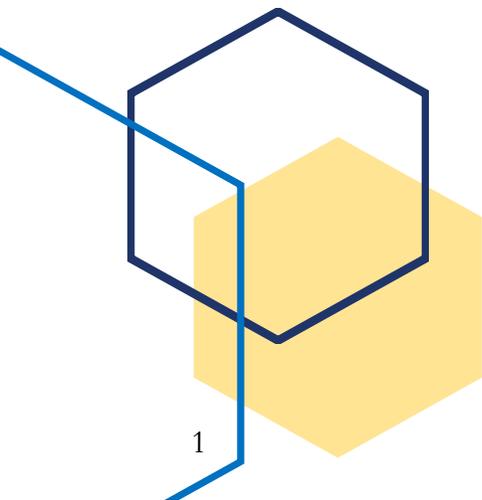




# Teaching Guide

UC DAVIS HORTICULTURE AND D-LAB TOOLKIT

How to teach a feasibility studies course



HORTICULTURE  
INNOVATION LAB

UC DAVIS  
UNIVERSITY OF CALIFORNIA

UC DAVIS  
D-Lab

UC DAVIS  
INNOVATION INSTITUTE  
FOR FOOD AND HEALTH

## EXECUTIVE SUMMARY

In a feasibility studies class, students evaluate whether a proposed technology, business, or other venture is a good idea; that is whether it solves a real problem, and if the market and key resources exist to make it viable. Through their work, they provide their client with the background research they need to make an informed decision about how to proceed. This guide contains information about the deliverables and analytical tools we use in our course to guide students through the process and ensure they're asking the right questions. It also has practical information about selecting teams, managing team dynamics, and grading and evaluation.

## ACKNOWLEDGEMENTS

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Funding for Davis D-Lab curriculum development was also provided by the UC Davis Institute for Food and Health and UC Davis Global Affairs, which helped inform the contents of this toolkit.

The original D-Lab was founded at MIT by Amy Smith in 2002 based on a single course called the "Haiti Class." Dr. Kurt Kornbluth was involved in setting up MIT's D-Lab and founded Davis D-Lab in 2009.

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## ABOUT FEASIBILITY STUDIES

At UC Davis, Feasibility Studies is the first of a 2-part series focusing on projects that address energy, agriculture, sustainability, and global poverty issues. Multi-disciplinary student teams work with their clients to perform feasibility studies using technical, social, environmental, and financial lenses. The client guides the D-Lab team in all phases.



At the end of the class, teams present their findings with regard to scale, context, market or financial analysis, and possible alternatives. Essentially, they provide the client with the information they need to move their project forward—or a well-researched, informed reason not to. The deliverables and accompanying lessons will guide students through holistically analyzing their client’s situation, doing their own background research, and applying relevant analytical tools to the situation. If appropriate, the projects continue into Design, Build Test, where students design a physical

There are countless examples— particularly in the realm of development—of projects that fail not because the technology was bad, but because some other aspect was overlooked; it wasn’t culturally appropriate, a product was more expensive than users would be able or willing to pay for, there was no distribution network in place, or it simply solved the wrong problem to begin with. The result is disillusionment and wasted resources and time on behalf of everyone involved. For this reason, we emphasize teaching feasibility studies before moving into prototyping, and we devote nearly half the feasibility studies course itself to problem framing.

## LEARNING OBJECTIVES

Students should expect to increase their ability to think critically, work in interdisciplinary teams, and synthesize their findings to create a final deliverable. By working with a real-world client, students will learn how to consult on a project and affect actual change. Students will also learn valuable tools that are applicable to any setting and will give them a competitive advantage in the workforce. This course is unlike most in the sense that the curriculum provides guidelines but in the end, students are given the agency to be the architect of their own education while fostering real-world impact.

LEARNING OBJECTIVES INDICATORS

Goal	Objectives	Indicators	Means of Verification
1. Students will engage in an authentic consulting experience	1.1 Connection between the student and the client is strengthened.	(1) Client will rate student's success in providing valuable consulting. (2) Client will report employing the recommendations	Client survey*
	1.2 The client needs are central to scope of project	Students proposed project framing and design direction will clearly address client needs	Evaluation of students' deliverables: Project Statement, Design Brief, Proposed Design Concept, and Final Project
2. Students employ the design process to solve a problem	2.1 Students will apply engineering, social science, and economic tools to evaluate a prospective project/venture	Deliverables demonstrate interdisciplinary project considerations + students correctly apply analytical tools in appropriate contexts	Evaluation of students' deliverables: Project Statement, Project considerations, and Final Project
3. Student develop creative and innovative thinking skills	3.1 Students self-report development of factors that represent innovative capacity	Gains between pre- and post-class survey results	Innovation capacity survey*
	3.2 Students perceive that they will use innovative and creative thinking skills in the future	Gains between pre- and post-class survey results	Innovation capacity survey (Intention to innovate)

