



Rewriting the Story:

Moving Toward an Upper-division Community of Practice

Paradigms in Physics

www.physics.oregonstate.edu/portfolioswiki

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ORAAPT - Corvallis, OR
10 March 2012



What are the Paradigms?

(1) Structure/Organization

(2) Content

(3) Pedagogy

(4) All of the above

Support

- National Science Foundation
 - DUE-9653250, 0231194, 0618877
 - DUE-0088901, 0231032, 1023120
- Oregon State University
- Oregon Collaborative for Excellence in the Preparation of Teachers
- Grinnell College
- Mount Holyoke College
- Utah State University



Telling a different story

- Fall

- Symmetries & Idealizations
- Static Vector Fields
- Oscillations

- Spring

- Energy & Entropy
- Periodic Systems
- Rigid Bodies
- Reference Frames

- Winter

- 1-D Waves
- Spin & Quantum Measurements
- Central Forces

- Capstones

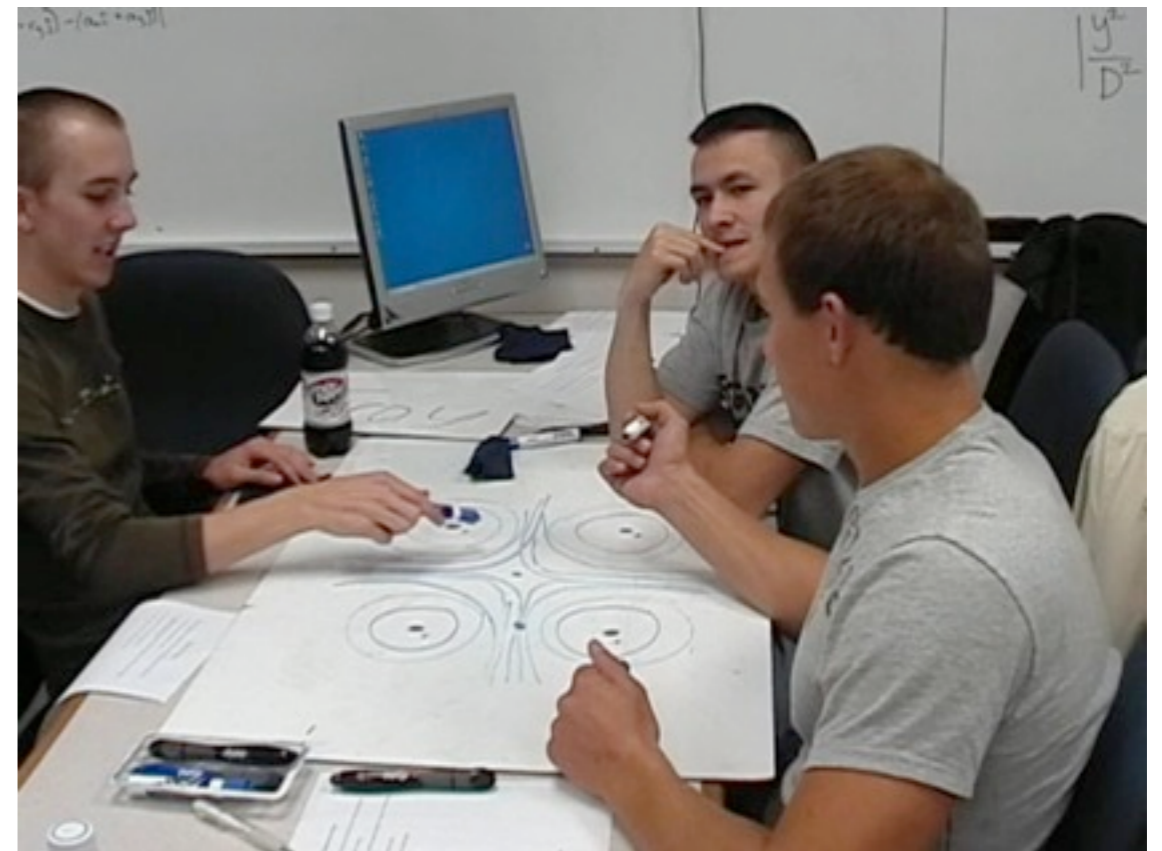
- Classical Mechanics
- Mathematical Methods
- Electromagnetism
- Optics
- Quantum Mechanics
- Thermal & Statistical Physics

