Civil Engineering Course Outcome Assessment

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Abstract

The implementation of the new ABET Engineering Accreditation Criteria 2000 (EAC 2000) into Civil and Environmental Engineering undergraduate curricula has been critical to the success of the education program. The EAC 2000 emphasizes an outcome- based system approach to engineering education where graduates must have demonstrated abilities (A-to-K), in math, science, engineering, design, teamwork, ethics, communication, and life-long learning. Although the student grades obtained may be a reflection of the course success and standard questionnaires are also employed to monitor the student feedback, little has concerned how to equip students with the skills and attitudes specified in those outcomes. The authors describe, in details, the development of an Excel spreadsheet and the associated assessment tools for a technical design course to measure its success and ensure its continuous improvement to meet the requirements of the ABET engineering criteria. Mapping of course outcomes to the Civil Engineering program (CE) objectives and outcomes and mapping of the course contents to criteria (A-to-K) are also discussed.
Keywords: Assessment tools; Quantitative and qualitative assessments; measuring outcomes; Results and improvements.

1.Introduction

To comply with the ABET engineering accreditation criteria, a program must formulate: *i*) a set of program educational objectives that address institutional and program mission statements and are responsive to the expressed interests of various groups of program constituencies, *ii*) a set of program outcomes that specify the knowledge, skills, and attitudes program graduates should have in order to achieve the program educational objectives and encompass certain specified outcomes (Outcomes A–to-K, shown in Table 1); this is ABET Criterion 3, *iii*) an assessment process for the program outcomes, iv) results from the implementation of the assessment process, and v) a sound plan for continuous program improvement using the assessment process results. The most relevant example is how to assess the eleven student learning outcomes, A-to-K, in Criterion 3 incorporated by the Accreditation Board of Engineering and Technology (ABET) in its Engineering Criteria 2000 (EC 2000), which is now critical to the success of the education program [1]. As a result, there has been an increased interest in assessment methodologies and research within the engineering educational community. As validated assessment methods begin to appear, there is a strong need to integrate them into adaptable and accessible system applications that must become an essential component of the engineering learning environment. However, the potential of the assessment to improve instruction depends strongly on how well engineering faculty understand it and appreciate the extent to which their full involvement in it is crucial. The assessment study by Light [2] of Harvard students indicates that one of the crucial factors in the educational development of the undergraduate is the degree to which the student is actively engaged or involved in the undergraduate experience. Light's research studies suggest that curricular planning efforts will reap much greater payoffs in terms of student outcomes if more emphasis is placed on pedagogy and other features of the delivery system, as well as on the broader interpersonal and institutional context in which learning takes place. Triangulation (using multiple methods to obtain and verify a result) is an important feature of effective assessment [3]. The more tools used to assess a specific program outcomes or course learning objectives, the greater the likelihood that the assessment will be both valid (meaning that the chosen assessment method is actually matching what is supposedly being assessed) and reliable (the conclusion would be the same if the assessment were conducted by other assessors or again by the same assessor). Carter et. al. [4] provide guidance on how to meet ABET Criterion 2. They suggest that programs seeking accreditation assemble university, college, and program/department mission statements, define the key stakeholders in the program (e.g., students, faculty, alumni, employers of program graduates, and funding sources), solicit their input on desirable program attributes, and write educational objectives that take into account the various mission statements and stakeholder desires. Their guidance did not concern course objectives and assessment. For every course in the program, observable outcome-related learning objectives that are guaranteed to be in place regardless of who happens to teach the course should be defined and assessment methods for each core objective should be identified [5]. The primary purpose of this paper is to examine that role, assessment of the individual courses outcomes.

2.Developing CE program objectives and outcomes

A major goal of the Civil Engineering (CE) program at the United Arab Emirates University (UAEU) is to provide students with the necessary preparation in the area of civil and environmental engineering to compete effectively for professional careers in this field and with the motivation for personal and professional growth through lifelong learning. Hence, the educational objectives of the CE program at the UAEU have been formulated following the specifications of ABET Criterion 2. The CE program outcomes that encompass ABET Outcomes A-to-K have in turn been formulated to address the CE educational objectives. The outcomes are threshold statements that describe the general expectations for what should be achieved by all those who graduate from the CE program at the UAEU. The CE program educational objectives and outcomes at the UAEU are shown in table 1. The assessment of educational objectives is carried out by mapping the A-to-K program outcomes to the relevant educational objectives. This linkage, along with the corresponding relevance weights, is presented in Table 1.

3. Developing course objectives and outcomes to meet CE program objectives and outcomes

The objectives and outcomes of each course have to be designed to meet the overall program objectives and outcomes. In addition, course objectives and outcomes have to be measurable in order to be assessed and improved. Identification and assessment of the outcomes of the Structural Steel Design (CIVL 417) course is the main focus of this paper. The course educational objectives and outcomes are summarized in Table 2. A course objective is a statement of an observable or measurable student action that serves as evidence of knowledge, skills, and/or attitudes acquired in a course. The statement must include an observable action verb, i.e. explain, calculate, derive, or design to qualify as a learning objective. On the other hand, a course outcome is a statement of non-observable actions such as knowledge, skills, learning, understanding attitudes that the students who complete a course are expected to acquire.

