Course Name:  
CvEEN 4910 Professional Practice & Design

Instructor Name:  
D.G. Schmucker

List learning goals for your course, lesson, or activity that highlight new sustainability elements.

OVERALL COURSE OUTCOMES: Via first-hand experiences, the student will be able to:

1. Describe the civil engineering design process, its phases, and provide examples of project delivery schemes.
2. Participate in the design of an engineering system or component.
3. Prepare an engineering design report and orally present an engineering project.
4. Identify characteristics of effective team members, leaders, and organizations.
5. Demonstrate self-sufficiency to learn a new topic.
6. Discuss the business of consulting practice including: marketing, finance, management, business development, and technical.
7. Identify the connections between civil engineering projects, public policy, licensure, ethics, service, and professional responsibility.
8. Identify the ethical, legal, and professional responsibilities of professional engineers.

SUSTAINABILITY RELATED OUTCOMES: Outcomes 1, 2, 6, 7, and 8 are supported by a Systems Thinking model. See below for explanation.

Explain the new sustainability element(s) you incorporated into your course and how they related to the learning goals above (at course, lesson, or activity level). Describe how you see these elements relating to sustainability.

GOAL
The most direct element of the Sustainability Workshop that has been incorporated into all of my courses has been the Systems Thinking model and rubric. Moving students away from a singular perspective of their learning (“calculate this, that, and the other”) towards why instead of just how is already a challenge for them. Here, though, my goals are to connect them to a broader context of what is trying to be achieved.

FOCUS
In this particular course, students demonstrate the vast majority of achievement of the outcomes via a team-based engineering design project. Focusing them on definitions of stakeholders, their needs, and incorporating these into the basis of design is a critical step
to move them away from the typical perspective that engineers only “calculate” even in
the design process (which, ultimately is a technician level viewpoint and not what the
degree nor professional path represent). A secondary focus is move them aware from a
model of sustainability that relates only to pollution, energy-use, and materials use but
towards a model that embraces a holistic picture of interconnected stakeholders.

IMPLEMENTATION
Distinct and clearly articulated models for engineering problem solving and engineering
design are presented during the first lesson. At each stage of the design process, the
students are required to connect their work to the Basis of Design, Design Criteria, and
Design Values that they have established. The expectation is that they have defined a
(reasonable) cadre of stakeholders, interests and needs, and used these to create their
Basis of Design. The importance of revisiting the “problem definition” throughout the
process is emphasized by requiring a prompted self-reflection essay after each milestone
in their project.

CONNECTION TO COURSE OUTCOMES
Outcomes 1: Design Process
The Systems Thinking model is introduced as part of implementation of the first stage of
the engineering design process (“defining the problem”).

Outcome 2: Participate in Design
The project-based delivery scheme provides the mechanism for students to implement the
Systems Thinking model. Scoring criteria directs them to Systems Thinking being an
inherent and graded element of their work.

Outcome 6: Broader Elements of the Business of Professional Practice
The Systems Thinking model is illustrated in a different way in this segment of the
course where students are presented with a model of the Five Dimensions of Consulting
Engineering. Here, they see a structured model wherein the Technical dimension is only
but one of five dimensions (activities) required for a consulting engineering firm to be in
business. The participation of engineers in each of these dimensions is also illustrated.
The primary outcome here is raising awareness as opposed to a direct change in the
students’ design-related tasks.

Outcome 7: Broader Elements of the Impacts and Requirements of Civil Engineering
Practice
The Systems Thinking model, when implemented in the design project, provides a natural
discussion point for why design standards exist, not in a generic high-elevation view of
the goodness of human-kind, rather in a pragmatic and direct way associated with the
students’ project. Such standards connect well to discussion of public policy and
decisions that the engineer makes as they attempt to reconcile the different stakeholders’
views to achieve a balanced design.
Wasatch Experience
Implementation Summary

Outcome 8: Broader Responsibilities of Professional Practice
Via the course project, the Systems Thinking model provides a direct framework from which to discuss the ethical, legal, and professional responsibilities of engineers. Rather than simply pragmatically listing requirements, the goal is meaningfully connect students to why these responsibilities exist and to do so in manner that is related to their personal walk.

Provide a concise listing of sustainability lessons and activities and show their location in the course schedule. For selected new activities attach a completed Activity Sheet.

<table>
<thead>
<tr>
<th>Week</th>
<th>Sustainability Topic</th>
<th>Activity</th>
<th>Where Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Systems Thinking</td>
<td>Summary of Individual Research</td>
<td>I1 Individual Assignment</td>
</tr>
<tr>
<td>4</td>
<td>Project and Stakeholder Definition, Basis of Design</td>
<td>30% Design Milestone</td>
<td>Team work product: report, presentation, and exhibits I2 30% Reflection (Individual Essay)</td>
</tr>
<tr>
<td>8</td>
<td>Sustainability and Preliminary Design</td>
<td>60% Design Milestone (Revisit definition of Project and Stakeholder needs and the Basis of Design)</td>
<td>Work product: report, presentation, and exhibits I3 60% Reflection (Individual Essay)</td>
</tr>
<tr>
<td>13</td>
<td>Sustainability and Final Design</td>
<td>90% Design Milestone (Revisit definition of Project and Stakeholder needs and the Basis of Design)</td>
<td>Work product: report, presentation, and exhibits I4 90% Reflection (Individual Essay)</td>
</tr>
<tr>
<td>15</td>
<td>Sustainable Design</td>
<td>Directed Individual Essay</td>
<td>I5 Summative Individual Assignment</td>
</tr>
</tbody>
</table>

See Appendix for Activity Sheets
What motivated you to change your course?

