

Outcomes Data

The ABET committee meets annually to review the collected data and evaluate the achievement of student outcomes. In particular, the committee members review the data resulting from the four primary assessment tools. The committee then ensures that each performance indicator is achieved with a score of 3 or greater for each assessment tool. Should the score for any performance indicator fall below the minimum level, the ABET committee determines the cause for the low score and formulates a corrective action. This corrective action is then brought to the full faculty for consideration. The committee also considers the written comments which are part of the senior interviews and Advisory Board assessments.

Student Outcome Evaluation Summary Results for 2012-13 Academic Year

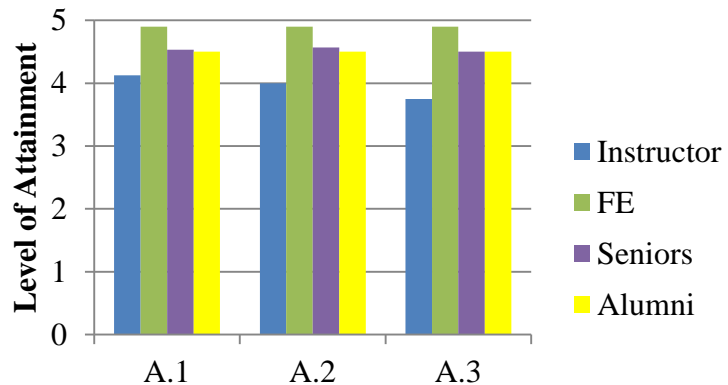
The following is a graphical summary of the numerical component of the assessment results from the 2012-13 academic year (AY) for each of the (A-L) student outcomes/performance indicators. Note that for 2013-14 and all subsequent years, Alumni results have been superseded by Advisory Board survey results (with significant alumni representation).

Based on the results presented below, it is clear that the department is, in general, doing an excellent job of meeting the student outcomes/performance indicators. This is not unexpected as the mechanical engineering program at Utah State University is a mature program that has operated successfully for many decades. However, we stress that a score of 3 or above in the assessment process does not mean that our students are all doing above average work; it does indicate that they are satisfactorily achieving the student outcomes as measured by the performance indicators.

Criterion A

3a) An ability to apply knowledge of mathematics, science, and engineering,

- 3a1: Students apply scientific and engineering principles to formulate a mathematical model of a system or process, which is appropriate for the required accuracy.
- 3a2: Students apply mathematical principles to obtain an analytical or numerical solution to model equations.
- 3a3: Students understand alternate approaches to solving engineering problems, in order to help choose an effective approach.



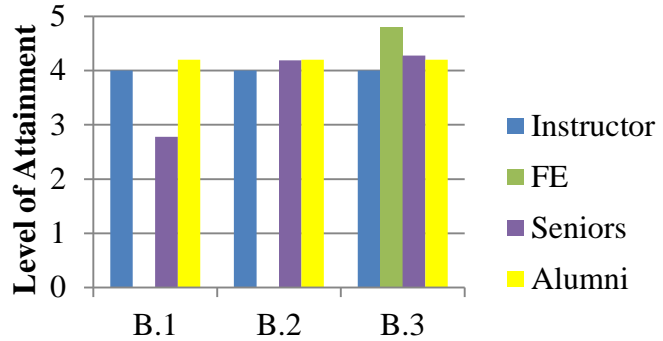
Performance Indicators for Criteria A

Recommendations/Concerns: None

Criterion B

3b) An ability to design and conduct experiments, as well as to analyze and interpret data,

- 3b1: Determines data that are appropriate to collect and selects appropriate equipment, protocols, etc. for measuring the appropriate variables to get accurate test results.
- 3b2: Students design and perform experiments and operate instrumentation in a manner appropriate for the required accuracy.



Performance Indicators for Criteria B

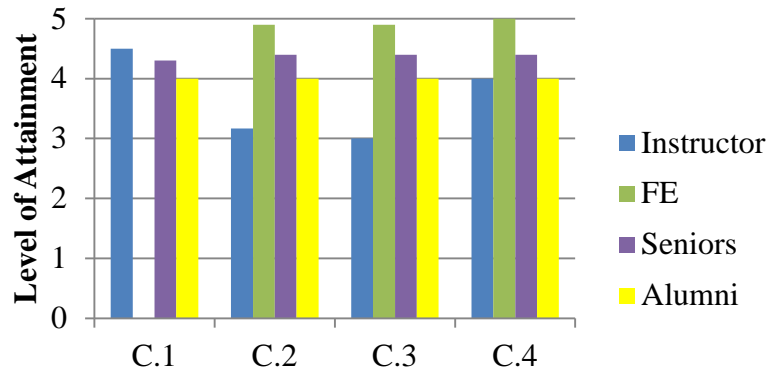
- 3b3: Uses appropriate tools to analyze data and verifies and validates experimental results including the use of statistics to account for possible experimental error.

