

Undergraduate Education in Kentucky: The Role of Undergraduate Research

John Mateja

URSA/McNair Programs
Murray State University

Kentucky (Past decade)



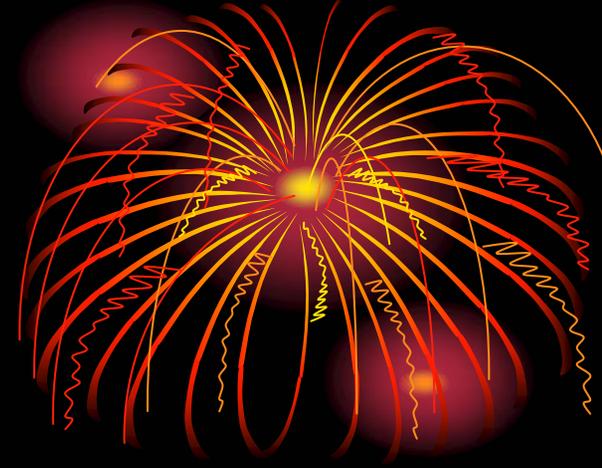
- Considerable emphasis on:
 - Bringing more students into college
 - Keeping them in college
 - Getting them college degrees
- Why?
 - Maintain standard of living by building a “knowledge-based” workforce
 - Tobacco and manufacturing jobs on a decline

Kentucky's Need – *Adult Education Act of 2000*



- 2020 Imperative
 - U.S. Census Projection
 - KY will need 800,000 adults with a bachelor's degree or higher
- Where was KY in 2000?
 - U.S. Census Data
 - 402,000 Kentuckians with a bachelor's degrees or higher

