Teaching Physics in Alabama

Alliance for Physics Excellence (APEX)

Physics Teaching Research Program (PTR)

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APEX Teaching Physics Cohort
PTI 2014

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Alliance for Physics Excellence

The goal of the *Alliance for Physics Excellence* (APEX) program is to integrate research-based teaching practices into Alabama physics classrooms via in-service teacher education, and evaluate the impact on physics teachers and their students in the state's school systems.

Teacher Action Research

Action Research is a strategy for extending APEX professional development and facilitating change in your physics teaching

How can you develop more effective physics teaching that supports student learning?

1. Consider your beliefs about teaching physics
2. Investigating your beliefs
3. Developing more effective, evidence-based physics classroom teaching that supports student learning

How can you develop more effective physics teaching that supports student learning?

1. View the lesson scenario, Nancy Module 1, analyze the lesson for instances of teacher knowledge that needs to be questioned, knowledge you think is appropriate or not-appropriate, to develop expertise in teaching.
2. For the items described, how would a teacher be sure that this knowledge is practical, that it works for their physics classroom better than alternative techniques?

Creating Change in Physics Classrooms

- All teachers have beliefs which guide their teaching.
- Beliefs are constructions of reality.
- Can you determine which of your beliefs are “truthful” or “misconceptions”?
- The process of changing is the process of changing beliefs.
- **How do you change beliefs?**
- How can you change your beliefs about physics teaching?

Creating Change in Physics Teaching

Activity:

What teaching actions do you believe, are certain about, areeffective in your physics classroom?

Write down 1 or 2.

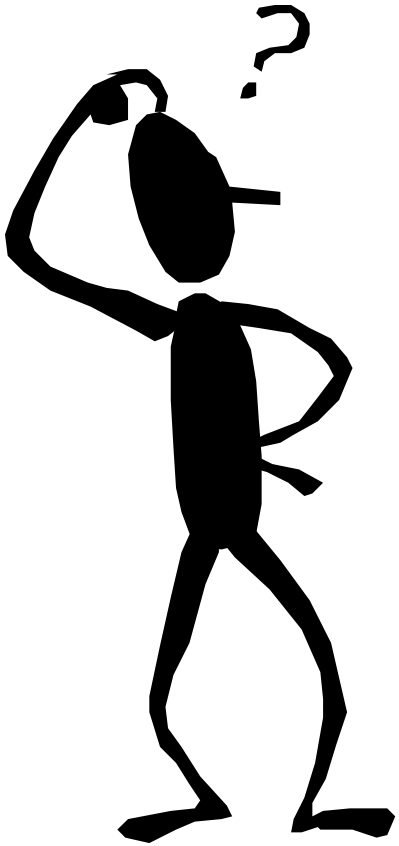
Classroom

These items or assumptions should represent specific, and not global, teacher knowledge about classroom practice.