Recommendations/Concerns: The senior's evaluation for performance indicator *b1* fell slightly below the minimum acceptable value of 3. The undergraduate curriculum committee has reviewed these results and modified MAE 3340, Instrumentation & Measurements, to address this issue as described in Section 4.B.1.

Criterion C

3c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability,

- 3c1: Students produce a clear and unambiguous needs statement for a design project.
- 3c2: Students identify the realistic constraints on a design problem.
- 3c3: Students develop criteria for acceptability and desirability of solutions.



Performance Indicators for Criteria C

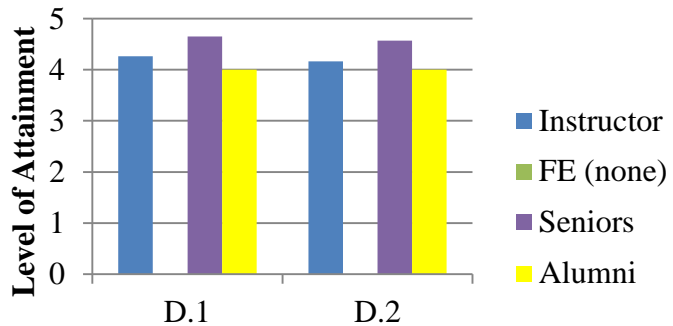
- 3c4: Students apply appropriate scientific and engineering principles to design a system, component, or process that meets desired needs.

Recommendations/Concerns: Performance indicators *c2* and *c3* will be closely monitored as instructor assessment results just met the minimum standards.

Criterion D

3d) An ability to function on multi-disciplinary teams,

- 3d1: Students participate in a team setting and fulfill appropriate roles to assure team success.
- 3d2: Students integrate input from all team members and make decisions in relation to the team objectives.



Performance Indicators for Criteria D

Recommendations/Concerns: None

Criterion E

3e) An ability to identify, formulate, and solve engineering problems,

- 3e1: Students apply scientific and engineering principles to formulate a complete mathematical model appropriate for the engineering problem.
- 3e2: Students apply mathematical principles to obtain an analytical or numerical solution to the complete mathematical model.
- 3e3: Students understand the accuracy associated with the analytical, numerical, or experimental method being used.

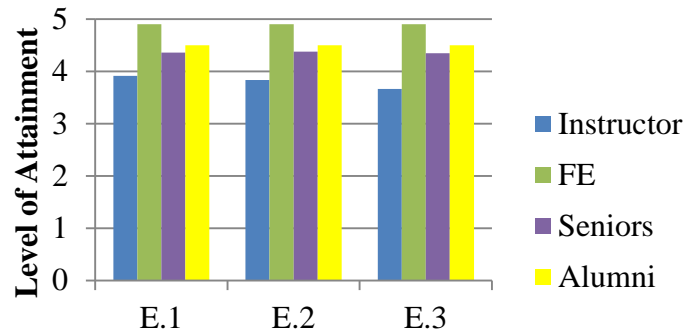
Recommendations/Concerns: None

Criterion F

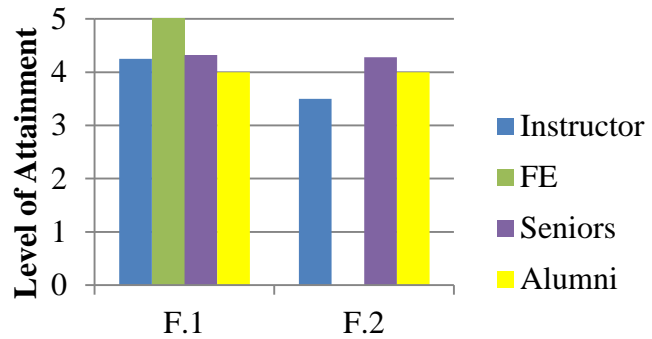
3f) An understanding of professional and ethical responsibility,

- 3f1: Students understand the ASME Code of Ethics of Engineers.
- 3f2: Students apply the ASME Code of Ethics to a case study to evaluate the ethical dimensions of an engineering problem solution.