I am always looking for ways to add value to the learning experience as well as different ways to motivate students to aspire to higher levels of thinking (and move away from a credentialing perspective).

The Systems Thinking model presented at the Workshop provided a direct vehicle by which to focus students towards a multi-stakeholder viewpoint. In other words, the right thing at the right time. Being engaged in a pragmatic profession (engineering), having direct ways to do things that are both transparent to the philosophy and connected to specific action is the “perfect” solution. In my way of thinking, the Systems Thinking model and its rubric communicates what to do with the philosophy of why we want do to “it.”
COURSE TITLE: Introduction to Civil Engineering

COURSE NUMBER: CVEEN 1000

CREDIT HOURS: 2-0-2 (Lecture-Lab-Total)

TERM & YEAR: Fall 2016

SECTION 01: 1400 – 1520

ROOM: WEB L105

Lead INSTRUCTOR: D. Schmucker, PhD, PE (IN, UT)

OFFICE HOURS: MW 1200-1400

EMAIL: doug.schmucker@utah.edu

INSTRUCTOR: Catherine Tucker

OFFICE HOURS: MW 1400 – 1300 or by appointment in Kiewit Mentoring Room MCE 1135

EMAIL: catherine.tucker@utah.edu

PREREQUISITES: Student status at the university

COURSE TOPICS: Provides an overview of the profession of civil and environmental engineering, including the major elements of the profession, a basic understanding of the core disciplines, and ideas of design. Emphasis is placed on the professional skills needed in addition to technical skills in order to be successful. These include but are not limited to writing, speaking, and teamwork skills.

COURSE MATERIALS: Much of the technical content of the course can be found via internet-based research. Each student will need to a laptop or tablet combination not only for taking notes but also for working in class on a variety of course project tasks.

COURSE OUTCOMES:

1. Describe the core disciplines that comprise the civil and environmental engineering professions and their role in developing sustainable (smart) communities.
2. Discuss the relationship of the practice of the profession to society, the inherent service nature of the profession, and how the nature of that service influences the nature of practice. These relationships are often characterized as Systems Thinking.
3. Define the characteristics of effective teams and team members; participate as an effective team member.
4. Discuss the role and type of communication skills required in the profession.
5. Define the knowledge, skills, and attitudes necessary for success in the profession.
PERFORMANCE EVALUATION (COURSE GRADE):
Overall performance evaluation (grade) will be assigned based upon the instructor’s interpretation of the weighted average of the levels of performance.

Performance = 0.5\[P_I + F_{TI} F_{TT} P_T \] × \( F_A \)

Where:
- \( P_I \) = total percentage of individual performance scores [Range: 0 to 100 %]
- \( P_T \) = total percentage of team performance scores [Range: 0 to 100 %]
- \( F_A \) = Attitude and Participation Factor [Range: 0 to 1.10]
- \( F_{TI} \) = Individual Adjustment Factor based upon individual effectiveness to the team.
- \( F_{TT} \) = Team Adjustment Factor associated with overall completeness of the project.

General Rubric

<table>
<thead>
<tr>
<th>Letter</th>
<th>Numeric Equivalent</th>
<th>Qualitative Description</th>
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<tbody>
<tr>
<td>A</td>
<td>&gt; 90%</td>
<td>No to minor mistakes.</td>
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<tr>
<td>B</td>
<td>&gt; 80%</td>
<td>Several minor mistakes; almost no conceptual mistakes.</td>
</tr>
<tr>
<td>C</td>
<td>&gt; 70%</td>
<td>Several mistakes, some major; conceptual mistakes.</td>
</tr>
<tr>
<td>D</td>
<td>&gt; 60%</td>
<td>Many significant mistakes and conceptual errors.</td>
</tr>
<tr>
<td>E</td>
<td>&lt; 60%</td>
<td>Non-response or completely incorrect response.</td>
</tr>
</tbody>
</table>

Excessive absence or failure to participate in activities may result in performance reduction. Plus Grades must fall within 2% of threshold values.

The individual adjustment factor is used to reflect an individual’s contributions to the team components of the course and citizenship in working towards team objectives. The individual adjustment factor is determined using values from a research-validated instrument and other instruments used at the discretion of the instructional team. The team adjustment factor is intended to adjust the cumulative team scores to represent an overall quality of the entire team’s efforts and deliverables during the course of the term. Its range of values is 0.80 to 1.20 and will be the same for all members of the primary project team. The individual attitude and participation factor is to be used in the event that a student has not completed all elements of the course or has otherwise created a positive or negative issue that is otherwise not accounted for in the course scores.

