

**Master of Science in Civil Engineering
AY 2020-21 Program Assessment Report**

**William Wright
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Report Narrative

0. Program Description and Student Enrollment:

The Civil Engineering Program offers a 30-unit Master of Science (MSCE) degree with an option in Water Resources & Environmental Engineering (WREE). Program requirements include completion of introductory course CE 210 Research Methods (min. grade B); completion of a graduate writing exercise (min. score 87.5%); completion culminating experience CE 298 project or CE 299 Thesis (min. grade C), or comprehensive exam (min. score 75%); and minimum GPA of 3.0.

Program curriculum consists of technical courses in five subject areas: Geomatics, geotechnical, structural, transportation and water resources/ environmental engineering. Students can take up to 6 units of coursework outside of the program curriculum. Students in the WREE option are required to take 12 units of WREE core courses and 3 units of related coursework outside of civil engineering.

MSCE Program student enrollment by semester during the past 5 years is presented in Figure 1. The Both conditionally classified and classified students are included. Enrollment during this period was at a low in Fall 2016 and Spring 2017 (23) and at a high in Fall 2019 (51). The WREE Option began accepting students in Spring 2014 and since then enrollment has fluctuated over time.

Fall 2021: Number: 40 (General MSCE: 29, WREE: 11); Male: 67%, Female: 33%.
Classified: 72%, Conditional 28%; Resident: 62%, Non-Resident: 8%, Foreign: 30%

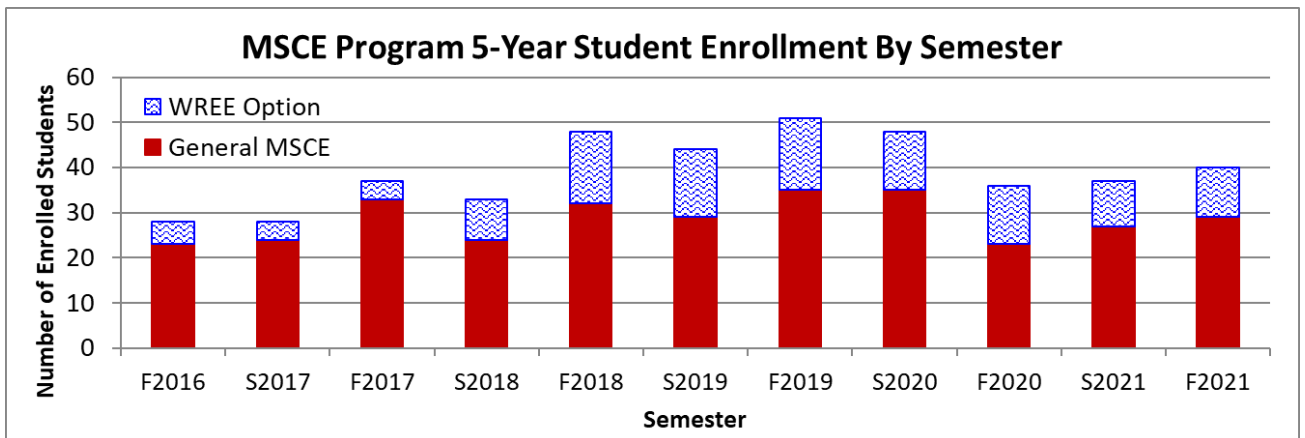


Figure 1. Enrollment in the MSCE program by semester (past 5 years).

1. Learning Outcomes Scheduled for Assessment This Cycle

3. Identify major regulations, codes, and specifications applicable to the planning, analysis, measuring, mapping, or design of the built infrastructure; and be able to specify where current versions can be obtained.
4. Solve problems using advanced methods of engineering analysis and design through the use of mathematical analysis including but not limited to geospatial analysis, differential equations, finite elements, finite differences, least square errors, machine learning, optimization, or other numerical methods.
6. Exhibit excellence in written and graphical communication, including technical documents, research reports, research papers, proposals, and presentations.
7. Exhibit excellence in oral communication, including public presentations to technical and non-technical audiences.

2. Instruments Used in the Assessment This Cycle.

A. Direct Measures:

- 1) **Communication skills in CE 210 Res. Methods in Civ Eng.:** **Outcomes 6 & 7**
- 2) **Score on specific questions in specific courses:** **Outcomes 3 & 4**
- 3) *Performance in culminating experience:* *Not scheduled this year*

B. Indirect Measures:

- 1) *Program Student Exit Surveys (MSCE Program):* *Not scheduled this year*
- 3) *Alumni Survey:* *Not scheduled this year*
- 4) *Employer Survey:* *Not scheduled this year*