4. Assessment of course outcomes

The evaluations conducted during an accreditation/reaccreditation cycle require that "each program must show evidence of actions to improve the program. These actions should be based on available information, such as results from Criteria 2 (educational objectives) and 3 (program outcomes) processes". Improving the program starts by improving the course objectives and outcomes. Accordingly, the tools utilized in the assessment of course outcomes are based on student learning and faculty performance. The tools used to assess Structural Steel Design (CIVL 417 are: Direct Tools (Homework assignments, Quizzes, Exams, Class participation) and Indirect Tools ("Student Assessment of Course" survey, Figure 1, Student's online course assessment, Instructor's teaching performance evaluation).With more emphasis put on orienting the assessment process towards improving the students' learning and the faculty performance, the assessment of the course outcomes and educational objectives was conducted both qualitatively and quantitatively. Qualitative assessment, using indirect tools, was based on feedback acquired from students, faculty members, and the department focus groups. This was done by reporting all the comments made by the course instructors and focus groups on the assessed courses. Table 2 shows the mapping of the sample Structural Steel Design course topics to the (A-to-K) criteria and its corresponding assessment tools. An Excel Spreadsheet was generated to carry out the quantitative assessment of course outcomes by mapping the course outcomes to program outcomes and their above four direct corresponding assessment tools. In addition, different topics taught are also mapped to the course outcomes. Information is inserted into the Excel sheet as follows:

a) "CAF Input" Sheet (Course Assessment Form): Mapping of course educational objectives and outcomes to relevant CE program outcomes, relevance levels between the course and the program outcomes, and the assessment tools utilized are typed into the Excel sheet to start the in the assessment process, as shown in Figure 1.

b) "F Input" Sheet (Faculty): For each of the course intended outcomes, the faculty member enters a number on a 1 to 5 scale (with 1 being very low and 5 being very high) that corresponds to the extent the faculty feels the class has helped him/her to cover the course topics satisfactorily over the course of the semester, as shown in Figure 2. This is an essential step in the course assessment process. Therefore selecting a number from 1 to 5 by the faculty member is a tough one and should be selected objectively to truly reflect how efficiently and effectively he/she was able cover the course materials depending on the batch of students attending the course.

c) "Q Input" Sheet (Questions - students' grades): Questionnaire given in the above four direct tools addressing outcomes A-to-K are selected. The students' answers to these questions are evaluated and marked, and these marks are mapped to outcome A-to-K in the Excel sheet as shown in Figure 3.

d) "S Input" Sheet (Survey): For each of the abilities, attributes, and skills listed in the "Student Assessment of Course" survey shown in Figure 4, the students check the appropriate boxes that corresponds to the extent they feel the class has helped them achieve over the course of the semester. This information is fed back into the Excel sheet as shown in Figure 5 to map it to and measure the outcomes A-to-K.

5 .Analysis and results

The tools to evaluate student-learning quality include: homework and quiz 35% of the total grade, midterm exam 25%, and final exam 35% of the overall class grade. Students' participation and oral presentation count 5% of the overall class grade and are evaluated by the course instructor. Suggestions to improve communication and presentation are made to students. This assessment also provides student observation on their team member's performance, when team work class activities are carried out. Figures 6 and 7 show the performance assessment sample of students taking Structural Steel Design (CIVL 417) in the Fall Semester of the 2007/2008 academic year. To make the evaluation a continuous improvement process, students will evaluate course contents (assessment tool shown in Figure 4) in terms of how they feel the class has helped them achieve abilities, attributes, and skills the course is anticipated to provide. Feedback from these evaluations is designed to make instructor aware of student's suggestions to spend more or less time on course topics. Figure 8 indicate that the performance criteria were net in this course for the Fall Semester of 2007. Figure 9 shows the performance criterion for each of the course contents/outcomes was met. Students didn't show very good level of satisfaction in utilizing computer software in analyzing structural systems. It was recommended to put more emphasis on the significance of this item by assigning a separate assignment that focuses on that goal.

6. Conclusion

This paper describes, in details, the development of assessment tools for an outcome based engineering undergraduate civil and environmental engineering (CEE) course, in particular, CIVL 417 Structural Steel Design, at United Arab Emirates University. Development of Excel spread sheet to perform the assessment of course, development of course objectives and outcomes to meet CE program objective and outcomes, mapping of the course contents to criteria (A-to-K) and assessment tools are discussed. The procedure to implement the criteria in class teaching and assessment tool was also discussed in details. Sample data collected from CIVL 417 Structural Steel Design class in the Fall 2007 indicated that the student learning performance was improved in the process. The data give us confidence that the development of assessment tool for the outcome based engineering courses is working in the positive direction. More data need to be collected to enhance and improve the assessment tools. The data collection is a long-term process. More data are needed to analyze the tools statistically in order to enhance student-learning performance and enhance instructor-teaching performance.