Telling a different story

- Quantum Mechanics
 - Spin first
 - Multiple representations
 - bra-ket, matrix, wave function
 - Geometric reasoning

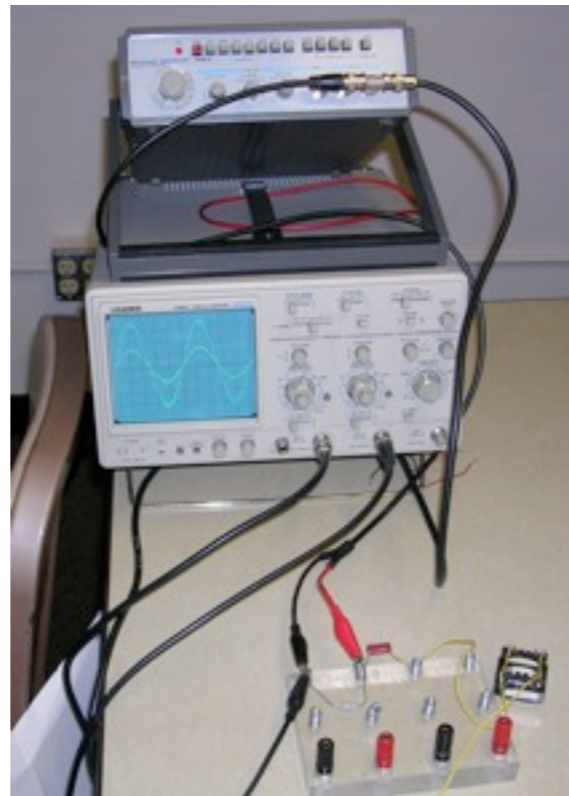
Telling the story differently

- Small group activities



Telling the story differently

- Integrated laboratories



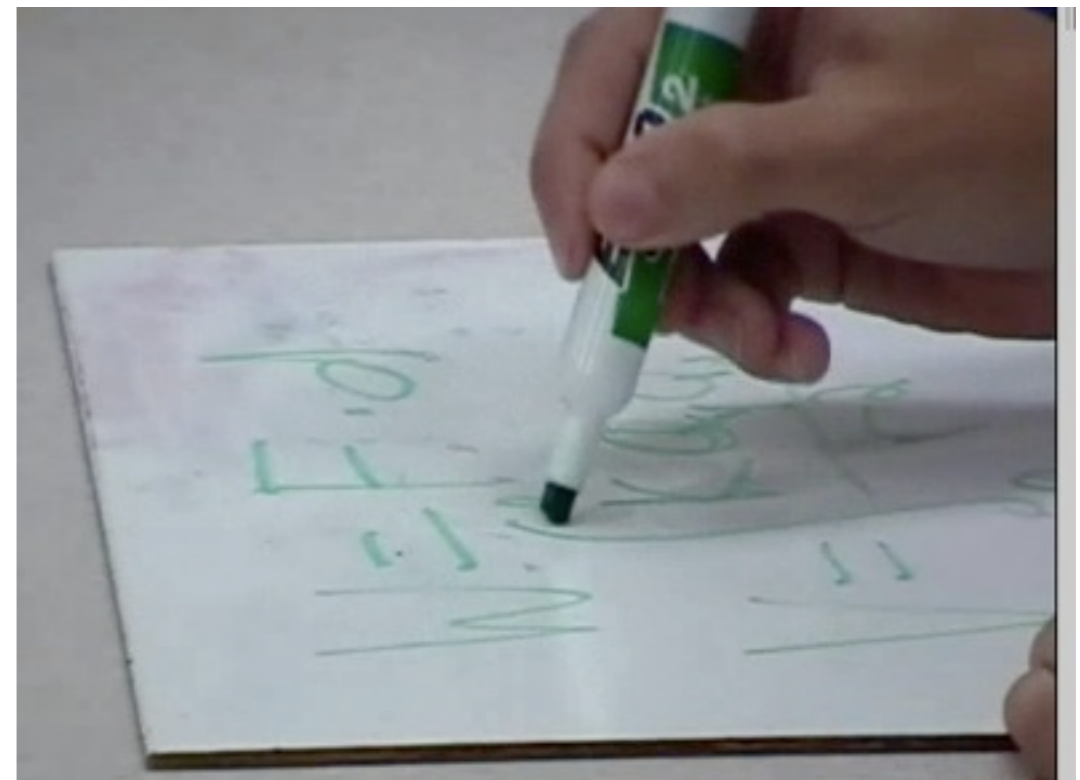
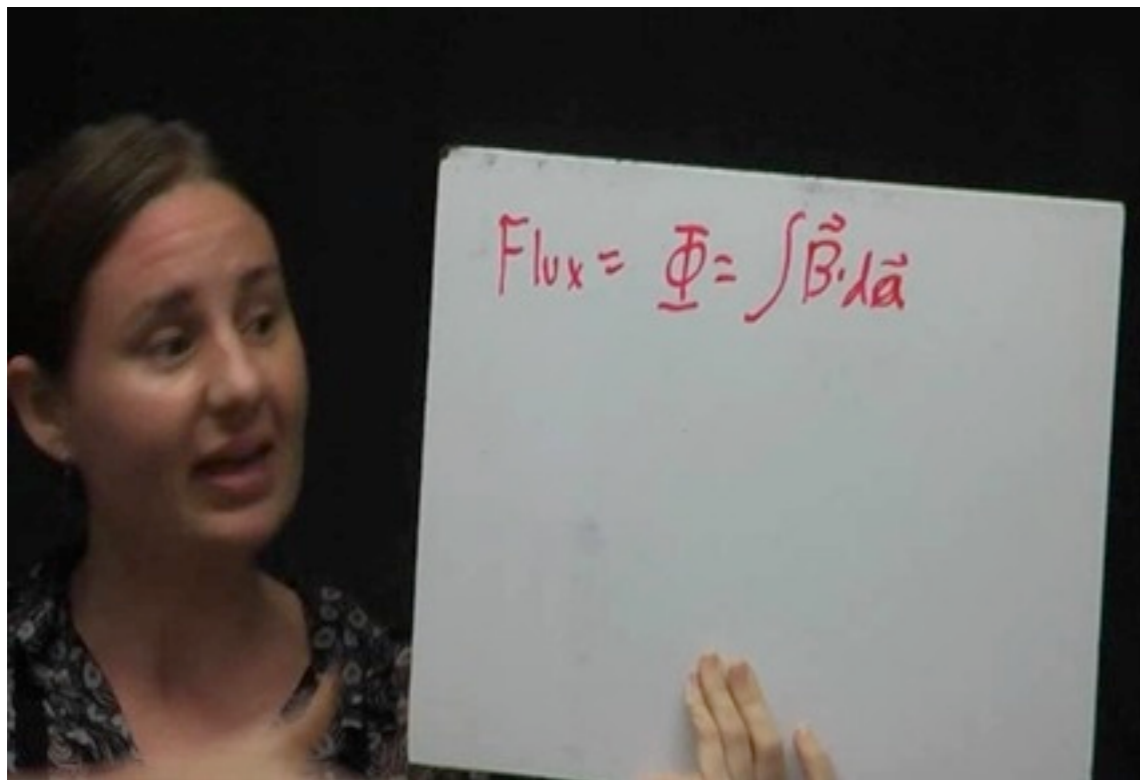
Telling the story differently