\* The client survey questions are attached in the Appendix. For information on our innovation survey, please contact [msslattery@ucdavis.edu](mailto:msslattery@ucdavis.edu)

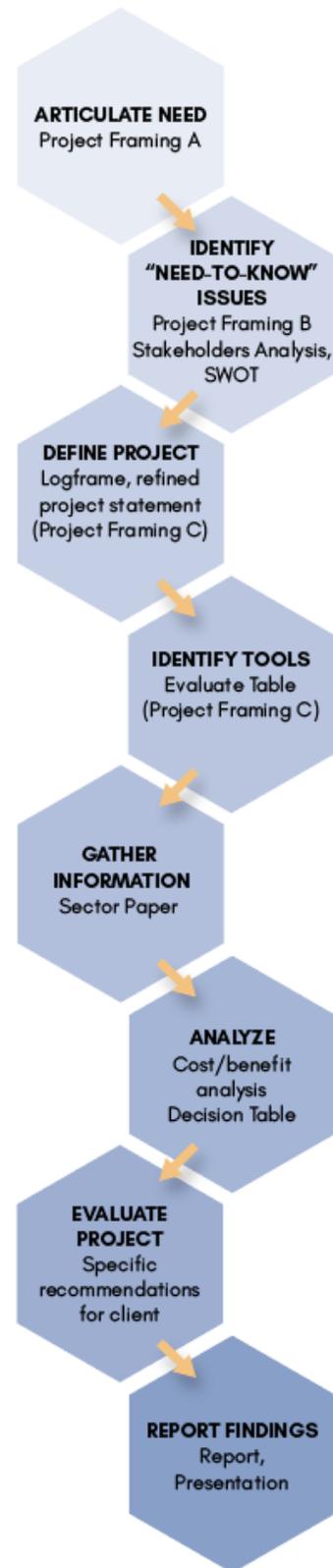
## COURSE ORGANIZATION

The feasibility studies course is structured around deliverables (documents or presentations that are either graded or checked for completion) where the students use the Four Lenses of Sustainability to analyze their client's situation. It is inspired by design thinking, specifically the concept of divergent and convergent thinking. Students start by gathering information, and at the start of the course, brainstorming as many ideas as possible before they start to refine their scope.

The first five deliverables facilitate the students' independent research to inform their own understanding of the clients' situation. By the midterm presentation, they should have an idea of what the final deliverable will look like so that they're able to get feedback from the instructor and reviewers.

The final deliverable could include a preliminary business model, design recommendations for prototyping, or a decision matrix to evaluate different alternatives (with proper justification). On the D-Lab website, we have an archive of previous projects from our feasibility studies course.<sup>1</sup> This may be helpful for instructors to look through to get a better sense of what students might be expected to create.

Aside from the deliverables, which must be presented and completed in a specific order, the class itself is a combination of guest speakers, sector-specific lectures, presentations of case studies, and **group work time**. For the last few weeks of a course, nearly half the class sessions are unstructured group time for students to work on their projects. The rest is for you to fill in based on what you think will be most useful and interesting to your students.



<sup>1</sup> Please visit <https://piet.ucdavis.edu/> for more information.

## DELIVERABLES

### 1. STUDENT PROFILE & PROJECT SELECTION

**Deliverable:**

One page single-spaced with the following (submitted individually):

- (Aspired degree) in (program) (if applicable)
- 3 main skills or strengths
- 3 top projects in order of interest (1, 2, 3)
- Phone number, email address, skype name
- A short paragraph explaining how your skillset applies to this project and what you hope to learn

**Objectives:** Students learn a structured method to choose between different alternatives, instructors use information to form project groups

**New tools:** Evaluative matrix

### 2. PROJECT FRAMING A: INITIAL PROJECT STATEMENT

**Deliverable:**

- 1) Project Goal & Scope Statement (single page, submitted as a team)
- 2) Assign communication officer for team, identify best way to communicate with client/point person for project
  - a. Each group should have one member who is the primary point of communication with the client. This student should include all members in the communication, but the client should almost exclusively communicate with this student (especially in the beginning of the term). This prevents confusion and avoids the client becoming overwhelmed.