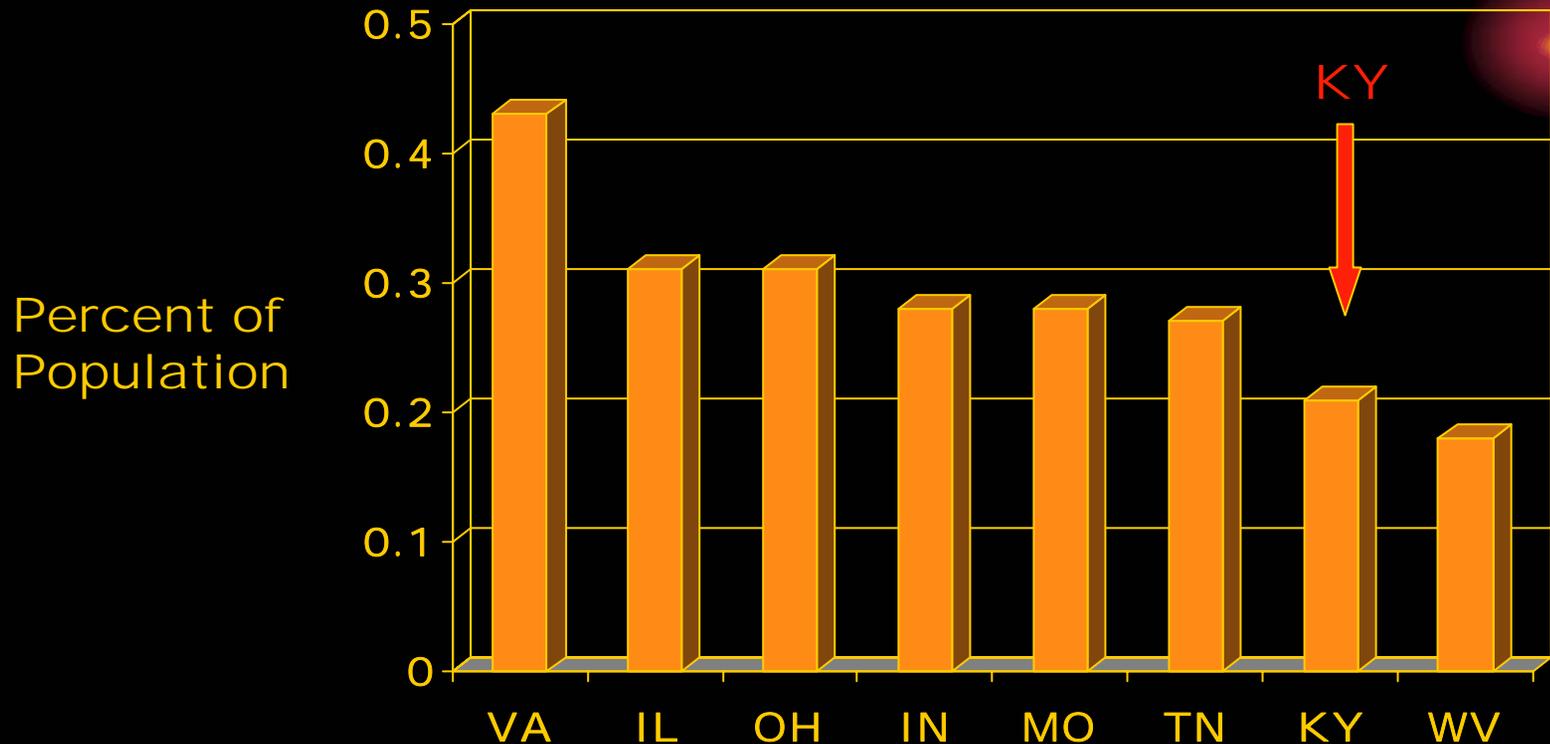
Kentucky



- How does Kentucky compare with the other 50 states?
 - In percentage of residents with college degrees and advanced degrees.

Total Doctoral (2001) Science and Engineering

Kentucky and Seven Surrounding States

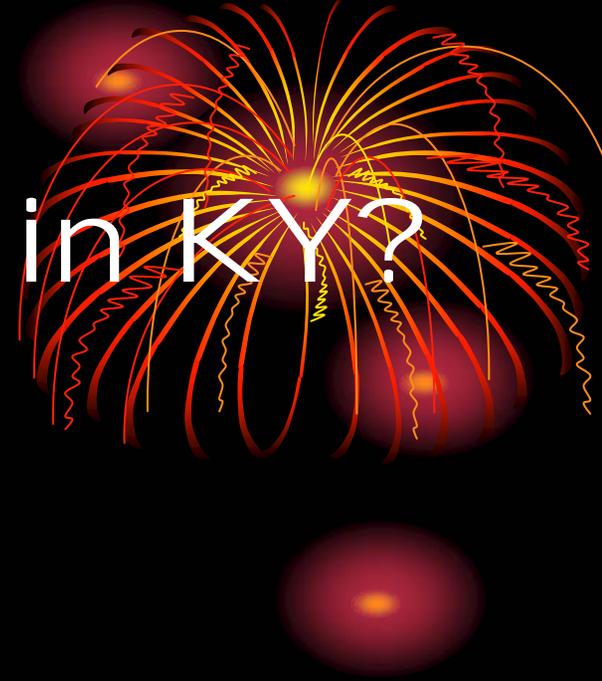


CPE – Review of Public Agenda (2005-2010)



- The New 5 Questions of Reform
 1. Are more Kentuckians ready for postsecondary education?
 2. Is Kentucky postsecondary education affordable for its citizens?
 3. Do more Kentuckians have certificates and degrees?
 4. Are college graduates prepared for life and work in Kentucky?
 5. Are Kentucky's people, communities, and economy benefiting?

What's Happening in KY?



PBS Documentary

"Declining by Degree"

Summer - 2005

Western Kentucky University

Opening the Doors

(Its Implications)

Kentucky's Mantra

Sink, Tread Water, or Swim

(Time on Task)

Is it Working?



- *“Measuring Up 2004”*

The National Center for Public Policy and Higher Education

- [Kentucky's] four-year college undergraduates **SCORE BELOW THE NATIONAL AVERAGE** on assessments of **WRITING, CRITICAL THINKING,** and **PROBLEM-SOLVING** skills.
- Kentucky's four-year college **GRADUATES ARE NOT PREPARED FOR GRADUATE STUDY.**
 - Not enough Kentuckians score well on examinations needed for admission to graduate school.

