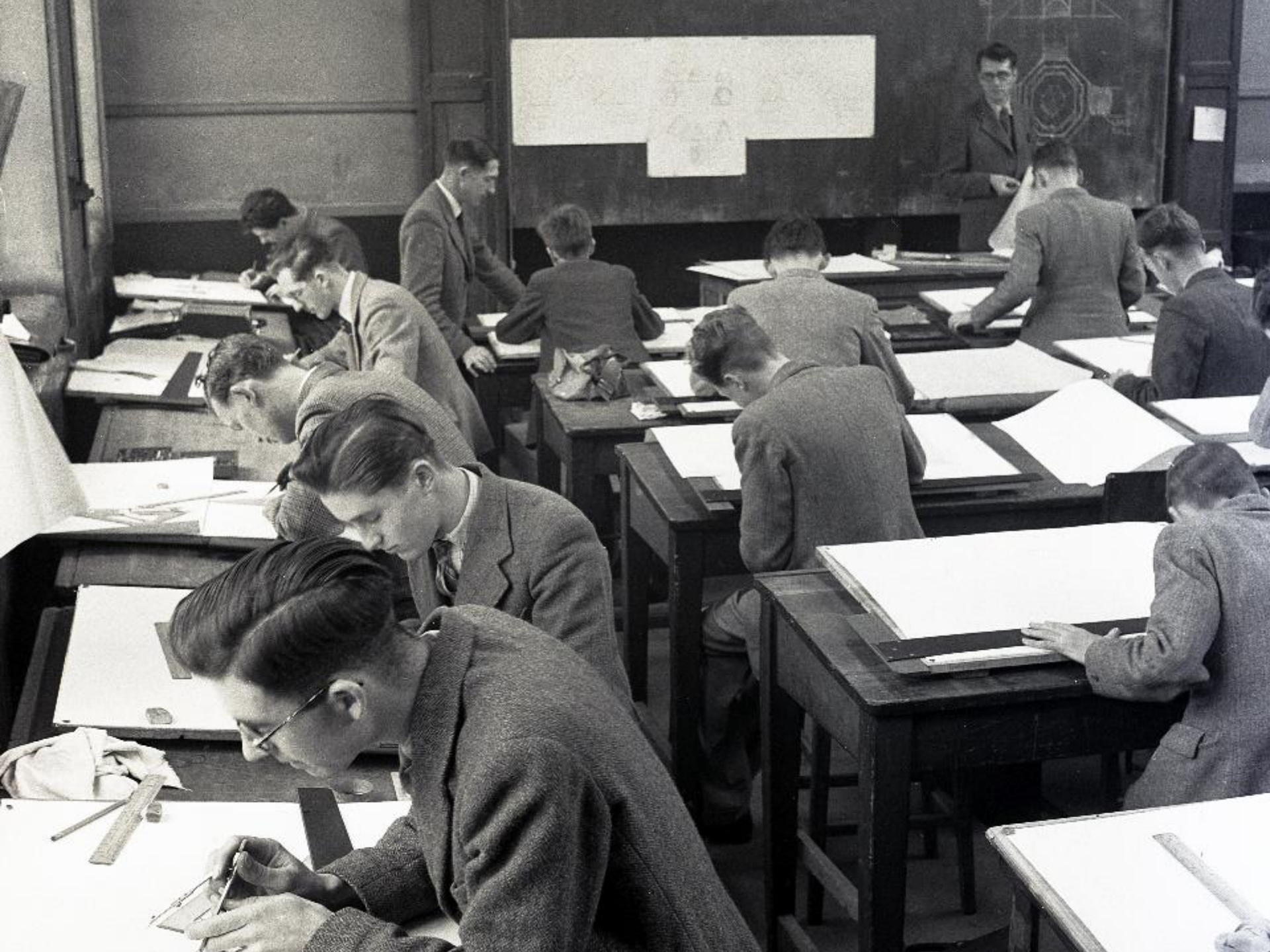
## *Case Study*

# WPI's Project-Based Curriculum:

## *An Unlikely Tale of Institutional Change*

(Don't try this at home)











# Proposed Educational Goals

December 17, 1969

## GOALS STATEMENT

(Endorsed by the Faculty, 17 December 1969)

It is the goal of the Worcester Polytechnic Institute to bring into the second century of its existence a new, dynamic version of its "Two Towers" tradition.

By means of co-ordinated programs tailored to the needs of the individual student, it is the fundamental purpose of WPI to impart to the student an understanding of a sector of science and technology and a mature understanding of himself and the needs of the people around him. The WPI student, from the beginning of his undergraduate education, should demonstrate that he can learn on his own, that he can translate his learning into worthwhile action, and that he is thoroughly aware of the interrelationships among basic knowledge, technological advance, and human need. A WPI education should develop in the student a strong degree of self-confidence, an awareness of the community beyond himself, and an intelligence that spurs him to continued learning.

- *Learn independently*
- *Translate learning into worthwhile action*
- *Apply knowledge to meet human needs*
- *Develop self-confidence*
- *Develop awareness of others and self*

WORCESTER POLYTECHNIC INSTITUTE  
Worcester, Massachusetts

May 29, 1970

To: WPI Faculty

From: Secretary of the Faculty

Subject: Vote on the Planning Committee Report

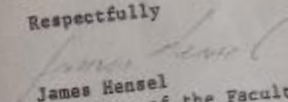
Pursuant to action at the May 12, 1970 Faculty Meeting, the final vote on the Planning Committee Report was to be by written ballot. The results follow:

MOTION: To adopt the sections of "The Future of Two Towers, Part IV: A Plan" as presented and amended at the Faculty Meetings of May 12, 13, 15, 18, and 19, 1970.