**Objectives:** Establish communication with client, articulate client's situation using 4 lenses

**New tools:** 4 Lenses of Sustainability, Group Protocol

### 3. PROJECT FRAMING B: IDENTIFY RESEARCH DIRECTIONS

**Deliverable:**

1. 1 page with project considerations (submitted as a team)
2. Identify and assign sectors for each teammate to research (submitted as a team)
  - a. Include initial brainstorm list
3. Annotated bibliography with 3 relevant articles as research leads (submitted individually)

**Objectives:** Identify the most important “need to know” issues to move forward with project

### 4. PROJECT FRAMING C: EVALUATIVE TABLE

**Deliverable:**

- 1) Evaluative Table defining objective functions you are trying to minimize or maximize, the target values, and the analytical tools you will use (submitted as a team)
- 2) Revised project goal & scope statement, proposed final deliverable (submitted as a team)

**Objectives:** Now that students are better informed about the background of their project and its constraints, they should redefine their scope, methodology, and end deliverable. The evaluative table helps students define what metrics are important to the success of their project, how they might measure or improve them, and what they should be aiming for.

### 5. IN-DEPTH RESEARCH: SECTOR PAPER

**Deliverable:** Five-page research paper (double-spaced) describing the current state of affairs in a sector relevant to the project. This is meant to be a straightforward and useful literature review, not an opinion piece or innovative new research. Each student should write their own paper about a different sector. (Submitted individually)

**Objectives:** Students improve their research skills, learn in-depth knowledge about a sector of interest, and apply that knowledge to their project

## 6. MIDTERM PRESENTATION

**Deliverable:** Students have no more than 7 minutes to present:

1. Project Statement
2. Framing
3. Research Findings
4. Proposed Methodology.

Team will get feedback from mentors and reviewers.

Presentations are evaluated on a basis of **clarity** of framing, **relevance** of content and **delivery**.

**Objectives:** Students will synthesize their project and present only relevant information in an intentionally short timeframe. Students will also receive critical feedback from mentors, reviewers, and even clients (if they are able to attend) and will use this feedback to proceed with their projects.



## 7. MENTOR CHECK-IN

**Deliverable:** No physical deliverable is turned in. Students will check in with their mentor(s) and get feedback 1-2 weeks before their final report and presentation are due.

**Objective:** Ideally, students have been in communication with their mentor(s) throughout the process, but this deliverable formalizes the process and encourages students to check-in one last time before presenting their final deliverable.

## 8. FINAL PRESENTATION

**Deliverable:** Students have no more than 10 minutes to present:

1. Final Project Statement
2. Background
3. Methodology
4. Results
5. Recommendations

After presenting, student teams receive feedback from mentors and reviewers.

**Objectives:** Students synthesize and clearly articulate the work they have done during the class and receive feedback to incorporate into their final report.



## 9. FINAL REPORT

**Deliverable:** Report must include:

- 1. Executive Summary:** 1 page that covers the whole project. Anyone should be able to read that and understand the whole study.
- 2. Introduction:** Finalized project statement, relevant background information (sectors literature review distilled down to the key insights, no general info that is unrelated to the project, we all know climate change is happening.)
- 3. Methodology:** What you did and how you went about it. Analytical tools and how you used them. Was it a Life Cycle Analysis?
- 4. Results and Discussion:** Results of whatever methodology was carried out and discussion that relates these results to the research you did.
- 5. Recommendations** for moving forward. Does the project live on in D-Lab 2? What are the next steps for your client?
- 6. References:** Cite sources thoroughly and consistently.
- 7. Appendices:** Photographs, maps, sketches, and any additional material that is relevant, but might interfere with the readability of your report. Not just a copy paste of sector papers, unless absolutely relevant.

Final papers are evaluated on a basis of: **relevance** of content, **clarity** of the writing (grammar, spelling, and coherence, tell the reader what you are going to say, say it, then tell the reader what you said!) **quality** of the work.

## ANALYTICAL TOOLS

Analytical tools give students a structured method for evaluating their project in a new way. Part of this “toolkit” includes PowerPoint presentations for four analytical tools that are useful for feasibility studies. The presentations are interactive and include group activity time to walk students through the analytical tools. If applicable, they may include these analytical tools in their final reports.