3. Assessment Methods and Results.

A. Direct Measures:

- 1) Student communication skills in CE 210: Students are graded for their skill in writing (Outcome 6) and oral presentation (Outcome 7) in CE 210 Research Methods in Civil Engineering, typically during the second or third semester of study. Five areas of written communication are assessed, with equal weighting, as follows: Content, organization, sentence structure, grammar, and references. Ten areas of oral communication are assessed, with equal weighting, consisting of eight parameters related to delivery and five parameters related to content. Rubrics for these assessments can be found in the Appendix of the SOAP and at the end of this report.
- 2) Average student score on specific questions in specific courses: Student Learning Outcomes are assessed by statistical analysis of student scores on one or more questions or problems on course exams or assignments. Questions are selected by the instructor and results are forwarded to the Assessment Coordinator. Course used, learning outcomes assessed, and the implementation schedule are shown in Table 5 of the SOAP. Courses and the associated outcomes assessed in a given academic year vary over time.

Learning outcomes scheduled to be assessed in courses this cycle: 3, 4, 6, & 7

Course(s) scheduled for assessment this cycle: CE 205 & CE 220

- 3) Results: Numeric results of student learning outcomes from direct measures are summarized in Table 1. Discussions are provided below the table.

Table 1: Numeric results – learning outcomes in courses.

Course (type)	No. of Students Surveyed	Learning Outcome	Score, %	
			Program Standard	Student Average
CE 205 (lecture)	14 *	4	75	94.3 *
CE 210 (lecture)	10	6	75	91.2
	10	7	75	95.7
CE 220 (lecture)		3	75	88.5
		4	75	81.3

* Civil Engineering students (students from other majors also take this course).

Discussion of Results

Outcome 3: Identify major regulations, codes, and specifications applicable to the planning, analysis, measuring, mapping, or design of the built infrastructure; and be able to specify where current versions can be obtained.

Results O3: Learning Outcome 3 was assessed in CE 220 on an exam question that required knowledge of a specified solution method that I presume is used as a standard by governing authorities (conjecture). Results indicate that the learning outcome was achieved.

Outcome 4: Solve problems using advanced methods of engineering analysis and design through the use of mathematical analysis including but not limited to geospatial analysis, differential equations, finite elements, finite differences, least square errors, machine learning, optimization, or other numerical methods.

Results O4: Learning Outcome 4 was assessed in CE 205 and CE 220 by way of exam questions. The results indicate that the department standard for Outcome 4 was exceeded in both courses.

Outcome 6: Exhibit excellence in written and graphical communication, including technical documents, research reports, proposals, and presentations.

Results O6: Learning Outcome 6 was assessed in CE 210. The results indicate that student achievement in written communication skill was well above the program standard of 75%.

Outcome 7: Exhibit excellence in oral communication, including public presentations to technical and non-technical audiences.

Results O7: Learning Outcome 7 was assessed in CE 210. The result indicates that student achievement in oral communication was well above the program standard of 75%.

B. Indirect Measures:

Not applicable to the AY 2020-21 assessment.

4. Changes Implemented Since Last Assessment Period.

A. Transportation Engineering to be assessed. The transportation engineering technical area will be included in assessments via the CE 250 Transportation System Design course. The MSCE program began offering graduate courses in transportation engineering a few years ago so it makes sense to begin assessing outcomes from that discipline.

B. CE 240 (formerly CE 242) will no longer be used to assess Learning Outcome 1. While principles of professional ethics, personal responsibility, and environmental stewardship are implicitly and explicitly integrated throughout the assigned reading there is little opportunity to reinforce that content during the semester due to the large number of other topics that are covered in that course.

C. SOAP:

- 1) The Learning Objectives of the University of California at Fresno were added.
- 2) Table 2 updated. Table 2 “Relationship between program courses and student learning outcomes” was updated to include the transportation technical area (CE 250) and to replace “Reinforce” with “Developed” and “Advance” with “Mastered.”
- 3) Table 5 updated. Table 5 “Schedule for formative assessment via mean student scores on specific questions in specific courses” was updated.

D. CE 210 writing rubric added to assessment report. The rubric used to assess graduate writing skill in CE 210 Research Methods in Civil Engineering has been added to this report as an appendix.

5. Changes Under Consideration and On-Going Tasks.

A. Employer Survey: The department has discussed implementation of an employer survey. Building and maintain an employer database would be required and the practical and legal aspects of doing so need to be explored. The survey is expected to provide insight on the preparedness of our graduates and on how they perform after several years on the job. Work on this initiative has been placed on hold pending the addressing of higher priority program action items (discussed further below).