Recommendations/Concerns: None



Performance Indicators for Criteria E

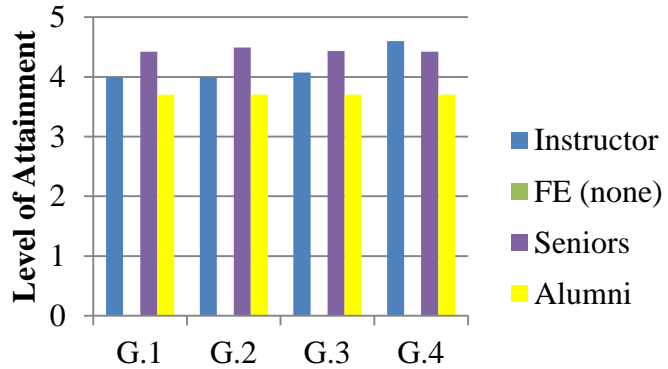


Performance Indicators for Criteria F

Criterion G

3g) An ability to communicate effectively,

- 3g1: Students apply the correct technical style and format appropriate for the audience.
- 3g2: Students use appropriate graphical standards in written and oral communications.
- 3g3: Students apply the rules of grammar and composition appropriately in written communication.
- 3g4: Students prepare and give oral presentations on technical topics.



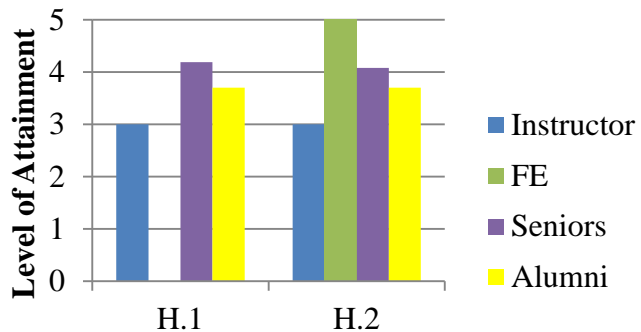
Performance Indicators for Criteria G

Recommendations/Concerns: Despite the high scores, qualitative feedback from MAE faculty course surveys supports increased need for technical writing and oral presentation training. The Industrial Advisory Board also supports this recommendation. The ABET Committee has recommended a plan outlined in section 4.B.3 to address this concern.

Criterion H

3h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context,

- 3h1: Students evaluate cases studied with conflicting/competing social values to make informed decisions about an engineering solution.
- 3h2: Students evaluate and analyzes the economics of an engineering solution.



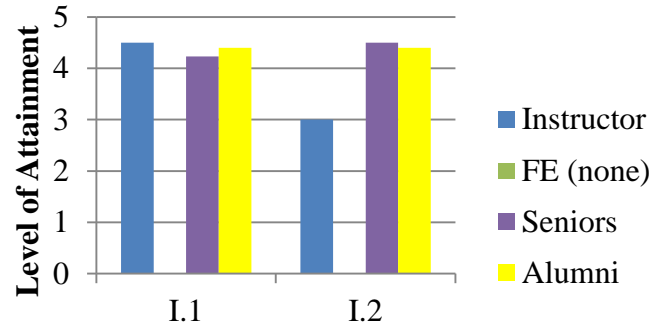
Performance Indicators for Criteria H

Recommendations/Concerns: None Although the *h1* and *h2* Instructor scores are at or above acceptable minimums, the ABET Committee recognizes the need to improve these scores. As such, the ABET Committee has recommended a plan outlined in section 4.B.3 to address this concern.

Criterion I

3i) A recognition of the need for, and an ability to engage in life-long learning,

- 3i1: Students find external information relevant to an engineering problem without guidance.
- 3i2: Students explain the need for lifelong learning.