References

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Table 1: UAE University-Department of Civil & Environmental Engineering (CE)
CE Program: Educational Objectives and Relevance Levels to Outcomes

CE PROGRAM EDUCATIONAL OBJECTIVES	**CE Program Outcomes***	**Relevance****
1. Take pride in their profession and have commitment to highest standards of ethical practices, and high level of awareness of social, economical, and environmental issues relevant to the civil engineering profession.	F	5
	J	4
	H	5
2. Successfully deal with real life civil engineering problems and achieve practical solutions based on a sound science and engineering knowledge.	A	4
	C	4
	D	4
	E	4
	H	4
	K	4
3. Efficiently design, build and/or evaluate a civil engineering system/component to satisfy certain client needs per design specifications and/or interdisciplinary requirements.	A	3
	B	4
	C	5
	E	4
4. Communicate effectively and use modern engineering tools efficiently in all aspects of professional practices.	D	4
	G	5
	K	5
5. Develop and update their knowledge and skills through professional programs and graduate studies to keep up with the rapidly evolving technologies.”	I	5
	J	4
	K	4

* A-to-K: are the CE Program Educational Outcomes, and are the same as ABET-suggested educational outcomes. They are defined as follows:
A. An ability to apply knowledge of mathematics, science, and engineering.
B. An ability to design and conduct experiments, as well as to analyze and interpret data.
C. An ability to design a system, component, or process to meet desired needs.
D. An ability to function on multi-disciplinary teams.
E. An ability to identify, formulate, and solve engineering problems.
F. An understanding of professional and ethical responsibility.
G. An ability to communicate effectively.
H. The broad education necessary to understand the impact of engineering solutions in a global and societal context.
I. A recognition of the need for, and an ability to engage in life-long learning.
J. A knowledge of contemporary issues.
K. An Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
** Relevance levels are based on 1 to 5 scale with 5 represents the highest relevance.

Table 2: CIVL 417 – Structural Steel Design
Course Objectives and Outcomes and relevance to CE Program Outcomes Mapping Course Contents to Criteria A-to-K

COURSE OBJECTIVES	COURSE OUTCOMES	Relevant CE Program Outcomes	Relevance*
1. To introduce the students to the different design philosophies for steel structures and the basic steps in the design process.	Select the most suitable structural system for a steel roof truss or a steel floor system.	**A, E**	**5, 5**
	Identify and compute the design loads on a typical steel building.	**A, E**	**5, 5**
2. To introduce the students to the design of the main steel members of a steel structure according to the AISC/ LRFD specifications	Identify the different failure modes of steel tension members, and compute the design strength of such members.	**A, E**	**5, 5**
	Select the least weight section size for a steel tension member.	**C**	**4**
	Identify the different failure modes of steel columns or compression members, and compute the design strength of such members.	**A, E**	**5, 5**
	Select the most suitable section shape and size for a steel compression member according to a specific design criterion	**C**	**4**
	Identify the different failure modes of steel beams subjected to simple or double bending, and compute the design strength of such members.	**A, E**	**5, 5**
	Select the most suitable section shape and size for a steel beam according to a specific design criterion.	**C**	**4**
3. To help students understand the behavior and design of direct shear steel connections.	Identify the different failure modes of bolted connections for tension or compression members, and determine the design strength of such connections.	**A, E**	**5, 5**
	Identify the different failure modes of welded connections for tension or compression members, and determine the design strength of such connections.	**A, E**	**5, 5**
	Design bolted or welded connection for tension or compression members.	**C**	**4**
4. To help students understand the behavior and design of different steel connections.	Identify the various types of bolted connections in steel construction, and design simple shear (beam-to-girder or girder-to-column) bolted connections.	**C, E**	**4, 5**
5. To develop students' computer skills in designing steel structures.	Utilize advanced computer software packages for the analysis and design of steel structures.	**C, E, K**	**4, 5, 2**
6. To help improve the verbal communication skills of the students.	Express their ideas more effectively during classroom discussions	**G**	**1**

* Based on 1 to 5 scale with 5 represents the highest relevance.

Fig. 1 Mapping of the CIVL 417 Outcomes/Contents to CE Program Outcomes (A-K)