COURSE REQUIREMENTS:

PROFESSIONAL CONDUCT and ATTENDANCE:
Participation in this course is largely measured by performance on submitted work and your engagement during class activities whether those are associated with active and collaborative exercises or in taking notes.

It is paramount that during the lesson that you are entirely focused on the subject and not involved in other activities such as social media, texting, etc. If those activities are noted, you may be asked to leave the room for that lesson with subsequent reductions in grade. Should you have an urgent need to remain in contact via such means or are experiencing other events that
distract you from full participation, it is your responsibility to discuss that with the instructional team in advance of the lesson.

It is expected that all students will be present in each lesson, courteous of others’ ideas, fully participative, and otherwise conduct themselves in a professional manner. Conduct determined to be unacceptable may result in evaluation reduction.

Attendance is measured by both direct and indirect means and methods. Unapproved tardiness, absences, and/or departures prior to the end of class will result in a grade deduction of 2% overall course grade per incident. It is important that you notify the instructors in advance of absence for in- or out-of-class activities.

Use of any form of tobacco, alcohol, or other drugs in the classroom is considered inappropriate.

Cell phones and other devices should be turned off. If you need to answer your phone during class, you need to leave the room; re-admittance may or may not be permitted.

Any activity that diminishes the professional quality of the class-room may result in an evaluation adjustment.

OTHER POLICIES:

• Late assignments will not be accepted unless otherwise approved by the instructors; the request must be made 48 hours in advance of the anticipated assignment due date.

• Athletes and others travelling on official university business must submit their travel dates prior to the end of Lesson 4. Since submission deadlines are not during class time, the travel itinerary must include all dates on travel and not only those specific class days to be missed.

• Administrative communication for the course will be via in-class announcements, the course web site, and/or u-mail/Canvas mail.

• Performance-related scores will be posted via the course web site.

AUTHORIZED AID: Unless otherwise noted,

• It is assumed that you subscribe to U of U policies on Academic Integrity and to the ASCE Code of Professional Ethics. Consequences for failure to adhere to those policies will follow the U of U Student Handbook and include the range of a zero grade for the item in question to possible failure in the course and/or dismissal from the university.

• For each work submitted in this course, you need to write and sign the following pledge: “I have not tolerated the use of unauthorized aid.” Providing a signature to this pledge is your statement that you have followed the U of U policy on Academic Integrity as supplemented by the course instructor. For digitally submitted items, type the pledge into the comments area of the Canvas system for that particular assignment. For group assignments submitted digitally, type the pledge in the comments area and type in each team member’s names.

• Deviations from the course pledge will be interpreted as a lack of adherence to the policies described herein and as a signal to the instructional team that you seek an investigation.
Individual assignments are to be completed without the direct assistance from other students in the class. General questions regarding understanding the scope of the assignment, suggestions about ways to approach the assignment, or general aspects of software are acceptable. Sharing answers, copying, or performing another person’s work is not acceptable. Writing assignments shall be cited in an appropriate manner. Individual Assignments will be submitted, in general, via electronic means on the course web page.

Team assignments shall reflect only the contribution of members in the team and advice provided by instructional team members, e.g., course instructors, campus writing center personnel, etc.
Complete one Activity Sheet for each activity you developed that incorporates sustainability into your course.

**Activity Name: I1 Systems Thinking Approach to Civil Engineering Design**

**Instructor Name: Schmucker**

State the activity learning goal(s).

**Learning Outcomes**

1. Describe the civil engineering design process, its phases, and project delivery schemes.
2. Demonstrate self-sufficiency to learn a new topic.
3. Discuss the business of consulting practice including: marketing, finance, management, business development, and technical.

Summarize activity.

- This is a “flipped” learning activity.
- Students watch a powerpoint show (video) to define basic ideas and principles.
- Students also conduct basic self-guided research into another topic.
- Students’ notes form the exclusive authorized aid for an in-class “exam” (really, quiz).

At what point in your course is this activity delivered?

**Week 1**

**DELIVERY**

**Task**

View the short presentations regarding the engineering design process and consulting business; conduct research on engineering project delivery schemes. Prepare an appropriate two to three-page summary that may be used as authorized aid for an in-class examination.

- [PP 1 5 Dims of Consulting Practice show.ppsx](#)
- [PP 2 Firm Getting Paid show.ppsx](#)
- [PP 3 Employee Costs show.ppsx](#)
- [PP 4 Consulting Rates show.ppsx](#)
- [PP 5 Design Participants show.ppsx](#)
- [PP 6 Design Phases show.ppsx](#)
- Research the two basic project delivery schemes: design-bid-build and design-build. You might consider the two course texts as your references as well as various on-line sources such as the [Design Build Institute of America (Links to an external site.)](http://www.designbuildinst.org).
Deliverable Requirements

- Upload your summary to Canvas by the deadline.
- Print your summary for use in class for an in-class "exam".
- You will eventually submit both the printed summary and your in-class responses.
- The in-class portion will be a traditional paper-based evaluation.