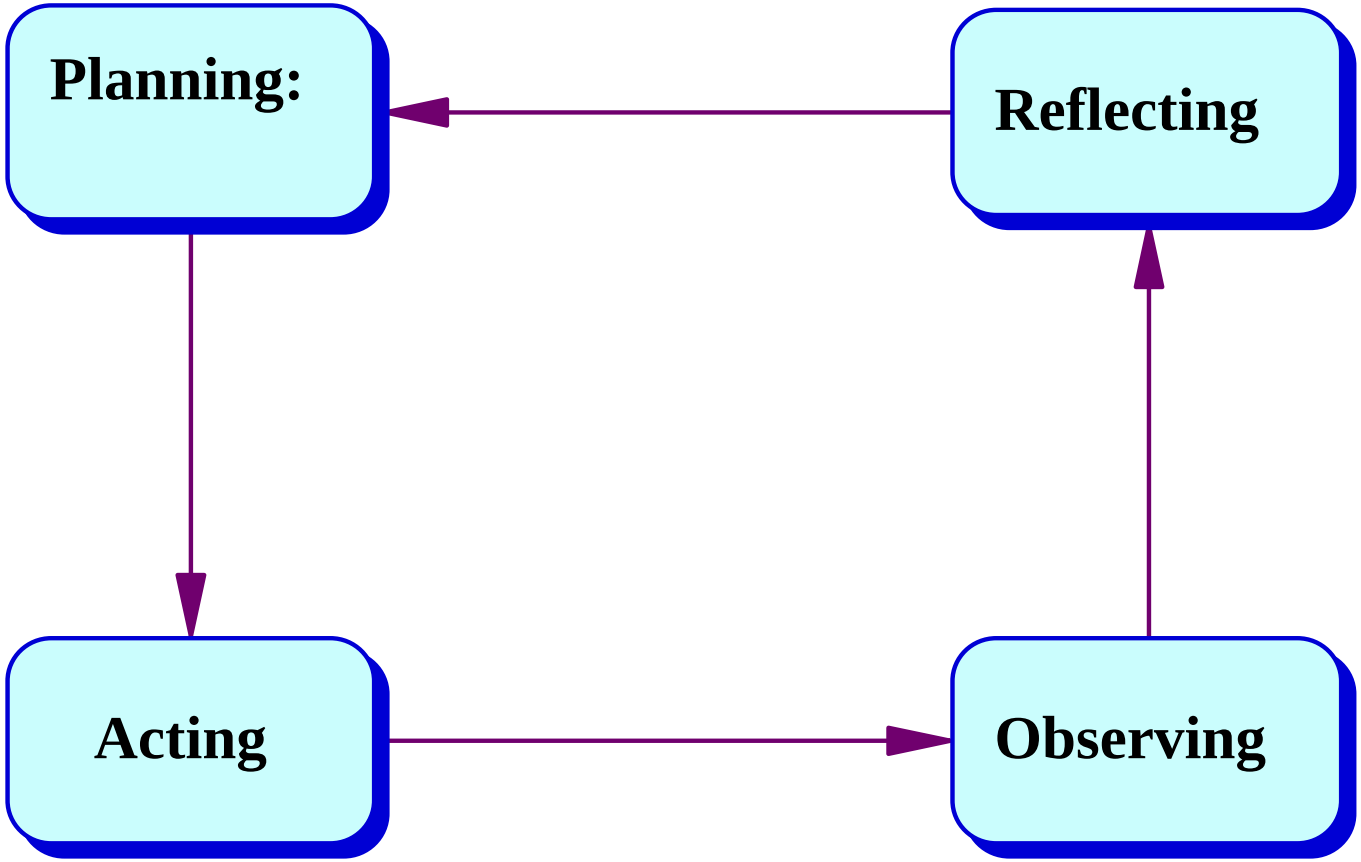
Creating Change in Classroom Teaching

Now consider:

- **For the item(s) you listed, how could a teacher be sure that this knowledge is practical, that it works for their physics classroom better than alternative techniques?**
- **<u>Describe</u> <u>this process</u> in terms of <u>one</u> of the items selected above.**

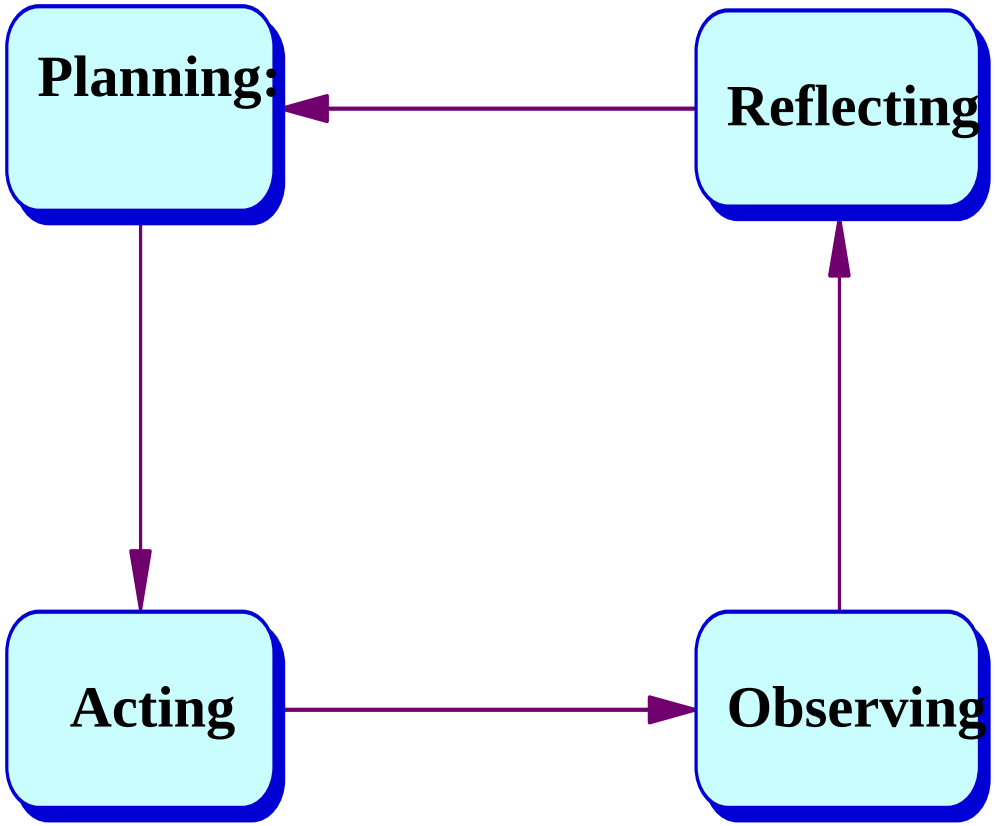


Basic Processes of Action Research



Processes of Action Research

- 1. Planning: Problem finding, question and hypothesis posing and deciding how to deal with a problem
- 2. Acting: Implementing the plan and testing it