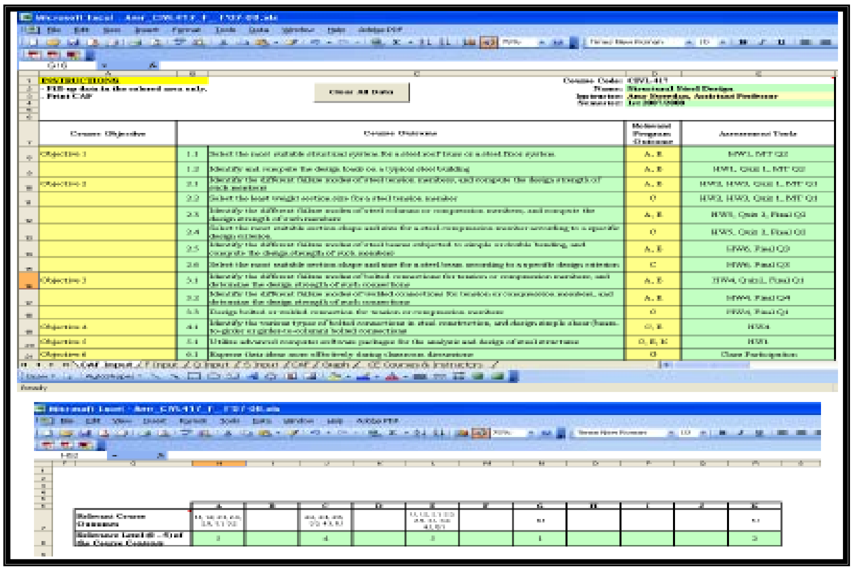
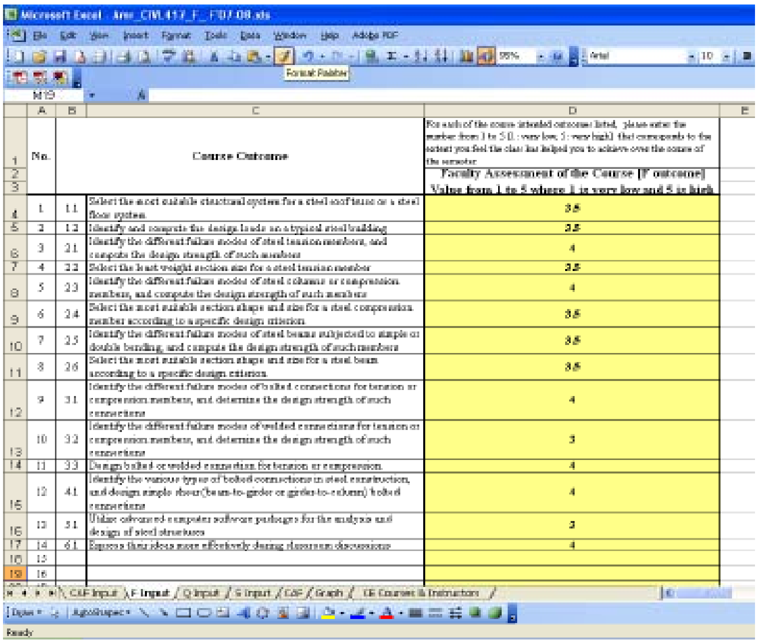
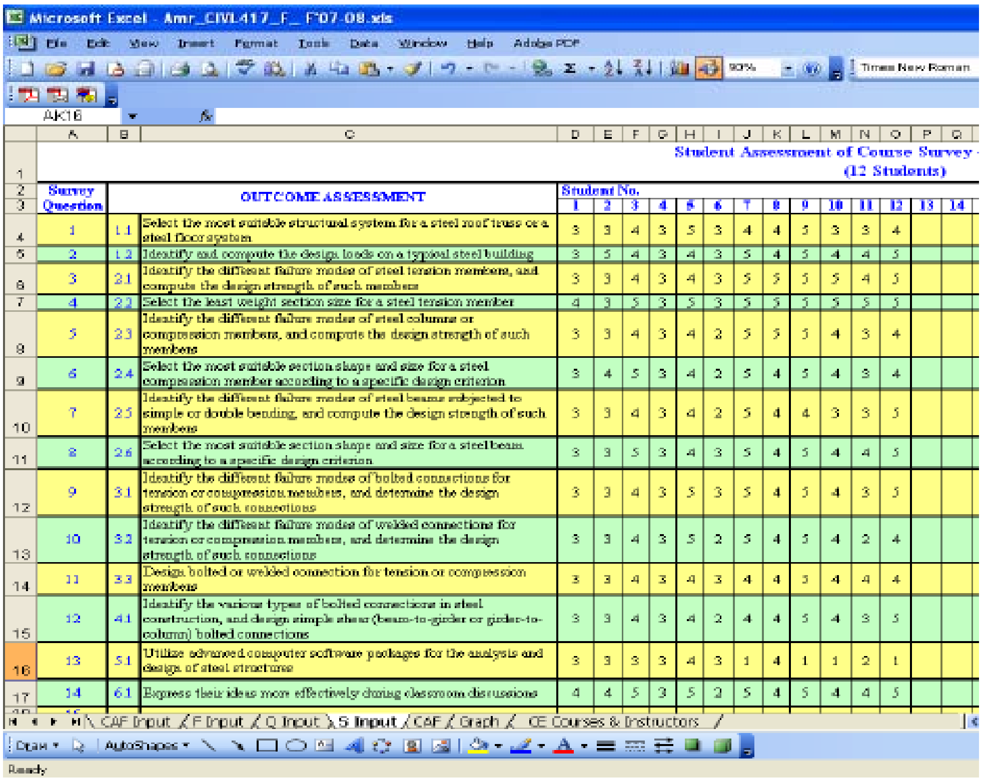


Fig. 2 Faculty course content/outcome assessment



No.		Course Outcome	Faculty Assessment of the Course [F outcome] Value from 1 to 5 where 1 is very low and 5 is high
1	1.1	Select the most suitable structural system for a steel roof truss or a steel floor system	3.5
2	1.2	Identify and compute the design loads on a typical steel building	3.5
3	2.1	Identify the different failure modes of steel tension members, and compute the design strength of such members	4
4	2.2	Select the least weight section size for a steel tension member	3.5
5	2.3	Identify the different failure modes of steel columns or compression members, and compute the design strength of such members	4
6	2.4	Select the most suitable section shape and size for a steel compression member according to a specific design criterion	3.5
7	2.5	Identify the different failure modes of steel beams subjected to simple or double bending, and compute the design strength of such members	3.5
8	2.6	Select the most suitable section shape and size for a steel beam according to a specific design criterion	3.5
9	3.1	Identify the different failure modes of bolted connections for tension or compression members, and determine the design strength of such connections	4
10	3.2	Identify the different failure modes of welded connections for tension or compression members, and determine the design strength of such connections	3
11	3.3	Design bolted or welded connection for tension or compression	4
12	4.1	Identify the various types of bolted connections in steel construction, and design simple shear (beam-to-girder or girder-to-column) bolted connections	4
13	5.1	Utilize advanced computer software packages for the analysis and design of steel structures	3
14	6.1	Express their ideas more effectively during classroom discussions	4
15			
16			

