PCC's Summer Sustainability Institute 2009

Curriculum Revision Template

Section I: Description

The Summer Sustainability Institute Curriculum Revision Template consists of a series of tables, questions, and instructions to help faculty plan their curriculum revisions and provide important feedback for evaluation of the SSI, with the support of PCC's Sustainability Training for Technical Educators (STTE) grant, funded by the National Science Foundation.

The SSI Curriculum Revision Template will help guide participants' development of new/revised curriculum and reveal important details about their curriculum revision plans, with the following objectives:

- Identify how faculty will integrate their SSI experiences and new knowledge into their curriculum.
- Document changes/additions instructors intend to make in their courses or teaching practices.
- Align course revisions with established standards for sustainability.
- Determine the impact on students that SSI participants expect from their course revisions. Will the students:
  - Develop new knowledge and skills relative to sustainability practices?
  - Apply new knowledge and skills to their school or extracurricular projects?
  - Change their perceptions and/or choices of courses, degree programs, or careers?
  - Improve their awareness and knowledge of sustainability principles, practices, and issues?
  - Change their attitudes toward sustainability principles and practices?
- Ensure curriculum revision plans contain essential elements of effective instruction, such as:
  - Measurable learning objectives
  - Description of instructional tools needed (multimedia, technology, other)
  - Description of instructional format used (lecture, hands-on learning, demo, other)
  - Description of outcomes or skills students will produce or demonstrate
  - Learning assessment plans (test, presentation, portfolio, observation by instructor, other)

The SSI Curriculum Revision Template will help faculty assess their curriculum revision experience and support continual improvement in course revision efforts.

- How has the SSI shaped their curriculum revision process?
- How can the curriculum revision process be improved?
- What are the major challenges to participating faculty in revising their courses?
- What resources do faculty need to help their students reach their learning objectives?

Section II: Curriculum Revision Plan

Please begin entering information in the tables in this section as soon as you can during the SSI. You will have an opportunity to share your ideas with each other during the week and at the follow-up Summit on September 11, 2009. We request that you submit your completed Curriculum Revision Plan at the Summit. Parts of your template input may be combined with other faculty input for use in evaluation reports, but names and other forms of identity will be removed to ensure anonymity. We appreciate all ideas and constructive criticism to help us improve the STTE SSI program.

The overall purpose of the Curriculum Revision Plan is to help you organize your ideas in a way that will facilitate implementation of your sustainability training in your courses. Revision of *at least one course is a requirement* of the SSI program. Revisions should include some new content and instruction techniques.

Complete Tables 1 and 2 during the week of the Summer Sustainability Institute. In Table 1, identify the course(s) you plan to revise using knowledge and skills you expect to gain from the SSI.

Table 1. Target Courses for Revision

College/Campus	Course Number & Title	Why did you choose this course for revision?
PCC/Cascade	PHY 20x General Physics sequence	Broad student audience, including many engineering technologist majors.
PCC/Cascade	PHY 21x General Physics sequence	High level students aspiring to a four year engineering degree

Table 2. Impact of New Curriculum on Students

Use Table 2 to describe the type of impact you expect your curriculum revisions will have on students. Mark "Yes" or "No" for each type of impact. Then, briefly explain your expectations.

Check each type of impact you expect your course revisions will have on your students below.			Explain why you expect this impact to occur and how you expect to achieve it for each type of impact below.
Develop new knowledge and skills of sustainability principles and practices relevant to the course(s) and discipline.	**Yes**	No	Students will be exposed to the underlying physics and some terminology being used in the sustainability fields; they will take this back to their individual major course sequences.
Apply new knowledge and skills to their school or extracurricular projects.	**Yes**	No	(see above)
Change student perceptions and/or choices of courses, degree programs, or careers.	**Yes**	No	A clearer understanding of why things work, i.e. certain related physical mechanisms, will improve their ability to absorb or utilize sustainable practices in their majors.
Improve awareness and knowledge of broader sustainability issues within their communities and the world.	Yes	**No**	This is a moving target; however, the physical science underlying sustainability technology will not change rapidly.
Change attitudes toward sustainability principles and practices.	**Yes**	No	(see above)
Better qualify students for jobs.	**Yes**	No	Better decisions in the workplace derive from a deeper understanding of the technology.
Other: Please describe.	Yes	No	

Section III: Curriculum Revision Description

This section contains four tables. Tables 3a, 3b, and 3c focus on new and revised learning objectives and instruction techniques. They are designed to help you organize your plans for adding content and/or new student learning activities to the courses you teach. Table 4 focuses on how to effectively assess what students have learned. Try to complete a portion of these tables during the Summer Sustainability Institute to describe new content and revisions you are planning for the courses you teach and have these tables and course revisions completed by the follow-up Summit on September 11, 2009.