Grading Criteria

- Demonstrate achievement in regards to the assignment's learning outcomes. In the context of this assignment, this means that your write-up and response to the in-class essay prompts show at least an Application level (Bloom's Taxonomy or see BOK2E_ (ASCE 2008) ebook.pdf ). The Application level means to not only be able to repeat the definitions of the various terms and concepts in the topics list, but to do so in your own words without losing accuracy and precision, and to apply the idea to the course's project. If the situation is complex, then one might reasonably conclude that you may also need to reach the Analysis level.
- The total points for the assignment will be assigned based upon an overall evaluation of all of the deliverables: the three-page summary, originality (meaning it is your own work), and the in-class responses.

Provide teaching tips to help other instructors implement your activity in their courses.

- The delivery and evaluation ideas are what are transportable, here. The technical content is specialized to civil engineering and not likely useful to anyone else.
- Powerpoint videos are okay, but some students will claim they are not able to “play” them. Although each time such a claim occurs it is almost invariably associated with an academically weaker student, there may be some value in providing a powerpoint hand-out “with notes” that represent a transcript as an alternative. At that point, am not sure what the difference is between having the students read a book, but nonetheless some students prefer the powerpoint video approach.
- The activity needs a little bit of set-up in class. For instance, introduce the Systems Thinking model during class. Then, assign the out-of-class flipped content. The in-class individual accountability portion is, sadly, a mechanism of motivating students by “fear” of a bad grade. Instead, consider that the next performance activity requires their understanding of the out-of-class and needs to demonstrate that understanding but is not just another quiz.
Describe your assessment strategy and instruments for student learning and attitudes. Attach grading rubric and/or assessment instruments.

- Bloom’s Taxonomy was used as the evaluation basis for performance.
- The in-class quiz that followed the out-of-class activity was focused on the lower-levels of Bloom’s. Although that meant less risk and stress on the part of the students, it also meant a lower-level performance overall and gave the impression that the work was all about regurgitation of knowledge rather than using the knowledge to be able to analyze a situation such as in preparation to execute their project.

How effective was the activity? What are your ideas for improvement in the future?

- Marginal demonstration of achievement was observed. Awareness increased; application of the concepts to an appropriate context was nearly non-existent.
- The out-of-class content did not sufficiently build the case for nor make the connection explicitly enough of a Systems Thinking approach.
- The small module approach is effective but could use more explicit connection to the System Thinking terminology.
- Students seem to lack the maturity to complete an assignment towards the spirit of what we need them to do and instead look for only the minimum that they can get away with. This inherently means: regurgitate knowledge when what you want them to do is gain the knowledge so that they then can apply to a new situation and do so in ways that are helpful in analyzing that new situation.
Complete one Activity Sheet for each activity you developed that incorporates sustainability into your course.

**Activity Name:** I2 30% Reflection

**Instructor Name:** Schmucker

State the activity learning goal(s).

**Learning Outcomes**

1. Identify and define the needs of stakeholders associated with the group’s project.
2. Define required and desired criteria and use those definitions to develop specific criteria for the project.
3. Discuss the impact that poorly stated criteria have on the development of a project and discuss what is within your circle of control that you can use to manage the process and to obtain sufficient information to develop a Basis of Design that will lead to a balanced design that reflects desired performance from the multitude of stakeholders.

Summarize activity.

- This is a learning activity based upon reflection after the event.
- Students have investigated the context behind a project and developed initial concepts. Usually, they have only poorly articulated the Basis from which those concepts have been developed.
- Students have just presented their work to their clients and are now ready to charge ahead … so, they think. First, though, they need to stop and reflect upon whether they actually have sufficient information to proceed. Hence, this activity is geared towards getting them to refine their Basis of Design used to date often with only implicit statements having been made to date.

At what point in your course is this activity delivered?

**Week 4**

**DELIVERY**

**Task**

Given the discussion from stakeholders at the 30% meeting, respond to each of the following prompts.

1. Create a list of the "must haves" (required criteria) in the design and a list of "should haves" (desired criteria).
2. From the lists that you created, write a clear criterion. For example, if you were designing an automobile and it was desired that it be environmentally friendly, a clear criterion to replace such
a vague (although desirable) goal would be that the car must have an estimated fuel mileage of at least 50 mpg. Desired criteria will eventually lead to a specific way to differentiate between and select alternatives.

3. Discuss what you could have done differently during the development phase of the project (leading up to 30%) that would have enabled a more efficient approach. Focus on what you have control over and not what others have provided or done. In what ways could you have been more proactive? What elements or information were unclear or not available and what could you have done to accommodate those unknowns while having also gone further with the work? You might consider orienting your discussion around the five-step design and problem solving process.

**Deliverable Requirements**

- Upload your summary to Canvas by the deadline.
- Print your summary for use in class for in-class discussion.

**Grading Criteria**

- Demonstrate achievement in regards to the assignment's learning outcomes. In the context of this assignment, this means that your write-up and response to the in-class show at least an Application level (Bloom's Taxonomy or see BOK2E_(ASCE_2008)_ebook.pdf). The Application level means to not only be able to repeat the definitions of the various terms and concepts in the topics list, but to do so in your own words without losing accuracy and precision, and to apply the idea to the course's project. If the situation is complex, then one might reasonably conclude that you may also need to reach the Analysis level.

