Assessment Report for Academic Year 2018 – 2019

Submitted to California State University, Northridge (CSUN) by The Manufacturing Systems Engineering Management (MSEM) Department, College of Engineering and Computer Science.

Program Assessed: B.S. Engineering Management & B.S. Manufacturing Systems Engineering

Overview of Annual Assessment Project(s) -- this is provided on a separate sheet as requested in the template provided to us.

1. An explanation for why your department chose the assessment activities (measurement, analysis, and/or application) that it enacted – The Manufacturing Systems Engineering & Management (MSEM) Department, just like other engineering departments has to follow ABET Accreditation guidelines. In order to fulfill the ABET accreditation requirements, we selected the classes to assess during the 2018 – 2019 academic year that would cover some of the student outcomes that ABET requires us to assess and then analyze and then implement continuous improvement on. This academic year of 2018-19 was extremely critical as far as the assessment goes for our ABET external accreditation as we had our site visit from October 6-8, 2019, which went well.

As in past year, the courses are selected as part of the direct assessment that is related to the SLOs and then to assess the data and then make corresponding changes so that we can show ABET that we are "closing the loop" and indeed implementing continuous improvement on our programs. Certain courses (and the related outcomes) were selected for the reason that they fit in with the department's long term assessment plan. It is important to note that the Engineering Management and Manufacturing Systems Engineering programs have most courses in common due to which the courses serve the purpose of assessment towards both degrees. There 2 courses that are specific only to the B.S. Engineering Management Degree are MSE 402 (Engineering Project Management) and MSE 406 (Engineering Cost Analysis) and the courses which are specific to the B.S. Manufacturing Systems Engineering degree are: MSE 409 (Fundamentals of Computer-Aided Manufacturing and Lab) and MSE 412 (Manufacturing Process and Lab).

2. If your department implemented assessment option A, identify which program SLOs were assessed (please identify the SLOs in full), in which classes and/or contexts, what assessment instruments were used and the methodology employed, the resulting scores, and the relation between this year's measure of student work and that of past years:

ABET changed the SLOs associated with engineering programs in December 2017 (that is when the announcement was made) and so effective Fall 2018, the MSEM department adopted the new SLOs as laid down by ABET.

The new ABET SLOs were 1 – 7 (instead of the old A – K SLOs) and they are listed below:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Hence, the department assessment coordinator, with consultation with the department faculty, created a new SLO to Course Matrix which is shown below:

Engineering Management & MSE Courses Versus Outcomes Matrix							
Courses ▾	Outcome						
	1	2	3	4	5	6	7
MSE 101			X	X	X		X
MSE 227	X			X			
MSE 227 L		X	X		X	X	
MSE 248/L		X				X	
MSE 304	X				X		
MSE 362		X				X	
MSE 401			X	X	X		X
MSE 402			X	X	X		X
MSE 403CS		X	X	X			X
MSE 406	X			X	X		X
MSE 407		X	X			X	
MSE 409		X				X	
MSE 410/L	X	X				X	
MSE 412/L		X				X	
MSE 415		X		X			
MSE 420			X	X	X		X
MSE 488A/B	X	X	X	X	X	X	X

Table 1: Courses versus Outcome Matrix for new ABET SLOs

The SLOs are reviewed periodically and then revised if deemed necessary by the stakeholders. The process for review and revision (if necessary) is shown in the figure below. However, since 2018 -- 19, was the first year that the new SLOs went into effect, we will examine them in 2021 as we re-examine the SLOs every 3 years, as that is the middle of a 6 year assessment cycle.