Your curriculum revisions may not include all the components identified in the tables. For example, adding sustainability topics to a lecture may not need any new "student guidance." However, even additions of topics to lectures require learning objectives (Table 3a) to describe the knowledge/skills you expect students to gain.

If you plan to create new teaching techniques, describe them in detail in Table 3c. Include such information as: how to set up the activity, students and instructor tasks, and resources needed.

Add new tables as needed for each curriculum revision you are planning. Just copy and paste tables, and re-enter information as needed to cover all your planned instruction.

Table 3a. Learning Objectives

New or revised learning objectives are essential for all curriculum revisions.

Learning Objectives: Complete this table for all curriculum revisions. If you plan to revise existing learning objectives, enter both the existing objective(s) and your revised objective(s).	Write student learning objectives that describe exactly what you expect students to be able to do after taking your course. Writing these as measurable actions rather than in general terms like "understand" is important. Reference the ***Verbs for Measurable Learning Objectives*** (at the end of this document) for help in identifying and assessing specific outcomes of enhanced student knowledge and skills.

	Enter any existing learning objectives to be revised below (if any):		**Enter new learning objectives for any new instruction you are planning:**
1	**Thermal energy transfer models**	1	**Define and describe the use of the R and U thermal conductivity metrics as used in the building technology** **Compute effective R values for building wall models, including the affect of windowing** **Describe modern (two-fluid) solar hot water heating technology and how it employs transfer to meet the engineering objectives**
2	**Light and electromagnetic radiation**	2	**Define and describe the use of common lighting engineering terminology** **Relate blackbody radiation energy distribution to that of the sun and**

			to the color temperature response scale of common lighting options, including incandescent, fluorescent, and solid state devices
3	**Solid state electronics**	3	**Describe the basic process of generating electricity using photodiode devices** **Assess the competitiveness of solar photovoltaic electric generation in relationship to coal and other electrical energy sources**
4		4	
5		5	
6		6	
7		7	

Note: Before writing objectives, review other parts of Table 3 and Table 4 and the "Verbs for Measurable Learning Objectives" at the end of Section III.

Table 3b. New Teaching/Learning Methods

Describe any new teaching or learning methods you plan to use as a result of your SSI experience.

New Methodology: Identify a new teaching/learning technique(s) you plan to integrate into your course(s).	**Purpose**: How will the new teaching/learning method increase students' knowledge or skills or change attitudes?	**Strategy**: How will the new method improve on existing pedagogy? Compare and contrast as appropriate.	**Implementation:** How will the new teaching/learning method be integrated into your course(s)? Use Table 3c. for your detailed plan.

Table 3c. Learning and Instruction Tasks

Describe the tasks necessary to implement your new teaching methodology.

Describe the new or revised Student Tasks. If you are revising an existing activity, briefly describe it, then describe the specific revisions you plan to make.	**Describe the new or revised Instructor Tasks.** If you are revising an existing activity, briefly describe it, then describe the specific revisions you plan to make.	**Describe how to set up the activity**: Describe what the instructor and/or students must do to prepare for the activity, step-by-step when possible. Identify equipment, materials, or supplies needed to complete the activity. Describe preparation students must do prior to the activity when appropriate (e.g., reading, studying, forming teams, etc.).

Task 1			Setup Procedure:
Task 2			
Task 3			Materials/Supplies:
Task 4			
Task 5			Activity Preparation:
Task 6			
Describe follow-up activities: Will there be follow-up work or events (e.g., capstone projects, publications or presentations, connections with internships)?			
Follow-up:			

Table 4. Student Assessment

Student assessment should be closely aligned with each learning objective.