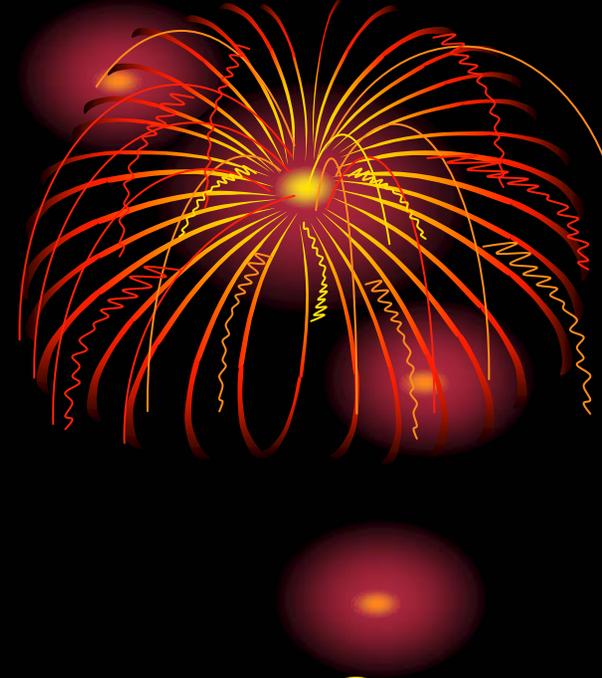
What Do Kentucky
Students NEED?



College DEGREES

and

College EDUCATIONS



Is more/better lecture the answer?

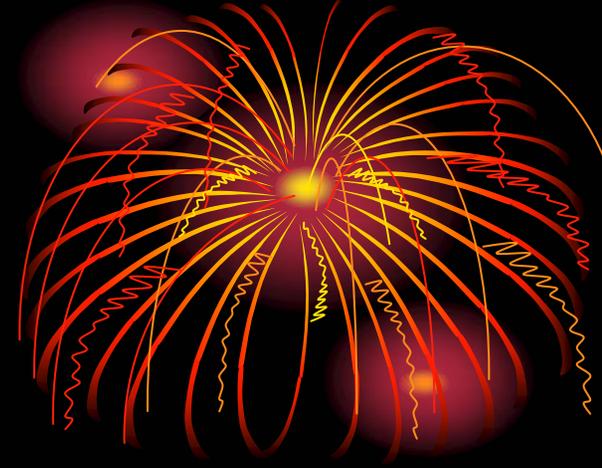
Lecture Effectiveness

(University of Arizona)

From Teaching to Learning: A New Paradigm for Undergraduate Education

Robert Barr and John Tagg

- Shift from INSTRUCTION to LEARNING
- Change from TRANSFERRING KNOWLEDGE to STUDENT DISCOVERY
- Emphasize the CREATION OF LEARNING ENVIRONMENTS rather than OFFERING CLASSES



“Nothing that is worth knowing can be taught.”

Oscar Wilde

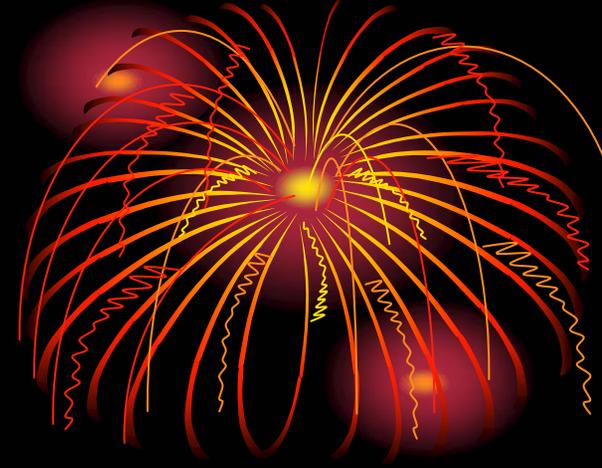
Irish Dramatist, Novelist, and Poet



"There Isn't any solution to this problem of Education other than to realize that the best teaching can be done only when there is a direct individual relationship between a student and a good teacher - a situation in Which the student discusses the ideas, thinks about the things, and then talks About the things..... It's impossible to learn very much by simply sitting in a lecture, or by doing assigned homework problems."

Richard Feynman

Nobel Laureate



UNDERGRADUATE RESEARCH:
Can it give Kentucky students
the education they need?

What Matters in College?