Planning: Developing a Focus

Try to more clearly formulate the problem into a

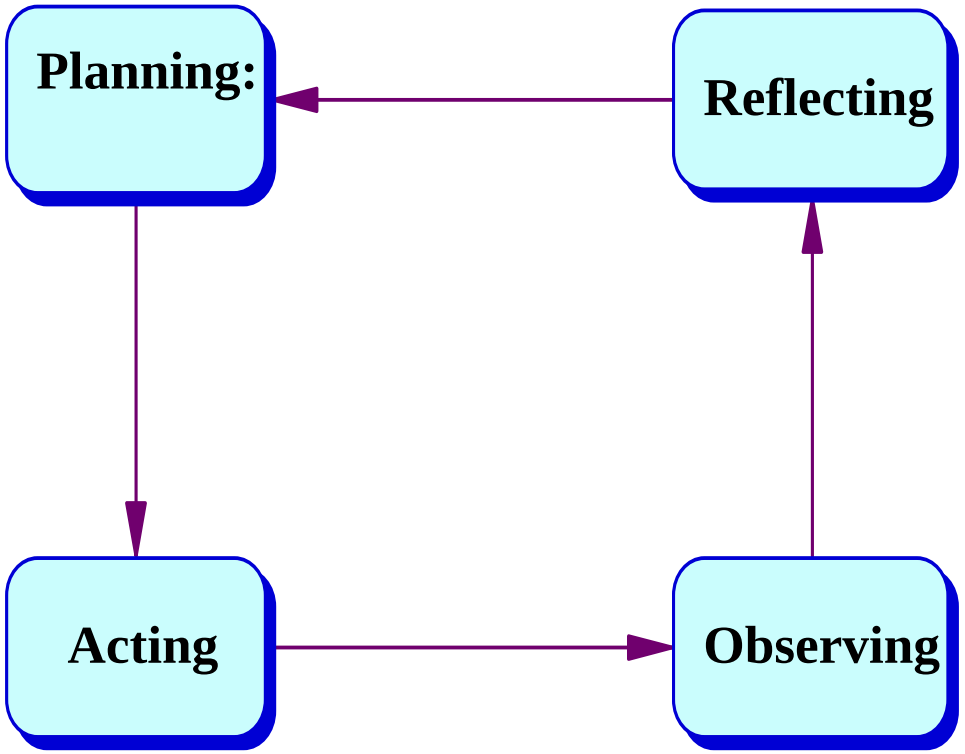
- **focus question and an**
- **hypothesis (also look for alternative hypotheses)**

There is a difference between Hypothesis Testing and Hypothesis Generation research in the classroom.

Acting: Implement New Idea and Test Hypothesis

- Test setting(what students)
- Test procedure (one class, or two classes, or ?)
- Data collection and analysis (act, observe, and assess)
- Results and conclusions leading to action (reflect, explain, and evaluate)

Processes of Action Research



- 4. Reflecting: Analyzing outcomes and checking with original plan and deciding what to do next
- 3. Observing: Collecting data and recording what happened