Performance Indicators for Criteria I

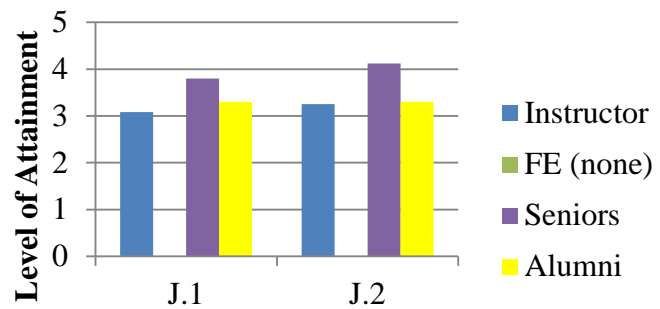
Recommendations/Concerns:

Performance indicator *i2* will be closely monitored as instructor assessment results just met the minimum standards.

Criterion J

3j) A knowledge of contemporary issues,

- 3j1: Students identify current critical issues confronting mechanical engineers.
- 3j2: Students evaluate case studied that present alternative engineering solutions or scenarios taking into consideration current issues.



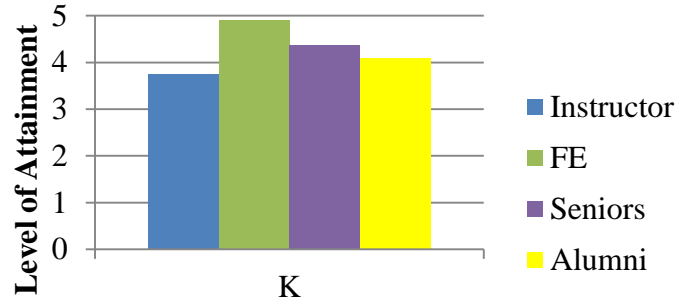
Performance Indicators for Criteria J

Recommendations/Concerns: Performance indicator *j1* and *j2* will be closely monitored as instructor assessment results just exceeded the minimum standards.

Criterion K

3k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Recommendations/Concerns: None



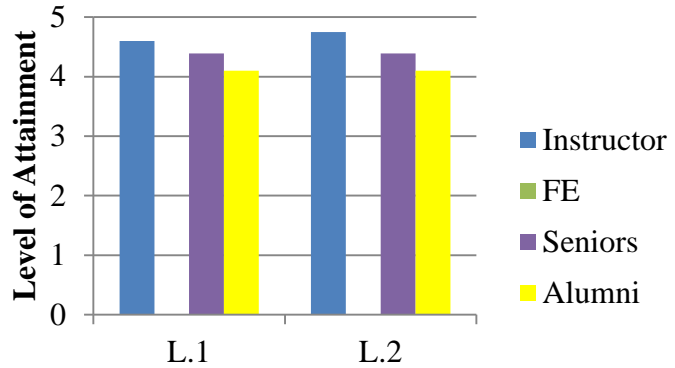
Performance Indicators for Criteria K

Criterion L

3l) An ability to work professionally in either thermal or mechanical system areas including the design and realization of such systems.

- 3l1: Students design a mechanical or thermal system, component, or process.
- 3l2: Students realize a mechanical or thermal physical system, component, or process.

Recommendations/Concerns: None



Performance Indicators for Criteria L

FE Results Mapped to Individual Courses

In addition to FE result mappings based on cumulative course averages (graphs above), we show in Table 4-3 below a mapping between performance indicators and FE exam subject areas, with sufficient detail to include individual course mappings. The five-year averages shown below indicate that with the exception of mathematics, students on average score in the 70th percentile or above for each FE exam topic. The mathematics score is above the 60th percentile. These individual course scores further support the achievement of student outcomes (that can be measured by the FE exam) at a high level.

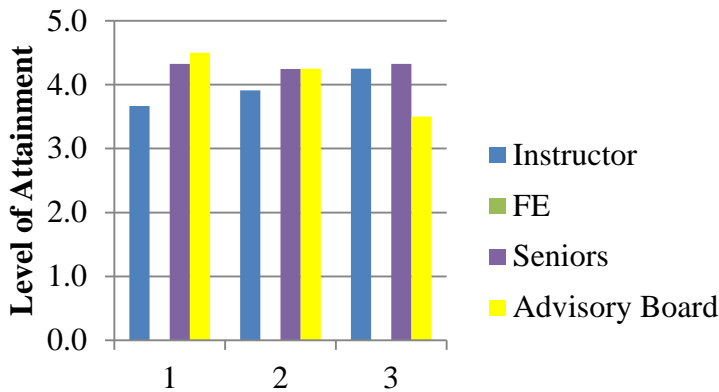
Table 4-3. Mapping between indicators and FE Exam Subject Areas