VOTED:

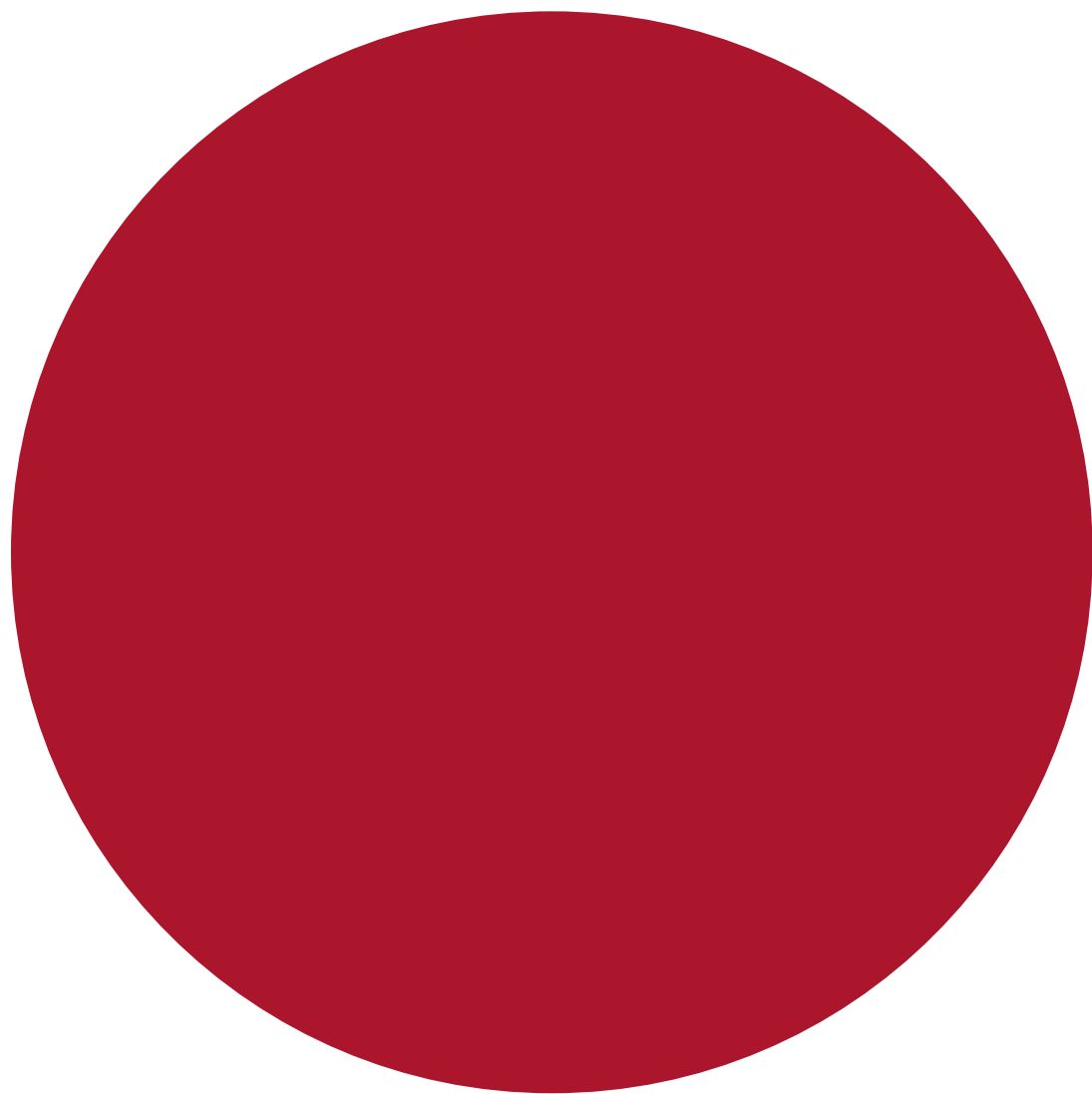
in favor	92
opposed	46
abstaining	<u>3</u>
total returns	141

