CL06: AAPT Winter 2002 Conference, Philadelphia, PA

What do students learn from example problem solutions?
Instructors' Beliefs*

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Outline

- **Details of the study**
- **Focus of the talks**
- **Analysis Procedure**
- **Instructors' beliefs on how Example Problem Solutions aid student learning**

Disclaimer: **"Student Learning" really means "instructors' beliefs about student learning"**

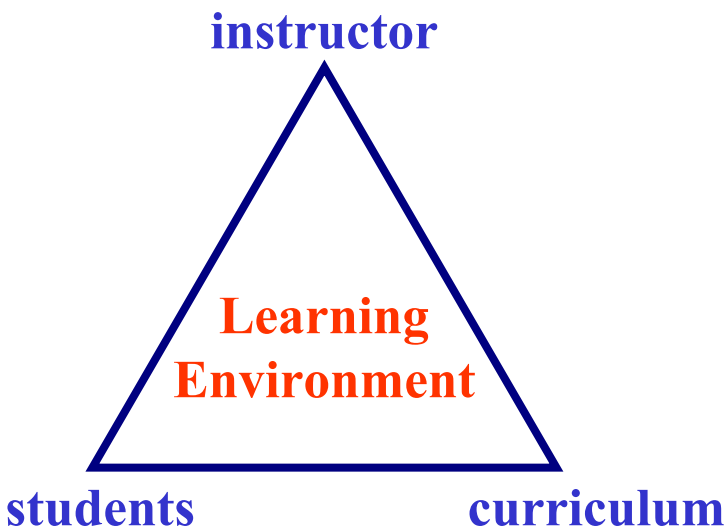
Focus of Our Group

Learning of physics through problem solving

in this study …

Instructors' beliefs and values about the teaching and learning of problem solving in physics

why instructors?



the questions is …

Can we determine what these beliefs and values are?

To understand instructors' beliefs and values

with respect to problem solving

We have developed and administered a 1½ hour open-ended interview to physics faculty guided by instructional artifacts:

1st) 3 Instructor solutions: varied in the details of their explanation, physics approach, and presentation structure

General & Specific Questions

2nd) 5 Student solutions

3rd) 4 Problem types

All artifacts were based on one problem -- instructors were given the problem and asked to solve it on their own before the interview.

Sample

Physics faculty in state of Minnesota:

taught introductory calculus-based physics course in the last 5 years (~107 possible).

Randomly Selected 30

Roughly evenly divided among:

1) Community College (CC) N = 7
2) Private College (PC) N = 9
3) Research University (RU) N = 6
4) State University (SU) N=8

Plan

Phase I : **Develop hypotheses about the range and nature of faculty conceptions based on 6 Research University Faculty**

Phase II: **Refine and test hypotheses with remaining 24 interviews.**

Phase III: **Determine the distribution of conceptions among faculty using a larger national sample.**

In these 2 talks …

about why instructors give EPS

We have developed a method to get at these beliefs

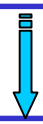
Talk 1: procedure on finding out what instructors think students get out of example problem solutions – learning from EPS

Talk 2: how do instructors choose to use example problem solutions – teaching using EPS

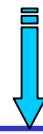
Analysis Procedure

Video- & audiotapes of 6 interviews (~9 hrs)

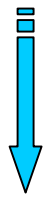
Interview transcripts (~180 pages)



Statements (~2400)



Concept Maps (15 x 6 = 90)