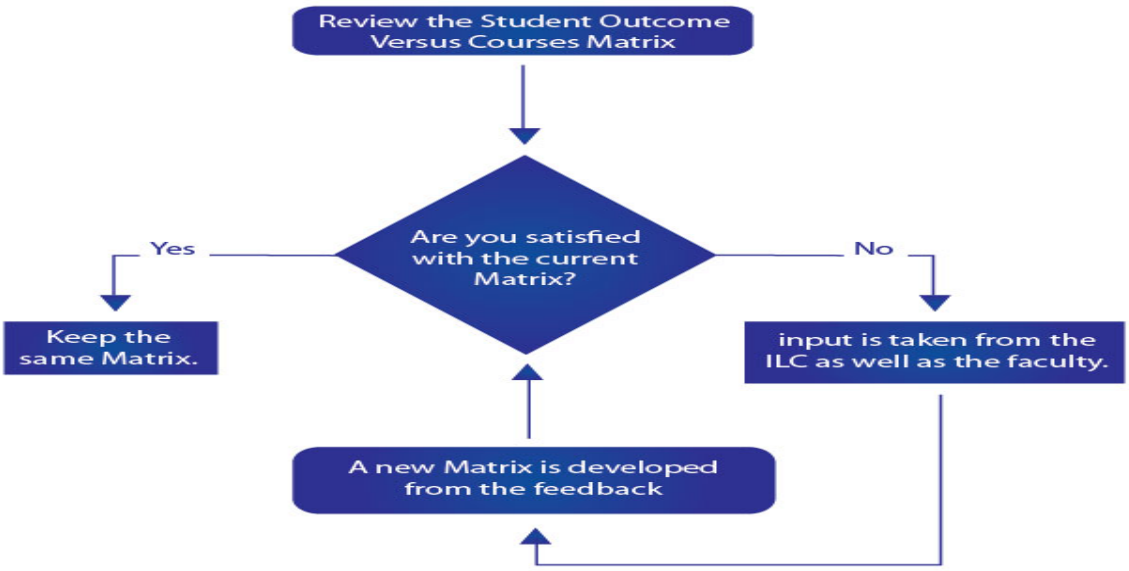
Figure 1: Process for Review & Revision of SLOs in B.S. Engineering Management & B.S. Manufacturing Systems Engineering program

Based on Table 1, it is important to note that the courses MSE 402 and MSE 406 are required courses only for the B.S. Engineering Management Degree whereas the courses MSE 409/L, MSE 410/L and MSE 412/L are required courses for the B.S. Manufacturing Systems Engineering Degree. But besides those courses, all the courses overlap for the B.S. Engineering Management Program and the B.S. Manufacturing Systems Engineering Program.

A similar process as the one shown in Figure 1, is used to assess and revise (if deemed necessary) the courses versus SLOs matrix as well

This process is shown in Figure 2 below:

Figure 2: Process to review and revise courses versus SLOs matrix



Assessment & Evaluation Process

For the assessment and evaluation process of the student outcomes, we use both Direct Measures as well as Indirect Measures. The direct measures include assignments, case studies, presentations, reports and exams of the courses which are related to the outcomes. The indirect measures include exit interviews conducted for the graduating students and also surveys that are conducted for the students as well as faculty.

Assessment & Evaluation Process for the Direct Measures

As mentioned above, the direct measures include assignments, presentations, reports and exams of courses associated with various student outcomes. These direct measures are assessed and evaluated initially by the instructor who teaches the course. Once that is completed, the Assessment Coordinator does the overall evaluation of all the course assignments/exams associated with a particular outcome.

To explain the process of how the contribution of an assignment/exam in a course in the B.S. EM or B.S MSE curriculum to a student outcome is identified, defined and then collected, we are going to consider the course MSE 403CS as an example. The course is titled, "Facilities Planning and Design," which is a senior level course that is required for all BS Engineering Management and B.S. Manufacturing Systems Engineering majors.

Step 1 in the process is to refer to the course versus student outcomes matrix (which in this report is Table 1) and determine which outcomes are associated with the course. Since we are considering the course MSE 403CS, the outcomes associated with the course would be Outcomes 2, 3, 4 and 7.

Step 2 involves relating the course learning objectives to the student outcomes listed above for the particular course, which in this case is MSE 403CS. This relationship is shown in a document titled "course assessment matrix." A sample of the course assessment matrix for MSE 403CS is shown in Figure 3.