- The nature of students' peer group (#1 influence)
- Quality and quantity of student interaction with faculty outside the classroom
- Level of student involvement
- Amount of time spent on task

A. W. Astin, *What Matters in College: Four Critical Years Revisited*,
San Francisco, Jossey-Bass, 1993

Twelve Elements of a Quality Education

“Making Quality Count”

Education Commission of the States (1995)



Impact of Undergraduate Research

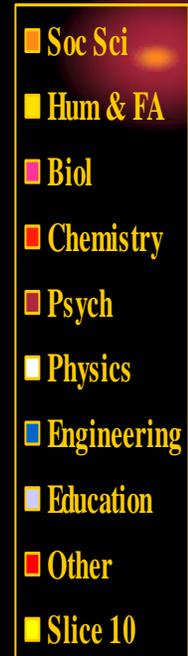
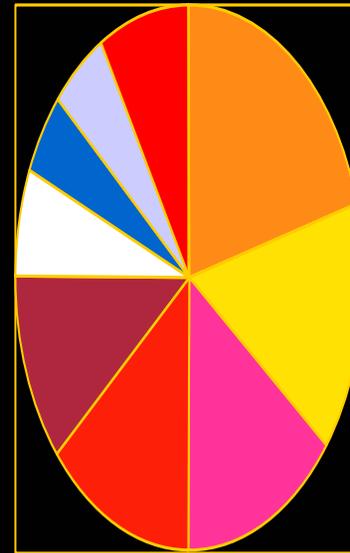
Element	High	Above Average	Average	Low
High Expectations	X			
Respect for Diverse Talents and Learning Styles			X	
Emphasis on Early Years of Study				X
Coherence in Learning	X			
Synthesizing Experiences	X			
Ongoing Practice of Learned Skills	X			
Integrating Education and Experience	X			
Active Learning	X			
Assessment and Prompt Feedback		X		
Collaboration	X			
Adequate Time on Task	X			
Out-of-class Contact with Faculty	X			

In What Disciplines Is UR Being Practiced ?



Non-Science (47%) Science (53%)

- Political science, history, sociology, economics (20%)
- Humanities & fine arts (14%)
- Biology (14%)
- Chemistry (13%)
- Psychology (11%)
- Physics (6%)
- Engineering (9%)
- Education (5%)
- Other categories (8%)
(including interdisciplinary)



Based on student presenter percentages at NCUR

What Institutions in the Region are Promoting UR?



- All Eight Kentucky Public Universities
- University of Tennessee – Knoxville
- University of North Carolina – Asheville
- Appalachian State University
- Middle Tennessee State University

What Evidence Do We Have That Undergraduate Research Works?

Lots of Testimonials and Anecdotal Stories

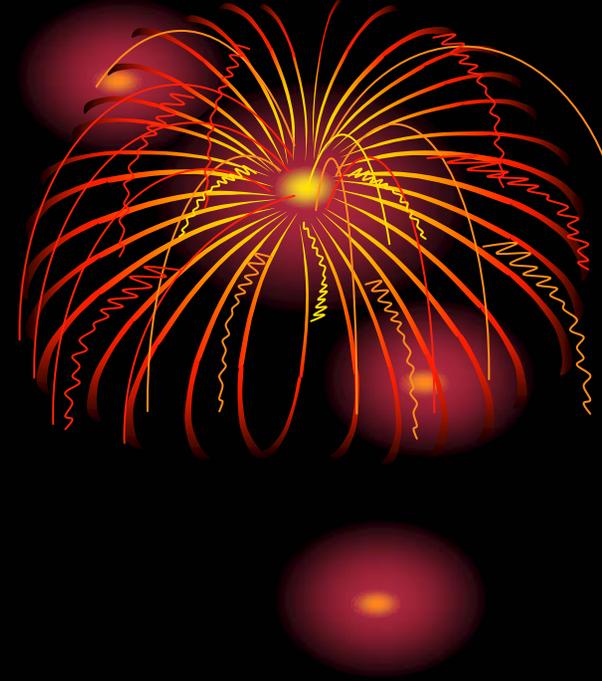
University of Arizona



What Does the Research on UR Show?