- Kinesthetic activities



Telling the story differently

- Small whiteboard questions



Adoption-Invention Continuum

- Henderson and Dancy, AJP, 2007

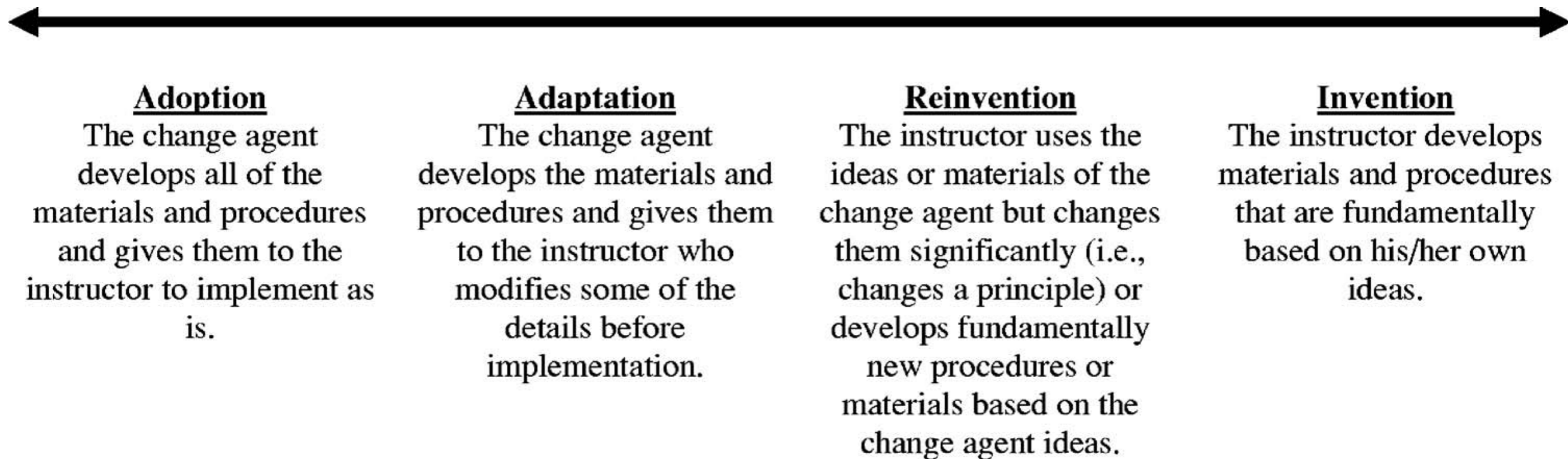



Fig. 1. Adoption-invention continuum.

Adoption-Invention Continuum




<u>Activity in the Change Process</u>	<u>Adoption</u>	<u>Adaptation</u>	<u>Reinvention</u>	<u>Invention</u>
• Identify an instructional problem	CA	Either CA or I	Either CA or I	I
• Develop general idea of a solution (awareness knowledge)	CA	CA	CA	I
• Develop principles of the solution (principles knowledge)	CA	CA	I (with or without CA help)	I
• Develop details of the solution (how-to-knowledge)	CA	I (with or without CA help)	I (with or without CA help)	I
• Implement solution	I	I	I	I

Fig. 2. Change agent (CA) and instructor (I) roles in developing and implementing new instructional strategies.