B. Culminating Experience:

- 1) **CE 298 Project:** Communication skills (Learning Outcomes 6 and 7) are currently being assessed in CE 298 based on the total score from Rubric I (written report) and Rubric II (oral presentation). Assessment of additional learning outcomes (i.e., 1-5) based on the existing evaluation rubrics or an expansion of it is being discussed within the department. Although beneficial to assessment, adding this component may make the grading rubrics overly burdensome and less likely that the rubrics would be used at all.
- 2) **CE 299 Thesis:** At present a rubric for CE 299 Thesis has not been developed. Instead, the one developed for CE 298 Project is used, but it is not a good fit in all areas of evaluation. The merits of developing a set of rubrics for CE 299 for use in future years are being discussed within the department.
- 3) **Comprehensive Exam:**
 - a) Only Learning Outcome 6 has been assessed in comprehensive exam. Although several technical learning outcomes can generally be assumed to have been met when the student passes the exam with a minimum score of 75%, assessment of specific could be assessed, resulting in greater resolution.
 - b) Students who select Plan C (Comprehensive Exam) are not required to do undergo an oral defense of their knowledge, which is required for all students who choose Plans A (Thesis) and B (Project). If oral defense of comp. exam were to be implemented a more complete/ accurate measurement of student attainment of oral communication skill in culminating experiences could be obtained.

C. Oral presentation evaluation rubric. A proposal to adopt the WASC written presentation evaluation rubric for CE 210 and the culminating experiences needs to be explored.

D. Professional License and Doctorate Degrees: The ability to obtain PE and PLS license attainment data from the State or NCEES, and the practicality of researching the number graduates from our program that went on to earn a doctorate degree, should be investigated. It would help asses the technical ability of program graduates. In AY 2018-19 a member of the State licensing board informed the MSCE coordinator that some data can be provided but follow-up is needed on this item.

6. Assessment Activities Planned for the 2020-21 Academic Year.

<u>Activity</u>	<u>Learning Outcomes to be Assessed</u>
Instrument 2 -- Questions in specific courses	5 & 1
Instrument 3 – Culminating Experience	6 & 7

7. Progress Made on Items from Last Program Review Action Plan.

The most recent program review took place in AY 2017-18 and Department faculty generally agreed with the findings. An action plan to improve the program's effectiveness was developed and approved at all levels of review. Goals and actions to explore or maintain are summarized below.

Goal 1. Promote Student & Employer Satisfaction in Course Offerings; Maintain Sustainable Levels of Course and Program Enrollment.

1.1. Promote student satisfaction in course selection, content and availability. **Actions to consider:**

- a) Provide sufficient number of faculty in each discipline.
- b) Provide sufficient number of courses in each technical discipline.
- c) Curriculum relevant and state-of-the-art.
- d) Utilize modern relevant software in classroom & lab.
- e) Include lab, field instructional experiences for students.

1.2. Maintain sustainable enrollment in courses. **Actions to consider:**

- a) Offer (more) interdisciplinary courses (CE 205, 206, 210, & 247; Formally adopt Reliability Methods? Sustainability? Other?) [see also Goal 3 below]
- b) Offer (more) courses that undergraduate and graduate students take concurrently.
- c) Accept students from other campuses in fully online courses (agreements required).

1.3. Maintain sustainable enrollment in the program. **Actions to consider:**

- a) Recruitment (improve web page, add videos; Improve brochures; make posters; Advertise; Establish fellowships; Raise money; Employer support; ...)
- b) Create attractive blended BS/MS program (e.g., double counting units, other)

Goal 2. Provide Effective Student Advising. **Actions to consider:**

- a) Advertise to all students that each student begins on Plan C (Comp. Exam) and they may change to Plan A or B if they can find willing advisor.
- b) Provide students with a project/ thesis advisor form, guidelines for research advising, and a project/ thesis grading rubric (ideally the proposed project/ thesis work would be approved prior to the student completing CE 210).

Goal 3. Add Cross-Disciplinary Courses to the Curriculum. **Actions to consider:**

- a) Dept. looks for opportunities to increase the number of cross-disciplinary course options MSCE students can select from.
- b) Provide to students list of cross-disciplinary courses outside of the Dept., e.g., in leadership, management, public policy, innovation and sustainability.

Goal 4. Incorporate leadership, project management skills, & innovation into program educational goals.

Actions to consider:

- a) Incorporate leadership, project management skills, and innovation into:
 - 1) program educational goals.
 - 2) courses, including the required course CE210, CE 205, 206, 299, 291T ..
- b) Complete specified courses in other Depts, colleges, campuses (Action 4.2), e.g., CM 177 Sust. Constr., MBA 210 Leadership & Organizational Behavior
- c) Students required to attend at least one workshop or seminar through affiliated institutes.

Goal 5. Recruit more students in the Geomatics Engineering area to support offering more graduate courses in that discipline. **Actions to consider:**

- a) Recruit more students in the GME area
- b) Offer more graduate courses in the GME area

Continued

Goal 6. Additional Actions to consider.