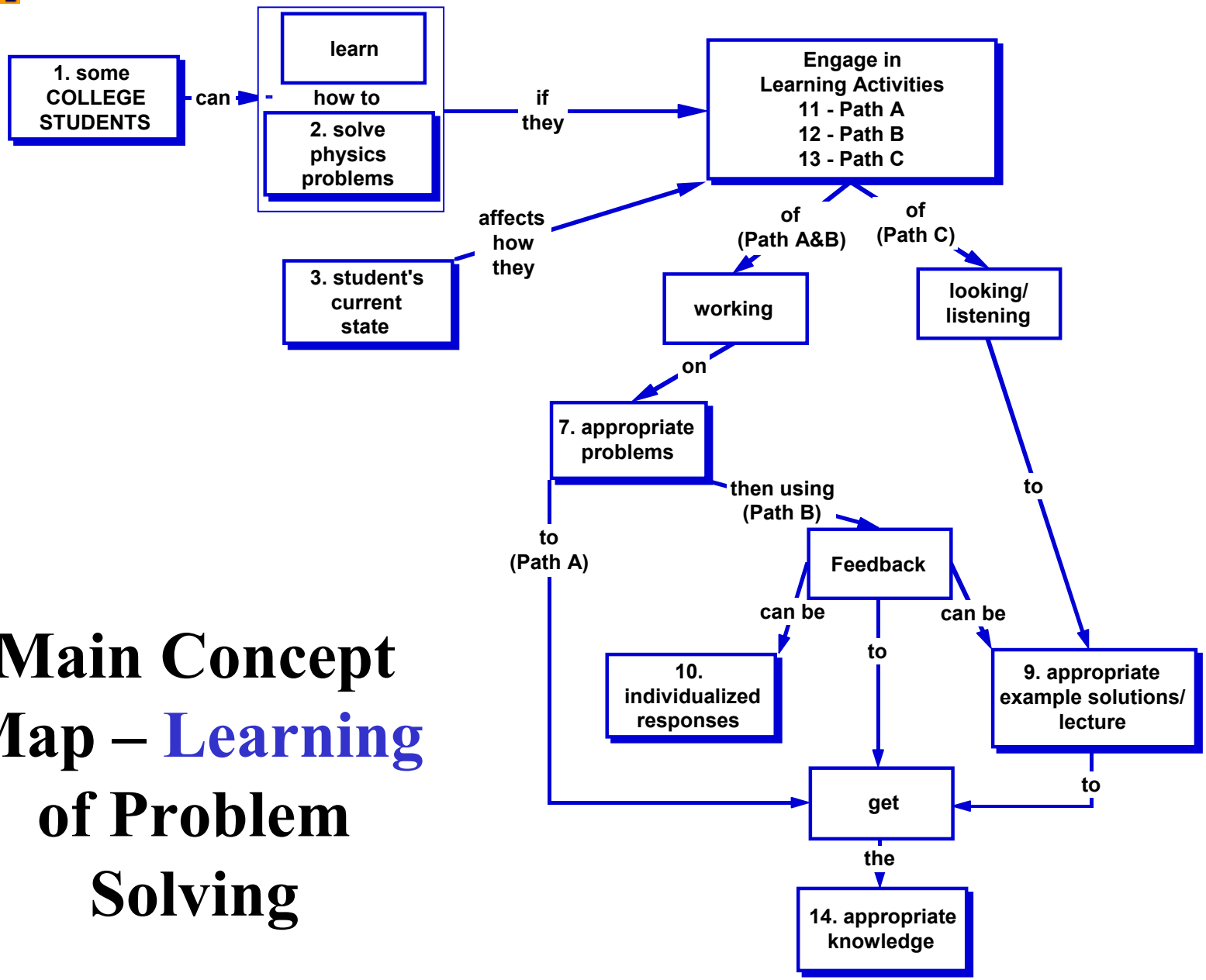
Combined Concept Map (15)