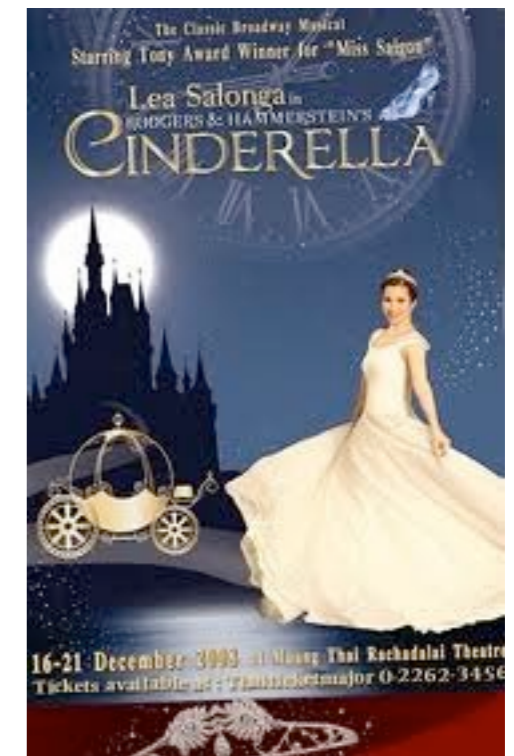
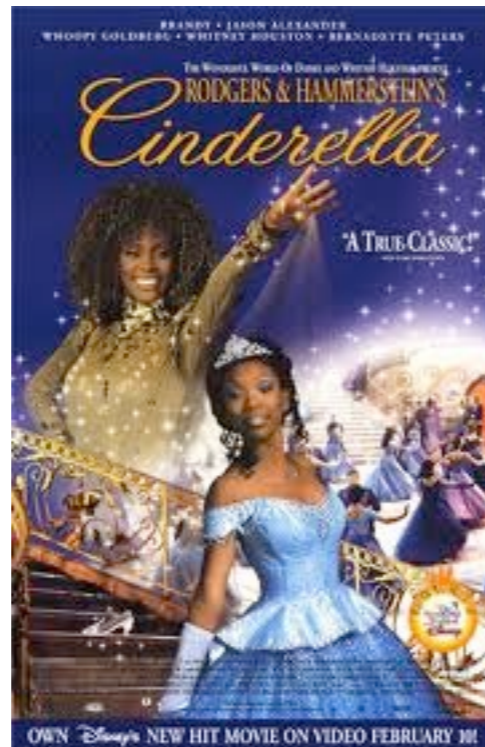
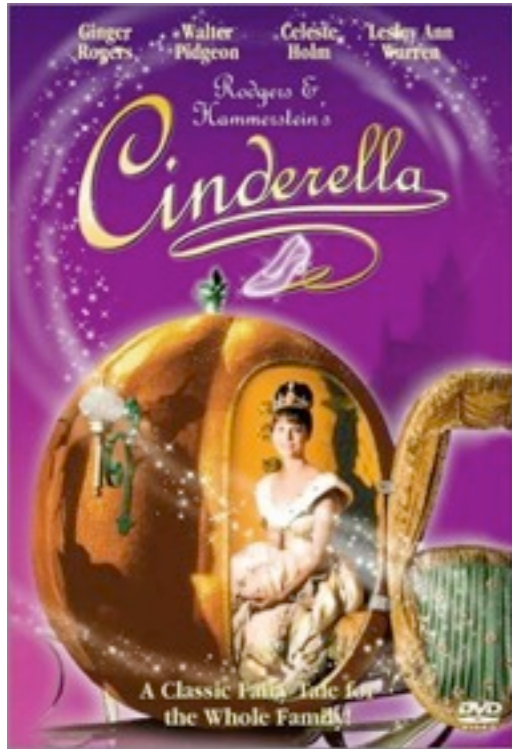
The Adoption-Invention
continuum does not account for
the **SPECTRUM** of
