Rewriting the Story:
Moving Toward an Upper-division Community of Practice

Paradigms in Physics
www.physics.oregonstate.edu/portfolioswiki

Mary Bridget Kustusch
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

Adoption
The change agent develops all of the materials and procedures and gives them to the instructor to implement as is.

Adaptation
The change agent develops the materials and procedures and gives them to the instructor who modifies some of the details before implementation.

Reinvention
The instructor uses the ideas or materials of the change agent but changes them significantly (i.e., changes a principle) or develops fundamentally new procedures or materials based on the change agent ideas.

Invention
The instructor develops materials and procedures that are fundamentally based on his/her own ideas.

Fig. 1. Adoption-invention continuum.
Adoption-Invention Continuum

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

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

[Images of various Cinderella-related media, including a DVD cover, a ballet poster, a children's book, and an animated movie poster.]
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

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

The Paradigms in Physics team is embarking on a new project to put detailed information about the various activities that we have developed on the web to encourage adoption by faculty at other institutions. We have already described our program as a whole in two papers and a general website. We are currently experimenting with a wiki format so that users will be able to offer detailed feedback. We expect this site to be updated on a nearly daily basis. Check back often!

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.

- More about us and our partners
- Reading mathematics in this Wiki

This material is based upon work supported by the National Science Foundation under DUE Grant Nos. 9653250, 0099901, 0231032, 0231194, 0619877, 0837629.

© 2010—The Paradigms in Physics Team

Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation (NSF)
Meeting the challenges

physics.oregonstate.edu/portfolioswiki

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

The Paradigms in Physics team is embarking on a new project to put detailed information about the various activities that we have developed on the web to encourage adoption by faculty at other institutions. We have already described our program as a whole in two papers and a general website. We are currently experimenting with a wiki format so that users will be able to offer detailed feedback. We expect this site to be updated on a nearly daily basis. Check back often!

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.

- More about us and our partners
- Reading mathematics in this Wiki

This material is based upon work supported by the National Science Foundation under DUE Grant Nos. 9653250, 0099901, 0231032, 0231194, 0619877, 0837829.

© 2010—The Paradigms in Physics Team

Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation (NSF)
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

The Paradigms in Physics team is embarking on a new project to put detailed information about the various activities that we have developed on the web to encourage adoption by faculty at other institutions. We have already described our program as a whole in two papers and a general website. We are currently experimenting with a wiki format so that users will be able to offer detailed feedback. We expect this site to be updated on a nearly daily basis. Check back often!

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.

- More about us and our partners
- Reading mathematics in this Wiki

This material is based upon work supported by the National Science Foundation under DUE Grant Nos. 0653250, 0099901, 0231032, 0231194, 0619877, 0837829.

Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation (NSF).
Meeting the challenges

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

The Paradigms in Physics team is embarking on a new project to put detailed information about the various activities that we have developed on the web to encourage adoption by faculty at other institutions. We have already described our program as a whole in two papers and a general website. We are currently experimenting with a wiki format so that users will be able to offer detailed feedback. We expect this site to be updated on a nearly daily basis. Check back often!

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.

More about us and our partners

Reading mathematics in this Wiki

This material is based upon work supported by the National Science Foundation under DUE Grant Nos. 0837829, 0619877, 0619894, 0231194, 0231032, 0989901, 0653250.

© 2010—The Paradigms in Physics Team

Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation (NSF)
Meeting the challenges

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

The Paradigms in Physics team is embarking on a new project to put detailed information about the various activities that we have developed on the web to encourage adoption by faculty at other institutions. We have already described our program as a whole in two papers and a general website. We are currently experimenting with a wiki format so that users will be able to offer detailed feedback. We expect this site to be updated on a nearly daily basis. Check back often!

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.

More about us and our partners
Reading mathematics in this Wiki

This material is based upon work supported by the National Science Foundation under DUE Grant Nos. 0632250, 0099901, 0231032, 0231194, 0619877, 0837629.

Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation (NSF)

© 2010—The Paradigms in Physics Team
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.