### 1. STAKEHOLDER ANALYSIS

This tool is used to make relevant connections to both current and potential stakeholders. This tool should be taught early in the course to encourage the students utilize stakeholder analysis to increase their knowledge of both the client and the project. Students can include a stakeholder analysis as part of their final report, making recommendations to their client regarding important connections to maintain, monitor, and/or create.

### 2. SWOT ANALYSIS

SWOT Analysis is crucial for understanding the Strengths, Weaknesses, Opportunities, and Threats of the focus project or business as well as a competitor. This tool can be used in a business plan/model to identify how the positive aspects of the focus project or business highlight the negative aspects of a competitor as well as address how the client is aware of and working to protect/remediate any weaknesses or threats. This tool is also important to show clients where any flaws may be in their project and allow students to formulate any recommendations to address them.

### 3. LIFE-CYCLE ASSESSMENT

Life-Cycle Assessment (LCA) encourages students to think about the complete environmental impact of a product or service. It is useful to compare between different manufacturing processes or alternative products.

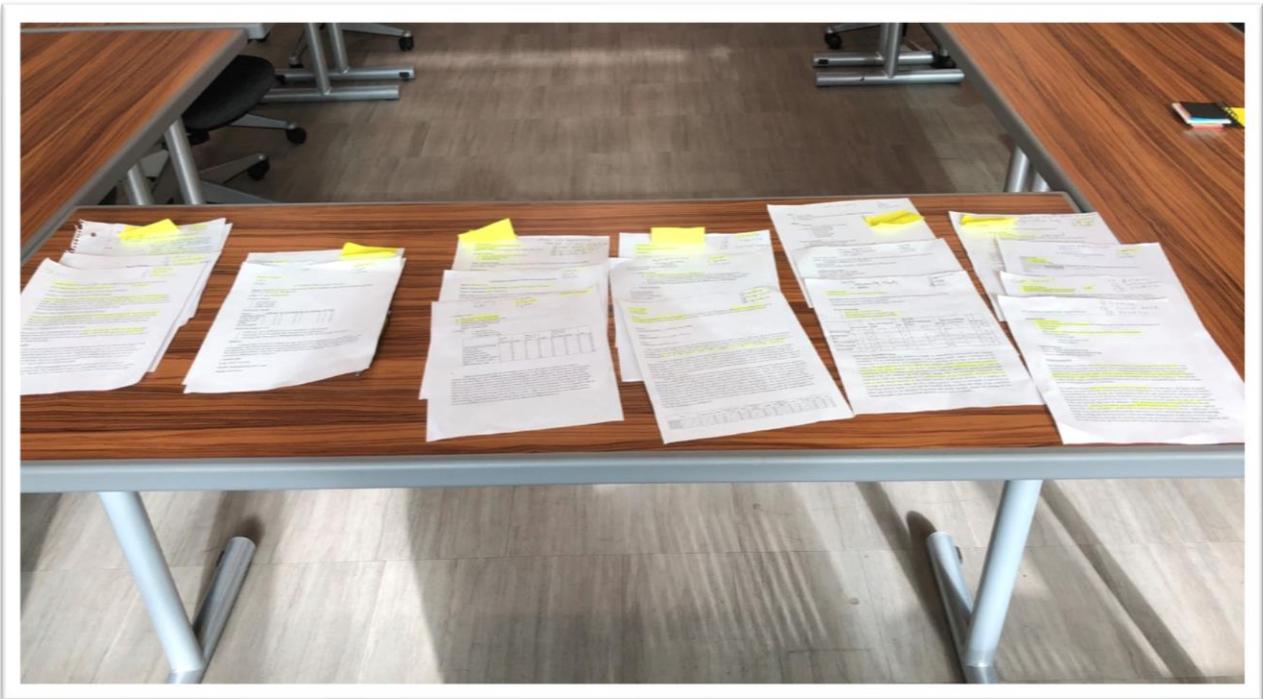
### 4. POLICY ID

Policies that are helpful for clients should be known and understood to ensure the client takes full advantage of the benefits. Alternatively, policies that are harmful for clients must be analyzed to ensure that the client is aware and takes the appropriate measures to be protected. This tool is also useful to identify gaps in existing policy so the client may consider working towards creating and/or supporting beneficial policies for their project.