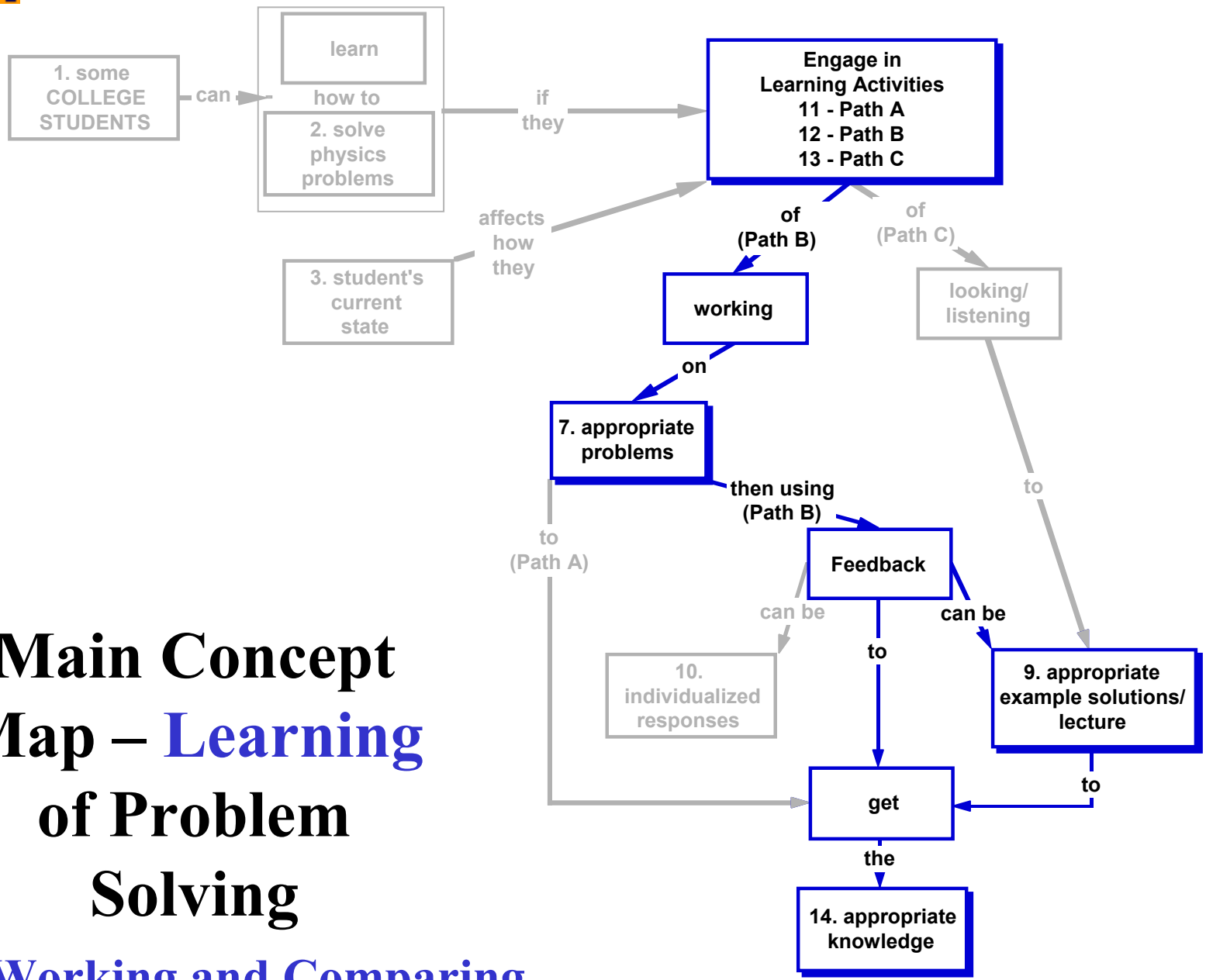
Concept Maps allow for:

the reduction of complex data into visual representations

explicit connections to be made between ideas that can then be tested

Main Concept Map – Learning of Problem Solving

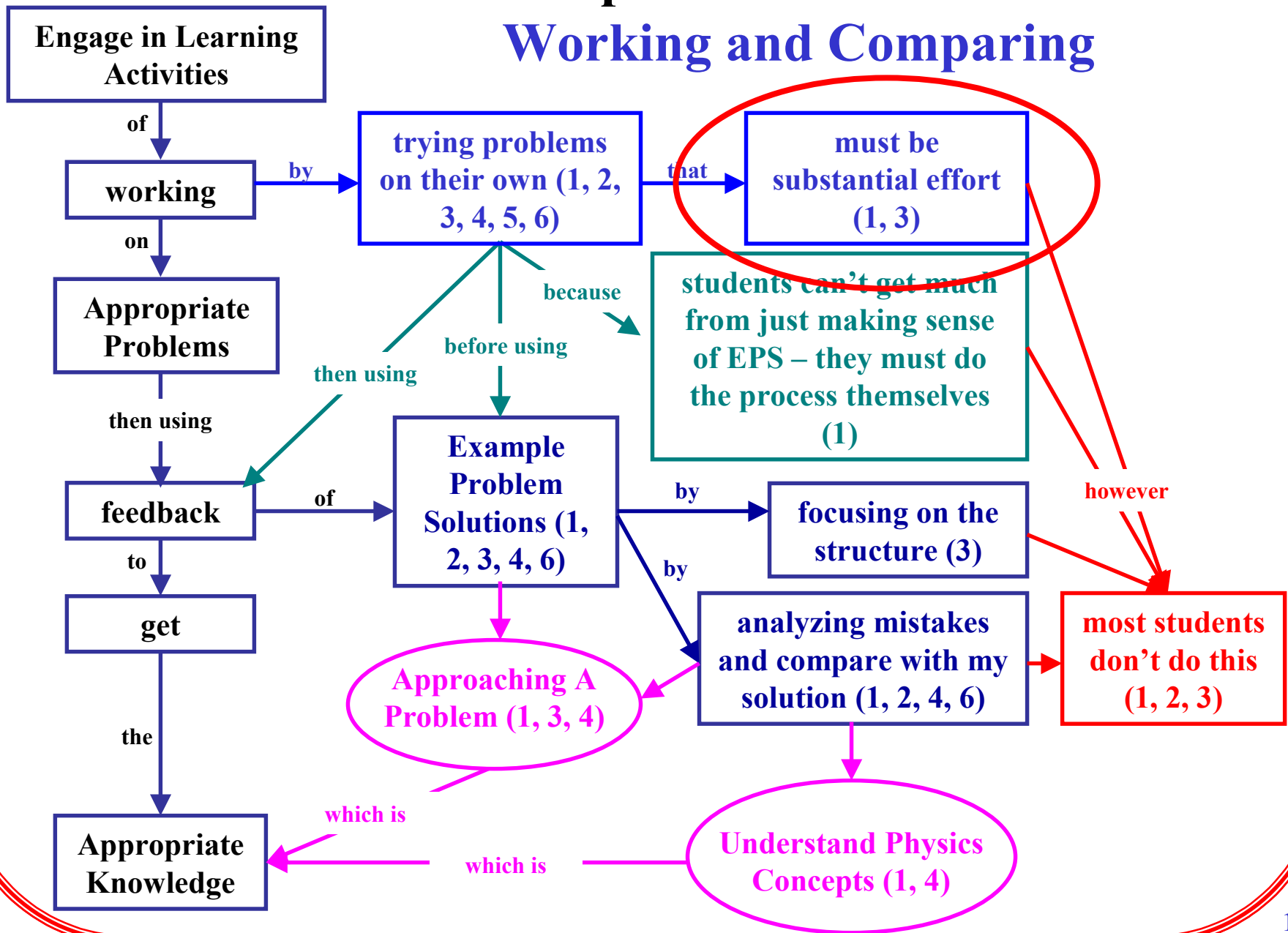




Main Concept Map – Learning of Problem Solving

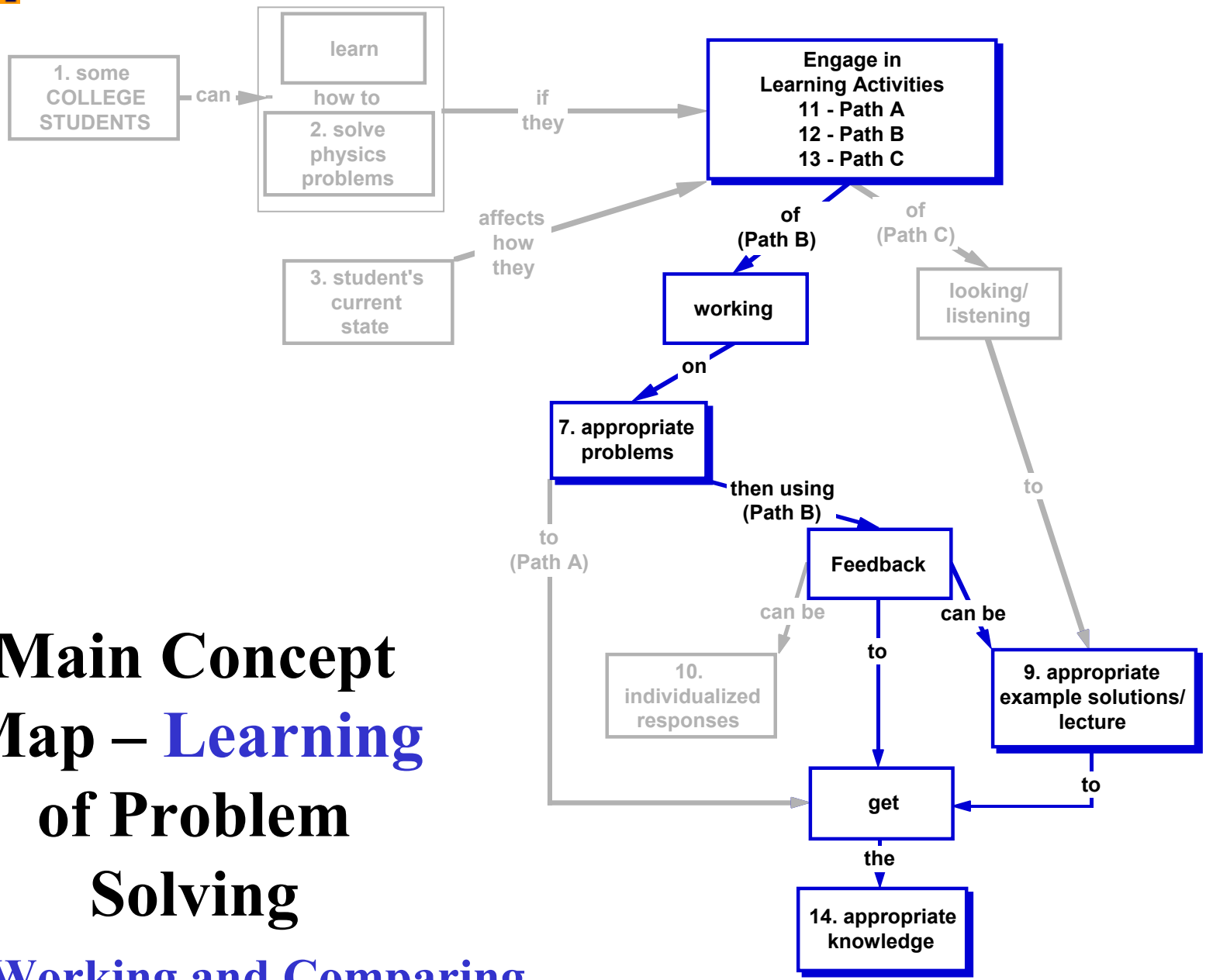