Fig. 3 Mapping the four direct assessment tools (Hwk, Quiz, Exam, Class participation) to outcomes A-K



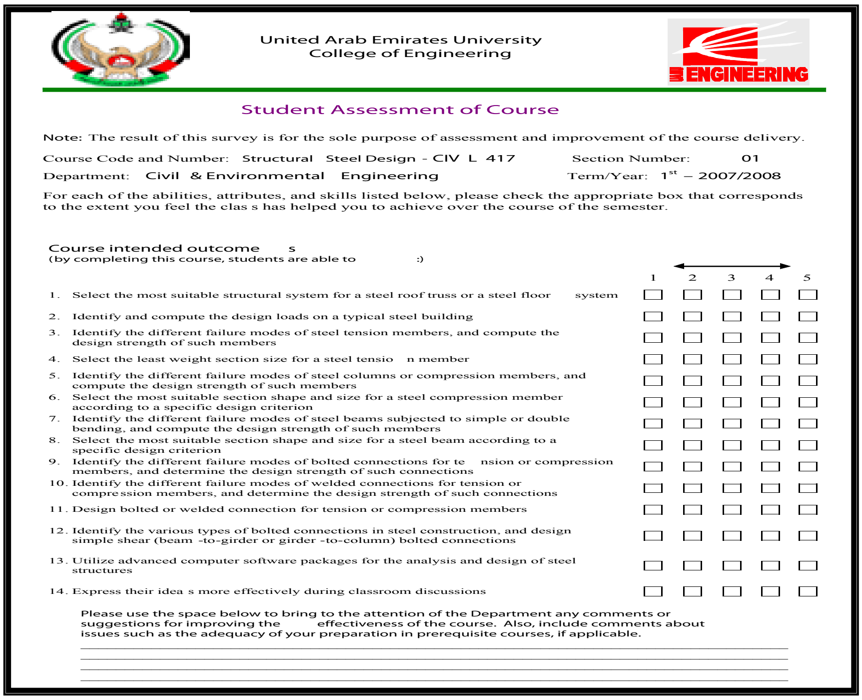
Microsoft Excel - Amr_CIVL417_F_ F'07-08.xls

Student Assessment of Course Survey - (12 Students)

Survey Question	OUTCOME ASSESSMENT		Student No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1.1	Select the most suitable structural system for a steel roof truss or a steel floor system	3	3	4	3	5	3	4	4	5	3	3	4		
2	1.2	Identify and compute the design loads on a typical steel building	3	5	4	3	4	3	5	4	5	4	4	5		
3	2.1	Identify the different failure modes of steel tension members, and compute the design strength of such members	3	3	4	3	4	3	5	5	5	5	4	5		
4	2.2	Select the least weight section size for a steel tension member	4	3	5	3	5	3	5	5	5	5	5	5		
5	2.3	Identify the different failure modes of steel columns or compression members, and compute the design strength of such members	3	3	4	3	4	2	5	5	5	4	3	4		
6	2.4	Select the most suitable section shape and size for a steel compression member according to a specific design criterion	3	4	5	3	4	2	5	4	5	4	3	4		
7	2.5	Identify the different failure modes of steel beams subjected to simple or double bending, and compute the design strength of such members	3	3	4	3	4	2	5	4	4	3	3	5		
8	2.6	Select the most suitable section shape and size for a steel beam according to a specific design criterion	3	3	5	3	4	3	5	4	5	4	4	5		
9	3.1	Identify the different failure modes of bolted connections for tension or compression members, and determine the design strength of such connections	3	3	4	3	5	3	5	4	5	4	3	5		
10	3.2	Identify the different failure modes of welded connections for tension or compression members, and determine the design strength of such connections	3	3	4	3	5	2	5	4	5	4	2	4		
11	3.3	Design bolted or welded connection for tension or compression members	3	3	4	3	4	3	4	4	5	4	4	4		
12	4.1	Identify the various types of bolted connections in steel construction, and design simple shear (beam-to-girder or girder-to-column) bolted connections	3	3	4	3	4	2	4	4	5	4	3	5		
13	5.1	Utilize advanced computer software packages for the analysis and design of steel structures	3	3	3	3	4	3	1	4	1	1	2	1		
14	6.1	Express their ideas more effectively during classroom discussions	4	4	5	3	5	2	5	4	5	4	4	5		

CAF Input / F Input / Q Input / S Input / CAF / Graph / CE Courses & Instructors

Fig. 4 Student Course Assessment Form



United Arab Emirates University
College of Engineering

ENGINEERING

Student Assessment of Course

Note: The result of this survey is for the sole purpose of assessment and improvement of the course delivery.

