

Incorporating Science Practices into STEM Classrooms

Danny Caballero

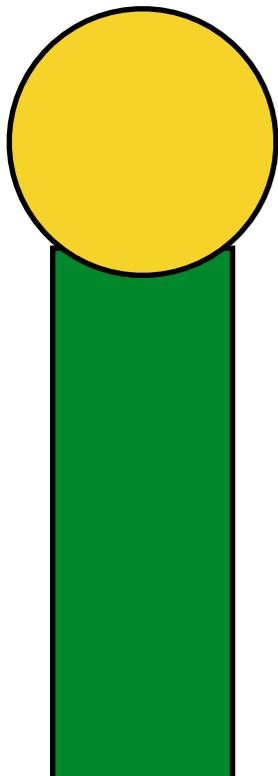


MICHIGAN STATE
UNIVERSITY



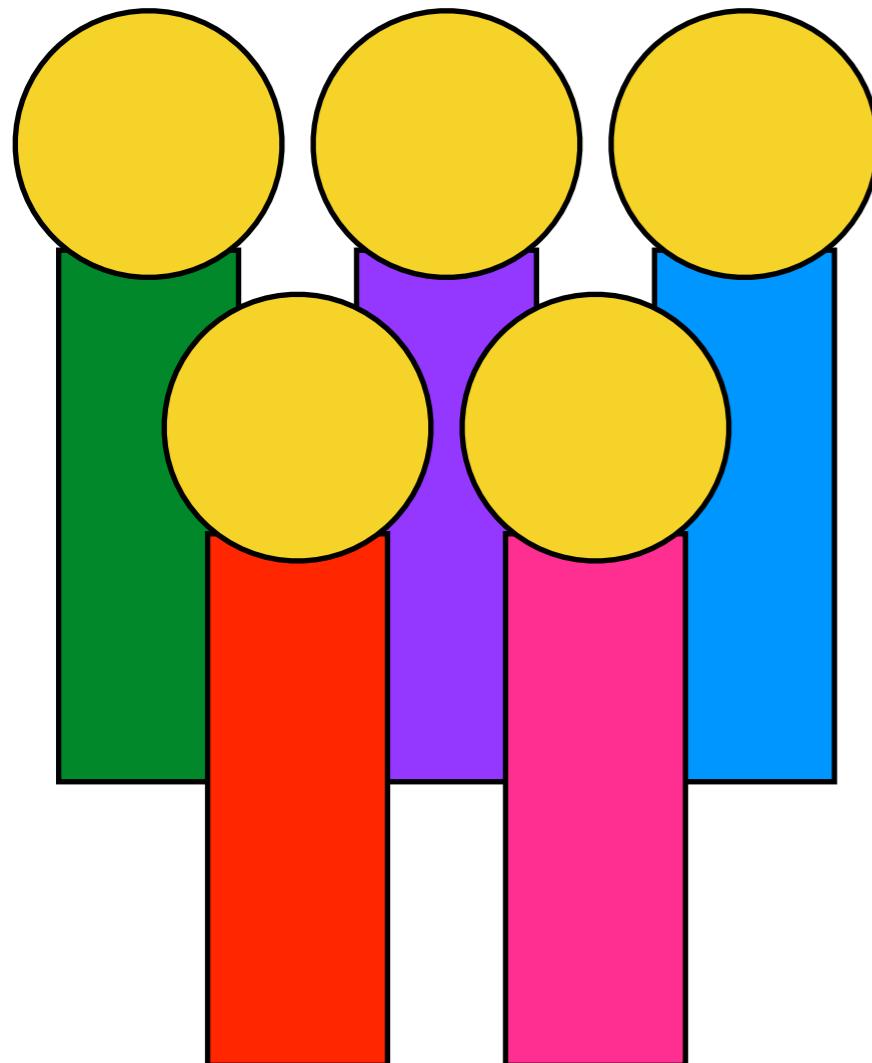
UiO : **Department of Physics**
University of Oslo