Respectfully

  
James Hensel  
Secretary of the Faculty

## The Vote May 29, 1970

<i>in favor</i>	<b>92</b>
<i>opposed</i>	<b>46</b>
<i>abstaining</i>	<b>3</b>



**MAJOR**



**GENERAL  
EDUCATION**

**MAJOR**

**GENERAL  
EDUCATION**

**GREAT  
PROBLEMS  
SEMINAR**

YEAR  
**1**

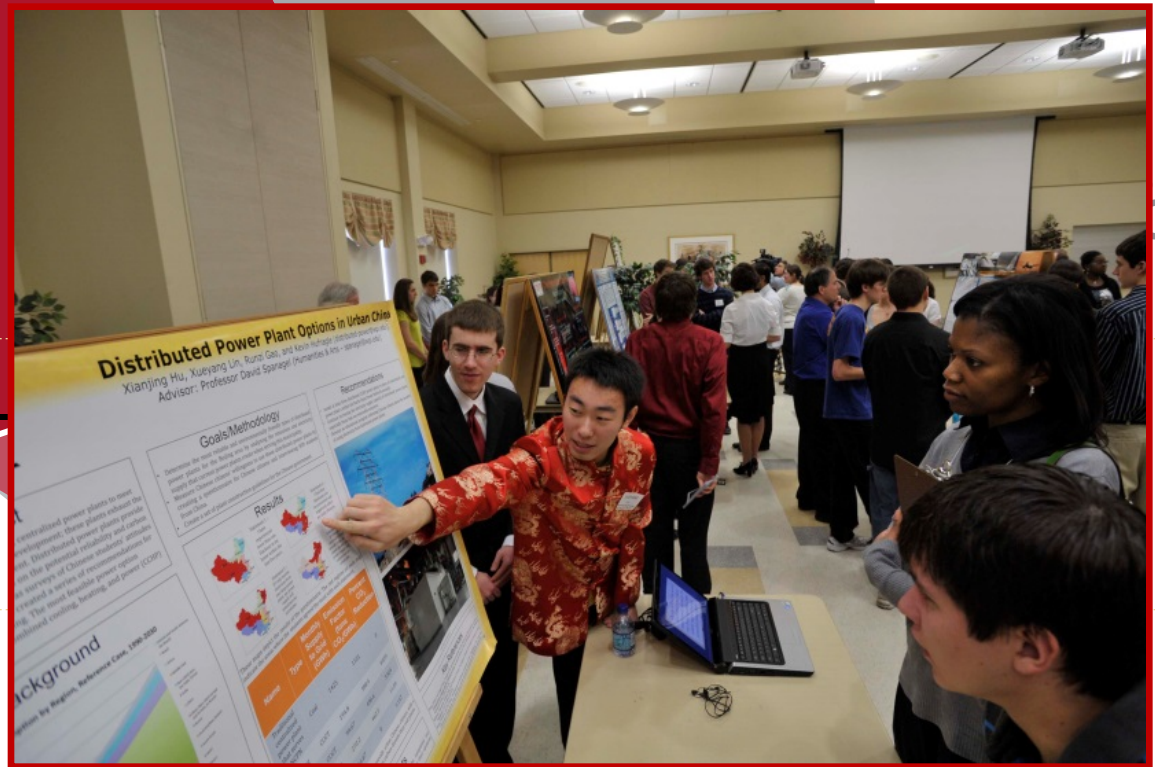