Course Code and Number: Structural Steel Design - CIV L 417 Section Number: 01

Department: Civil & Environmental Engineering Term/Year: 1st – 2007/2008

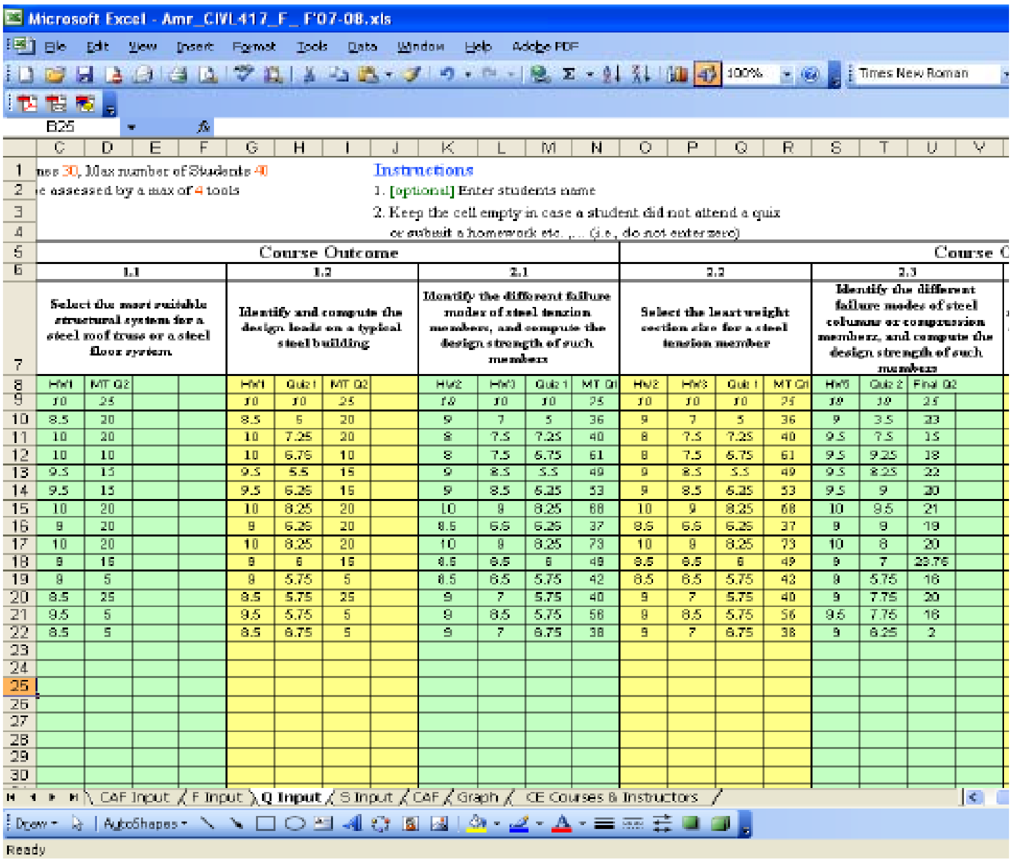
For each of the abilities, attributes, and skills listed below, please check the appropriate box that corresponds to the extent you feel the clas s has helped you to achieve over the course of the semester.

Course intended outcome s
(by completing this course, students are able to :)

	1	2	3	4	5
1. Select the most suitable structural system for a steel roof truss or a steel floor system	☐	☐	☐	☐	☐
2. Identify and compute the design loads on a typical steel building	☐	☐	☐	☐	☐
3. Identify the different failure modes of steel tension members, and compute the design strength of such members	☐	☐	☐	☐	☐
4. Select the least weight section size for a steel tensio n member	☐	☐	☐	☐	☐
5. Identify the different failure modes of steel columns or compression members, and compute the design strength of such members	☐	☐	☐	☐	☐
6. Select the most suitable section shape and size for a steel compression member according to a specific design criterion	☐	☐	☐	☐	☐
7. Identify the different failure modes of steel beams subjected to simple or double bending, and compute the design strength of such members	☐	☐	☐	☐	☐
8. Select the most suitable section shape and size for a steel beam according to a specific design criterion	☐	☐	☐	☐	☐
9. Identify the different failure modes of bolted connections for te nsion or compression members, and determine the design strength of such connections	☐	☐	☐	☐	☐
10. Identify the different failure modes of welded connections for tension or compression members, and determine the design strength of such connections	☐	☐	☐	☐	☐
11. Design bolted or welded connection for tension or compression members	☐	☐	☐	☐	☐
12. Identify the various types of bolted connections in steel construction, and design simple shear (beam -to-girder or girder -to-column) bolted connections	☐	☐	☐	☐	☐
13. Utilize advanced computer software packages for the analysis and design of steel structures	☐	☐	☐	☐	☐
14. Express their idea s more effectively during classroom discussions	☐	☐	☐	☐	☐