Observing - Classroom Data Gathering and Analyzing Data

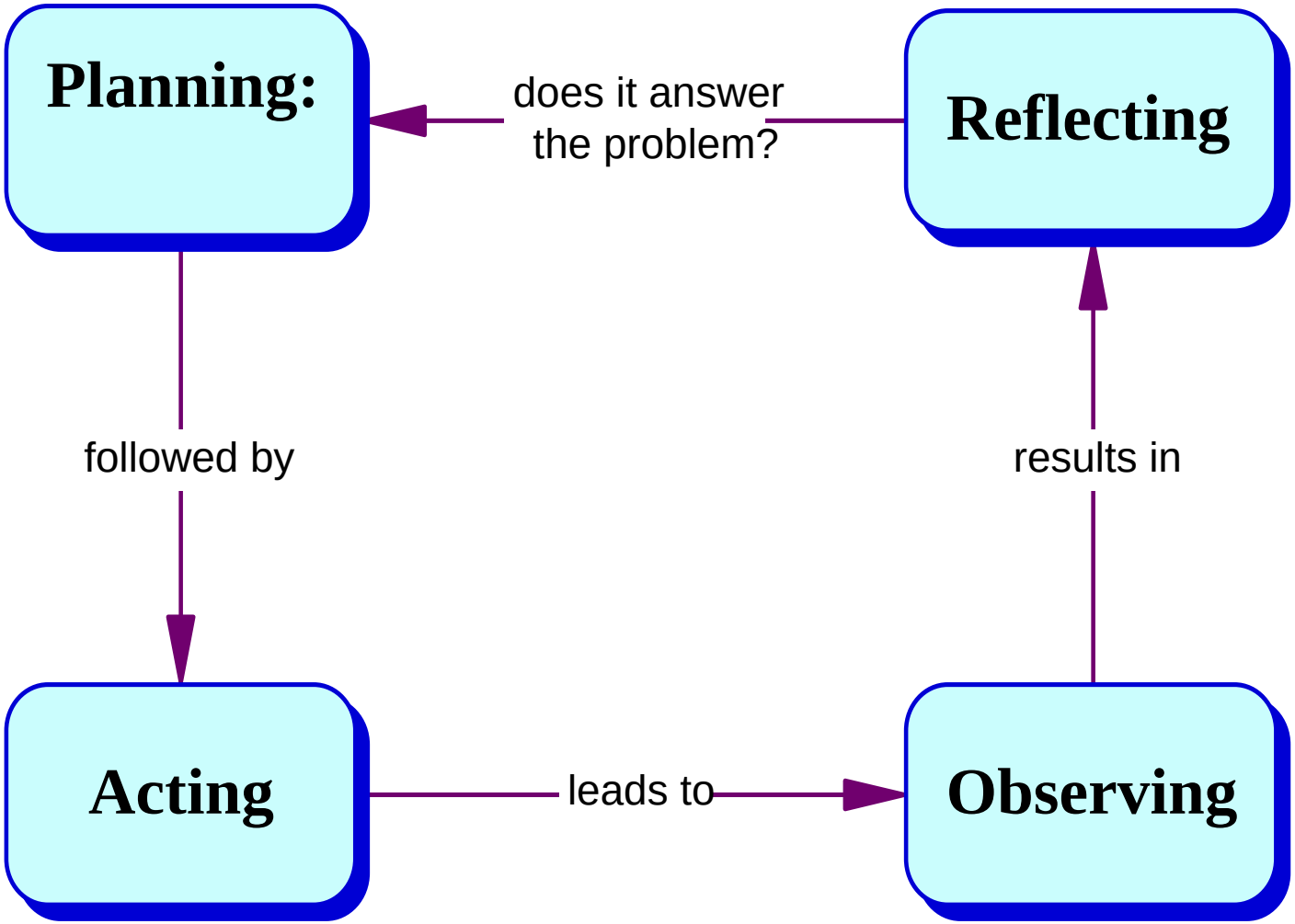
- Implement the virtual labs and continue traditional labs
- Using your action research design collect the needed data, make observations and perform interviews.
- Data analysis should go on concurrently.
- Revise your testing procedure based on observed needs (and fairness of testing).