- Few high-quality studies on actual impact of UR on students
 - Most studies look at student satisfaction
- Few studies outside the sciences

Recent Studies



- **Student Benefits**

1. Lopatto (Grinnell College)
2. Waddill and Mateja (MSU)

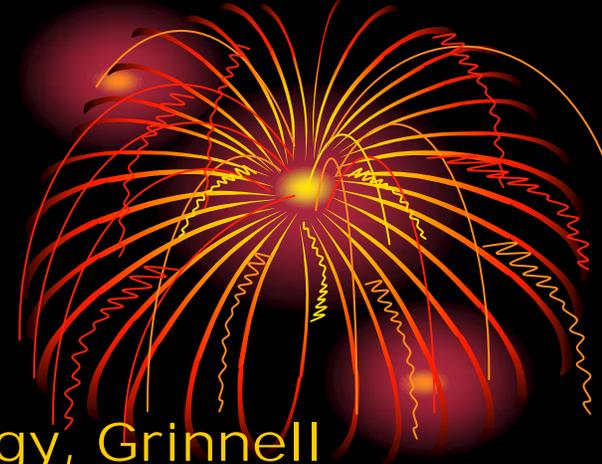
- **Student Intellectual Development**

1. Rauckhorst, Czaja, and Magolda (Miami University)

- **Impact on Pursuit of Graduate/Professional Degrees**

1. Hathaway, Nagda, Gregerman (University of Michigan)

Benefits



David Lopatto, Department of Psychology, Grinnell College *"The Essential Features of Undergraduate Research"*

- Research Question
 - "What BENEFITS do faculty and students perceive from an UR research experience?"
- Surveyed
 - 41 science faculty from Grinnell, Wellesley, and Harvey Mudd Colleges
 - 249 students from these same institutions involved in summer undergraduate research program

Benefits Seen by Students (One-Time Appointments)



- Enhance professional or academic credentials
- Clarify career path
- Understand the research process in your field
- Learn a topic area in depth
- Develop a continuing relationship with a faculty member
- Learn to work independently
- Learn laboratory techniques
- Learn tolerance for obstacles faced in research process
- Understand how a scientist thinks
- Understand how professionals work on real problems

Red – Murray State Student Responses

Benefits - MSU HHMI Study

(Multiple-Year Appointments)



- Develop **self-confidence**
- Develop a **relationship with a faculty member**
- Clarify **career path**
- Sense of **accomplishment**
- Understand the **personal demands of a career**
- Develop **leadership skills**
- Learn to **persevere at a task**
- Develop **tolerance for obstacles** in research process
- Develop ability to **solve technical/procedural issues**
- Develop an **understanding of how scientists think**

Intellectual Development



Rauckhorst, Czaja, and Magolda
(Miami University)