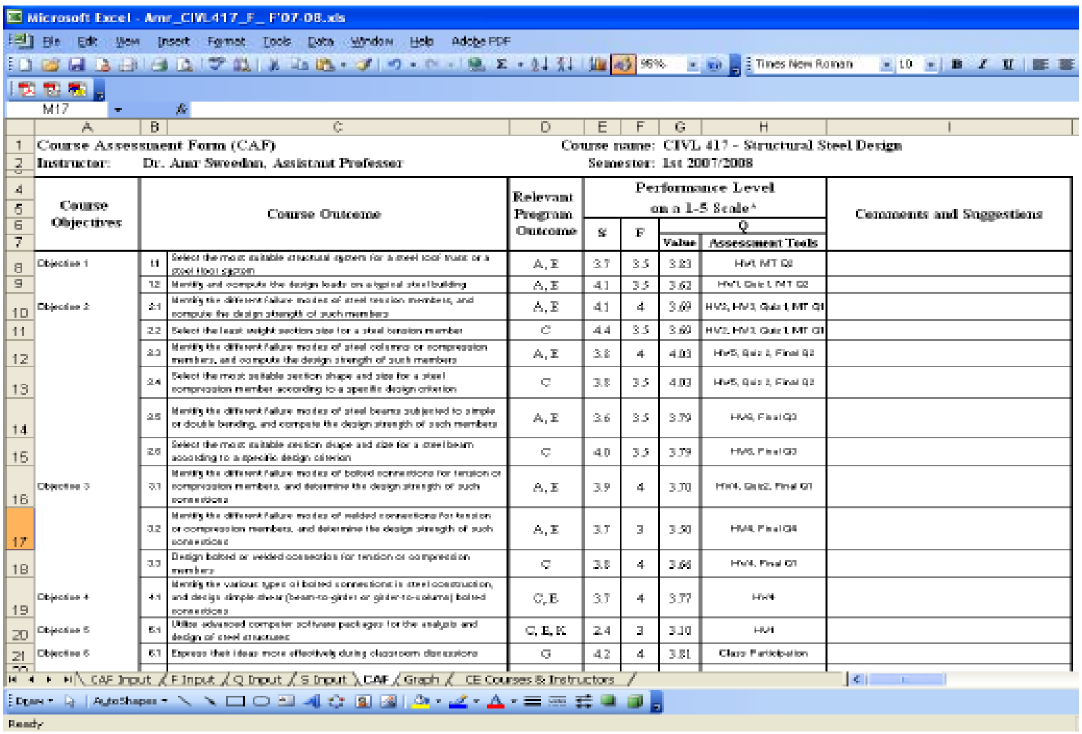
Please use the space below to bring to the attention of the Department any comments or suggestions for improving the effectiveness of the course. Also, include comments about issues such as the adequacy of your preparation in prerequisite courses, if applicable.

Fig. 5 Student Assessment of Course Survey Inserted into the Excel Sheet



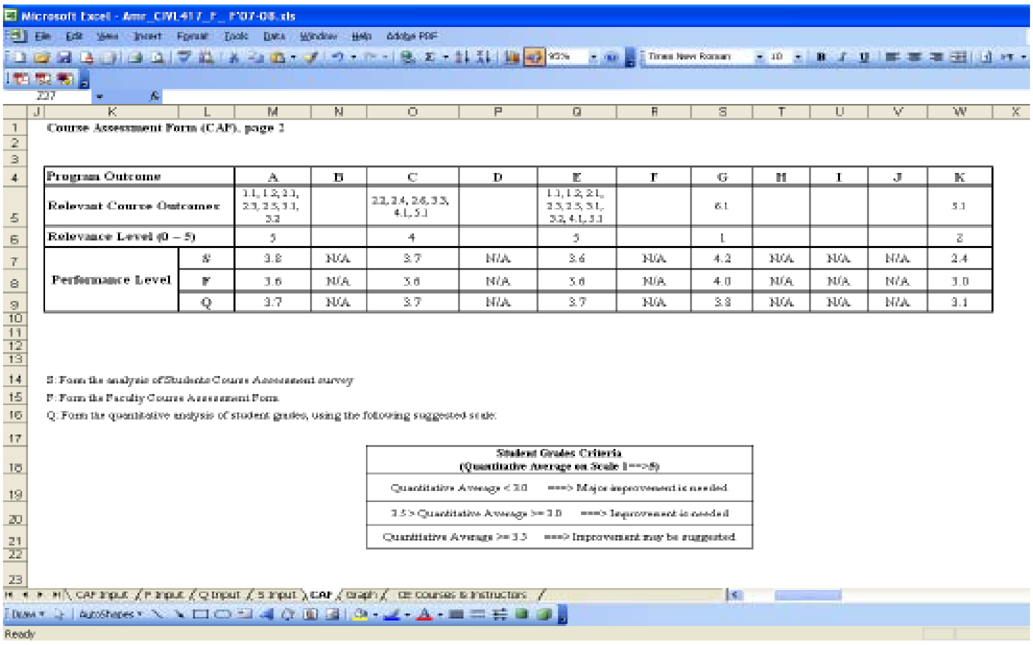
Row	1.1 Select the most suitable structural system for a steel roof truss or a steel floor system: HW1	MT Q2	1.2 Identify and compute the design loads on a typical steel building: HW1	Quiz 1	MT Q2	2.1 Identify the different failure modes of steel tension members, and compute the design strength of such members: HW2	HW3	Quiz 1	MT Q1	2.2 Select the least weight section size for a steel tension member: HW2	HW3	Quiz 1	MT Q1	2.3 Identify the different failure modes of steel columns or compression members, and compute the design strength of such members: HW5	Quiz 2	Final Q2
9	10	25	10	10	25	10	10	10	25	10	10	10	25	10	10	25
10	8.5	20	8.5	5	20	9	7	5	36	9	7	5	36	9	3.5	23
11	10	20	10	7.25	20	8	7.5	7.25	40	8	7.5	7.25	40	9.5	7.5	15
12	10	10	10	6.75	10	8	7.5	6.75	61	8	7.5	6.75	61	9.5	9.25	18
13	9.5	15	9.5	5.5	15	9	8.5	5.5	49	9	8.5	5.5	49	9.5	8.25	22
14	9.5	15	9.5	6.25	15	9	8.5	6.25	53	9	8.5	6.25	53	9.5	9	20
15	10	20	10	8.25	20	10	9	8.25	68	10	9	8.25	68	10	9.5	21
16	9	20	9	6.25	20	8.5	6.5	6.25	37	8.5	6.5	6.25	37	9	9	19
17	10	20	10	8.25	20	10	9	8.25	73	10	9	8.25	73	10	8	20
18	9	15	9	6	15	8.5	6.5	6	49	8.5	6.5	6	49	9	7	23.75
19	9	5	9	5.75	5	8.5	6.5	5.75	42	8.5	6.5	5.75	42	9	5.75	16
20	8.5	25	8.5	5.75	25	9	7	5.75	40	9	7	5.75	40	9	7.75	20
21	9.5	5	9.5	5.75	5	9	8.5	5.75	56	9	8.5	5.75	56	9.5	7.75	16
22	8.5	5	8.5	6.75	5	9	7	6.75	38	9	7	6.75	38	9	6.25	2

