Astronomy & Astrophysics Outreach & Teaching in 2042
Astronomy & Astrophysics Department: Culture of Education & Outreach

Astro 1-2-3

• Then & Now:
  - history
  - highlights
  - evolution

• Next?
“early” days
“lookback time” ~2

- Yerkes Observatory Tours (by faculty)
- Ryerson Astronomical Society (RAS)
- Physical Science Division Open House
- Adler Planetarium & Astronomy Museum - in charter (1930), courses, guest lectures, visiting committee (1972)
- Billions and Billions (AB 1954, SB 1955, PhD 1960)
context

• science & technology impact on WW’s

• space race

• War on Poverty/Upward Bound/Trio

• Office of Special Programs - Larry Hawkins (1968)

• department moves to campus (circa 1972)

• NSF - Broader Impacts criteria evolution/emphasis (also NASA - e.g., Space Telescope Institute bid)
Examples & Evolution

• **CUIP** Chicago Public Schools | University of Chicago Internet Project

• Yerkes Outreach

• Space Explores

• Sci Comms - museums etc.

 evolution -> outreach ecosystem

guest-> engaged
In the neighborhood

**CUIP**

Don York

- 1995 1st internet node @ CPS (NASA grant)
- 1996 24 schools infrastructure (UofC, CPS)
- 1997 eCUIP Digital Library w/Regenstein
- 1999 Chicago Web Docent- curriculum modules
- 1997-2006 Web Institute for Teachers trained >700 technology & teaching
- 2002-14 NASA/CPS astronomy curriculum, capstone classes, & integrated computer based Library System in over 400 schools

digital divide - need university -> the community
Yerkes Observatory Education Program - dedicated to using the historic legacy and resources of Yerkes Observatory to provide immersive educational experiences for learners of all ages and to anchor a vibrant intellectual community that makes strong and lasting contributions to national educational priorities.

- hosted Space Explorers
- 1999 Vivian Hoette -> Yerkes
- Hands-On Universe (HOU)
- Yerkes Astrophysics Academy for Young Scientists (YAAYS) - summer enrichment
- Skynet Junior Scholars - robotic telescopes
- Teacher Professional Development
- Maker Space
Multi-year commitment
- ~25 inner-city students/yr, ave. 3yrs
- Over 100 contact hours/yr
  - Weekly labs & residential immersion experiences
  - 10-15 volunteers/year

Goals:
- kindle & sustain interest, prepare for STEM careers
- next generation teacher/scholars

“real game changer”
- Kron

Space Explorers (since 1991)

1991

2015

Ashley McCann, MD ~ 1 lookback time
Space Explorers Index

- 24 years
- 49 Yerkes Institutes
- hundreds of labs
- 111 instructors@Yerkes
- 90% had an impact (41% great)
- 443 high school students
- 98% had an impact (56% great)
- >50,000 contact hours

Outcomes Index

- students*
- 84% BA (31% STEM)
- only 8% of CPS HS freshman graduate college
- 50% of BA to grad school (1/3 STEM)
- many MS, JDs, MD's & PhD's
- 25 lead instructors
- 10 faculty (40%)
Communicate/Connect

Astronomy Conversations: >30 active volunteers, 300 presentations/yr, reaching over 22,000 visitors

Wednesday, November 5, 2014
6:00 PM
School of the Art Institute of Chicago
112 South Michigan Ave.
MacLean Ballroom
Free and Open to the Public
(space limited, no pre-registration, doors open at 5:30PM)

For more information:
http://astro.uchicago.edu/brinson/2014

THE BRINSON FOUNDATION

NEUTRON STARS, A COSMIC GIFT

VICTORIA M. KASPI
LORNE TROTTIER CHAIR IN ASTROPHYSICS AND COSMOLOGY, MCGILL UNIVERSITY

2014 Brinson Lecture
Department of Astronomy and Astrophysics

six (6) > 5% of all NSF AAPF @ UofC

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Next?