Working and Comparing

Example Problem Solution – Working and Comparing



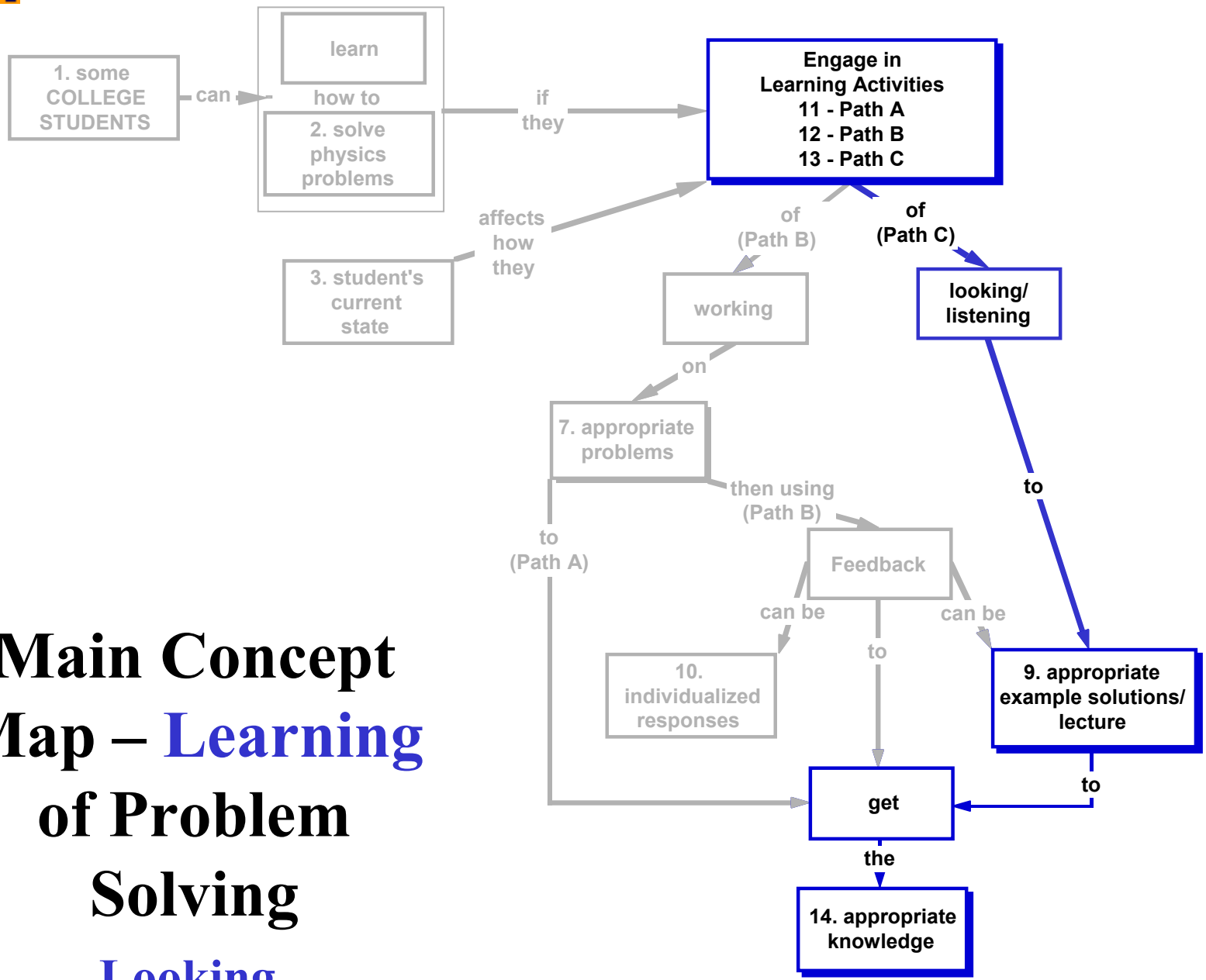
Main Concept Map – Learning of Problem Solving