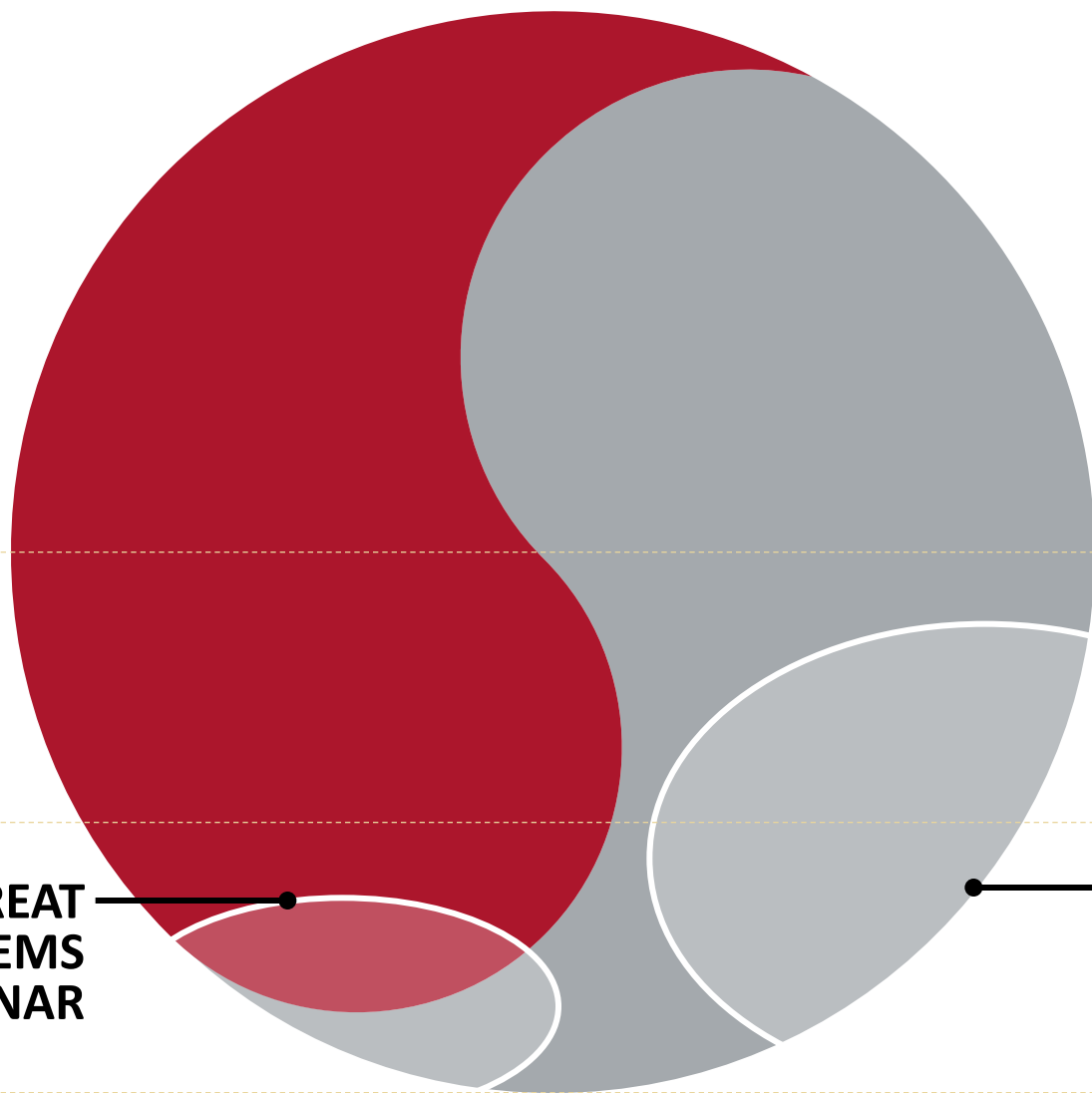


MAJOR

YEAR  
1

GREAT  
PROBLEMS  
SEMINAR





YEAR  
**2**

**MAJOR**

**GENERAL  
EDUCATION**

YEAR  
**1**

**GREAT  
PROBLEMS  
SEMINAR**

**HUMANITIES  
AND ARTS**

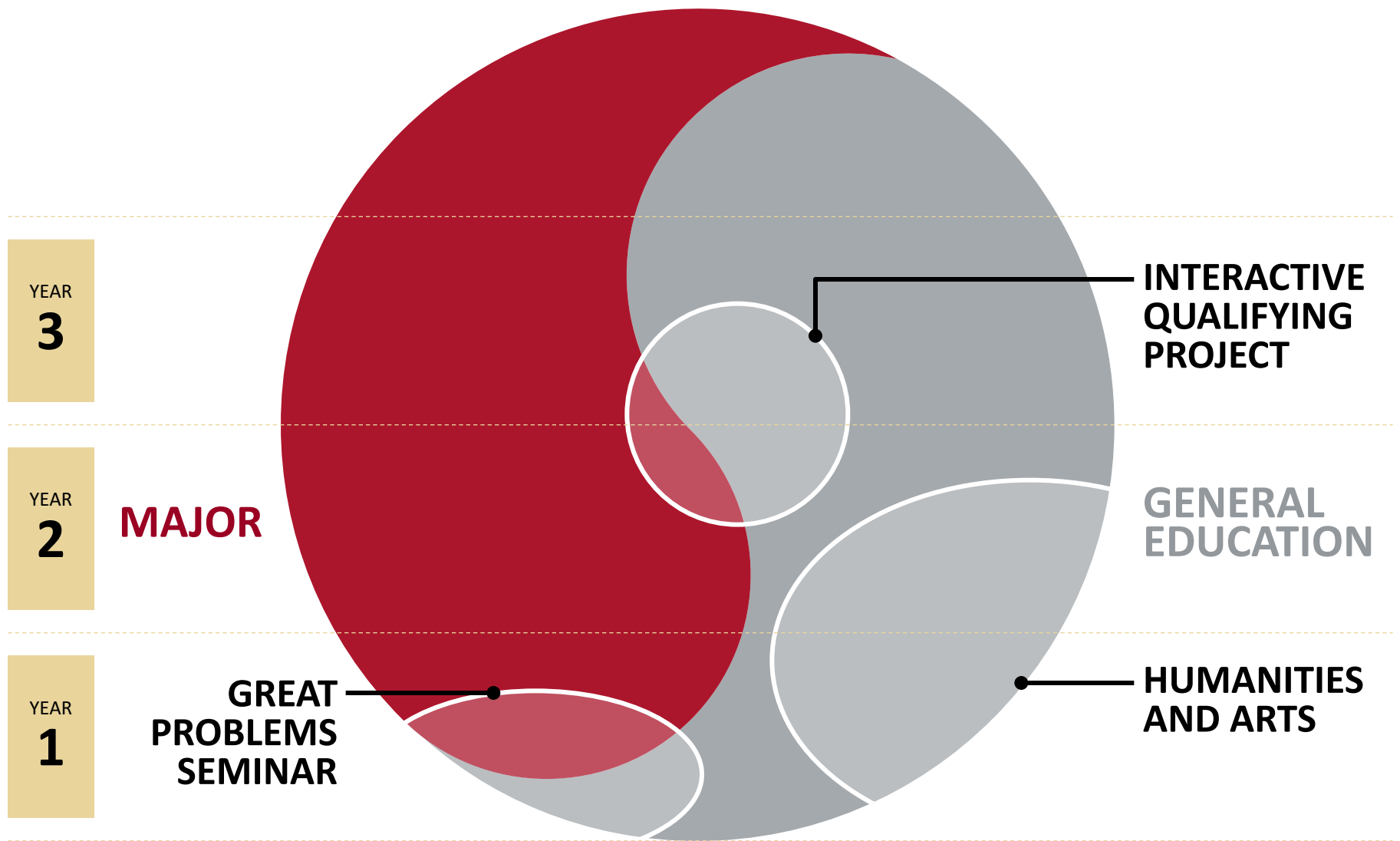
YEAR  
**2**

YEAR  
**1**



GENERAL  
EDUCATION

HUMANITIES  
AND ARTS



YEAR  
**3**

YEAR  