- a) Develop, schedule and execute an employer survey to find out how our graduates are doing from the employer perspective.
- b) Increase CE and GME Advisory Board engagement with our graduate program
- c) Discuss placing some or all of our master project reports in the project repository at the Henry Madden Library (digital format).
- d) Encourage faculty and students to select thesis option more than we are doing now.

In the Fall of 2020, an Action Plan Implementation Decision Tool was developed to score each action in terms of importance, urgency and “doability.” The sum of these scores was used to establish the order in which the actions would be considered by the department. The highest priority items are as follows:

Priority Tier 1:

1. Advertise to all students that each student begins on Plan C (Comp. Exam) and they may change to Plan A or B if they can find willing advisor.

Priority Tier 2:

2. Provide sufficient number of faculty in each discipline.
3. Offer (more) courses that undergraduate and graduate students take concurrently.
4. Provide students with a project/ thesis advisor form, guidelines for research advising, and a project/ thesis grading rubric (ideally the proposed project/ thesis work would be approved prior to the student completing CE 210).
5. Recruit more students in the Geomatics Engineering area to support offering more graduate courses in that discipline and offer more graduate courses in the GME area.
6. Increase CE and GME Advisory Board engagement with our graduate program.

The importance of Item 2 has increased since the development of the action item implementation decision tool because two faculty have left our department since then (John Green and Cordie Qualle). Progress has been made on Item 6 by providing updates at quarterly meetings.

The department has been working on a new prerequisite course policy for applicants who do not have a degree in our discipline. This and demands related to the COVID-19 pandemic have slowed progress on addressing the above action items.

End of M.S.C.E. Assessment Report AY 2020-21

APPENDIX

Graduate Communication Skills Rubrics for CE 210 Research Methods in Civil Engineering

Graduate Writing Skill Rubrics in CE 210 Research Methods

Criteria	Excellent (4)	Good (3)	Acceptable (2)	Unacceptable (1)
Content	Balanced presentation of relevant information that shows a thoughtful, in-depth analysis of main topic	Information provides support for a central argument and displays evidence of a basic analysis of main topic	Information supports a central purpose at times. Analysis is basic. Reader gains few insights.	Central argument is not clear. Analysis is vague. Reader is confused or misinformed.
Organization	Ideas arranged logically to support main argument. Ideas flow from one to another and are clearly linked together.	Ideas arranged logically to support main argument. Ideas usually but not always, linked together.	In general, writing is arranged logically, although occasionally ideas fail to make sense together. Some clarity of writers' intend.	Writing is not logically organized. Frequently ideas fail to make sense together. Hard to identify a line of reasoning.
Sentence Structure	Sentences are well structured and varied in length. Sentences flow smoothly from one to another.	Sentences are well structured as there is some variety in length. Sentence flow is generally but not always present.	Some sentences are awkwardly constructed so that reader is occasionally distracted.	Mistakes in sentence structure and major distraction to the reader.
Grammar	Writing is free or almost free of errors.	Occasional errors.	Writing has many errors, and reader is distracted by them.	So many errors that meaning is obscured. Reader is confused and stops reading.
References	Primarily peer-reviewed professional journals.	Although most of the references are peer-reviewed, a few are questionable (e.g., popular magazines, trade books, etc.)	Most of the references are from sources that are not peer-reviewed.	There are no professionally reliable sources. Reader seriously doubts the value of the material.

Graduate Oral Presentation Skill Rubrics in CE 210 Research Methods

Student's name _____

Delivery

Was the presenter enthusiastic about the presentation
1 through 5 (5 = best) []

Was the voice clear, audible, and understandable
1 through 5 (5 = best) []

Did the presenter use proper terminology and grammar
1 through 5 (5 = best) []

Did the presenter introduced her/himself and the topic concisely
1 through 5 (5 = best) []

Was there an outline of the presentation given at the beginning
1 through 5 (5 = best) []

Did the presenter summarize the presentation at the end
1 through 5 (5 = best) []

Did the presenter allow for questions at the appropriate time
1 through 5 (5 = best) []

Was time allotted used appropriately
1 through 5 (5 = best) []

Delivery Subtotal (out of 40): _____

Content

Were the objectives of the research topics clearly presented?
1 through 10 (10 = best) []

Was the State-of-the-Art presented factually, quantitatively, precisely?
1 through 10 (10 = best) []

Were the Research Needs presented clearly as a natural continuation of the State-of-the-Art?
1 through 10 (10 = best) []

Was the Methodology presented clearly and convincingly?
1 through 10 (10 = best) []

Was the analysis presented clearly and quantitatively as appropriate
1 through 10 (10 = best) []

Were the conclusion presented succinctly, and clearly supported by the data and analysis
1 through 10 (10 = best) []

Content Subtotal (out of 60): _____

Total Score _____ out of 100 points or _____ %