ABET COURSE ASSESSMENT MATRIX Course: MSE403CS – Facilities Planning and Design Prepared by: Bingbing Li Date: December 2018 Outcome-related course learning objectives	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6	Outcome 7
1. Knowledge of, and ability to integrate product, process, and schedule design information to plan, analyze, and design new or modify existing manufacturing and service facilities.		5					
2. Knowledge of and ability to define personnel requirements to design new or modify existing manufacturing and service facilities.				7			
3. Knowledge of and ability to apply models and analytical procedures for the study of facilities layout planning.		7					
4. Knowledge of and ability to use current methodology to evaluate and design material handling.		5					
5. Knowledge of and ability to describe the features and particulars of computerized heuristic plant layout systems.							5
6. Knowledge of and ability to prepare a written project report for a newly designed/modified facility.			5				
TARGETED CONTRIBUTIONS TO PROGRAM OUTCOMES		17	5	7			5

Figure 3: Sample of Course Assessment Matrix

As you can see from Figure above, the instructor teaching the course and collecting the data has to establish a relationship between the course learning objectives and the student outcomes. In this case, the course learning objective #s 1, 3 and 4 are all related to Student Outcome 2; course-learning objective # 2 is related to Student Outcome 4, course-learning objective # 5 is related to Outcome 7 and the course-learning objective # 6 is related to Student Outcome 3. Once this initial relationship has been established, a quantitative value has to be assigned to judge the expected extent to which the course learning objective could be related to the outcome. The values that can be assigned to show the extent of the relationship between the course-learning objective and the student outcome are:

1 = incidentally, 3 = low level, 5 = moderate level, 7 = high level, 9 = exceptionally high level.

Step 3: Once the quantitative relationships have been established, the totals for each outcome are summed up. For example, for Outcome 2, the total targeted contribution is 17. Similarly, for Outcome 3 the total targeted contribution is 5 and so on and so forth for all the remaining outcomes associated with MSE 403CS.

Step 4: Once the targeted contributions are put into the course assessment matrix, the course evidence table is prepared. A sample of the course evidence table is shown in Figure 4.

ABET COURSE EVIDENCE TABLE
Course: MSE403CS – Facilities Planning and Design
Prepared by: Bingbing Li Date: December 2018

Course Learning Objective Number	SLOs	Contribution Ratings(s)	Specific Evidence source(s)	Achievement Criteria	Assessment Results	Evidence Location(s)	Assessment Location(s)
1	2	5	HW 1 HW 2 Exam 1	Mean ≥70% Mean ≥70% Mean ≥70%	Mean was 86.09 Mean was 93.04 Mean was 88.22	Course drawer	JD3315
2	4	7	HW 2 Final Project	Mean ≥70% Mean ≥70%	Mean was 93.04 Mean was 92.61	Course drawer	JD3315
3	2	7	HW 3 HW 4 Exam 1 Final Exam	Mean ≥70% Mean ≥70% Mean ≥70% Mean ≥70%	Mean was 73.48 Mean was 80.65 Mean was 88.22 Mean was 84.09	Course drawer	JD3315
4	2	5	HW 5 HW 6 Exam 1	Mean ≥70% Mean <70% Mean ≥70%	Mean was 90.00 Mean was 55.52 Mean was 88.22	Course drawer	JD3315
5	7	5	HW 3 Exam 1	Mean ≥70% Mean ≥70%	Mean was 73.48 Mean was 88.22	Course drawer	JD3315
6	3	5	Final Project	Mean ≥70%	Mean was 92.61	Course drawer	JD3315

Figure 4: Course Evidence Table

As seen in Figure 4, the course evidence table shows the specific direct measures that have been used from the particular course to assess the extent of fulfillment of the concerned outcome. For example, it is shown that for course learning objective # 1, which relates to student outcome 2, the direct measure tools, i.e, assignments used to evaluate the actual contribution rating were HW 1, HW 2 and Exam 1.