**Provide teaching tips to help other instructors implement your activity in their courses.**

- The delivery and evaluation ideas are what are transportable, here. The technical content is specialized to civil engineering and not likely useful to anyone else.
- The current activity assumes that you are in a project-based situation.
- The current activity assumes that the students are thinking big picture. However, many are not. Hence, you may need to guide them to explicitly conduct the activity from different stakeholder perspectives. In other words, re-structure the activity to be a role-playing exercise rather than a generic reflection activity.

Describe your assessment strategy and instruments for student learning and attitudes. Attach grading rubric and/or assessment instruments.
Bloom’s Taxonomy was used as the evaluation basis for performance.

How effective was the activity? What are your ideas for improvement in the future?

- This activity should probably be re-written as a Week 1 or 2 activity so that it is pro-active instead of re-active.
- In class time needs to be spent on utilizing the results of the out-of-class work instead of presuming that the activity plants a seed of which they will provide the nurturing. Instead, the nurturing needs to be directed by the instructor. (This is a senior-level course, and it is disappointing that the instructor needs to be so hands-on.)
- One of the primary barriers is the presumption from the students that they do not need to perform these early stages of project development. In their view, they should be provided a well-defined and narrow-range task. In their defense, that is mostly what they have been provided their entire academic careers and, for those who have practical employment, in their business careers. Everything to date supports a technician-centric viewpoint. Most lack the experience, insight, and/or maturity to see that in order to progress in their careers (or to have a jump-start), they need higher level critical thinking skills: the very thing that is needed in order to understand sustainability. Hence, which comes first?
Activity Name: Project Planning – Integration of Sustainability (CvEEN 4910)

Instructor Name: D.G. Schmucker

State the activity learning goal(s).

Increase the awareness of students to the multi-dimensional needs, concerns, and desires of stakeholders in civil engineering infrastructure projects.

Summarize activity.

Mr. Myron Willson, Deputy Chief Sustainability Officer for the University of Utah spoke to the class about the Sustainability Master Plan. The course project is directly related to the campus and involves alternative (and more sustainable) approaches to transit on campus. In his presentation, Mr. Willson laid out the issues associated with energy, social, and business demands on campus. As well, Mr. Willson laid out the basic model of how sustainability is understood on campus.

Later, students will be asked to develop a project planning document that clearly demonstrates how their project will connects with and contributes towards the sustainability goals of the campus.

At what point in your course is this activity delivered?

The activity happens in Lesson 3 of the course.

Provide teaching tips to help other instructors implement your activity in their courses.

Given the uniqueness of the project and class, not sure how this activity would be directly applicable. However, the broader view of requiring students to make direct connections to published stakeholder goals is potentially transportable. Two barriers to success are significant: available examples that do not also “give the answer” in a manner where students just plug-n-play, and getting students to creatively identify metrics such that their work contributes pragmatically and not only philosophically.

Describe your assessment strategy and instruments for student learning and attitudes. Attach grading rubric and/or assessment instruments.

Strategy: Review individual responses and provide direct feedback (via TA).

General Grading Rubric
## Wasatch Experience
### Activity Sheet

<table>
<thead>
<tr>
<th>Letter Grade</th>
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<td>&gt; 90%</td>
<td>Significant value added beyond minimum; No to minor mistakes.</td>
</tr>
<tr>
<td>B</td>
<td>&gt; 80%</td>
<td>Value added beyond minimum yet many/several minor mistakes; almost no conceptual mistakes.</td>
</tr>
<tr>
<td>C</td>
<td>&gt; 70%</td>
<td>Minimum Competency; basic content; follows template; little value added beyond a cut and paste approach in the response.</td>
</tr>
<tr>
<td>D</td>
<td>&gt; 60%</td>
<td>Many significant mistakes and conceptual errors.</td>
</tr>
<tr>
<td>E</td>
<td>&lt; 60%</td>
<td>Non-response or completely incorrect response.</td>
</tr>
</tbody>
</table>

How effective was the activity? What are your ideas for improvement in the future?
Complete one Activity Sheet for each activity you developed that incorporates sustainability into your course.

Activity Name: I3 60% Reflection

Instructor Name: Schmucker

State the activity learning goal(s).

Learning Outcomes

1. In light of mid-stream project development, identify how a project’s statement of work influences the ability to successfully meet client needs.
2. Identify the role that an engineer plays in a project beyond technical processes.
3. Discuss via first-hand experiences the impact of poor planning or understanding of client needs to a project and how one can anticipate, organize, and design a more effective process.

Summarize activity.

- This is a learning activity based upon reflection after the event.
- Students have developed preliminary designs.
- Students have just presented their work to their clients and are now ready to charge ahead to a final design yet are frustrated that the clients seem to want something different. Hence, this activity is geared towards getting them to revisit their assumptions about what design is, what its process is particularly the iterative portion, how the Basis of Design is essential in developing useful concepts for clients, and how it is often the case that clients do not know what they want nor need until they see ideas applied to their situation.