Knowledge Assessment: Additions to lectures may need only a few new test items added to an existing test. Hands-on learning activities refer to students doing something other than reading, listening to a lecture, or watching a video or live demonstration. Try to ensure that students demonstrate active use of new knowledge by solving problems, making critical decisions, or creating new information or products from what they learn.		**Skill Assessment**: Assessment of skill may require direct observation of students as they perform a task or engage in collaborative work with peers. To make your observations consistent and accurate, you may wish to create a checklist or rubric that enables you to assign ratings of student performance (e.g., excellent, good, acceptable, poor) on each critical element, decision point, or process.	
Describe knowledge assessment method and core items being assessed.		**Describe skill assessment method and core items being assessed.**	
Description of method:		Description of method:	
Item 1		Item 1	
Item 2		Item 2	
Item 3		Item 3	
Item 4		Item 4	
Description of method:		Description of method:	
Item 1		Item 1	
Item 2		Item 2	
Item 3		Item 3	
Item 4		Item 4	
Description of method:		Description of method:	
Item 1		Item 1	
Item 2		Item 2	

Item 3		Item 3	
Item 4		Item 4	
Note: Before completing your plans for student assessment, review the assessment recommendations at the end of Section III.			

At the level envisioned, each of the learning extensions related to sustainability engineering can be accommodated in the physics curriculum via enhanced lectures and supplementary reading assignments. Practice and demonstration of these skills will be done primarily via homework problem assignments, based on the lectures. The courses I teach involve a term-paper type of project and I would expect some students would propose a sustainability project. The sustainability topics that integrate best into the general physics curriculum at the college level will involve insertions at appropriate instances throughout the three-term sequence of courses. However, the mathematical sophistication required is not high so that the material can be discussed at approximately in the same way for each of the sequences (algebra and calculus levels).

Having completed the 2009 SSI, I am convinced that a new, one-term course on the physics of sustainability could be justified and offered at a 200 level. Such a course would require at least a co-requisite of PHY 202 or PHY 212 so that the students would have the mathematical introduction to thermodynamics, fluid mechanics, waves, radiation, and the other topics in 202-3 and 212-3. In turn, the sustainability course would build on that foundation (or developing foundation) to investigate in more detail how the modern technology of sustainability actually works and, to some extent, consider its comparative economic value to our more common technological options. (However, given that I am relatively new to PCC, I am not yet familiar how such an idea would be pursued.)

Verbs for Measurable Learning Objectives

add	chart	compute	defend	discriminate	evaluate	generate	label	order	present	rephrase	solve
alter	check	conduct	define	dissect	execute	group	list	organize	propose	replace	sort
analyze	choose	connect	demonstrate	distinguish	expand	guide	locate	outline	prove	report	state
apply	classify	construct	derive	distribute	explain	identify	manipulate	paraphrase	provide	reproduce	structure
arrange	collect	contrast	describe	divide	express	illustrate	map	perform	rearrange	restate	suggest
articulate	combine	convert	design	document	extend	include	mark	place	recall	restructure	summarize
assemble	communicate	coordinate	designate	draw	extract	increase	match	plan	reconstruct	score	support
build	compare	correct	detect	duplicate	extrapolate	indicate	measure	plot	regroup	select	translate
calculate	compile	criticize	develop	eliminate	find	insert	modify	position	relate	show	troubleshoot
calibrate	complete	critique	diagram	employ	finish	integrate	name	predict	remove	signify	verify
categorize	chart	decrease	differentiate	estimate	formulate	isolate	number	prepare	reorganize	sketch	write

Recommendations for Planning Student Assessment

Understanding: It is hard to measure "understanding." If you expect students to "understand" a particular concept or principle, try to create a measureable task that will verify their understanding. Students should be able to demonstrate their capability to use new knowledge to make decisions or communicate information to others. Some examples: apply a principle in a particular context, find a solution to a problem, consider tradeoffs between economic and environmental factors, make a critical decision based on sustainability planning and practice.

New Teaching Methods and Strategies: You may decide to use a new teaching method or change your student learning environment as a result of your SSI experience. Consider how best to integrate the method into your course. A new method may be as simple as using an analogy to help students understand a sustainability concept. Or, it could be as complex as a student capstone project.

Peer Assessment: You may wish to use a peer assessment method (e.g., critique of student projects by other students). This method can expand learning opportunities—students learn to defend and judge the quality of design decisions based on key principles and practices.

Standards: If you are using established industry or educational standards, please list them as part of your learning objectives. Include a reference citation (publication or Internet URL) where the standards may be found.

Quality and Value of Assessment: Effective assessment is essential for good teaching and learning. Regardless of your chosen method for measuring student learning, try to ensure that degrees of achievement can be measured. Use specific criteria to grade students, while providing feedback that impels improvement.