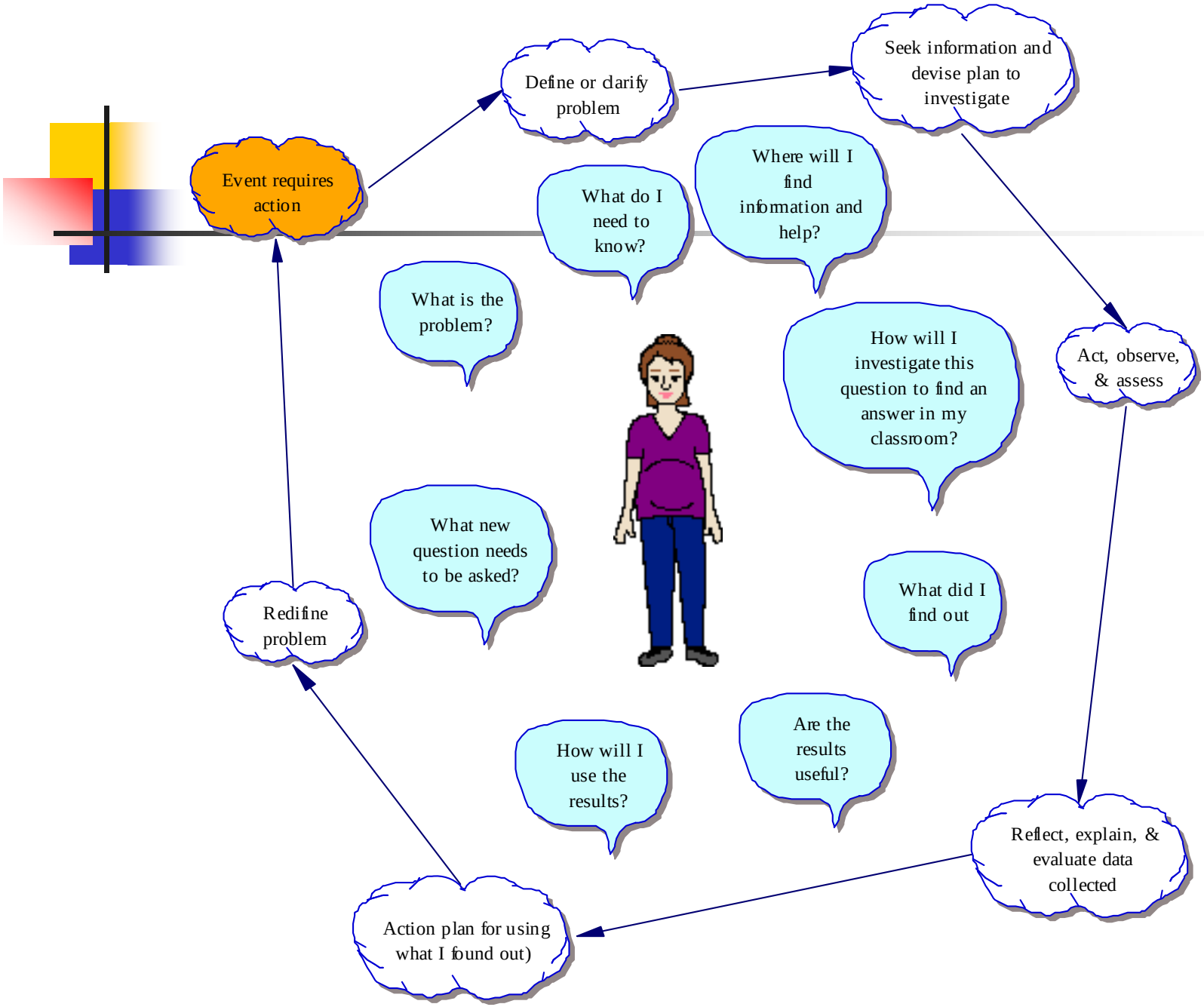
Reflecting - Continuing the Action

Reflect on results and draw conclusions

- Continue the innovation as completed or
- Plan modified or new action
- Act on the conclusions by making changes and monitoring effects
- Continue with a new cycle of action research

Teacher Action Research




Event requires action
Define or clarify problem
Seek information and devise plan to investigate
What do I need to know?
Where will I find information and help?
What is the problem?
How will I investigate this question to find an answer in my classroom?
Act, observe, & assess
What new question needs to be asked?
What did I find out
Redifine problem
How will I use the results?
Are the results useful?
Reflect, explain, & evaluate data collected
Action plan for using what I found out)

Continuing Cycle of Action Research

- problem situation (reflect)

Plan

- develop focus (define problem)
- reflect on hypotheses (plan design)

Act & Observe

- data collection and analysis (act and observe, and assess)