Step 5: Once the individual quantitative relationships have been established and the total targeted contributions have been calculated for each outcome associated with the course, the instructor has to calculate the actual achieved values for the relationships through the direct measures related to the course that have been used for this purpose. The actual achieved values of the relationships of the course learning objectives to the outcomes is calculated using the formula that has been developed by the assessment committee. The formula is to take the mean values of the direct measures used and add them all up and divide by the number of direct measure assessment tools in that particular case. Multiply this answer by the initially stated correlation between the course-learning objective and the student outcome and then divide that by 70. That result gives the demonstrated contribution to the program outcome in consideration in that case.

To demonstrate the above explanation provided in Step 5, consider that for course learning objective # 1 versus student outcome 2, the initial expected contribution is 5. The direct measure assessment tools used were HW 1, HW 2 and Exam 1, for which the mean values were 86.09,

93.04 and 88.22 respectively. So the formula to calculate the **actual contribution** for the above specific case of course learning objective # 1 versus student outcome 2 is:

Actual Contribution

= Contribution Rating * ((MeanHW1 + MeanHW2 +MeanExam1)/3)/70

= 5 * ((86.09+93.04+88.22)/3)/70

= 5 * (89.11) / 70))

= 6.35

In the above equation, the numerator is (86.09+93.04+88.22)/3), which is divided by the minimum acceptable value, which is 70%; and the result of that is called the prorated average. This prorated average, which in this case is 1.273. If this prorated average is > 1, then the achieved value is greater than the achievement criteria. The minimum acceptable value is assigned to be 70% because that equates to a C-, which is the minimum passing grade required in all major courses in the program and also equates to a 2.0 GPA.

These actual contributed values are displayed in the course assessment report that is shown in Figure 5.

Step 6: Once these values have been calculated, the values are summed up and the demonstrated contribution for each outcome is calculated as shown in Figure 5.

ABET COURSE ASSESSMENT REPORT Course: MSE 403CS – Facilities Planning and Design Prepared by: Bingbing Li Date: December 2018 Outcome-related course learning objectives	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5	Outcome 6	Outcome 7
1. Knowledge of, and ability to integrate product, process, and schedule design information to plan, analyze, and design new or modify existing manufacturing and service facilities.		6.35					
2. Knowledge of and ability to define personnel requirements to design new or modify existing manufacturing and service facilities.				9.28			
3. Knowledge of and ability to apply models and analytical procedures for the study of facilities layout planning.		8.16					
4. Knowledge of and ability to use current methodology to evaluate and design material handling.		6.56					
5. Knowledge of and ability to describe the features and particulars of computerized heuristic plant layout systems.							5.78
6. Knowledge of and ability to prepare a written project report for a newly designed/modified facility.			6.62				
DEMONSTRATED CONTRIBUTION TO PROGRAM OUTCOMES		21.07	6.62	9.28			5.78
TARGETED CONTRIBUTIONS TO PROGRAM OUTCOMES		17	5	7			5
COMPRASONS WITH TARGETS		>	>	>			>

Figure 5: Course Assessment Report

Step 7: Once the **demonstrated contribution** totals have been calculated for each of the outcomes, it has to be compared to the targeted contribution for that outcome. This targeted contribution value is obtained from the course assessment matrix and if the total value achieved for the outcome is greater than the targeted value, then the measures used are supposed to have fulfilled that particular course's contribution to achieving the outcome. For example, in Figure 5, we can see for Outcome 2, since the actual achieved value is 21.07 and the targeted value was 17, MSE 403CS has fulfilled its contribution towards achieving Outcome 2. The last row of the course assessment matrix clearly shows the result of the comparison with targets. If the achieved value is greater than the targeted value, it is denoted by " > ", if the actual value is lesser than the targeted value, it is denoted by " < " and finally if the targeted value and the actual value achieved are equal it is denoted by "=".

If the course has not fulfilled its contribution towards achieving a particular student outcome, there have to be specific recommendations made which would help to achieve the student outcome better. Even if the course has fulfilled its contribution towards achieving a particular student outcome, the instructor is still encouraged to make suggestions for continuous improvement.