At what point in your course is this activity delivered?

Week 8

DELIVERY

Task

A) Review the South Park Loop Pathway Project Plan's Stages of Project Development (http://www.friendsofpathways.org/teton-county-engineering-to-present-50-design-of-south-park-loop-pathway/#prettyPhoto) Links to an external site.. Compare and contrast the project development for your basin with that of Teton County's for the pathway. Aspects to consider: Where in their process do your activities correspond? What aspects of their project are similar or different to yours? What does 50% represent in their project? What does 60% represent in yours?

B) Given the discussion from stakeholders at the milestone meeting, respond to each of the following prompts.
1. What priorities, biases, preferences emerged from the stakeholders? In what ways are these consistent with or different than previous conversations?
2. In what way are these various viewpoints reflected in the decision analysis?
3. Identify the specific ties between the Basis of Design, Project Requirements, Project Criteria, Design Requirements, Design Criteria, Decision Factors, and Decision Criteria for your group’s project.
4. Discuss what you could have done differently during the development phase of the project (leading up to the milestone) that would have enabled a more efficient approach. Focus on what you have control over and not what others have provided or done. In what ways could you have been more proactive? What elements or information were unclear or not available and what could you have done to accommodate those unknowns while having also gone further with the work? Orient your discussion around the five-step design and problem solving process.

In addition to an appropriately formatted and communicated reflection on the topics above, provide a copy of your notes taken during the meeting. Canvas permits you to upload more than one file for an assignment.

**Deliverable Requirements**

- Upload your summary to Canvas by the deadline.
- Print your summary for use in class for in-class discussion.

**Grading Criteria**

An essay that reaches the following level earns approximately the associated grade in the table shown. Note, to reach a high level implies having demonstrated performance at the levels below, i.e., the system shown is hierarchical.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description/Characterization</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthesis</td>
<td>Develops new understanding of the relationships between concepts and sub-concepts; displays understanding of the balance and compromise that evaluation sets-up.</td>
<td>90% - 100%</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Explains inter-relationships between parts, considers the impacts of these relationships, determines what works well and not.</td>
<td>90% - 100%</td>
</tr>
<tr>
<td>Analysis</td>
<td>Identifies component parts of the whole; breaks the complex into a series of parts. Considers inter-relationships.</td>
<td>80% - 90%</td>
</tr>
<tr>
<td>Application</td>
<td>Applies the basic concepts a situation that does not have a rote answer; in so doing reveals an individual understanding that goes beyond simple definitions.</td>
<td>70% - 80%</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Reveals an individual understanding of the concepts but without connection to the specific project or situation</td>
<td>60% - 70%</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Repeats definitions and ideas but without revealing an individual understanding</td>
<td>50% - 60%</td>
</tr>
</tbody>
</table>

Provide teaching tips to help other instructors implement your activity in their courses.

- The delivery and evaluation ideas are what are transportable, here. The technical content is specialized to civil engineering and not likely useful to anyone else.
- The current activity assumes that you are in a project-based situation.
Describe your assessment strategy and instruments for student learning and attitudes. Attach grading rubric and/or assessment instruments.

- Bloom’s Taxonomy was used as the evaluation basis for performance.

How effective was the activity? What are your ideas for improvement in the future?

- This activity could be re-written as a Week 1 or 2 activity so that it is pro-active instead of re-active. It could also be used as a before and after activity. Use it in Week 1 to promote the basic ideas and definitions and support the early development of sustainable approaches. Then, use it in a reflective mode to encourage new understanding.
- In class time needs to be spent on utilizing the results of the out-of-class work instead of presuming that the activity plants a seed of which they will provide the nurturing. Instead, the nurturing needs to be directed by the instructor. (This is a senior-level course, and it is disappointing that the instructor needs to be so hands-on.)
Complete one Activity Sheet for each activity you developed that incorporates sustainability into your course.

**Activity Name: I4 90% Reflection**

**Instructor Name: Schmucker**

State the activity learning goal(s).

**Learning Outcomes**

1. Identify how a project’s statement of work influences the ability to successfully meet client needs.
2. Identify the role that an engineer plays in a project beyond technical processes.
3. Discuss via first-hand experiences the impact of poor planning or understanding of client needs to a project and how one can anticipate, organize, and design a more effective process.

Summarize activity.

- This is a learning activity based upon reflection after the event.
- Students have developed final designs.
- Students have just presented their work to their clients and think they are finished. This activity is geared towards getting them to revisit their assumptions about what design is, what its process is particularly the iterative portion, how the Basis of Design is essential in developing useful concepts for clients, and how it is often the case that clients do not know what they want nor need until they see ideas applied to their situation.

At what point in your course is this activity delivered?

Week 13

**DELIVERY**

**Task**

Conduct a brief search and define "design." I suggest that you consider appropriate sources such as related professional organizations (hint: think ASCE, state boards of engineering, etc.).

In light of the definition that you selected, discuss the success of your group’s design efforts.