FE Exam Topic	Student outcomes/Performance indicators												
	3a1	3a2	3a3	3b3	3c2	3c3	3c4	3e1	3e2	3e3	3f1	3h2	3k
Morning Exam													
Mathematics	4	4	4	4	4	4	4	4	4	4			4
Eng. Probability & Statistics				5		5	5			5			5
Chemistry													
Computers	5	5	5	5	5	5	5	5	5	5			5
Ethics and Business Practices							5				5		
Engineering Economics												5	
Eng. Mechanics (Statics & Dynamics)	5	5	5		5	5	5	5	5	5			5
Eng. Mechanics (Statics)	5	5	5		5	5	5	5	5	5			5
Eng. Mechanics (Dynamics)	5	5	5		5	5	5	5	5	5			5
Strength of Materials	5	5	5		5	5	5	5	5	5			5
Material Properties	5	5	5		5	5	5	5	5	5			5
Fluid Mechanics	5	5	5		5	5	5	5	5	5			5
Electricity and Magnetism	5	5	5		5	5	5	5	5	5			5
Thermodynamics	5	5	5		5	5	5	5	5	5			5
Afternoon Exam													
Mechanical Design & Analysis	5	5	5		5	5	5	5	5	5			5
Kinematics, Dynamics & Vib.	5	5	5		5	5	5	5	5	5			5
Materials and Processing	5	5	5		5	5	5	5	5	5			5
Measurements, Instrumentation & Controls	5	5	5	5	5	5	5	5	5	5			5
Thermodynamics and Energy Conversion Processes	5	5	5		5	5	5	5	5	5			5
Fluid Mechanics and Fluid Machinery	5	5	5		5	5	5	5	5	5			5
Heat Transfer	5	5	5		5	5	5	5	5	5			5
Refrigeration and HVAC	5	5	5		5	5	5	5	5	5			5
Overall Score	4.9	4.9	4.9	4.8	4.9	4.9	5	4.9	4.9	4.9	5	5	4.9

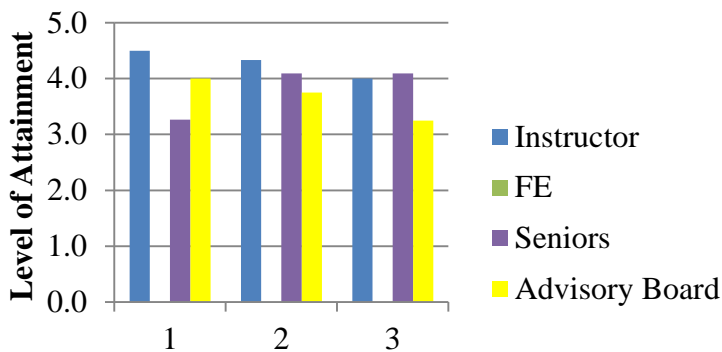
Student Outcome Evaluation Summary Results for 2013-14 Academic Year

Similar to the previous data, summary results for the 2013-14 AY are presented below. Note that the FE data for students completing the exam under the new format during the spring 2014 semester will not be available until mid-July, and hence are absent from the graphs. Upon receipt of this data, the ABET committee will meet to review results from all assessment tools and make recommendations to the undergraduate curriculum committee. Consequently, the recommendations/concerns are not listed, but will be available for the September site visit. Note that the Alumni results for the 2012-13 evaluation have been superseded by Advisory Board results.

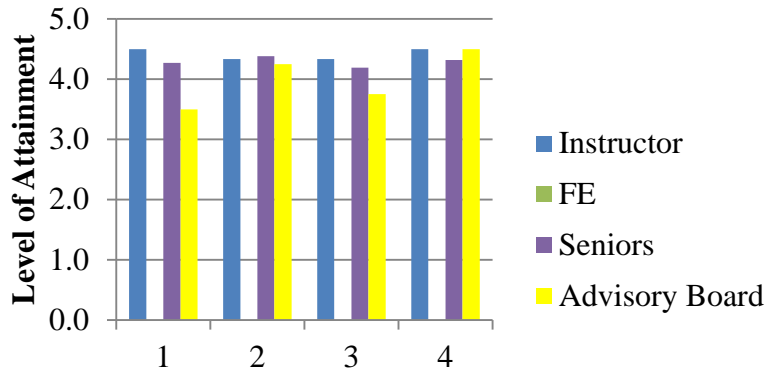
A preliminary review of the data indicates that instructor evaluations of performance indicators *c2*, *c3*, *h1*, and *h2* have significantly improved. However, the instructor evaluation for *i2* remained at the minimum acceptable level of 3. Consequently, the ABET committee will further address this issue during the July 2014 meeting.