**2**

YEAR  
**1**

**MAJOR**

**GREAT  
PROBLEMS  
SEMINAR**

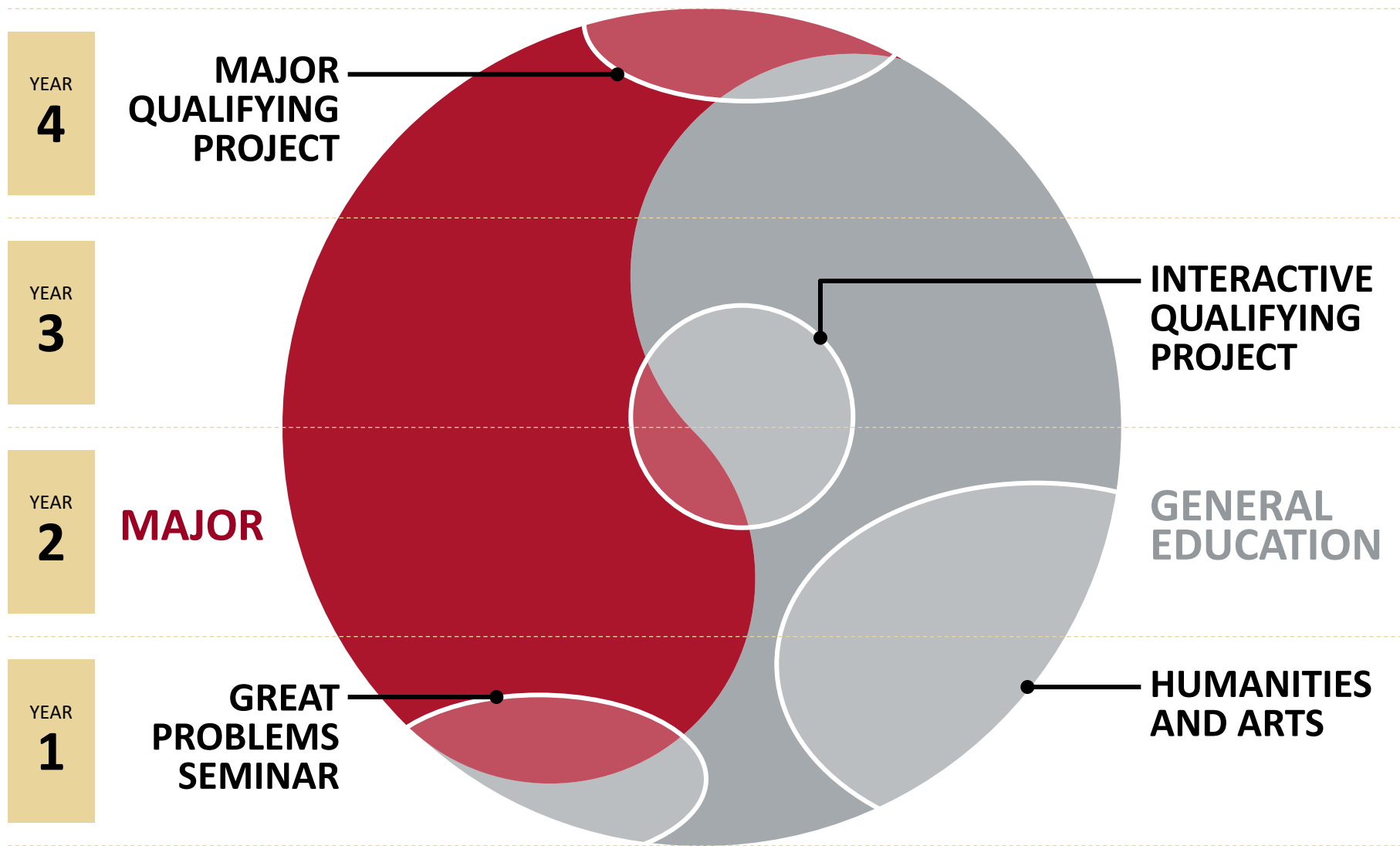


**INTERACTIVE  
QUALIFYING  
PROJECT**

**GENERAL  
EDUCATION**

**HUMANITIES  
AND ARTS**





YEAR  
**4**

**MAJOR  
QUALIFYING  
PROJECT**

YEAR  
**3**

**INTERACTIVE  
QUALIFYING  
PROJECT**

YEAR  