The above steps that describe the process for assessing and evaluating student outcomes using direct measures in the courses related to the outcome is shown in Figure 6. It is important to note that in this case the direct measures are the exams, assignments, reports, presentations, etc. from the engineering management classes related to the various student outcomes.

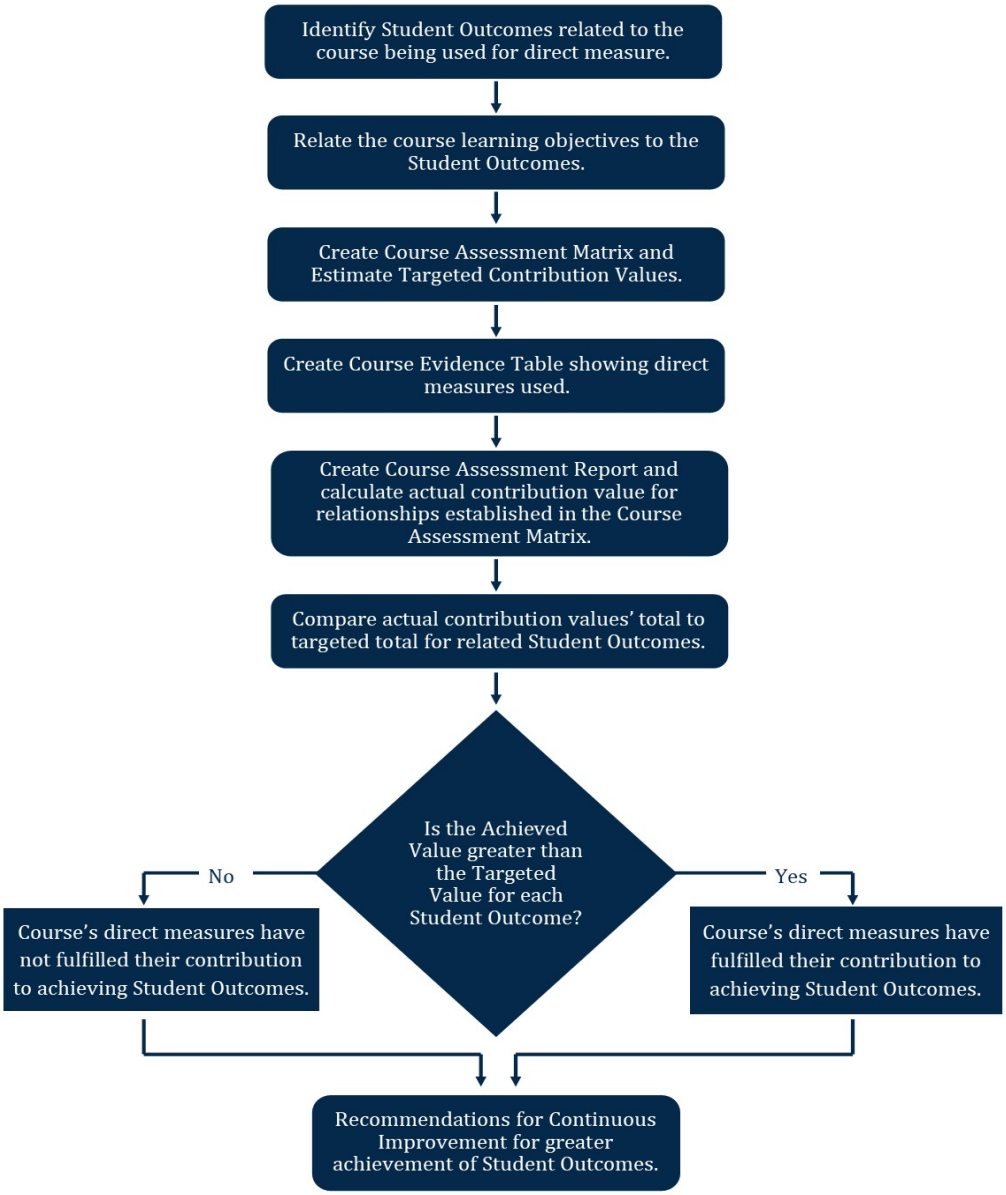


Figure 6: Process to assess & evaluate student outcomes using part of the direct measures only, i.e. assignments, reports, exams, etc. in the courses of the EM curriculum.