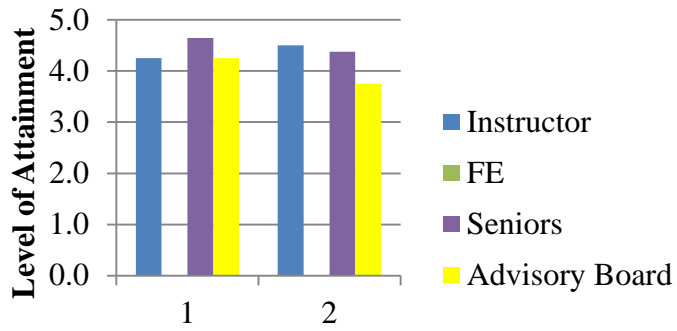
Performance Indicators for Criteria A



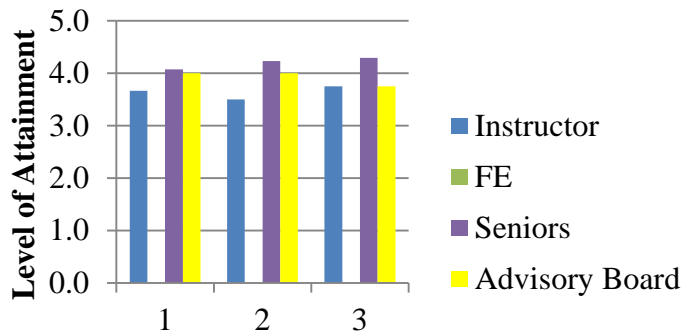
Performance Indicators for Criteria B



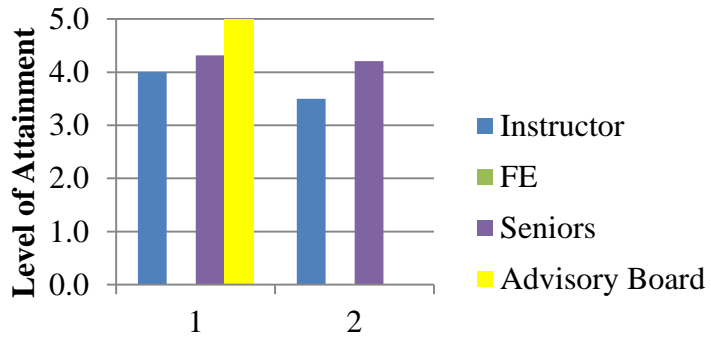
Performance Indicators for Criteria C



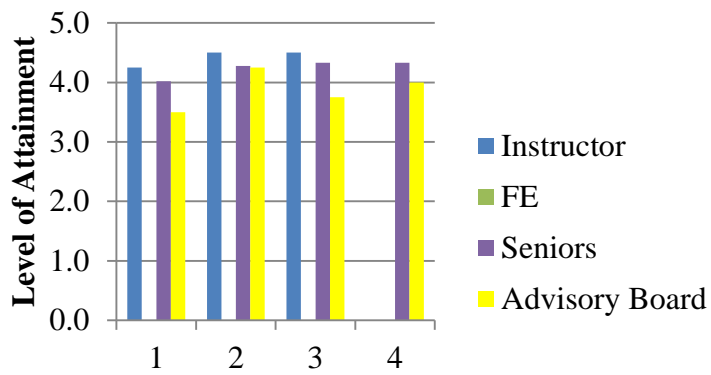
Performance Indicators for Criteria D



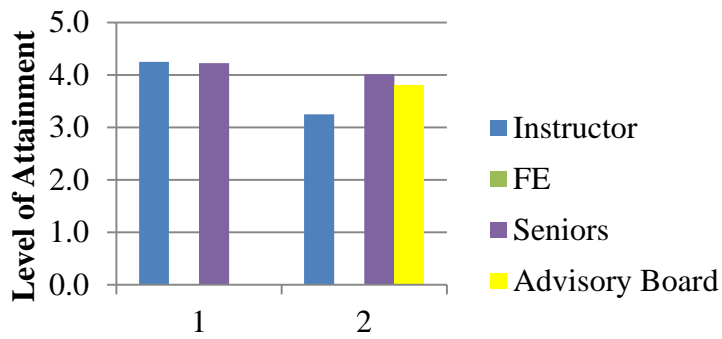
Performance Indicators for Criteria E



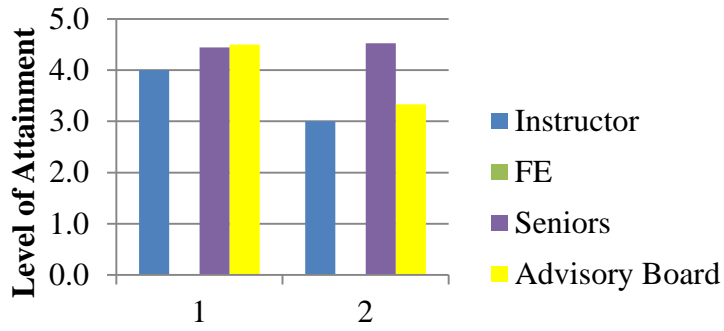
Performance Indicators for Criteria F



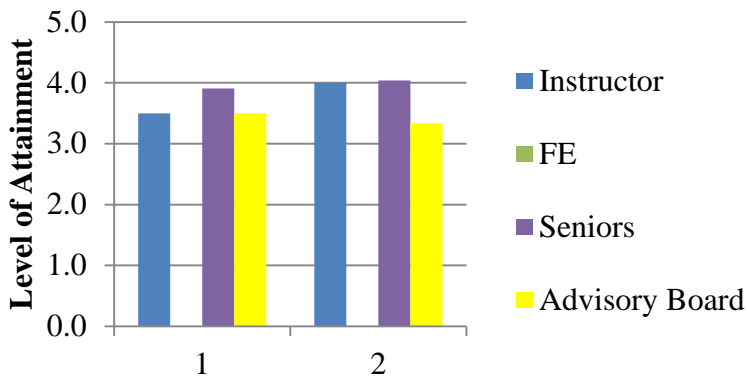
Performance Indicators for Criteria G



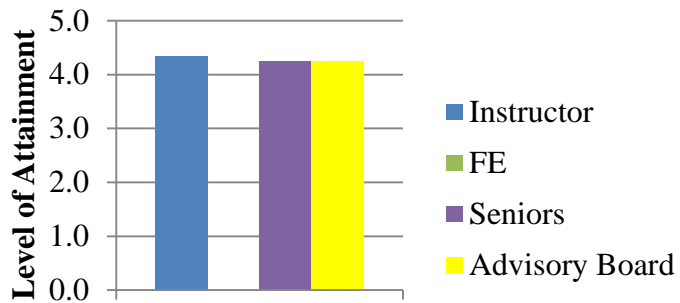
Performance Indicators for Criteria H