**2**

**MAJOR**

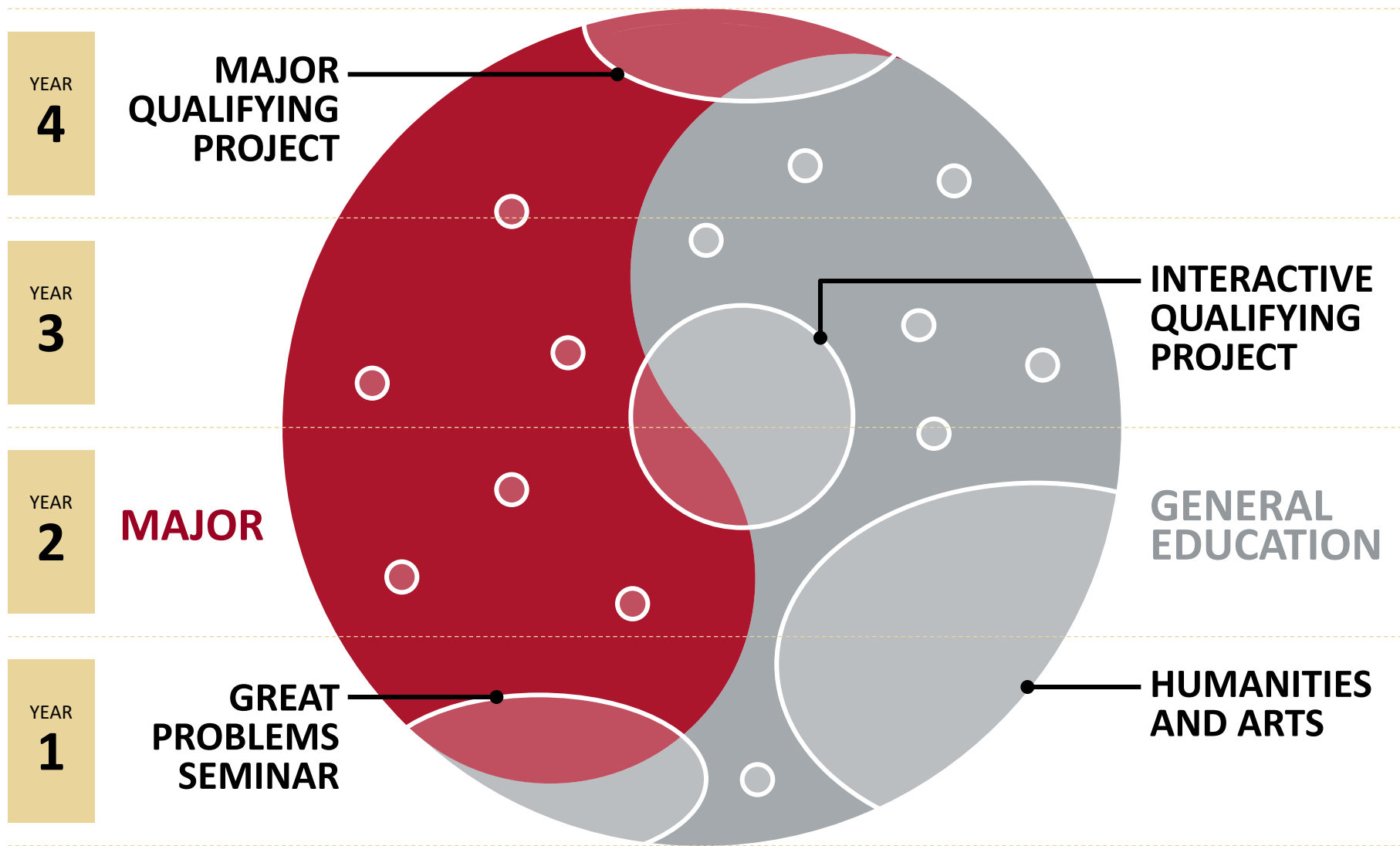
**GENERAL  
EDUCATION**

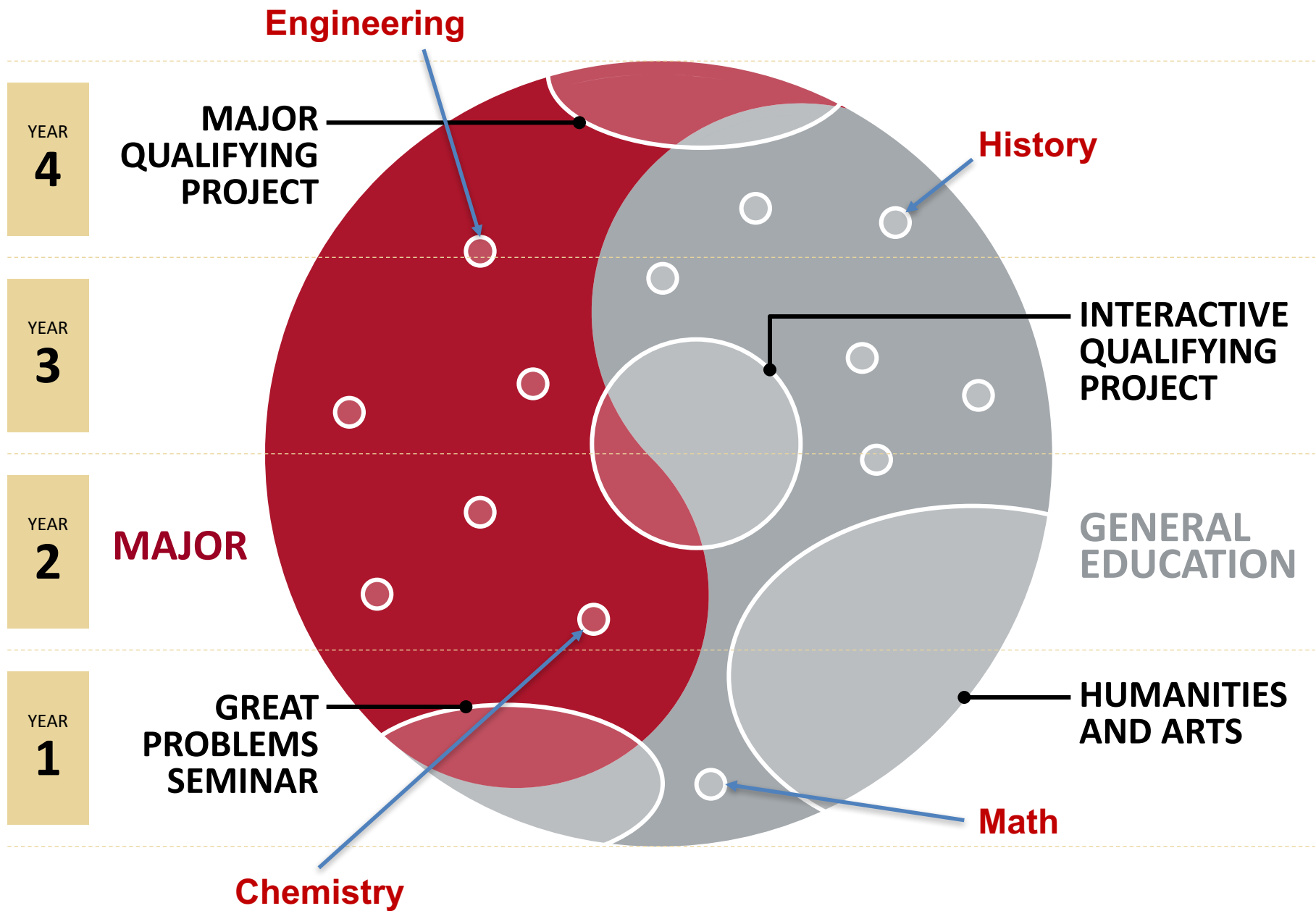
YEAR  
**1**

**GREAT  
PROBLEMS  
SEMINAR**

**HUMANITIES  
AND ARTS**









**Long-term impacts of projects?**

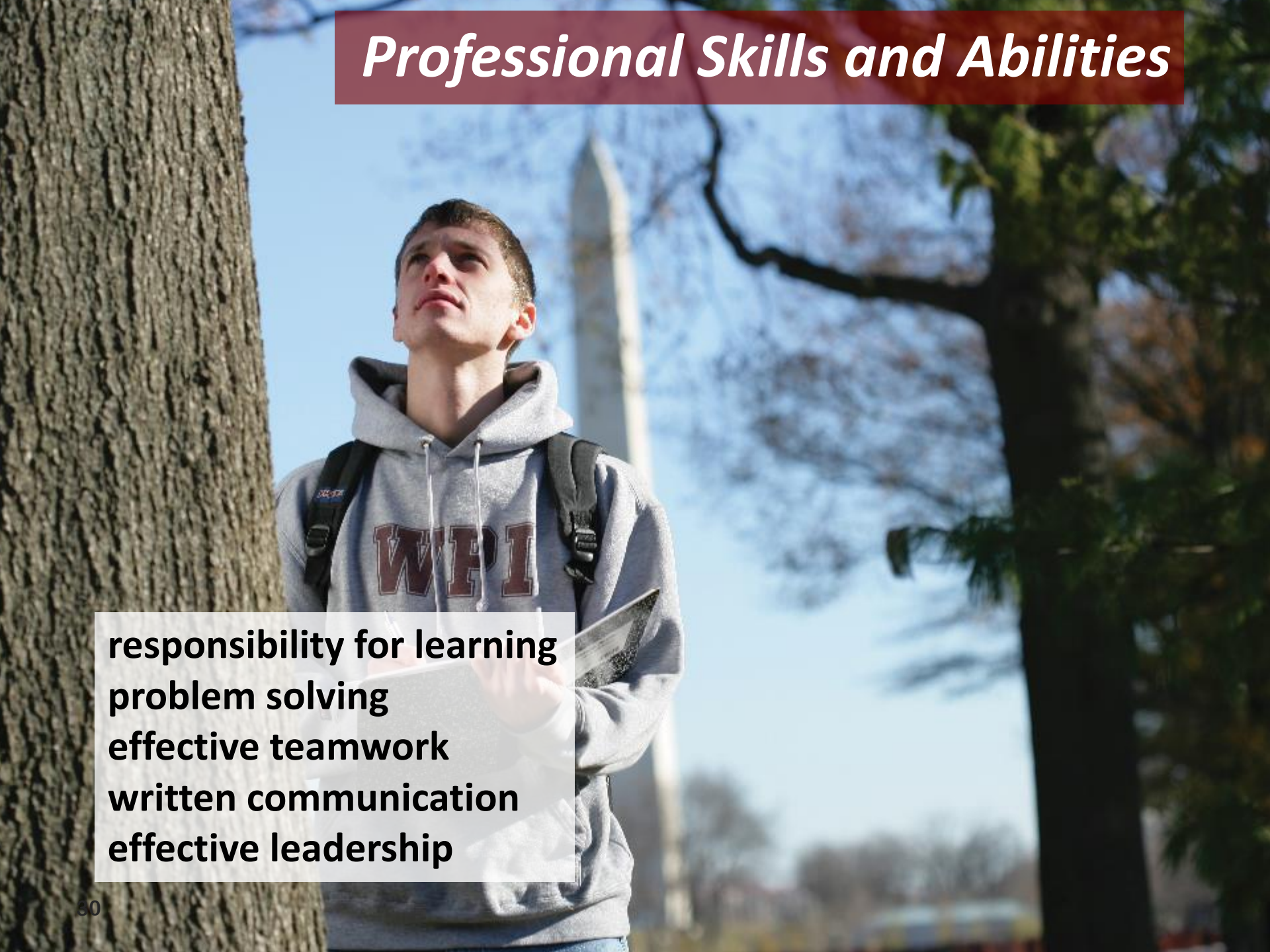
**Preparation for career and life?**

**Experience of different groups?**






# *Professional Skills and Abilities*

A young man with short brown hair, wearing a grey hoodie with 'WPI' in maroon letters and a backpack, stands outdoors. He is looking up at a large tree trunk on the left. In the background, the Washington Monument is visible against a clear blue sky. The scene is brightly lit, suggesting a sunny day.