Model of Learning



Vygotsky, 1980; Lave and Wenger, 1991; Wenger, 1998

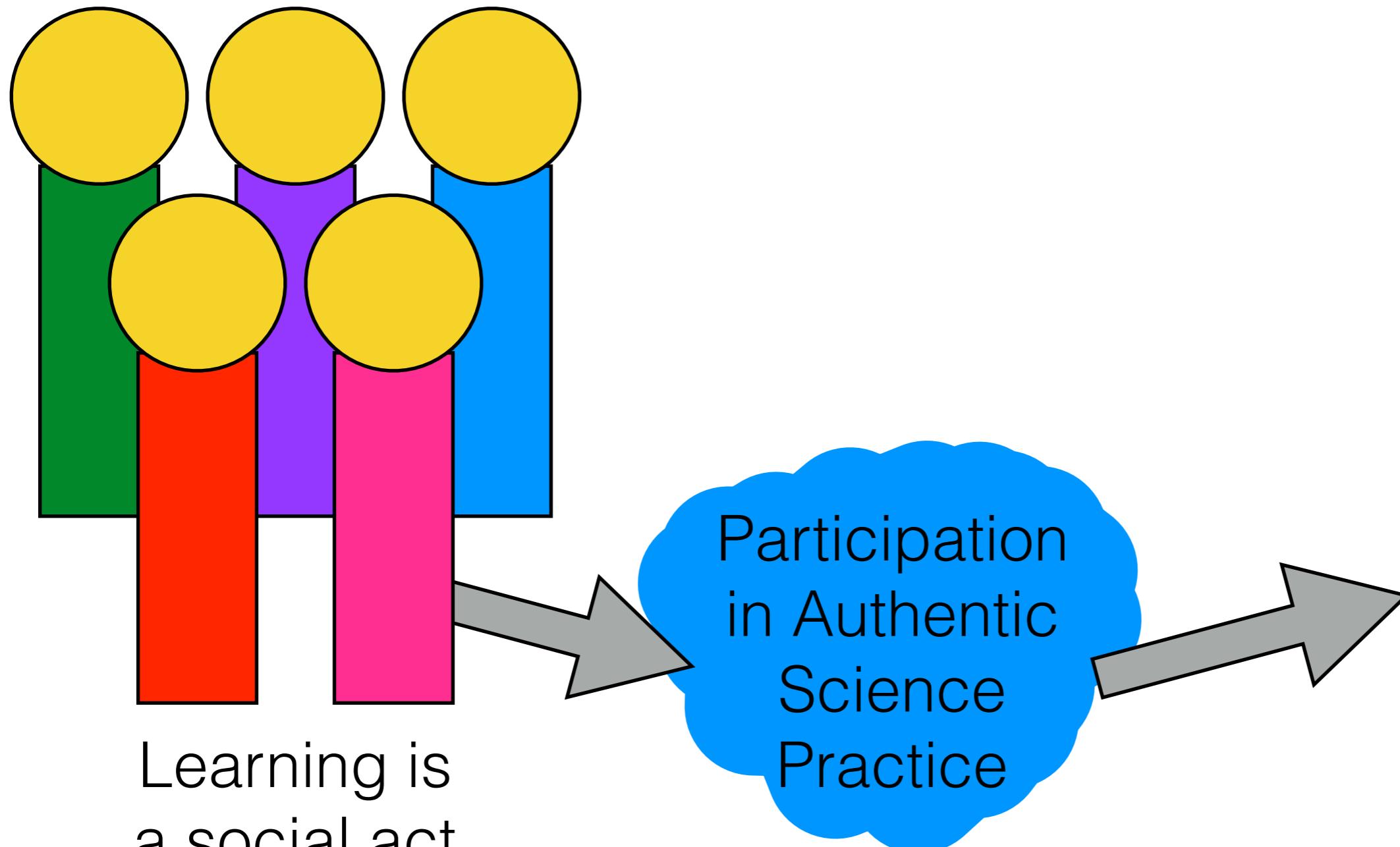
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Learning is
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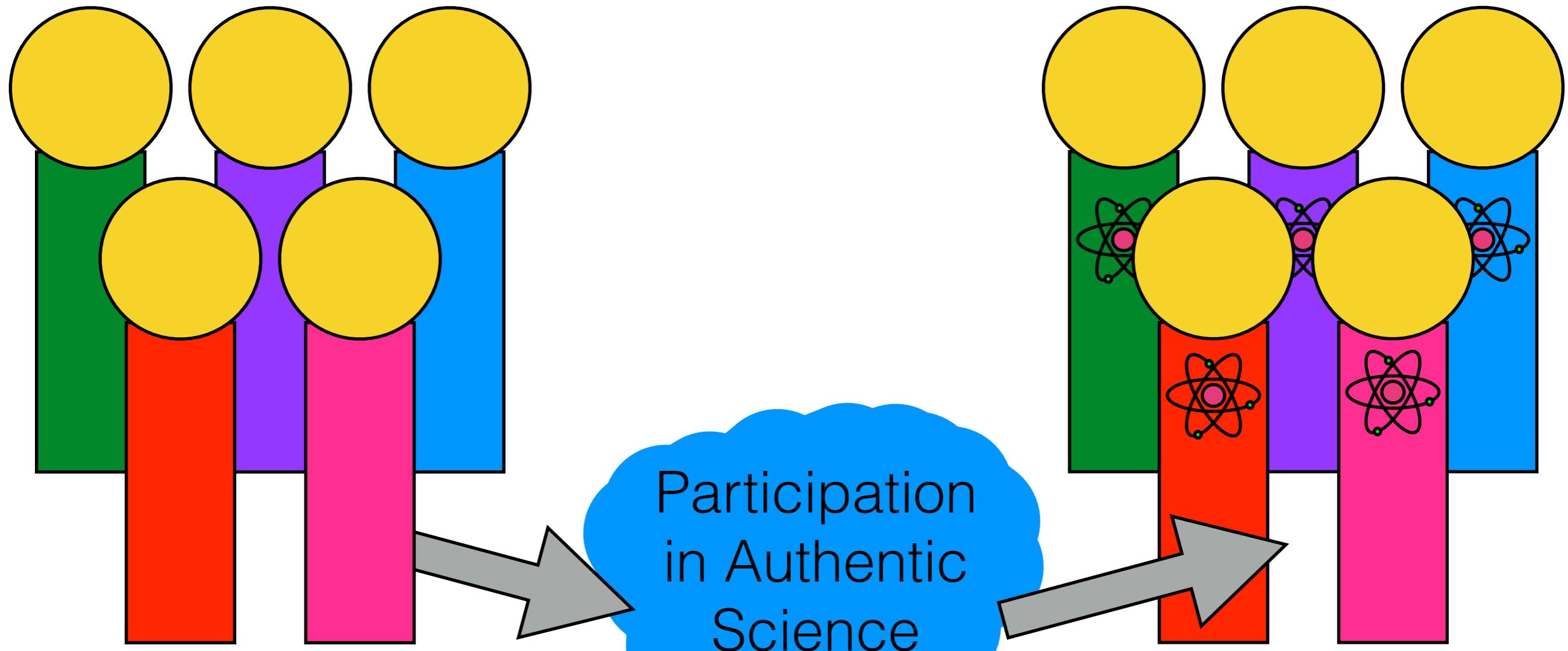
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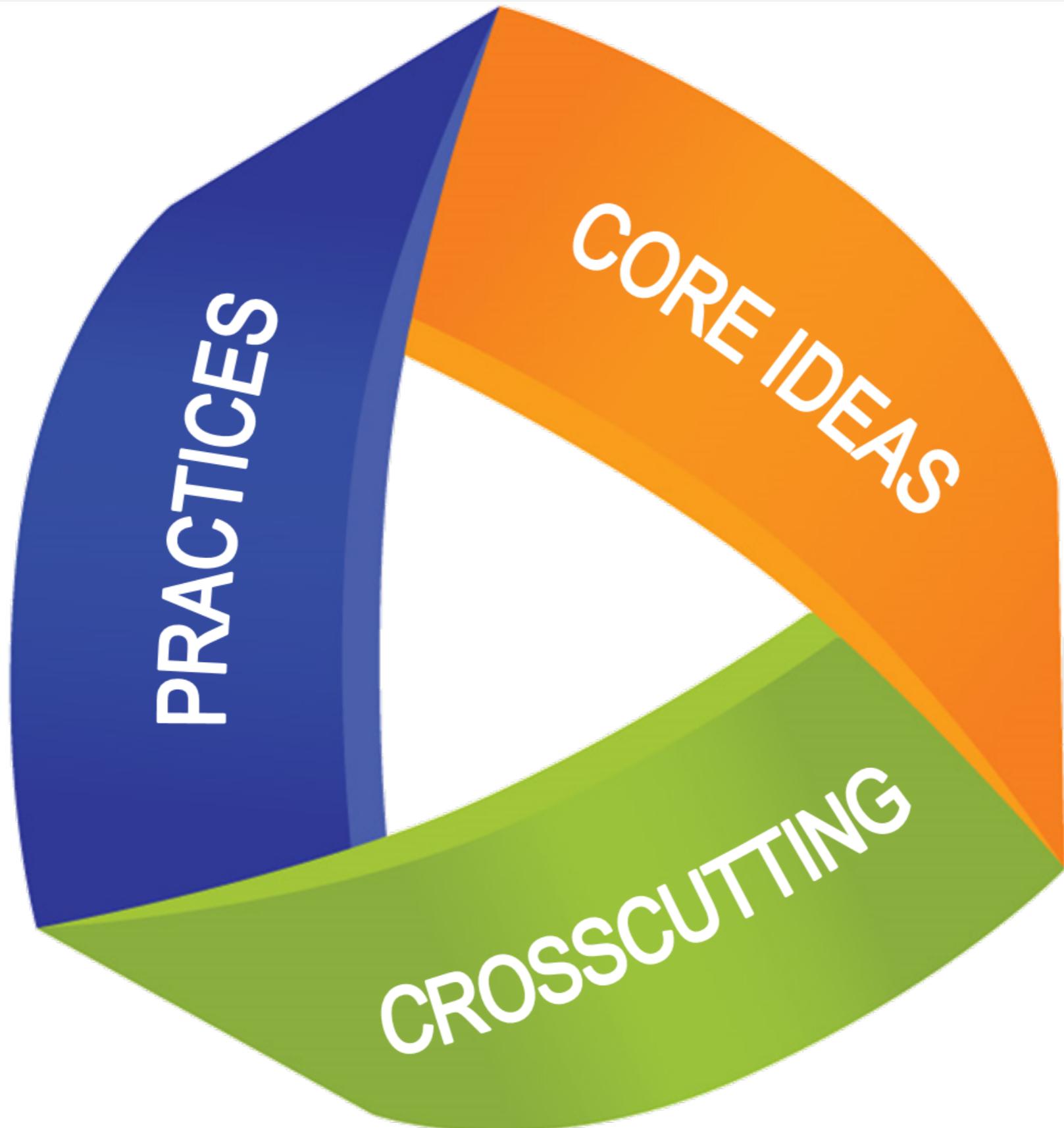
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Science and Engineering Practices