What this assignment actually means is to reflect upon the process that your group has followed in developing your design. Connect the parts that have gone well and not as well to a relevant, systematic problem solving process. Discuss in what ways your group followed the process and how that directly led to or not to success at each stage. Discuss ways in which had your group followed the process that problems would have been alleviated. And, discuss what elements were in your control and not and suggest ways that your group could have better prepared for those situations.
Note, this is not an opportunity for stream-of-conscious personal journal or diary entries nor an open opportunity to criticize your group members, client, instructor, etc. Rather, prepare a cohesive, clear, and direct essay about your design experience thus far. There are no bonus points for going on for a large number of pages; nor are there bonus points for being too brief. The substance of the discussion is the primary component being evaluated.

**Deliverable Requirements**

- Upload your summary to Canvas by the deadline.
- Print your summary for use in class for in-class discussion.

Provide teaching tips to help other instructors implement your activity in their courses.

- The delivery and evaluation ideas are what are transportable, here. The technical content is specialized to civil engineering and not likely useful to anyone else.
- The current activity assumes that you are in a project-based situation.

Describe your assessment strategy and instruments for student learning and attitudes. Attach grading rubric and/or assessment instruments.

- Bloom’s Taxonomy was used as the evaluation basis for performance.

**Grading Criteria**

An essay that reaches the following level earns approximately the associated grade in the table shown. Note, to reach a high level implies having demonstrated performance at the levels below, i.e., the system shown is hierarchical.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description/Characterization</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthesis</td>
<td>Develops new understanding of the relationships between concepts and sub-concepts; displays understanding of the balance and compromise that evaluation sets-up.</td>
<td>90% - 100%</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Explains inter-relationships between parts, considers the impacts of these relationships, determines what works well and not.</td>
<td>90% - 100%</td>
</tr>
<tr>
<td>Analysis</td>
<td>Identifies component parts of the whole; breaks the complex into a series of parts. Considers inter-relationships.</td>
<td>80% - 90%</td>
</tr>
<tr>
<td>Application</td>
<td>Applies the basic concepts a situation that does not have a rote answer; in so doing reveals an individual understanding that goes beyond simple definitions.</td>
<td>70% - 80%</td>
</tr>
</tbody>
</table>
Wasatch Experience
Activity Sheet

<table>
<thead>
<tr>
<th>Comprehension</th>
<th>Reveals an individual understanding of the concepts but without connection to the specific project or situation</th>
</tr>
</thead>
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How effective was the activity? What are your ideas for improvement in the future?

- This activity could probably be re-written as a Week 1 or 2 activity so that it is pro-active instead of re-active. It could also be used as a before and after activity. Use it in Week 1 to promote the basic ideas and definitions and support the early development of sustainable approaches. Then, use it in a reflective mode to encourage new understanding.
- In class time needs to be spent on utilizing the results of the out-of-class work instead of presuming that the activity plants a seed of which they will provide the nurturing. Instead, the nurturing needs to be directed by the instructor. (This is a senior-level course, and it is disappointing that the instructor needs to be so hands-on.)
- The prompts are a bit generic. It would help to fine tune them to be focused to the project itself. Many students tend to take a minimal approach to the reflection. Instead, require them to apply directly to their project’s activities. As well, hold them to a high cognitive standard just to reach a minimal score. Be prepared for initial failure. Set the standard at one of the first assignments.
Complete one Activity Sheet for each activity you developed that incorporates sustainability into your course.

Activity Name: 15 Summative Reflection

Instructor Name: Schmucker

State the activity learning goal(s).

Learning Outcomes

Students will discuss how they have been able to:

A. determine the information needed to evaluate and design an engineered system, structure or component (SSC) (i.e., planned learning via curiosity and independence),
B. find relevant information needed to support the design of the SSC (i.e., initiative),
C. apply the information to the design of the SSC (i.e., transfer), and
D. evaluate the benefits and dis-benefits of the proposed SSC in terms of meeting project goals or clients’ needs (i.e., reflection).

Summarize activity.

• This is a learning activity based upon reflection after a semester-long project.

At what point in your course is this activity delivered?

Week 15

See end of this sheet for Delivery and Essay Prompts

Deliverable Requirements

• Upload your summary to Canvas by the deadline.
• Print your summary for use in class for in-class discussion.

Provide teaching tips to help other instructors implement your activity in their courses.

• The delivery and evaluation ideas are what are transportable, here. The technical content is specialized to civil engineering and not likely useful to anyone else.
• The current activity assumes that you are in a project-based situation.
Describe your assessment strategy and instruments for student learning and attitudes. Attach grading rubric and/or assessment instruments.

- Bloom’s Taxonomy was used as the evaluation basis for performance.

## Grading Criteria

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<td>80% - 90%</td>
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<td>Application</td>
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<td>70% - 80%</td>
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<tr>
<td>Comprehension</td>
<td>Reveals an individual understanding of the concepts but without connection to the specific project or situation</td>
<td>60% - 70%</td>
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<td>Knowledge</td>
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How effective was the activity? What are your ideas for improvement in the future?