implementation of the Paradigms



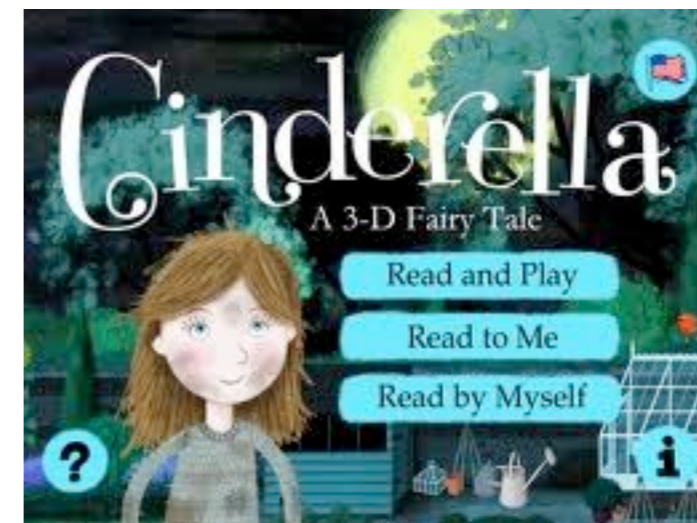
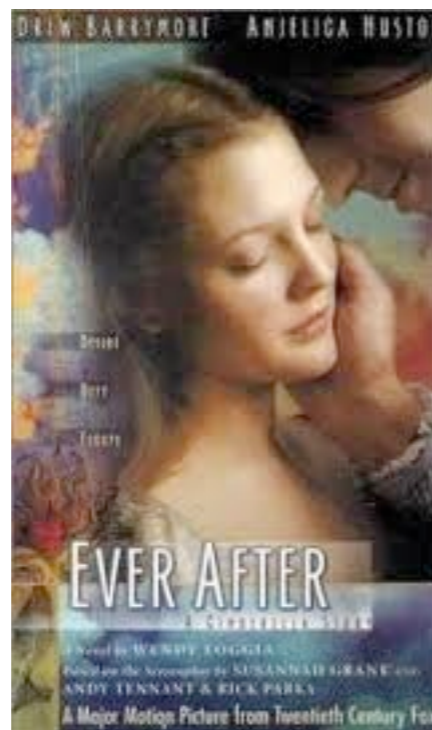
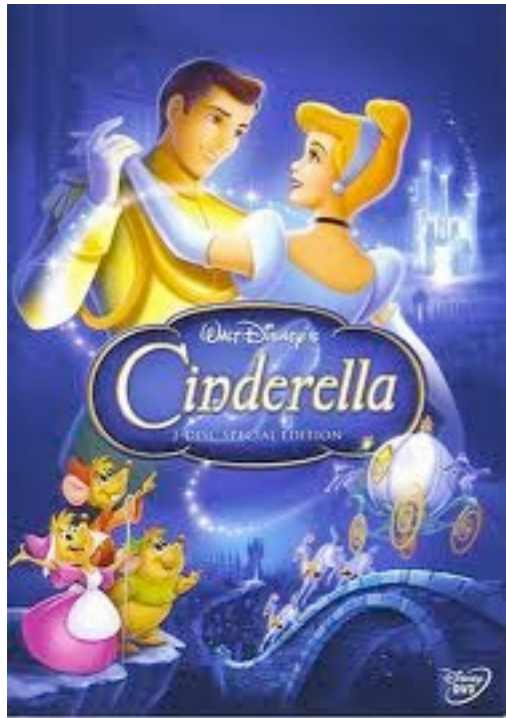
Spectrum of Implementation