Asking questions and defining problems

Developing and using models

Planning and carrying out investigations

Analyzing and interpreting data

Using mathematics and computational thinking

Constructing explanations and designing solutions

Engaging in argument from evidence

Obtaining, evaluating, and communicating information

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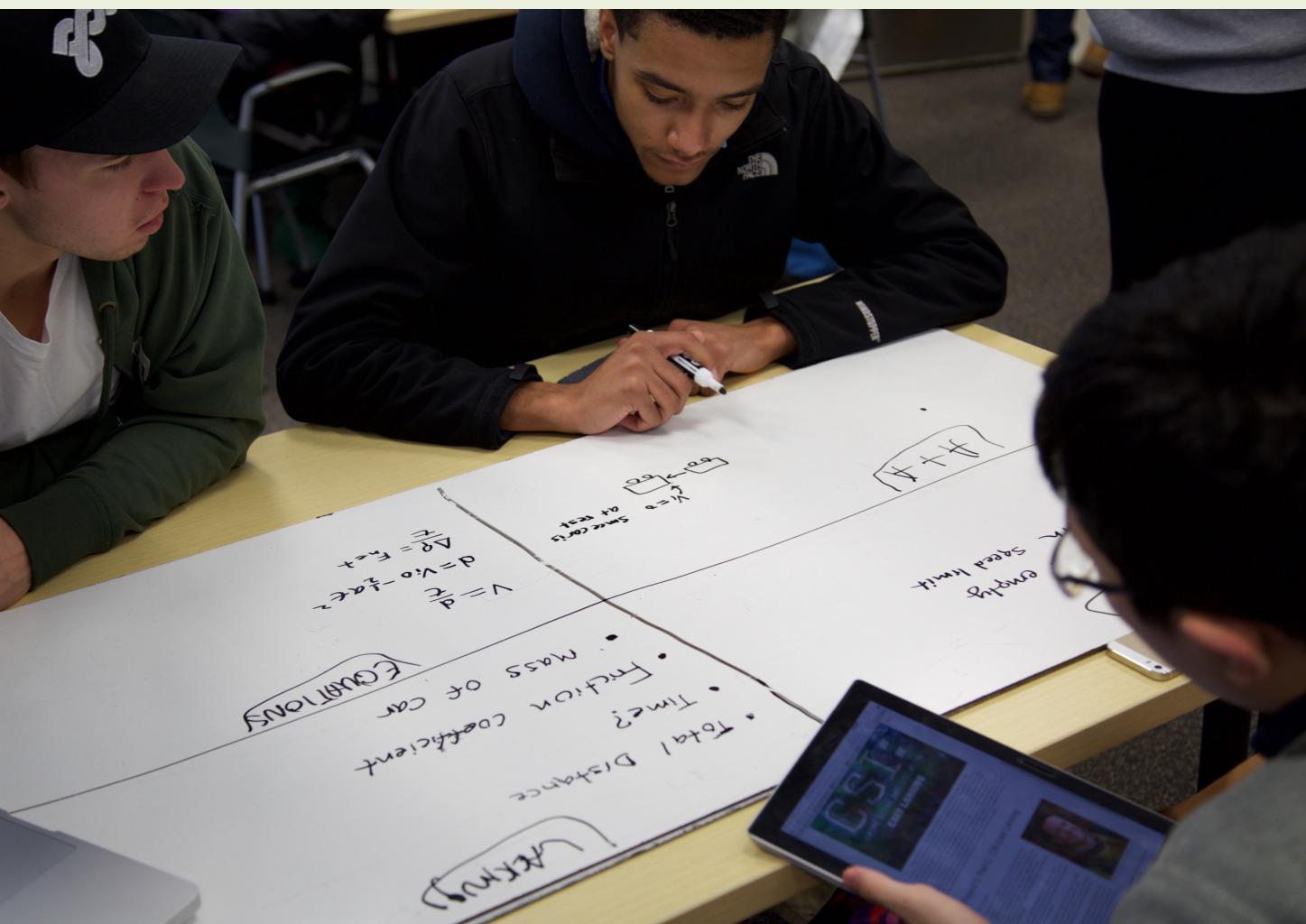
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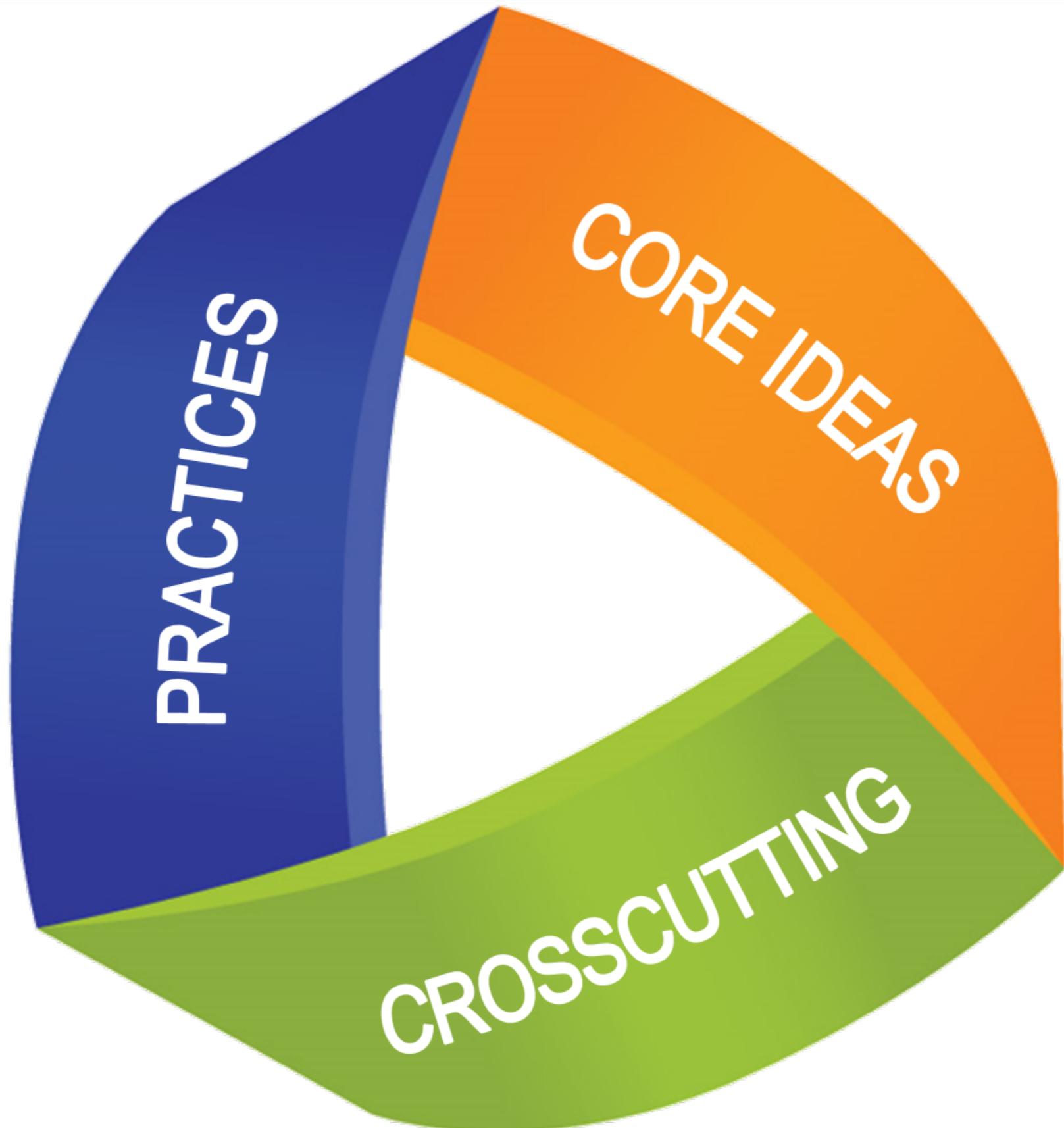
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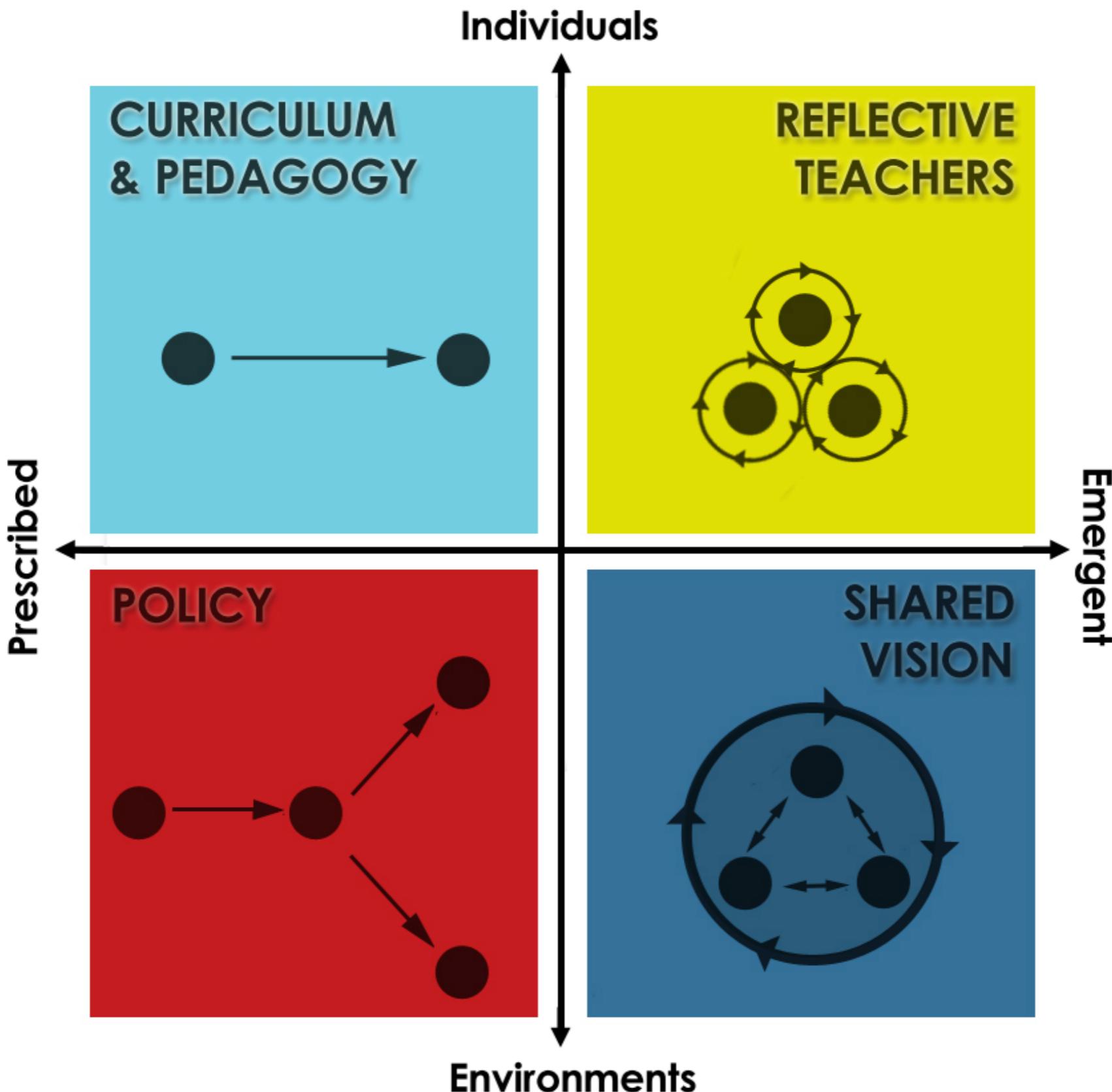
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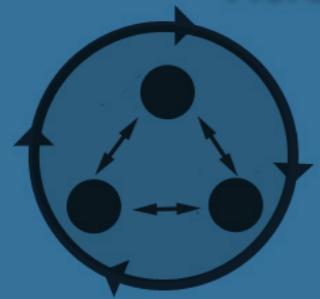
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The story of Physics and Astronomy