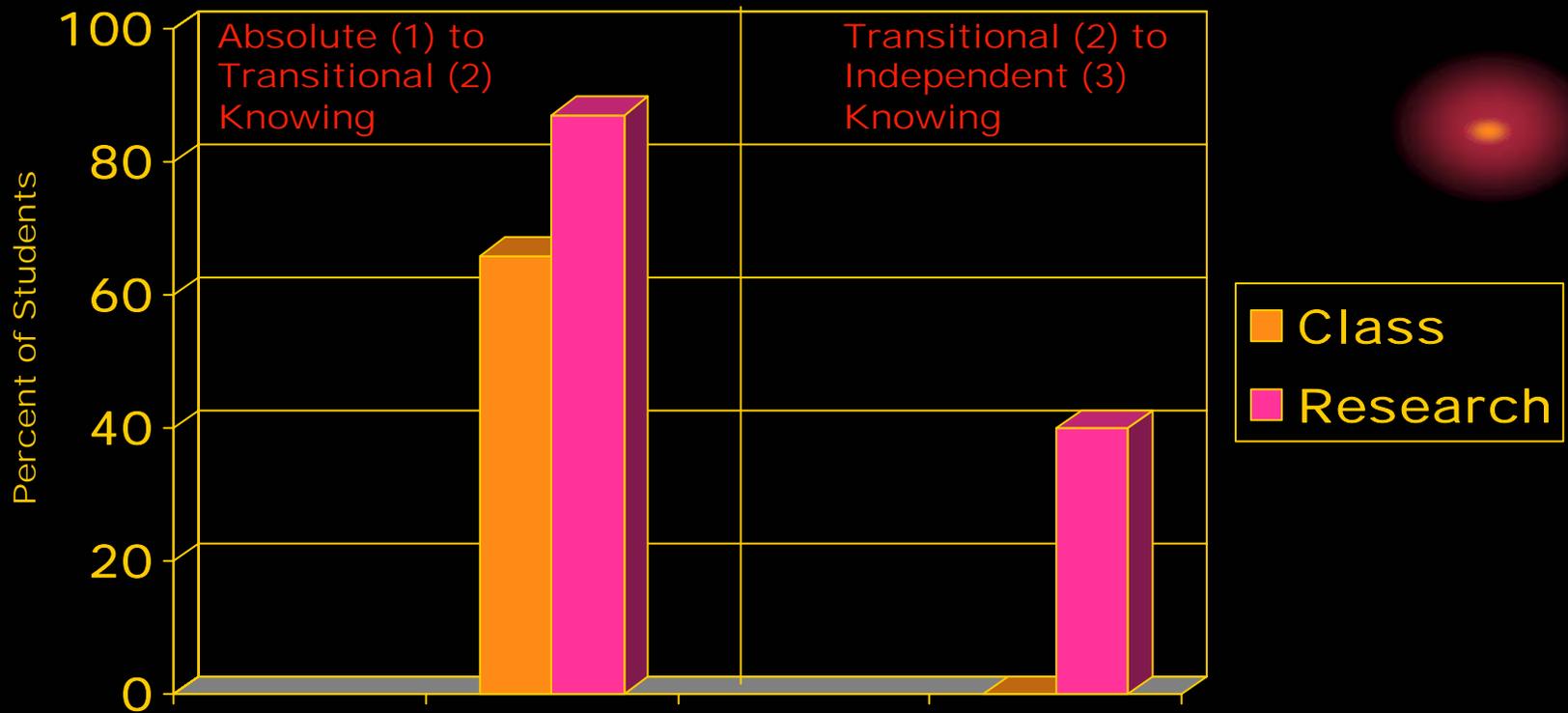
- Test Group – 100 students in Miami University's Undergraduate Summer Scholars (USS) Program
 - Students at the end of their Sophomore and Junior Year
 - 10-week period of research/creative activity
 - 25 different departments

Intellectual Development



- Test students' epistemological assumptions (i.e, assumptions about nature, certainty, and limits of knowledge) and degree of independent thinking
- Four Categories of Knowing
 - ABSOLUTE KNOWING (knowledge certain, obtained from authorities)
 - TRANSITIONAL KNOWING (some knowledge absolute; must find process to search for the truth)*
 - INDEPENDENT KNOWING (most knowledge less than absolute; individuals can have their own beliefs and think for themselves)
 - CONTEXTUAL KNOWING (theories constructed based on judgment of evidence; must think through problems and integrate theories)
- * Where most students spend their college years

Intellectual Development



Epistemological Change in Research and Control Groups

Intellectual Development



Four characteristics that helped move students from transitional to independent knowing

- Highlighted the discrepancies in data and encouraging students to **embrace multiple perspectives**
- Encouraged **student ownership and responsibility** of the project
- Created a **community of scholars** in which participants exchange ideas
- Established a **mentor/student relationship** that provides for student autonomy