- Structure/Organization
- Content
- Pedagogy

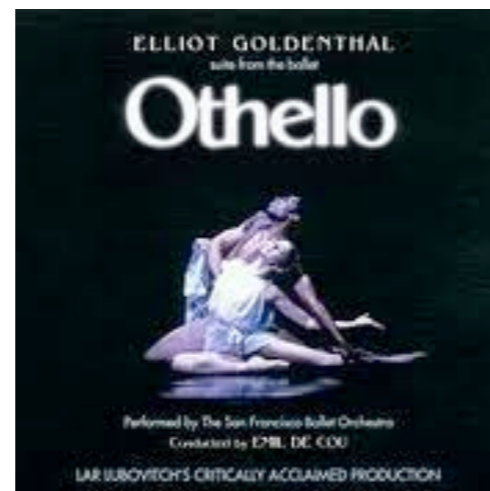
Spectrum: Structure



Spectrum: Content



Spectrum: Pedagogy



Recommendations from Henderson & Dancy

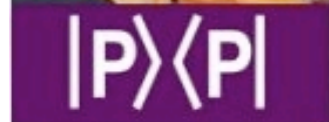
- View faculty as partners
- Provide easily modifiable materials
- Disseminate research ideas in addition to curriculum
- Acknowledge that change is difficult and support instructors

Conclusions - assumptions for dissemination

- Instructors care about students and their students' learning
- Instructors have something to contribute to the conversation

Meeting the challenges

physics.oregonstate.edu/portfolioswiki



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Paradigms in Physics

Teaching is the art of leading students into a situation in which they can only escape by thinking.

— *Dr. C. T. Bassoppo-Moyo*

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You may enter this website at six different levels: individual [activities arranged by content](#), individual [activities arranged by pedagogical strategy](#), [sequences of activities](#) that we have found work well together to achieve particular pedagogical goals, descriptions of our courses, descriptions of things we have learned about [how students learn](#) and descriptions of things we have learned about [how departments and teachers change](#).

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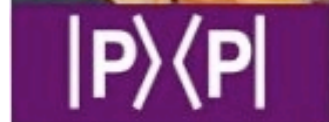


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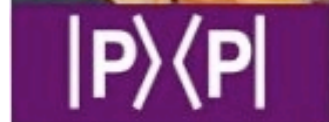


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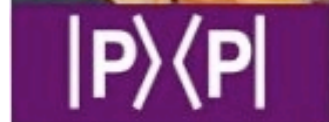
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**Being respectful pays off:
in dissemination, in our classrooms,
and in our research.**



**Create a community of instructors at
the upper-division that is engaged in**

re-writing the story