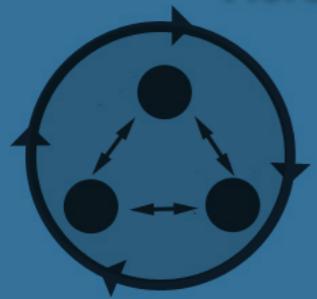


* Graphic courtesy of C. Henderson (Western Michigan)
C. Henderson, A. Beach, and N. Finkelstein, JRST, 48(8), 952-984 (2011).

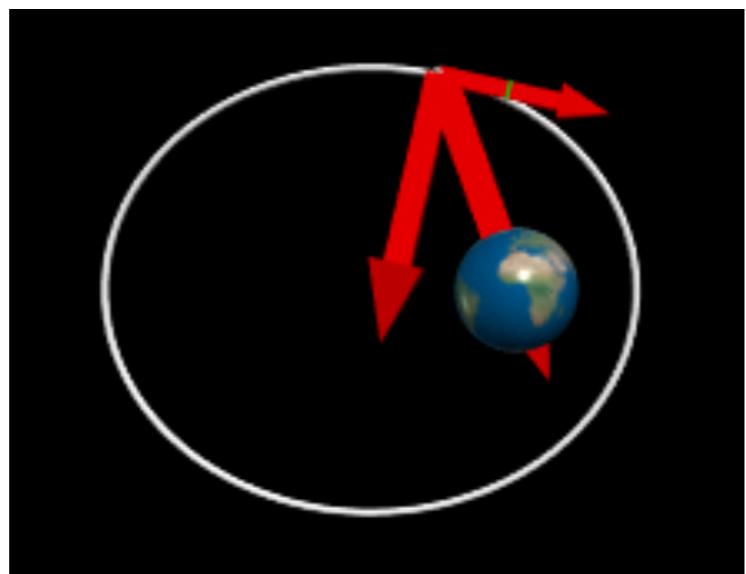
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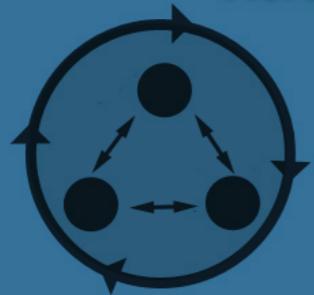
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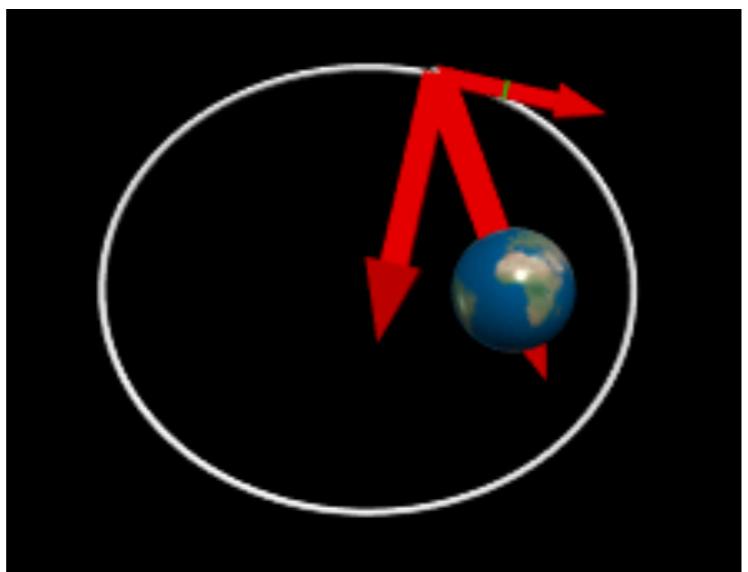
Introductory Physics for Scientists and Engineers