## SELECTING TEAMS

The teaching team will select teams based on Deliverable 1: Student Profile and Project Selection. We use the following process:

1. Print out the student submissions, or have students turn them in as a hard copy.
2. Read through all submissions. Highlight the most important information; for example, unique skills, experience or motivation.
3. Write down the names of each project on post-it notes
4. Choose an anchor person for each project; someone who has listed the project as their top choice and has relevant experience in that topic. Put that student's profile under the project post-it.
5. Build out the teams, doing your best to *complement* the skills and experience of the anchor student. For example, if your anchor student is an engineer, add a student from a different discipline. You want the teams to be as diverse as possible in terms of age, background, discipline, gender, etc.
6. When you have completed all the teams, double check to make sure each student is assigned to one of their top three choices.



## MANAGING GROUP DYNAMICS

Conflict will inevitably arise when students are working together in groups. This is a common concern voiced by instructors who are contemplating starting their own project-based class. Ultimately, it is the responsibility of the students to resolve interpersonal issues, and that's a good life lesson. Indeed, we find that if the teaching team is involved in resolving a conflict, it often aggravates the situation. However, there are a few steps the instructor or teaching team can take to ensure things go as smoothly as possible:



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### BE ACCESSIBLE

Be available for students to voice concerns; this can include holding office hours, staying behind for a few minutes after class, or offering to meet with students outside of class and office hours. Often students will come to the teaching team to express frustration or concern about other group members. The role of the teaching team is to mentor these students to resolve the conflict on their own and, in extreme cases, intervene if necessary.

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### PEER EVALUATIONS

We give students two opportunities to evaluate their group members and themselves, once in the middle of the course and once at the end. The score they receive is factored into their final grade. This holds students accountable to each other and provides a way to reward students for contributing and working hard. Students evaluate each other on attendance and punctuality, level of contribution, and interpersonal relations. A sample peer evaluation form is provided in the Appendix.

## GRADING AND EVALUATION

The project selection and problem framing deliverables are only graded for completion, meaning that students receive full credit as long as they are turned in on time. The remaining assignments are graded using the following criteria:

### SECTOR PAPER

We grade the sector papers as individual assignments, which provides students with an opportunity to distinguish their grade from their group grade. The paper is graded in four categories:

- Research Content (Credibility of Sources [5 points] and Explanation of Relevance [30 points])
- Topic Relevance (Stayed on Sector Topic [5 points] and Relevance to Project [30 points])
- Quality (Page Length [5 points], Spelling and Grammar [5 points], and Organization [5 points]),
- References and Bibliography (Number of References [5 points] and Formatting [10 points])

## MIDTERM PRESENTATION

Midterm presentations are graded by 3 evaluators who use the rubric below to score each presentation. Raw scores are added together to produce the midterm presentation grade. At the end of the presentations, evaluators are given an opportunity to provide feedback and ask student groups questions. We highly encourage students to write feedback down to address in the final presentation and recommend that students do not try to defend their project or decisions. Clients should be encouraged to attend to ask questions and provide feedback but should not be official evaluators (i.e. giving grades).

Evaluators can be professors or individuals from industry. Try to get evaluators in varying disciplines. For example, have an evaluator who is a specialist in engineering, an evaluator who is an expert in design, and an evaluator who is educated in community development. Diversifying evaluators will allow students to receive differing feedback on their projects and recommendations moving forward.

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### MIDTERM PRESENTATION SCORING RUBRIC

Clarity Score: /5

Was problem framed clearly, relevant and not too broad or overstated?

Did they express what the client wants?

Has their problem statement been clearly redefined?

Content Score: /5

What work has been done?

Client Background

Possible Tools: Monitoring & Evaluation, Prior Art, Stakeholders, Policy ID, SWOT, Evaluative Table, etc.

Are the right questions being asked?

Style Score: /5

Did their point come across well?

How was the message communicated?

Organized? Readable graphics?

## FINAL PRESENTATION

Final presentations are graded by 3 evaluators who use the below rubric to score each presentation, raw scores are added together to produce the final presentation grade. Similar to the midterm presentation, the end of the presentations, evaluators are given an opportunity to provide feedback and ask student groups questions. Student groups use this feedback to improve their final reports. Again, we highly encourage students to write feedback down to address in the final presentation and recommend that students do not try to defend their project or decisions. Ideally, evaluators are the same individuals as the midterm presentation but can be different individuals if this is not possible.

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### FINAL PRESENTATION SCORING RUBRIC

Clarity Score: /5

Was problem framed clearly, relevant and not too broad or overstated?

Did they express what the client wants?

Did they articulate the next steps/recommendations?

Content Score: /5

What work has been done?

Were the results presented?

Did they link the results with the next steps?

Style Score: /5

Did their point come across well?