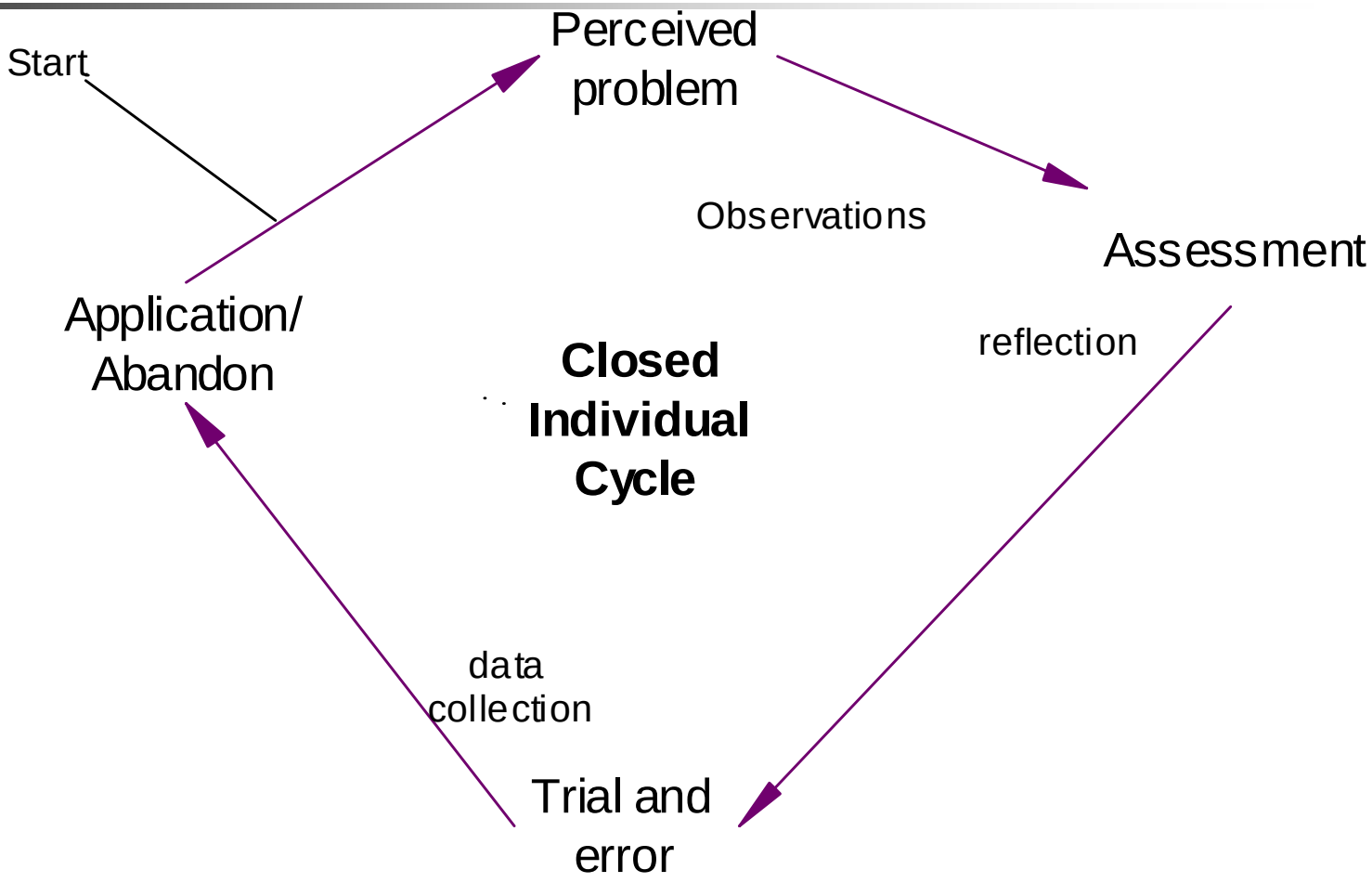
Reflect

- conclusions leading to action (reflect, explain, and evaluate)
- make decisions (redefine problem)

Action Research: What is it?

- An approach to research that can provide answers to questions and problems you have about your existing teaching practice and to check new ideas put into practice
- A systematic process of practitioner (teacher) problem posing and problem solving
- Designed to be carried out by teachers in a real classroom setting

Continuing Cycle of Action Research



Developing and Revising Your Physics Teaching for your High School Students

APEX Cohort 1 Model for Action Research with PTI Physics Teaching of Force and Motion Strategies

Developing and Revising Your Physics Teaching for your High School Students

Plan -

- **Problem (reflect):** What should PTI Force and Motion activities be used effectively in my teaching?
- **Develop a focus question (define problem):** How can PTI Force and Motion activities lead to learning outcomes that are as good as traditional teaching in physics classrooms.
- **Develop hypothesis:** Students can apply concepts they learn from incorporating PTI as well as students in traditionally taught classrooms.

Developing and Revising Your Physics Teaching for your High School Students

Act -

- **Reflect on hypothesis (plan test procedure):** Plan a physics unit that implements PTI Force and Motion activities so that they facilitate student understanding and application of concepts they learn.

Observe -

- **Collect** pre/post achievement scores on a common test and student interviews.
- **Compare** student outcomes from their pre-test scores or another comparison course completed in a traditional classroom.

Developing and Revising Your Physics Teaching for your High School Students

Reflect -

- **Reflect on Outcomes:** What happened, how do the results compare to your goals? Should you continue next year or the next unit using this type of approach, if not what should be changed?

Repeat of this Unit: Plan revisions for the next time you teach your physics unit that implements PTI Force and Motion activities.

Next Unit: What did you learn from this unit that you can apply to your next PTI unit (e.g.. Energy) to facilitate student understanding.

Developing and Revising Your Physics Teaching for your High School Students

- **Conclusion (1)**

My application of PTI activities in the class increased student physics knowledge, transfer, and their comfort with conducting inquiry activities as well as traditional physics instruction.

Developing and Revising Your Physics Teaching for your High School Students

Conclusion Options (2&3)

My application of PTI activities in my physics class:

a. increased student physics knowledge, transfer, and their comfort with conducting inquiry activities as well as traditional physics instruction. I will continue the innovation as just completed in the next unit and see if it works there too.

b. did not increase student physics knowledge, transfer, and their comfort with conducting inquiry activities as well as traditional physics instruction. I will plan a new way of implementing PTI in the next unit and see if it works there.

Developing and Revising Your Physics Teaching for your High School Students

Conclusion Option (4)

My application of PTI activities in my physics class:

c. did not increase student physics knowledge, transfer, but did increase student comfort with conducting inquiry activities as compared to traditional physics instruction. I will use the conclusions to make changes, modify application of PTI and monitor the effects in a new cycle of action research in the next unit.