**responsibility for learning  
problem solving  
effective teamwork  
written communication  
effective leadership**



## *Personal Impacts*

A photograph showing a woman with blonde hair, wearing a maroon sleeveless shirt, interacting with three young children. They are standing on a concrete ledge, painting a wall with colorful letters (A, B, C, D, E, F, G, H, I, J, K, L) and white dots. The woman is holding a small red cup of paint, and the children are also holding paint containers. The scene is outdoors, with a concrete wall and a metal structure in the background.

**stronger personal character  
confidence in one's ideas  
taking multiple perspectives  
being able to make a difference**



# *Impacts of Project Work Off-Campus*



more positive benefits in **33/39** areas



# *Impacts of Projects on Women*



**more positive benefits in 36/39 areas**

# Essential Elements of Project-Based Learning

*Buck Institute of Education*

---

- **Challenging Problem or Question** - at the appropriate level of challenge
- **Sustained Inquiry** - an extended process of asking questions, finding resources, and applying information
- **Authenticity** - real-world context, tasks and tools, quality standards, or impact
- **Student Voice & Choice** - students make decisions, including how they work and what they create
- **Reflection** - students reflect on learning, the effectiveness of their inquiry, the quality of their work, and obstacles
- **Critique & Revision** - students receive and use feedback to improve their process and products
- **Public Product** - students make their project work public by explaining, displaying and/or presenting it beyond the classroom

# Essential Elements of Project-Based Learning

*Buck Institute of Education*

---

- ✓ **Challenging Problem or Question** - at the appropriate level of challenge
- ✓ **Sustained Inquiry** - an extended process of asking questions, finding resources, and applying information
- ✓ **Authenticity** - real-world context, tasks and tools, quality standards, or impact
- ✓ **Student Voice & Choice** - students make decisions, including how they work and what they create
- ✓ **Reflection** - students reflect on learning, the effectiveness of their inquiry, the quality of their work, and obstacles
- ✓ **Critique & Revision** - students receive and use feedback to improve their process and products
- ✓ **Public Product** - students make their project work public by explaining, displaying and/or presenting it beyond the classroom

# Changing Faculty and Student Roles

- Faculty move away from

- Dispensing information
- Authority and expert

and toward

- Monitoring inquiry
- Coach and facilitator



- Students move away from

- Listening/watching
- Dependence
- *Gaining* knowledge

and toward

- Creating/discovering
- Independence
- *Making* knowledge



# CREATING

USE INFORMATION TO  
CREATE SOMETHING NEW

*Design, Build, Construct,  
Plan, Produce, Devise, Invent*

# EVALUATING

CRITICALLY EXAMINE INFO &  
MAKE JUDGEMENTS

*Judge, Test, Critique,  
Defend, Criticize*

# ANALYZING

TAKE INFO APART &  
EXPLORE RELATIONSHIPS

*Categorize, Examine,  
Compare/Contrast, Organize*

# APPLYING

USE INFORMATION IN A NEW (BUT SIMILAR) SITUATION

*Use, Diagram, Make a Chart, Draw, Apply, Solve, Calculate*

# UNDERSTANDING

UNDERSTANDING & MAKING SENSE OUT OF INFORMATION

*Interpret, Summarize, Explain, Infer, Paraphrase, Discuss*

# REMEMBERING

FIND OR REMEMBER INFORMATION

*List, Find, Name, Identify, Locate,  
Describe, Memorize, Define*



# How Are Project Students Evaluated?

---

- Quality of *results*
  - Careful research
  - Valid analysis
  - Persuasive arguments
  - Responsive solutions
  - Awareness of limitations
  
- Quality of *process*
  - Steadiness of effort
  - Interactions with others
  - Written and verbal communication
  - Timeliness and professionalism



# Faculty Roles in Project Work

---



- Identifying sponsors and project topics
- Academic guidance
  - Discussing research plans
  - Meetings with team and sponsor
  - Responding to written drafts and presentations
  - Evaluating results and process
- Less traditional roles
  - Logistical arrangements
  - Coaching, mentoring
  - Maintaining relationships with sponsoring organizations

# Institutional Impacts of PBL

- Student learning and attitudes
  - transferrable skills and abilities
  - confidence, self-efficacy
- Faculty culture
  - shift of focus toward learning
  - opportunities to collaborate
- Community and academic partners
  - mutual benefits
  - sustainable relationships
- Opportunities for advancement, marketing



# Other Benefits

---



- Rich accreditation evidence
  - Ability to apply knowledge
- Faculty professional development
  - Powerful experiences, attractive opportunities
- Multidisciplinary collaboration
  - Team teaching leads to other partnerships



# Discussion