How was the message communicated?

Organized? Readable graphics?

## FOLLOWING UP WITH CLIENTS

One of the objectives of the class is that students have provided a useful, professional service for their client through their final report, and their communication throughout the class. The quality of students' deliverable is one indicator of success in this respect. We also evaluate whether students have provided a useful service through a survey that is sent to clients when the class has finished:

When students have submitted their final reports, the teaching team should review them for clarity and correct any serious errors before sending it to the client. The survey should be sent out within the next few weeks.

In certain cases, the project will have potential to continue after the class has ended. There may be resources available at your institution or an affiliate to encourage this. For example, the UC Davis office of Global Affairs has a grant to fund students who wish to travel abroad to work on projects related to poverty alleviation and/or sustainable development.

Another good option could be applying to local startup incubators or competitions. We invite the people who are responsible for these programs to visit our class as guest lecturers towards the beginning of the class. That way, students are aware of the opportunities that are available to them and how to apply early on, and can keep that in mind as they work on their projects.

While the teaching team can provide guidance and letters of recommendation if students choose to apply for funding to continue with their project, it is ultimately up to the student team and client to move things forward once the class ends.



## APPENDIX

### GROUP PROJECT PEER REVIEW FORM

A portion of your participation grade for the class will be determined through peer review. This allows an opportunity for recourse if a group member is not contributing their share or is otherwise hindering progress. Similarly, peer reviews provide an opportunity for reward if a group member is doing exceptional work.

#### Directions

Multiple peer review forms are provided below. Use one (1) peer review form to rate each group member, including yourself. For example, if your group has 3 members, you would need to complete 3 reviews (1 for each of your peers, and 1 for yourself).

Your review should encompass the whole project period so far. You are welcome to comment on how performance changed over the course of the project if it helps explain your review.

#### General Information

Name of group member being rated:

Your name:

Your project:

#### Performance

Use the following scale to rate each of the three categories below.

Strongly Disagree: 1   Disagree: 2   Neutral: 3   Agree: 4   Strongly Agree: 5

*Attendance and Punctuality: Group member was present for group meetings, conference calls, internet chats, or other scheduled meetings/conversations for working on the project. Group member arrived at scheduled meetings on time.*

Rating:

*Level of Contribution: Group member's contributions were on-time, thorough, and accurate. Group member took responsibility for completing integral portions of the project.*

Rating:

*Interpersonal Relations: Group member positively contributed to group performance (e.g., helped group move ahead, constructively resolved conflicts, was not destructive to group functioning, showed respect for other group members, assisted in ensuring everyone had an opportunity to contribute equally, etc.)*

Rating:

#### Comments

Please provide any further comments here:

## CLIENT SURVEY QUESTIONS

- 1 Please rate the following statements/questions based on your experience with the student consultant team.

	Strongly agree (1)	2	3	neither agree nor disagree	5	6	Strongly disagree
The consultant willingly adjusted their proposed solution to meet developments of the project requirements/constraints.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My needs were central to the solution development.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- 2 Please rate the following statements/questions based on your experience with the student consultant team.

	Successful (1)	2	3	4	5	6	Unsuccessful (7)
How do you rate the consultant service for this project overall?	<input type="radio"/>						

- 3 Please rate the following statements/questions based on your experience with the student consultant team.

	Completely (1)	2	3	4	5	6	Incompletely (7)
The consultant was able to identify my needs for this project.	<input type="radio"/>						
The consultant was able to successfully respond to the identified needs.	<input type="radio"/>						

4 Please rate the following statements/questions based on your experience with the student consultant team.

	High (1)	2	3	4	5	6	Low (7)
How satisfied are you in the improvements the consultant proposed?	<input type="radio"/>						
How confident are you in the consultant's recommendations?	<input type="radio"/>						
What value do you place on the consultant's services overall?	<input type="radio"/>						

5 Please rate the following statements/questions based on your experience with the student consultant team.

	Complete (1)	2	3	4	5	6	Incomplete (7)
How do you rate your understanding of the solutions proposed by the consultant?	<input type="radio"/>						
How do you rate the documentation provided by the consultant?	<input type="radio"/>						

6 Please rate the following statements/questions based on your experience as a project client

	The whole proposed solution (1)	2	3	Some of the proposed ideas	5	6	None of the proposed ideas (7)
What portion of the solution do you expect to actually implement going forward?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7 Please describe any components of your experience with the consultant team that were not addressed or insufficiently addressed in the previous questions.