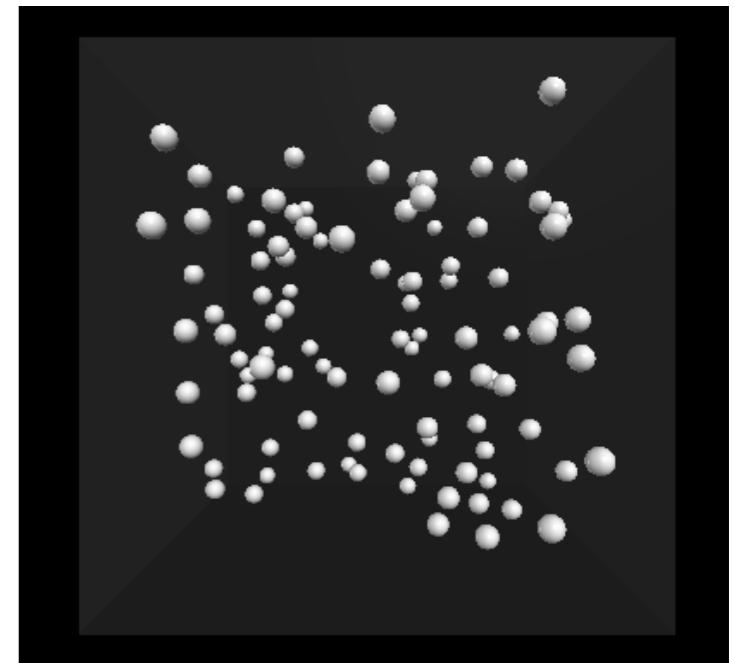
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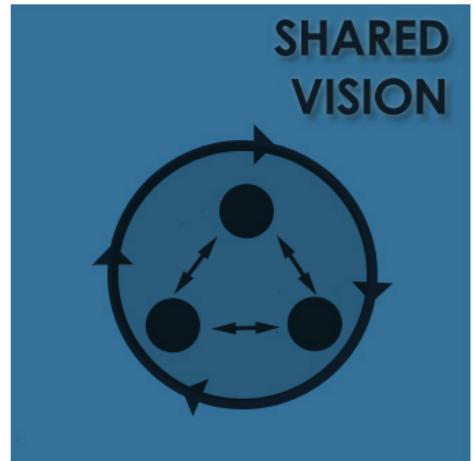


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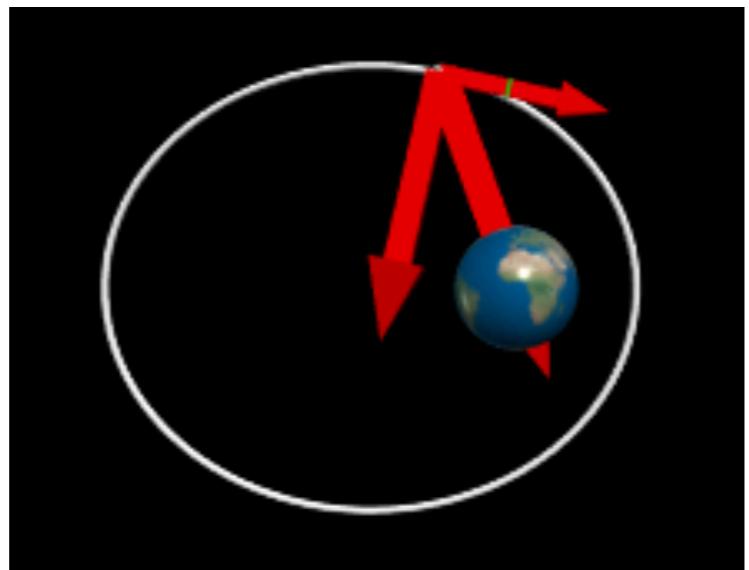


Introductory Physics for the Life Sciences

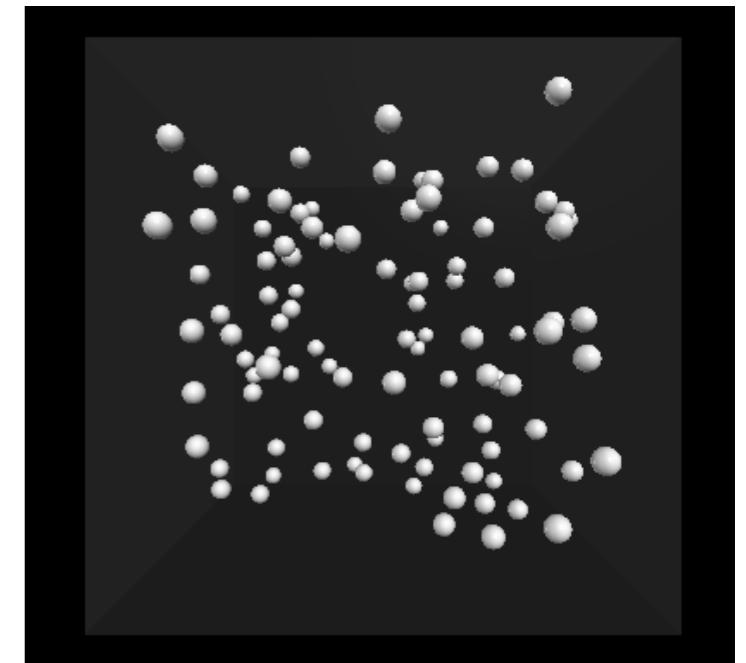




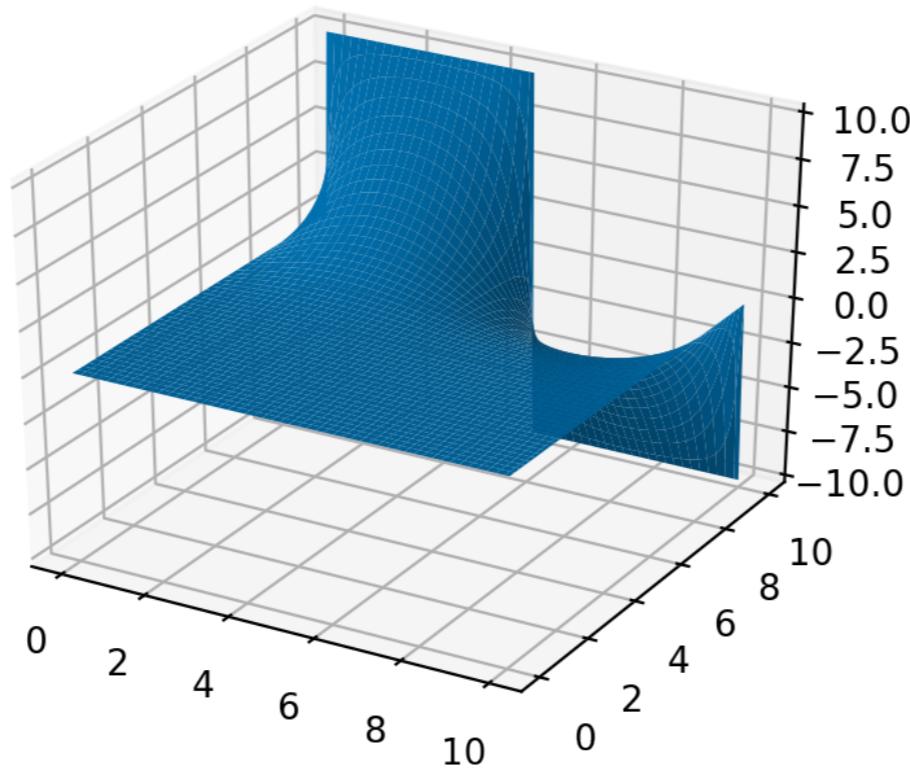
Introductory Physics for Scientists and Engineers



Introductory Physics for the Life Sciences



Advanced Electromagnetism for Physics & Astronomy Majors



CURRICULUM & PEDAGOGY



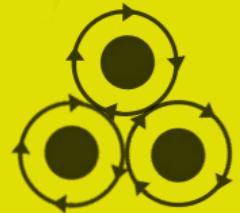
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**REFLECTIVE
TEACHERS**



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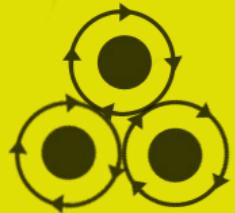
workshop for
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November 2017 New Faculty Workshop

November 2-5, 2017 - Holiday Inn, College Park, MD



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Campus + Science & Technology

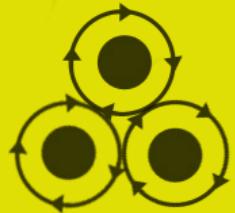
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MSU'S STEM EDUCATION INITIATIVE ANNOUNCES INAUGURAL FELLOWSHIPS

Nine Michigan State University College of Natural Science faculty members have been named inaugural fellows of the [STEM Gateway](#).