The above-mentioned process is followed for all the courses that are selected to be part of the assessment process, which consists of core courses in the BS Engineering Management and BS Manufacturing Systems Engineering program. Once this data using direct measures, is collected and evaluated by an individual faculty member, it is then evaluated all together for each outcome.

For the academic year 2018-19, the following courses were assessed:

Semester	Courses Assessed for Direct Measures	SLOs covered by the courses assessed
Fall 2018	MSE 101 MSE 227/L MSE 304 MSE 401 MSE 403CS MSE 415 MSE 488A	1, 2, 3, 4, 5, 6, 7
Spring 2019	MSE 488B Please Note this is the senior design class which addresses all SLOs	1, 2, 3, 4, 5, 6, 7

Figure 7: Scheduule of courses assessed in 2018-19 academic year

<u>Results of Data Assessed and how it has been used for continuous improvement</u>

Based on the courses assessed in the academic year, 2018 – 19, and the data that was analyzed from those courses, the findings were as follows:

<u>Fall 2018 Data</u>

	SO_1	SO_2	SO_3	SO_4	SO_5	SO_6	SO_7
Target Value	99	104	102	136	119	37	97
Demonstrated Value	117.43	133.52	141.79	180.45	163.5	47	130.02
% (Dem Vs Target)	118.6%	128.4%	139%	132.7%	137.4%	127%	134%
Status	>	>	>	>	>	>	>

Figure 8: Fall 2018, Data Collected for ABET Assessment

In Figure 8, it is shown which student outcomes were assessed during that semester. It also shows the total targeted value for student outcomes 1, 2, 3, 4, 5, 6 and 7 for Fall 2018 and the total of the corresponding actual demonstrated value. If the demonstrated value is greater than the target value, the contribution of those courses towards that outcome is said to have been fulfilled. As mentioned earlier in this report, from Fall 2018, the department started collecting data using the new [1—7] outcomes.