Fig. 6 Performance levels of the course by the faculty (F), student's survey (S) and Student's performance (Q)



Course Objectives		Course Outcome	Relevant Program Outcome	S	F	Q Value	Q Assessment Tools	Comments and Suggestions
Objective 1	1.1	Select the most suitable structural system for a steel roof truss or a steel floor system	A, E	3.7	3.5	3.83	HW1, MT Q2	
	1.2	Identify and compute the design loads on a typical steel building	A, E	4.1	3.5	3.62	HW1, Quiz 1, MT Q2	
Objective 2	2.1	Identify the different failure modes of steel tension members, and compute the design strength of such members	A, E	4.1	4	3.69	HW2, HW3, Quiz 1, MT Q1	
	2.2	Select the least weight section size for a steel tension member	C	4.4	3.5	3.69	HW2, HW3, Quiz 1, MT Q1	
	2.3	Identify the different failure modes of steel columns or compression members, and compute the design strength of such members	A, E	3.8	4	4.03	HW5, Quiz 2, Final Q2	
	2.4	Select the most suitable section shape and size for a steel compression member according to a specific design criterion	C	3.8	3.5	4.03	HW5, Quiz 2, Final Q2	
	2.5	Identify the different failure modes of steel beams subjected to simple or double bending, and compute the design strength of such members	A, E	3.6	3.5	3.79	HW6, Final Q3	
	2.6	Select the most suitable section shape and size for a steel beam according to a specific design criterion	C	4.0	3.5	3.79	HW6, Final Q3	
Objective 3	3.1	Identify the different failure modes of bolted connections for tension or compression members, and determine the design strength of such connections	A, E	3.9	4	3.70	HW4, Quiz2, Final Q1	
	3.2	Identify the different failure modes of welded connections for tension or compression members, and determine the design strength of such connections	A, E	3.7	3	3.50	HW4, Final Q4	
	3.3	Design bolted or welded connection for tension or compression members	C	3.8	4	3.66	HW4, Final Q1	
Objective 4	4.1	Identify the various types of bolted connections in steel construction, and design simple shear (beam-to-girder or girder-to-column) bolted connections	C, E	3.7	4	3.77	HW4	
Objective 5	5.1	Utilize advanced computer software packages for the analysis and design of steel structures	C, E, K	2.4	3	3.10	HW1	
Objective 6	6.1	Express their ideas more effectively during classroom discussions	G	4.2	4	3.81	Class Participation	

Fig. 7 Performance assessment of the program-outcome-related course contents outcomes



Course Assessment Form (CAF), page 2

Program Outcome		A	B	C	D	E	F	G	H	I	J	K
Relevant Course Outcomes		1.1, 1.2, 2.1, 2.3, 2.5, 3.1, 3.2		2.2, 2.4, 2.6, 3.3, 4.1, 5.1		1.1, 1.2, 2.1, 2.3, 2.5, 3.1, 3.2, 4.1, 5.1		6.1				5.1
Relevance Level (0 – 5)		5		4		5		1				2
Performance Level	S	3.8	N/A	3.7	N/A	3.6	N/A	4.2	N/A	N/A	N/A	2.4
	F	3.6	N/A	3.6	N/A	3.6	N/A	4.0	N/A	N/A	N/A	3.0
	Q	3.7	N/A	3.7	N/A	3.7	N/A	3.8	N/A	N/A	N/A	3.1

S: Form the analysis of Students Course Assessment survey
F: Form the Faculty Course Assessment Form
Q: Form the quantitative analysis of student grades, using the following suggested scale:

Student Grades Criteria (Quantitative Average on Scale 1==>5)
Quantitative Average < 3.0 ===> Major improvement is needed
3.5 > Quantitative Average >= 3.0 ===> Improvement is needed
Quantitative Average >= 3.5 ===> Improvement may be suggested

Fig. 8 Assessment of course results

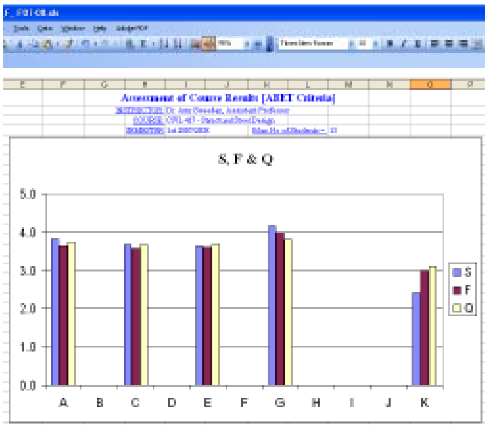


Fig. 9 Assessment of the course outcomes