Working and Comparing

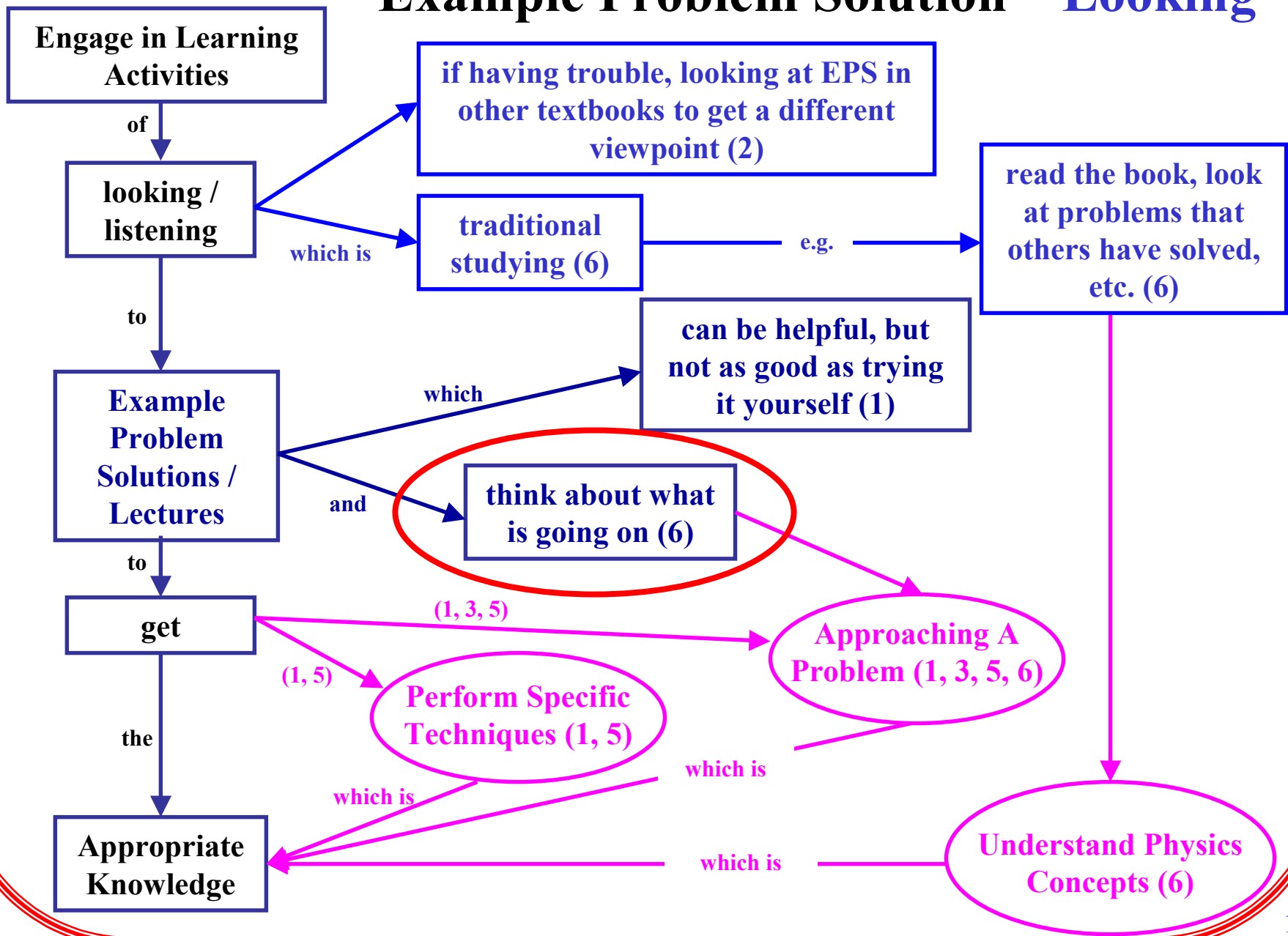


Main Concept Map – Learning of Problem Solving

Looking



Example Problem Solution – Looking



Preliminary Hypotheses

with respect to the usefulness of Example Problem Solutions

- **Instructors believe that students can learn from EPS if: (these should not be surprising)**
  1. **Students work on problems and then compare their solutions to the EPS**

     many faculty don't think that students typically do this comparison

  2. **Students look at solutions from example problems that the instructor solves during lecture**

     faculty rarely mention the types of thought processes that students should engage in while watching the solutions

Preliminary Hypotheses

with respect to the usefulness of Example Problem Solutions

- **Instructors believe that students can learn these 3 things from EPS: (again, these should not be surprising)**

1. **Approaching problems**
   - **e.g. Recognize what is relevant and what is not**
2. **Understanding physics concepts**
   - **e.g. Identify the physics that underlie the problem**
3. **Performing specific techniques**
   - **e.g. Free Body Diagrams**

What have we learned?

- **Concept maps:**
  - **Reduced complex data into visual representations**
  - **Identified beliefs and values of the instructors**
  - **Made explicit connections between ideas from various parts of the interview, and can thus be tested**
  - **Identified areas / ideas that need further exploration**

The end …
Thank You!

For more information,
visit our web site at:

http://www.physics.umn.edu/groups/physed/