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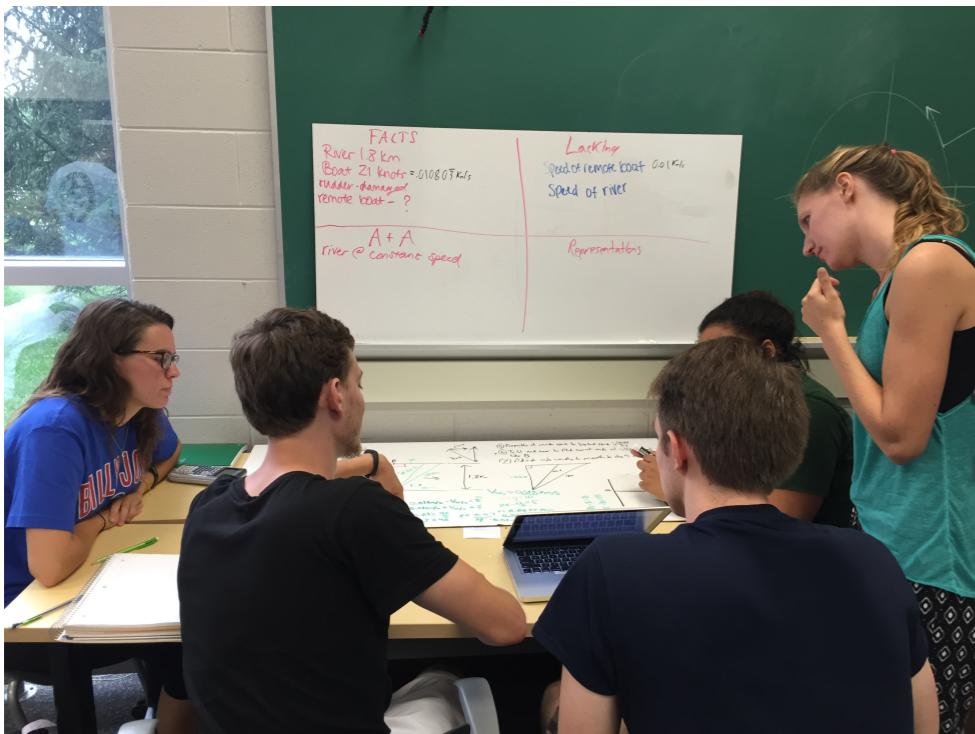
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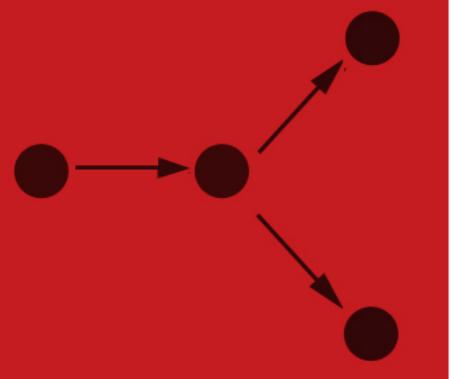
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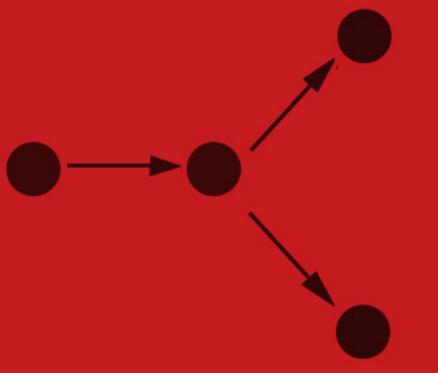
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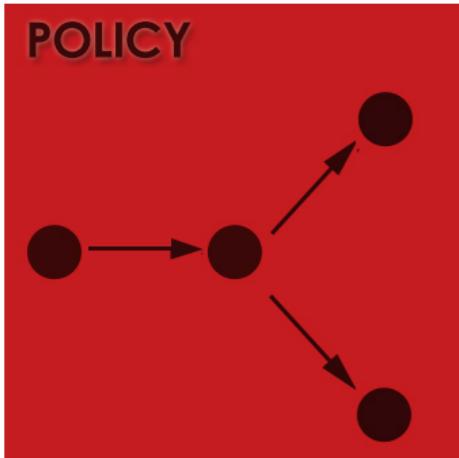
POLICY





Departmental Changes

- Junior faculty placed in transformed courses
- Teaching evaluation committee reviews junior faculty once per year
- Student learning data now expected in junior faculty's yearly review