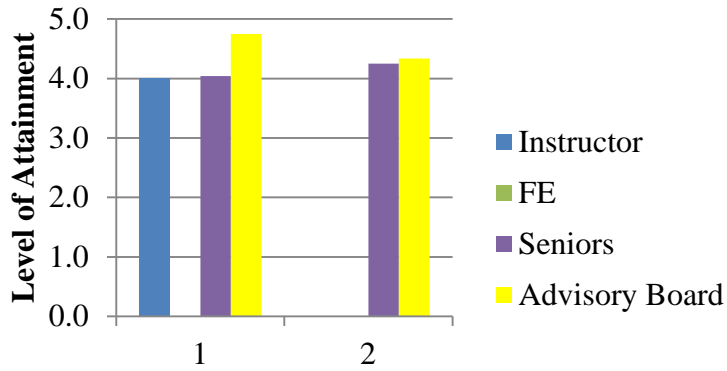
Performance Indicators for Criteria I



Performance Indicators for Criteria J



Performance Indicators for Criteria K



Performance Indicators for Criteria L

Advisory Board Review of Senior Design

Beginning with the 2013-14 AY the department implemented a formal advisory board review of several representative senior design projects. This review is scheduled to take place annually during the board's spring semester visit and covers attainment of student outcomes 3c, 3d, 3e, 3g, and 3k. Results are shown in the bar chart below, and reveal scores above the minimum acceptable value of 3.