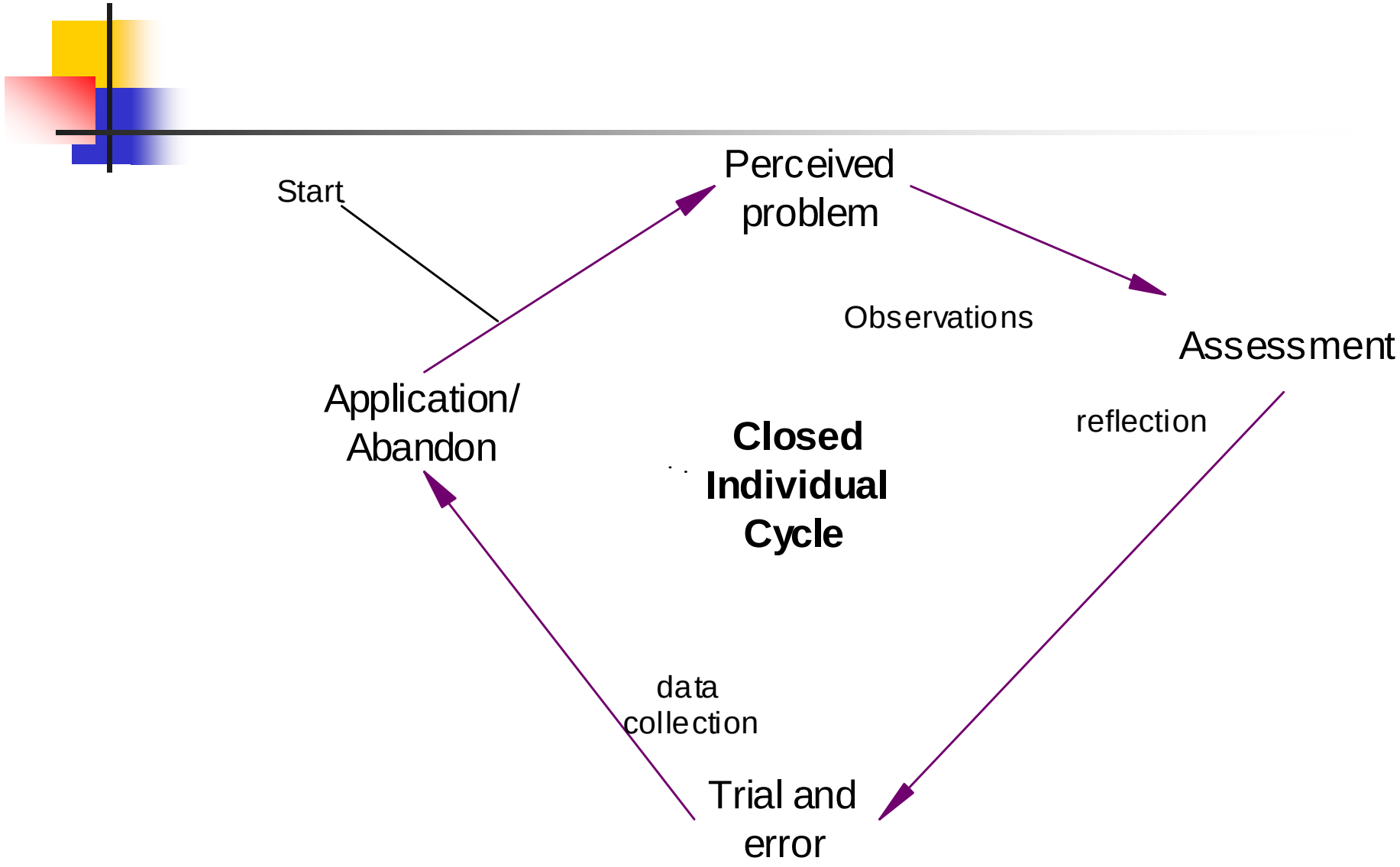
⇩

Later, you should modify sections of the your physics courses, investigate other variables in and monitor the effects in other units, disseminate information to other teachers in the school about the effective use of PTI activities in physics.

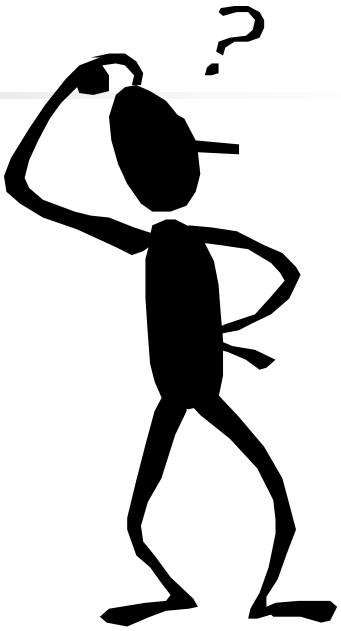
Ongoing Action Research Model
(perhaps several cycles for a complex innovation)

A Spiraling Process:

- revise focus (**redefine problem**)
- modify or use new hypotheses (**plan**)
- leading to new actions and new data analysis (**act, observe & assess**)
- revise previous conclusions (**reflect, explain & evaluate**)
- redevelop grounded theory (**understand**)
- etc.... in a continuous spiral leading to self-professional development and change