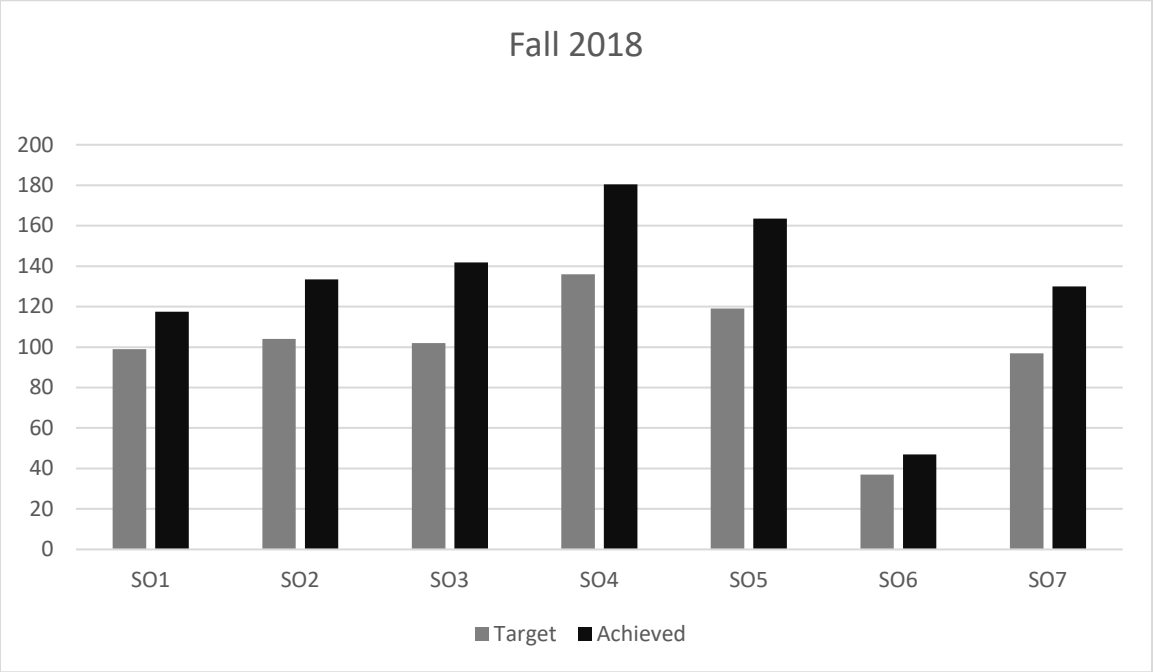


Figure 9: Fall 2018, Data Collected for student outcomes 1, 2, 3, 4, 5, 6 and 7

Spring 2019 Data

	SO_1	SO_2	SO_3	SO_4	SO_5	SO_6	SO_7
Target Value	40	38	39	24	57	37	28
Demonstrated Value	48.9	46.2	50.1	29.1	70.8	45.5	34.4
% (Dem Vs Target)	122.3%	121.6%	128.5%	121.3%	124.2%	123%	122.9%
Status	>	>	>	>	>	>	>

Figure 10: Spring 2019, Data Collected for ABET Assessment

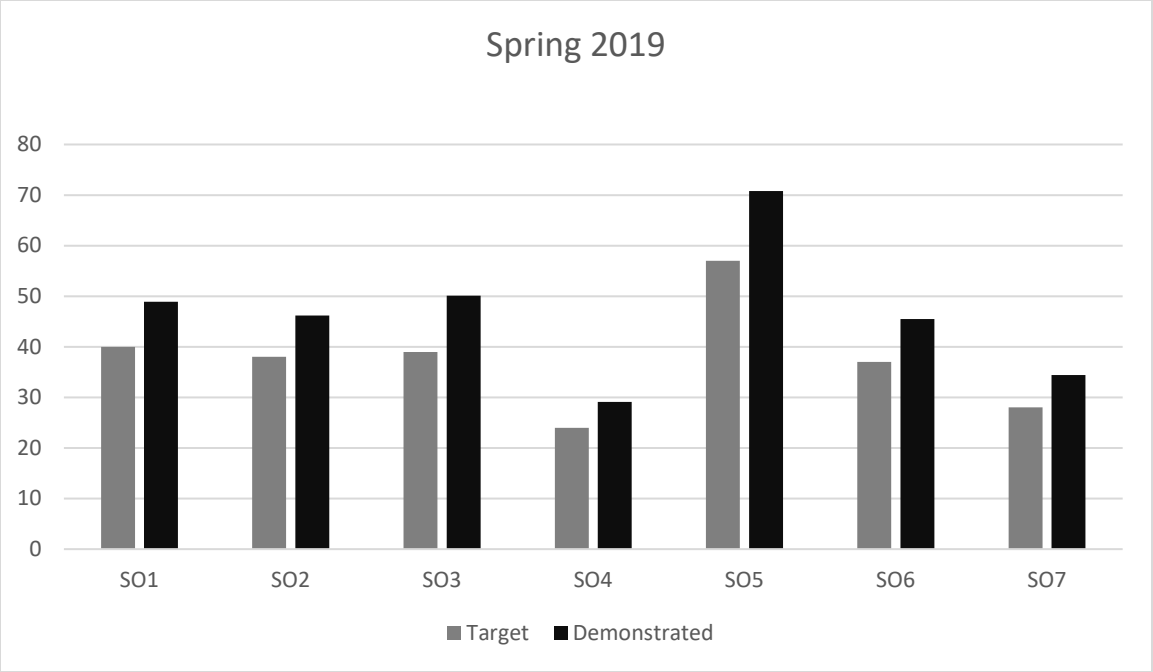


Figure 11: Spring 2019, Data Collected for student outcomes 1, 2, 3, 4, 5, 6 and 7

From the data assessed for the academic year 2018-19 ONLY, it shows that the MSEM department is achieving the SLOs set forth by ABET.