in 2042
movie pitches

John Carlstrom in Frozen II

Turner’s “From the big bang to the multiverse and beyond” joins the holiday classic line up
Knowledge will reside in computers. Inner-city students will not rely on their 12 year, public education for a lifelong educational tool box, but rather will obtain in those years a love of learning and wisdom to adapt to a changing society. (The knowledge in the computers will be the basis for life-learning.)
Kelly Holley-Bockelmann  
Fisk-Vanderbilt MS-PhD Bridge Program

Professor Brittany Kamai, Fisk-Vanderbilt Masters-to-PhD Bridge Program graduate, donated one trillion dollars to the University of Chicago Astronomy Department. Kamai earned her fortune using Holographic Noise as an uncrackable cybersecurity cipher. Department Chair Matthew Richardson, also a Bridge graduate plans to invest the fund in really excellent pre-colloquium snacks.
Dovetta McKee OSP- 2042 forecast

Astronomy will continue to require our students to look outward and inspire them to see that there is something greater than the individual.
Val Kass (NSF)

Prediction/Warning: The style of future astronomy outreach 27 years hence will still not include skirts but definitely must include more women and under-represented as the field addresses the most tantalizing question of all: "Are we alone?"
Not going to H-E-double hockey sticks

Rob Semper
The climate change problem was solved by 2042 after people responded to do something when they saw the actual issue was dire.

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- Rob Semper
“…some form of virtual reality will play a big role in future outreach efforts. Astronomical images have always been fantastic at conveying awe and wonder. I can only imagine the kind of impact flying through the far reaches of space will have on young scientists to-be.”
By 2042, kids of all ages will be able to virtually explore the universe as easily as they explore their own backyards with the collective intelligence of the world's knowledge at their fingertips.
“Department productivity will skyrocket as grad students can simply do their public outreach as holograms without ever having to leave campus.”

-Doug Watson, former KICP AAPF
I think we'll be beyond digital communication. It'll all be telepathic. The mechanisms by which paralyzed people now can move computer cursors with their thoughts will be so deeply understood and highly developed -- not to mention monetized -- that the web will be the snail mail of 2042, no longer the web, but the cobweb, used only by grandparents and homeless people who hang out in public libraries. Instead of email, we'll have nmail (n for neuro), and podcasts will be uploaded directly into the brain, where they can play silently round the clock. Imagine how science-literate ordinary people will become when they can "n-listen" to Science Friday all the time, even during sex, childbirth and their mother's funeral. (Not to mention during those catastrophic "weather events" that will be wracking the earth.) Even better, you'll be able to rent neuro-Neil DeGrasse Tyson and Bill n-Nye to camp in your brain and beat back the intelligent-design neurobots trying to gain entry. Sleep, as always, will be the most perilous, most promising time of our lives. Only the wealthy and the neuro-tech elite will be able to be sure of dreaming their own dreams.
me?
bullish on outreach
going global

Argentina
Italy
Antartica
New Zealand
South Africa
Chile
Paris
Taipei
Tokyo
Beijing
...

...
going global

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Beijing
...

going galactic
P2P  people to people

Slow Food®
P2P people to people

Slow Food

boys can do science!
Astronomy & Astrophysics Teaching in 2042
Origins
YERKES OBSERVATORY
ASTRONOMY AND ASTROPHYSICS RESEARCH METHODS WORKSHOP
OCTOBER 16, FRIDAY 4:30 PM - OCTOBER 18, SUNDAY 8:00PM
SIGN UP ON FACEBOOK AT: HTTP://TINYURL/YERKES2015
OR
BY EMAILING YERKES.WORKSHOP@GMAIL.COM
SPOTS ARE LIMITED — IT’S A SMALL GROUP, BUT THERE WILL BE A WAITLIST. 1ST AND 2ND YEARS ENCOURAGED. THIS WORKSHOP WILL FOCUS ON BASIC STARGAZING, ASTROPHOTOGRAPHY, AND ASTROPHYSICS RESEARCH SKILLS. NO EXPERIENCE REQUIRED. FURTHER INFORMATION TO BE CONVEYED AFTER SIGN UP. THE WORKSHOP IS STUDENT RUN AND WILL BE STUDENT LED.
Chicago’s Pantheon
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Millennial is not a four-letter word.