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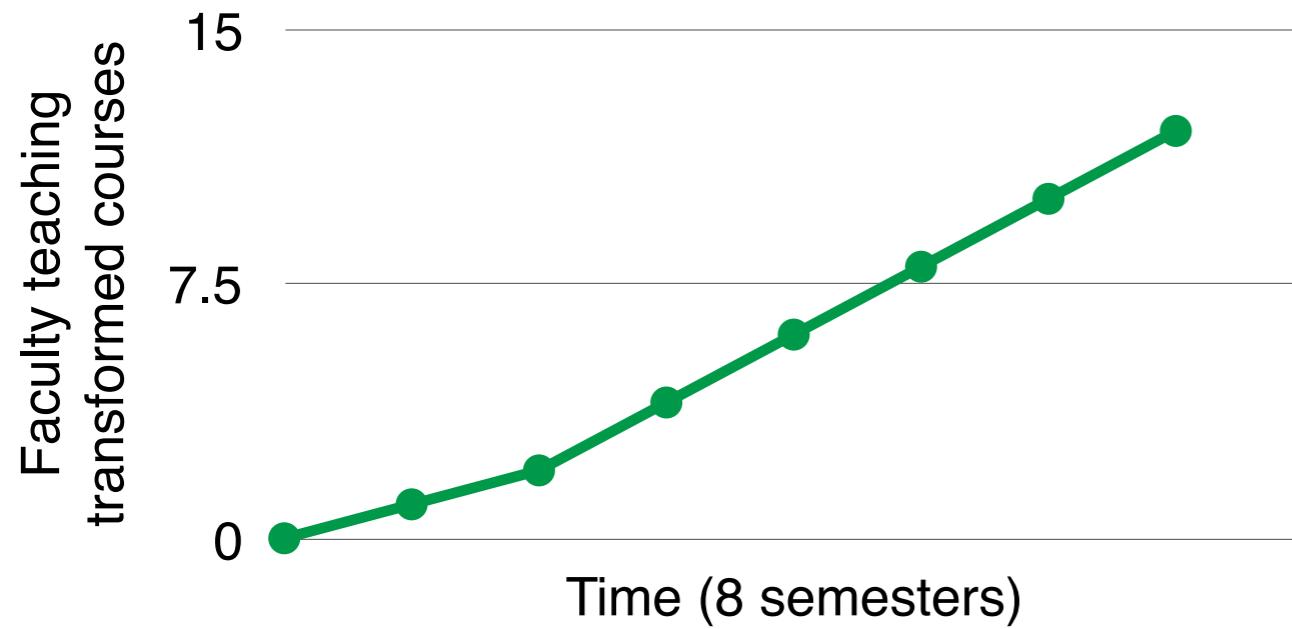
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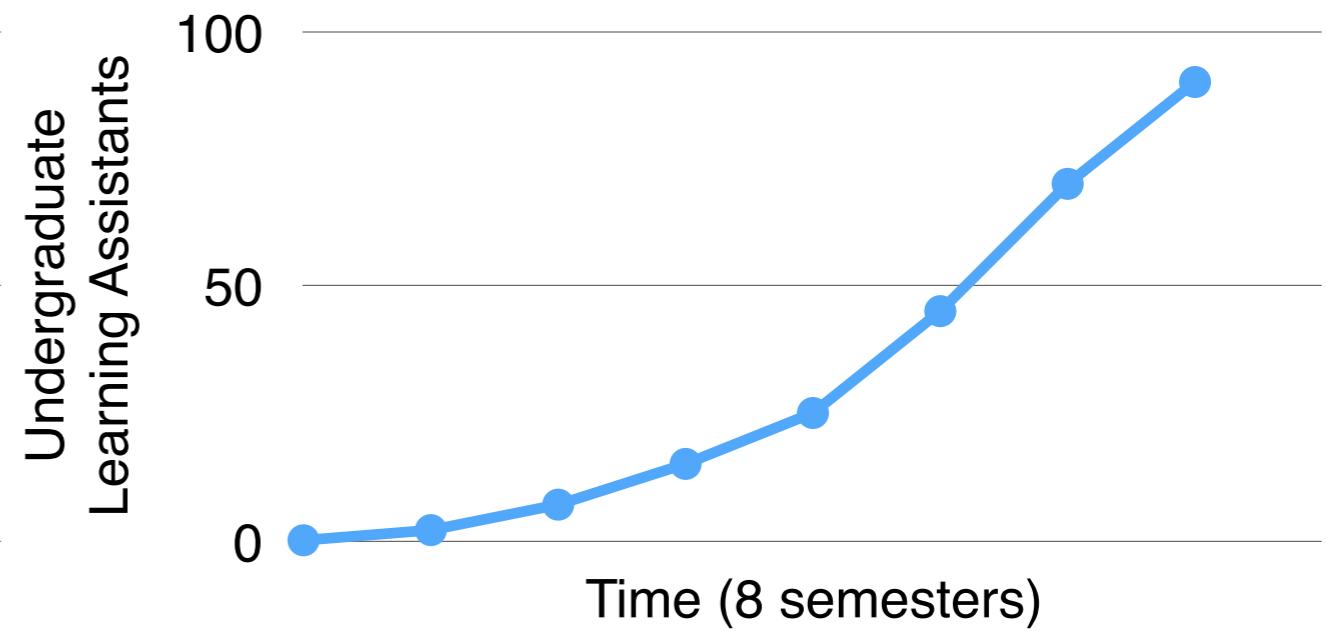
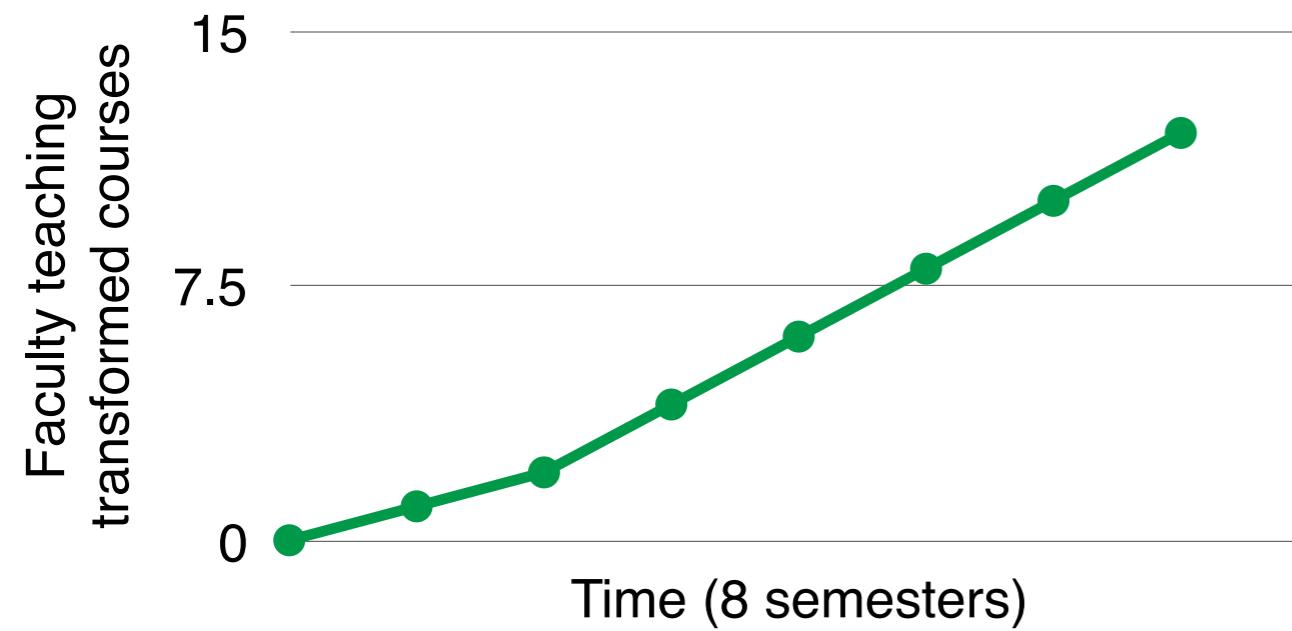
- Teaching portfolio now strongly encourages data on student learning
- Departmental teaching reviews taken more seriously