Grad/Prof School Pursuit



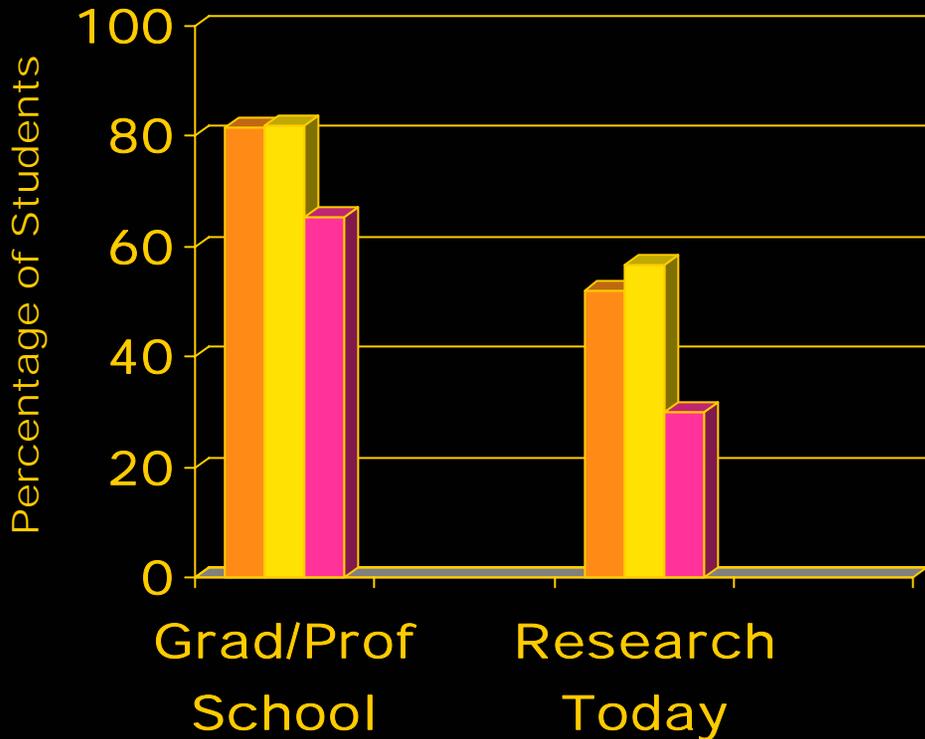
Hathaway, Nagda, and Gregerman, *"The Relationship of Undergraduate Research Participation to Graduate and Professional Education Pursuit: An Empirical Study"*

UROP (University of Michigan)

- Open to **ALL FRESHMAN and SOPHOMORES**
- Admission determined by **LOTTERY** (All applicants should have the same predisposition to pursue advanced degrees)
- Faculty-student **RESEARCH COLLABORATION**
- Students work 10 hours/week for credit or work study
- Other program support (orientation, peer group meetings, peer advisor, poster presentation)

Surveyed **UROP ALUMNI** and **CONTROL GROUP**
UROP Participation, Other Research, and No Research Experience

Grad School/Research Participation after B.S.



University of Michigan Alumni Survey



MSU HHMI Participants: 79%

ACTION: Collective



- KAS
 - Needs to take a PROACTIVE position
 - Educate administrators and “funders” of higher education in Kentucky – USE STUDIES
- Posters-at-the-Capitol
 - Initiative to educate legislators about the importance of UR

ACTION: Institutional

- Develop initiatives to support UR
 - UR Offices (MuSU, UK) – move beyond the sciences
 - Centers of Distinction (NKU, WKU)
 - UR Fellowship/Internship initiatives (MoSU, UK, NKU)
 - Events that “Spotlight” UR
 - Sigma Xi Conference, Scholars Week
 - Awards/Grants
 - Travel Award (NKU), Supplies/Equipment (MuSU)
 - UR Journals (UK, MuSU) – KAS Journal??



ACTION: Individual



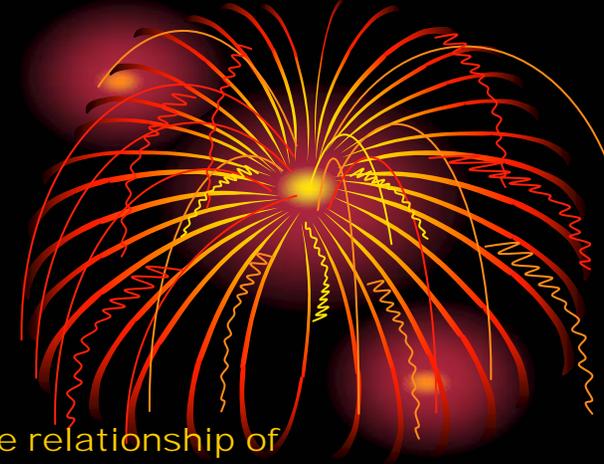
- Maximize number of mentored students
 - Create Win-Win scenarios
 - Encourage publication and presentation
 - Start students early
 - Develop teams
- Seek external support
 - EPSCoR (NSF REGs), KBRIN, REU (KAS inter-institutional awards ?)
- Promote UR
 - Have students participate in local and state UR conferences
 - Get it written up in campus and local paper!

Summary



- Clear need in Kentucky for more residents with college EDUCATIONS
- Current strategy coming up short
- Undergraduate Research can address educational needs
- Need for ACTION now !

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