Start
Perceived problem
Observations
Assessment
reflection
Application/ Abandon
Closed Individual Cycle
data collection
Trial and error

Cohort 1
PTI Action Research Case Study
For Fall 2013



Cohort 1 Fall APEX Activity:

- **Using the unit on Force and Motion and Electricity and Magnetism you will be teaching next year in one of your physics classes, conduct an action research activity to determine the effectiveness of your application of the PTI professional development you received this summer.**
- **Consider the Case Study example to represent the process for you to ask and form your physics teaching action research question**

See the Cohort 1: PTI Action Research Case Study instruction sheet for additional guidance.

Action Research: Summary

- Note that the question is not, “What should the teacher do next Monday?”, but rather “How can you select, adapt, use, or re-conceptualize PTI materials to make learning more productive for students?”
- Action Research, also, involves physics teachers in the process of defining, making decisions about, and solving problems leading to their own professional change and growth.

Action Research - An Act Used to

- Enhance (understand) your own teaching and others teaching
- Test assumptions you make in teaching everyday (evidence-based practice)
- Enhance teacher judgment (evidence-based practice)
- Evaluate and/or determine meaning of what happened in class
- Understand more fully understand the effectiveness of innovations in practice (evidence-based practice)
- Implement new ideas into the physics classroom

Action Research

- **Not a deficit model**
- **Experience is not enough**
- **Creates a climate of search for knowledge. This is more likely to produce change than finding answers.**
- **Not traditional formal research**
- **Self-reflective inquiry to improve teaching**

Why Action Research?

- ✓ **Educational ideas of others are of little real use on their own**
- ✓ **Any "good idea" is a only working hypothesis, not a conclusion. It needs to be tested by you in your physics classroom to gain credibility. Then it becomes our idea that is fully meaningful to us.**
- ✓ **Successful change must use our ideas**

References

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- Angelo, T. & Cross, P. (1993). *Classroom assessment techniques*. San Francisco: Jossey-Bass
- Lawson, A. (1995). *Science teaching and the development of reasoning*. Belmont, CA: Wadsworth
- Sagor, R. (2005). *The action research guidebook: A four-step process for educators and school teams. Thousand Oaks CA: Corwin Press.*
- Schmuck, R. (2006). *Practical action research for change.* Thousand Oaks CA: Corwin Press.
- White, R. & Gunstone, R. (1992). *Probing understanding*. New York: Falmer Press.

Action Research Related Web Sites

Developing an Action Research Plan with Examples

http://www.bamaed.ua.edu/sciteach

Web-based Action Research Activities:

http://archon.educ.kent.edu/Oasis/Pubs/0200-08.ht

An Introduction to Action Research

http://www.phy.nau.edu/~danmac/actionrsch.html

Action Research-Linked Sites

http://carbon.cudenver.edu/~myder/itc/act_res.html

Virtual Fly Lab:

http://vcourseware3.calstatela.edu/VirtualFlylab/IntroVflyLab.html

Physics Teaching Resource:

Pathway: Physics Teaching Web Advisory. Ask an expert a question.

- ***http://www.physicspathway.org/***
- ***Digital video library for physics teaching at secondary school level***
- ***Four expert physics teachers provide expert advice in short scenes through synthetic interviews - Roberta Lang, Paul Hewitt, Chuck Lang, & Leroy Salary***
- ***Related Videos are also available***

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Questions

- What are “daily researches?”
- How do we get away from (and convince others- parents, administrators) the belief and view that teaching and learning are “a bag of tricks” we perform each class day?
- Not all research is of equal value. What are the characteristics of professional information on teaching and learning that teachers <u>need</u> to consider and evaluate critically.

Questions

- **What is your REAL belief about the statement "Educators who work in … schools remain unconvinced of the efficacy of most of what gets published in scholarly [research] journals in the field of education?" Do you agree? Explain!**
- **How can research be a way of knowing for all of us? In what sense is this possible? Aren't there people who do research and the rest of us don't do research, so we have to trust what they tell us?**

Questions

- **To call yourself an "expert teacher" do you have to be proficient in *searching for*, *reading*, *planning*, *writing*, and *conducting* research in your classroom. Explain why or why not! Must all teachers be proficient? Why?**
- **What is the meaning of "Research provides us with a 'Lens' to consider our practice…"**

Questions

- Rate yourself on each of these rubrics in the way you deal with research:
- Lack of time 1 2 3 4 5 Have adequate time
- Impractical 1 2 3 4 5 Practical
- Not Proficient 1 2 3 4 5 Proficient
- Based on these rubrics and other factors do you avoid research in any of its forms (*searching for*, *reading*, *planning*, *writing*, and *conducting*)? Explain!