- The primary barrier to the activity is that students are exhausted at the end of the term and are not willing to place substantial effort into a cohesive response (or are notable).
- The essay calls for them to self-analyze. However, there is no real means by which to hold them to realistic self-analysis. Hence, the data is marginally useful at best.
In several of the prompts, you will be asked to respond to the ability of someone to perform at the levels defined below.

<table>
<thead>
<tr>
<th>Performance Level</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Re-statement or recitation of facts, figures, definitions, relationships, etc.</td>
<td>Memorizing and repeating (near) verbatim the definition of these performance levels.</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Re-stating facts, figures, definitions, relationships in one’s own terms in a reasonably precise and accurate manner</td>
<td>Describe the performance levels using terms that an above average grandmother can understand without losing precision nor accuracy.</td>
</tr>
<tr>
<td>Application</td>
<td>Apply the concept in a reasonably direct manner; identify the level of a given task and/or performance</td>
<td>Given tasks in the scope of work for a project, select the level appropriate to each.</td>
</tr>
<tr>
<td>Analysis</td>
<td>Break down a complex set of concepts or tasks into a series of application oriented concepts and tasks</td>
<td>Taking a scope of work and dividing it into a series of tasks.</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Developing something new often characterized by design. Design in this case means a new understanding, process, product, method, etc.</td>
<td>Creating a set of drawings or report that documents the results of a project.</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Applying judgement to determine whether something meets criteria, determining the consequences of and/or need for changes and improvements.</td>
<td>Demonstrating that a design meets criteria, selecting the “best” alternative, and/or developing changes and improvements and determining their impacts.</td>
</tr>
</tbody>
</table>
Context: Self-image of you as a professional

1. Rate the level at which you think are able to perform in each category.

<table>
<thead>
<tr>
<th>SKILL SET</th>
<th>Level of Achievement</th>
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</thead>
<tbody>
<tr>
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<tr>
<td></td>
<td>5 Synthesis</td>
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<tr>
<td></td>
<td>6 Evaluation</td>
</tr>
<tr>
<td>Foundational</td>
<td></td>
</tr>
<tr>
<td>1. Mathematics</td>
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<td>2. Physics</td>
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<td>3. Chemistry</td>
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<td>4. Breadth in basic science</td>
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<td>5. Humanities</td>
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<tr>
<td>6. Social sciences</td>
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<tr>
<td>Technical</td>
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<td>7. Mechanics</td>
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<td>16. Sustainability</td>
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<td>18. Technical specialization</td>
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<tr>
<td>Professional</td>
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<tr>
<td>19. Communication</td>
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<tr>
<td>20. History and heritage</td>
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<td>21. Globalization</td>
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<td>22. Professional &amp; Ethical Responsibility</td>
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<td>27. Life-long learning</td>
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<td>28. Attitudes</td>
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</tr>
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Context: Image of what you think others see you as a professional

2. Rate the level at which you think that a 20+ year engineering veteran that knows you would think that you are able to perform in each category.

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**Foundational**

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**Technical**

7. Mechanics
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One of the expected skill sets of graduates of the CvEEN program at the University of Utah is that they have “a recognition of the need for and an ability to engage in life-long learning.” The course CvEEN 4910 – Professional Practice and Design supports this program outcome via a community-based design-related project wherein teams develop and evaluate alternatives leading to the conceptual and preliminary design of a structure, system, or component. These activities involve acquiring the skills, knowledge, and aptitude required for evaluation and design, some of which are self-taught and require the characteristics attributed to life-long learning.

The CvEEN program at the University of Utah has defined life-long learning as demonstrated in CvEEN 4910 in the following way:

CvEEN students will

A. determine the information needed to evaluate and design an engineered system, structure or component (SSC) (i.e., planned learning via curiosity and independence),
B. find relevant information needed to support the design of the SSC (i.e., initiative),
C. apply the information to the design of the SSC (i.e., transfer), and
D. evaluate the benefits and dis-benefits of the proposed SSC in terms of meeting project goals or clients’ needs (i.e., reflection).

3. Discuss in detail how you have demonstrated the ability to engage in life-long learning (via the course project) in light of the definition(s) provided above. Focus on the knowledge, skills, and/or aptitudes that you developed specifically related to the project and that fits into the definitions provided above.
4. Discuss the impact that this design project, if constructed, would have both positively and negatively on each of the following areas: users, neighboring areas, and regional areas.
5. Discuss your contributions to the team project in light of the characteristics of effective team members. Provide specific examples.
6. Infrastructure engineering specifically brings a systems perspective, i.e., a large scale and holistic set of perspectives, to the design throughout the life of a facility (e.g., see “cradle to cradle” perhaps at http://www.c2ccertified.org/drive-change/built-environment). Discuss in what ways each of the following areas impacted, were considered, and/or would have been better if considered in your design project. This is not a prompt whereby we ask you to list things but rather to be reflective and demonstrate critical thought.

*Programming and Funding*

*Site Requirements*

*Safety*

*Economic*

*Environmental*

*Aesthetic*

*Construction*

*Operations*

*Maintenance*

*Risk and Uncertainty*

*Security*