

## A Framework for Categorizing Beliefs and Practices

We are working on the development of a framework that can be used to describe instructional practices and instructional beliefs associated with the teaching of introductory physics. Our goal is to be able to describe most possible teacher, instructional idea, or curriculum. We hope that this will be useful in enhancing communication about instruction both within PER and between PER and non-PER teachers.

This is a work in progress. This document contains a rough draft of the framework based on the educational literature and interviews with both faculty and curriculum developers. Yet, we realize that it still has significant weaknesses. We would appreciate your help in identifying these weaknesses – and, even better, proposing solutions. These could be anything from aspects of practices and beliefs that are not present or in the wrong place to unclear wording to disagreements about what is “traditional” and what is “alternative”.

We appreciate any help that you might offer us in this ongoing project and look forward to talking with you in Albuquerque or hearing from you once you return home.

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<b>Instructional Practices</b>	
<b>Generally Traditional Practices</b>	<b>Alternative Practices</b>
Minimal Degree of Interactivity	Significant Degree of Interactivity
Teacher does most of the talking. Few students talk (Lecture)	Students and teacher share talking. Most students talk (Conversation)
All discourse is teacher-student	Significant student-student discourse
Discourse focuses on teacher’s ideas (e.g., students ask clarifying questions and teacher asks rhetorical and/or closed questions)	Discourse focuses on students’ ideas (e.g., students and teacher ask and answer conceptual and/or open-ended questions)
Students write teacher’s ideas (i.e., take notes)	Students write their own ideas
Students are physically passive.	Students are physically active (e.g., interacting with equipment or materials)
Lesson progression is basically fixed in advance (e.g., based on instructor’s notes)	Lesson progression is adjustable and shaped by student questions/comments
Teacher makes all instructional decisions	Students have input in instructional decisions
Teacher decides on content and depth of course	Students influence content and depth of course (e.g., individual projects, significant changes in plans based on questions/interests of students during course)
Teacher decides how class time will be spent (e.g., lecturing or other highly structured activities/labs)	Students decide what they will do in class (e.g., student designed-activities/labs, centers)
Teacher decides when and how students will be assessed.	Students have choice over types and/or timing of assessment.
Teacher decides what knowledge is valued (e.g., students expected to learn and use physicists’ terms, definitions, conventions, etc.)	Community knowledge is valued (e.g., students develop own language to discuss ideas, students share experiences/perspectives with goal of learning from one-another)
Class structure decided by teacher and/or school (e.g., bolted down chairs/tables, length of	Student have choice in class structure (e.g., flexible room arrangement, independent study

class/semester, class size, etc.)	courses)
Fixed expectations of students	Adjustable expectations of students
Success defined by set standards	Success defined by individual improvement
Same instruction for all students	Attempt to meet the different learning needs of all students
Encourage or support competitive/individualist learning modes	Encourage or support cooperative learning modes
Grading on a curve	Require students to work together
Make only individual assignments	Graded group assignments
External Motivators	Internal Motivators
Grades and testing for evaluation (to sort, rank or certify)	Assessment for feedback.
	Link course to interest/needs of students
Knowledge-Based Assessment	Process-Based Assessment
Timed evaluations	Untimed evaluations
Prime value on right answer	Prime value on right process
Familiar problems/questions on exams	New problems/questions on exams
Derivations	Open-ended questions/problems
Test for factual recall	Test for conceptual understanding
Knowledge-Based Content	Broad Content
Explicitly teach only physics facts and principles	Explicitly teach learning, thinking, and PS skills in addition to physics content
Focus on derivations and formulas	Focus on conceptual understanding
	Explicitly address epistemological/attitudinal issues
	Explicitly connect course to other disciplines/social issues.

Instructional Beliefs	
Beliefs Consistent with Traditional Practices	Beliefs Consistent with Alternative Practices
Transmissionist Learning Views	Constructivist Learning Views
students receive knowledge from teacher or textbook	learners construct knowledge based on prior knowledge
Learning is a rational activity.	Learning is an emotional activity.
Mentally passive students	Mentally active students
Learning is primarily an individual activity	Learning is primarily a social activity
Expertise is accomplished by Accumulation	Expertise is accomplished by qualitative changes in thinking
Understanding is measured by factual recall	Understanding is measured by ability to explain or chose correct approach
Understanding is measured by ability to apply ideas quickly and accurately to familiar problems or situations	Understanding is measured by ability to apply ideas to new problems or situations
Modernist Knowledge Views	Post-Modernist Knowledge Views
Knowledge is absolute	knowledge is socially constructed
Students should learn others knowledge	Students should develop their own knowledge
Physics is Quantitative Discipline	Physics is a Broad Discipline

Doing physics means solving mathematical problems.	Doing physics involves a variety of things, including solving conceptual problems.
<b>Role of schooling and physics education</b>	<b>Role of schooling and physics education</b>
Selection process (sort students for economic and social roles)	All students should be allowed to succeed
Certification process (grades certify that students have certain skills)	Grades should be feedback for student only and used for self-improvement
School should teach students to follow directions, respect authority, and obey rules	School should teach students to become independent, creative, and critical thinkers who can question authority
School should teach skills that are only focused on students' professional lives.	School should teach skills that make students' personal lives richer.
<b>Beliefs about students</b>	<b>Beliefs about students</b>
All students can learn using the same methods	Students think/learn differently, have different needs
Only some students are capable of learning physics	All students can learn physics
Students must be forced to learn physics	Students want to learn physics
Students are best motivated externally by grades/punishments	Students are best motivated intrinsically (make learning meaningful, connected to student's lives)
Students can't make good decisions about their learning needs	Students can make decisions about their learning needs
<b>Role of the teacher: Teacher should teach</b>	<b>Role of the teacher: Teacher should guide</b>
Determine what and how students should learn	Provide a resource to students as they decide what to learn and at what pace
Determine the pace of the class	Lead discussions among students
Present knowledge, be an expert	Develop situations where students can learn
Judge students performance	Provide feedback
	Motivate Students
<b>Views on Diversity</b>	<b>Views on Diversity</b>
A nonhomogeneous class is a nuisance because the students aren't all the same	A nonhomogeneous class is a resource because different students bring different perspectives
Only the "good" students are valued	All students are valued
Students should adapt to the teacher, failure is the fault of the student alone.	Teachers should adapt to the students, Both teachers and students are responsible for failure.
<b>Content Goals of physics education</b>	<b>Process Goals of physics education</b>
To expose students to facts, concepts of physics	To develop an understanding of physics concepts.
Students should be able to quickly and accurately solve familiar problems.	Students should be able to apply physics ideas to new situations.
<b>Traditional Views of Scientific Literacy</b>	<b>Alternative Views of Scientific Literacy</b>
Develop an appreciation for science and its methods	Develop ability/confidence to critique science and its methods
Informed citizen who understands scientists' science and can use it in decision making	Informed citizen who can produce science to improve their world
Individual based	Community based