Growth in Physics

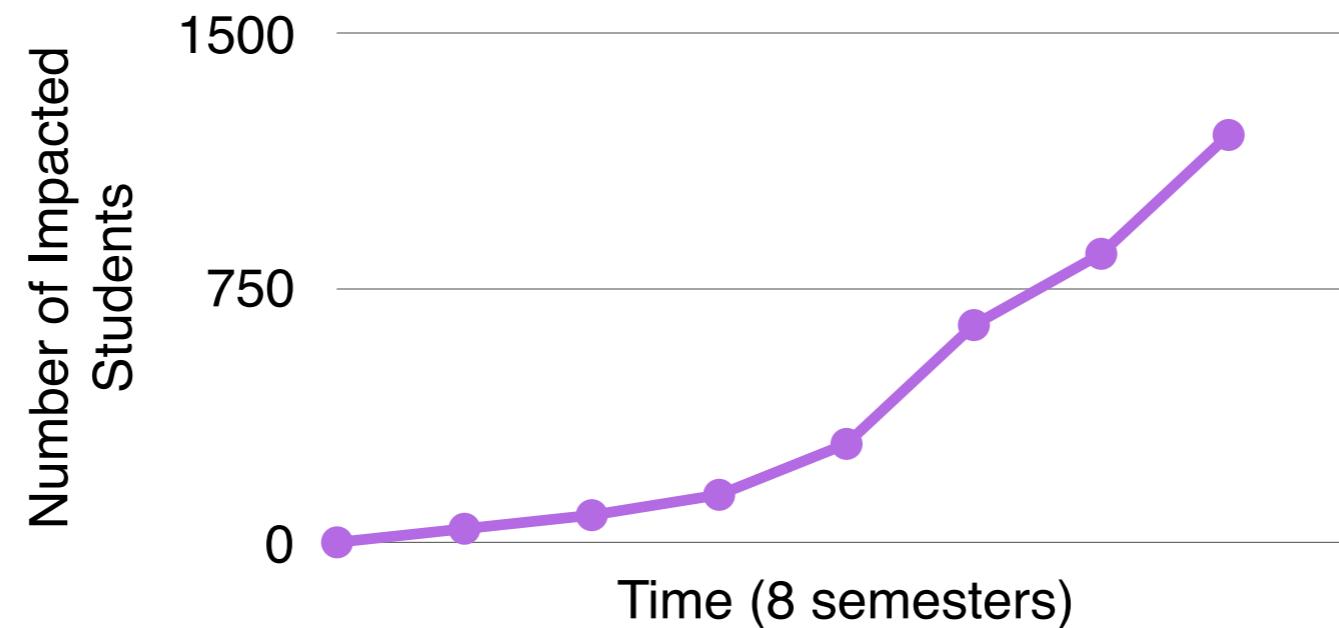
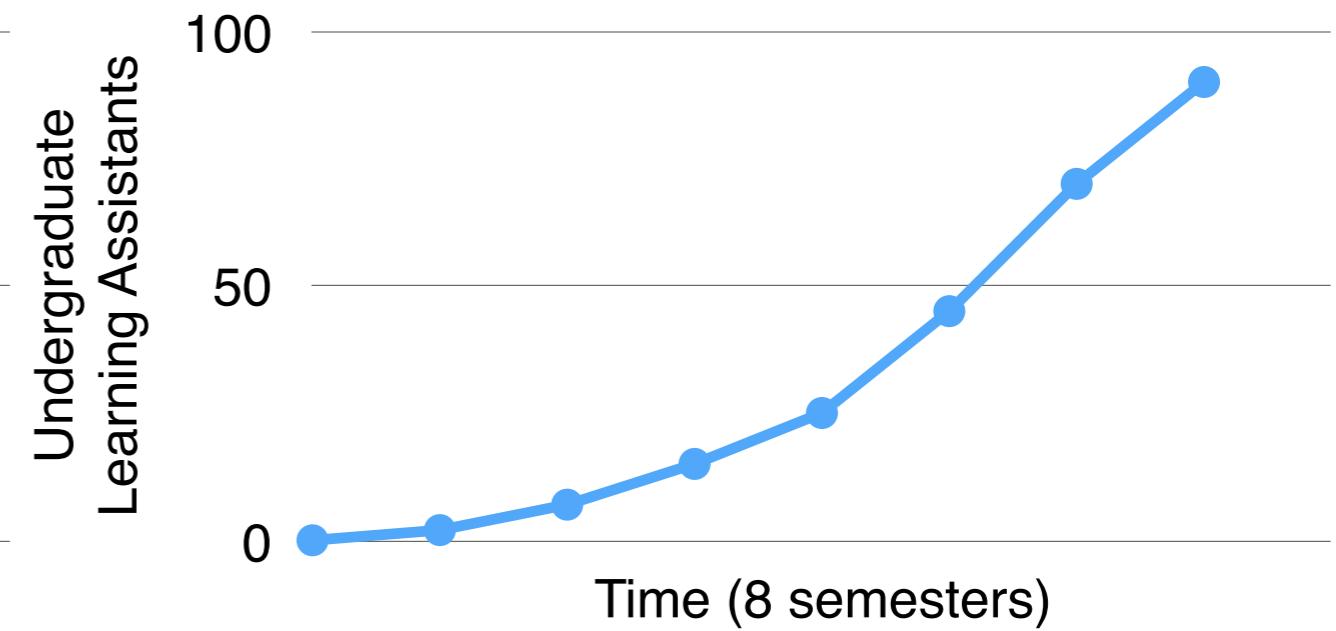
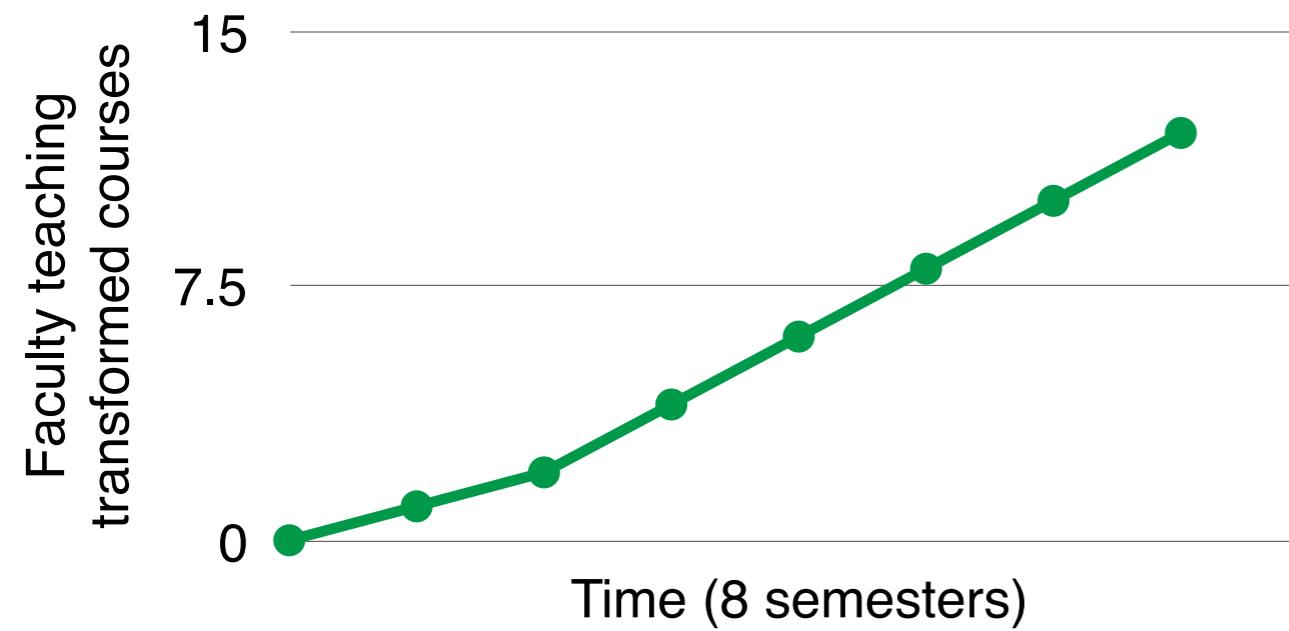
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Sustaining Efforts

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- Cost
(Integrating lecture and laboratory results in cost savings!)



MICHIGAN STATE
UNIVERSITY
perl.natsci.msu.edu

Mentor Faculty

Danny Caballero
Katie Hinko
Paul Irving
Vashti Sawtelle

Postdocs/Scientists

Angie Little
Daryl McPadden

Collaborating Faculty

David Stroupe (TE)
Brian O'Shea (CMSE)
Niral Shah (TE)
Stuart Tessmer
Anders Malthe-Sørensen (UiO)
Christine Lindstrøm (UiO)

Undergraduates

Grant Allen
Justin Gambrell
Abby Green
Kristy Griswold
Nat Hawkins
Bridget Humphrey
Helena Narowski
Dan Oleynik
Ashleigh Leary
Matt Ring
Alec Shrode
Alyssa Waterson

Graduate Students

Kelsey Funkhouser
Paul Hamerski
May Lee (TE)
Abhilash Nair
Mike Obsniuk
Alanna Pawlak
Brean Prefontaine
Laura Wood
Nick Young
John Aiken (UiO)
Odd Petter Sand (UiO)



The Research Council
of Norway



PICUP



SCIENCE +
SOCIETY @ STATE



Alumni

Leanne Doughty (PD)
J.T. Laverty (PD)
Bill Martinez (PD)
Steve Wolf (PD)
Tom Finzell (FAST)
Adam Fritsch (FAST)
Brian Hancock (TE)
Sarah Boyer (UG)
Laura Hunter (UG)
Sonny Ly (UG)
Camila Monsalve (UG)
Anna Turnbull (UG)
Mike Zwartz (UG)

Local Collaborators

Melanie Cooper (Chem)
Erin Duffy (Chem)
Diane Ebert-May (Bio)
Cori Fata-Hartley (Bio)
Becky Matz (Bio)
Lynmarie Posey (Chem)
Ryan Sweeder (Chem)
John Stolzfus (Bio)
Ryan Stowe (Chem)
Mark Urban-Lurain (Eng)

Thank you!

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