- Greater diversity
- Exposed to group and team-oriented environments at younger ages
- Tend to be pragmatic
- Accustomed to pressure
- Project confidence
- Communications practices are centered on technologies that are have immediacy, ubiquity, and convenience
- Grew up with technology and a consumer mentality that influences how they approach their education.
2042

- Complex scientific problems will alter the composition of our community
- New skill development will be introduced into the curriculum
- Expansion into distance (online) learning will contribute to astronomy education planet-wide
- Increased diversity among the broader astronomical community in Chicago and beyond
- Innovations in instruction will change how classroom and lab experiences are delivered, blurring the formal and informal
Challenges

• K-12 sector
• Socialization into science
• Widening the pipeline and closing off leaks
• Institutional change
• Pedagogy
STEM Education at UChicago

Kiki Zissimopoulos, PhD
Associate Director
Chicago Center for Teaching
Teaching-as-Research involves the deliberate, systematic, and reflective use of research methods to develop and implement teaching practices that advance the learning experiences and outcomes of students and teachers.
What might be the steps to apply a research approach to teaching practice
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4. Defining measures of success. (What evidence will we need to determine whether students have achieved learning objectives?)
5. Developing and implementing teaching practices within an experimental design. (What will we do in and out of the classroom to enable students to achieve learning objectives?)
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5. Developing and implementing teaching practices within an experimental design. (What will we do in and out of the classroom to enable students to achieve learning objectives?)
6. Collecting and analyzing data. (How will we collect and analyze information to determine what students have learned?)
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6. Collecting and analyzing data. (How will we collect and analyze information to determine what students have learned?)
7. Reflecting, evaluating, and iterating. (How will we use what we have learned to improve our teaching?)
The Process of Developing and Implementing a Teaching-as-Research Project

**Get Inspired!**
See something in the classroom that could be improved.

**Define and Refine TAR Question**
Does active learning improve learning?

**Perform a Literature Review**
What have others published that is similar to your proposal?

**Perform Methods & Evaluation Tools**
What data do you need to answer your question?
Do you need a control group to convince you of results?

**Obtain IRB Approval**
Find out how you need to do this at your institution

**Analyze Data**
Are your data sufficient to answer your question?
What would you change in the next iteration?

**Be specific!**

- a new video module on actin & myosin
- Does active learning improve learning?
- application of protein behavior in muscle?

**Perform Intervention, Collect Data**

**Report, Reflect**

Students seem to be struggling with exam questions in a class 1 TA (PHYSIOL 100).
Specifically, they struggle with questions on muscle proteins actin & myosin.

**Bloom's Taxonomy**
Creating - Evaluating - Analyzing - Applying - Understanding - Remembering

**Evaluation: Exam Scores**
(Look at exam question that applies knowledge about actin & myosin)

**Control:** Compare with prior scores in years that did not use video module

**Think about posting your project on the CIRTL Site**

Wow! Look at the difference! Let's do stats!

![Graph showing exam question score improvement](image-url)
Encouraging Student Engagement Through a Collaborative Revision of Introductory Psychology

- How does a change in classroom format from lecture to hybrid affect student engagement?
  - Class size reduced
  - Online videos created by experts
  - Recitation activities and frequent quizzing

- Engagement measured with:
  - Attendance
  - DFW rate
  - Percentage of students receiving As and Bs
  - Qualitative student comments
Constructive Alignment

What do I want my students to be able to do at the end of my course? How will they be different?

What will students do in and out of class to achieve these objectives? How will I facilitate learning?

How will I know that students have achieved the objectives?
Orientation

- 1-day series of panels and workshops

Getting Started

- 4-week fundamentals of teaching workshops
- Eat, Teach, Talk, Run!
- Other workshops on various pedagogies
- Teaching tips on CCT website

TA/Independent Teaching

- Instructional feedback: Mid-Course Reviews and Individual Teaching Consultations
- Course on College Teaching

Launching a Teaching Career

- Assistance with writing a teaching statement and creating a teaching portfolio
- myCHOICE - teaching career exploration
Resources


• CCT Website