

Current as of 12 April 2024

MEMORANDUM FOR THE ADVISORY BOARD MEETING

SUBJECT: AY24-2 USMA Chemical Engineering Advisory Board Meeting Minutes

1. The Chemical Engineering Advisory Board meeting convened at 0800 hours in BH465 for an assessment of USMA CLS chemical engineering program. The following board members were present as indicated below:

Original Board Members attending:

No.	Name	Title	Industry - University	Email	Attending?
1	COL(R) Paul Dietrich	Chemical Officer & Refinery Manager	Chemical Officer/Industry	paul@the-dietrichs.com	Yes
2	Prof. Matthew Liberatore	Professor, Chemical Engineering	University of Toledo	matthew.liberatore@utoledo.edu	Yes
3	Prof. Kelly Schultz	Associate Professor, Chemical Engineering	Purdue University	kmschultz@purdue.edu	Yes
4	Prof. Gautham Krishnamoorthy	Professor, Chemical Engineering	University of North Dakota	gautham.krishnamoort@und.edu	Yes
5	Mrs. Kisondra Tanev	Director, Power & Renewables Investment Banking	Bank of America	kisondra@gmail.com	Yes
6	Mr. Kevin Shipe	Account Manager, Chem E (Old Grad '08), Former Automation Engineer	The Graham Company	kevin.a.shipe@gmail.com	Yes
7	Mr. Michael DeForest	Industry, Chem E (Old Grad '07), Senior Director of Operations	Fortna	michaeldeforest@fortna.com	Yes
8	Mr. Michael Theising	Industry, Chem E (Old Grad '11), Vice President of Operations	Brenntag Group	m.theising@gmail.com	Yes
9	Prof. Susan Daniel	William C. Hoey Director and Fred H. Rhodes Professor of Chemical Engineering	Cornell University	sd386@cornell.edu, Admin Assistant: ah	Yes
10	Prof. Robert Savinell	Distinguished University Professor, Professor of Chemical Engineering	Case Western Reserve University	rfs2@case.edu	Yes
11	Dr. Lucy Hair	Specialist and Chemical Engineer	Jacobs Engineering at Lawrence Livermore National Laboratory	hair1@llnl.gov	No
12	LTC(R) Matthew Armstrong PhD	Associate Professor (Retired LTC) and Principal Engineer	Fluor Marine Propulsion, Schenectady, NY	armstm@udel.edu	NO
13	COL Aaron Hill, PhD, PE	Deputy Head, Department of Civil & Mechanical Engineering	USMA; CME	aaron.hill@westpoint.edu	NO

2. Session 1: Introductory remarks and ABET orientation.
 - a. At 08:10, COL James began the meeting. The advisory board and chemical engineering faculty introduced themselves.
 - b. At 08:16, Dr. Nagelli gave the overview of the meeting schedule to the board. He also set the goals of advisory meeting.
 - c. At 08:23, COL James offered introductory remarks to the board. He thanked the members for their participation and input and offered his views on the value of the board process. He highlighted measures of success for the department: student performance/outcomes, faculty retention, and faculty recruitment. He continued by highlighting the technically sophisticated nature of the modern battlefield and how chemical engineering allows students to develop the thinking skills and knowledge base to succeed in war. He emphasized the value of the board and what he hopes the board will accomplish today. COL James closed his remarks by publicly thanking Dr. Biaglow for his contributions to shepherding the Chemical Engineering program and mentoring its faculty and cadets.
 - d. At 08:31, Dr. Biaglow offered some historical context to the nexus of the chemical engineering program at West Point in 2000.
3. Session 2: Assessment and Program Objectives feedback from Board and future challenges.
 - a. At 08:32, LTC Cowart gave an overview of the ABET Accreditation process and discussed plans to prepare for the upcoming ABET year (AY25-26), mentioning about the consistency of program and assessment of program data. He stated the importance of ABET accreditation, emphasizing the standards of courses, the engineering profession, opportunities for graduates, and requirement by Army. He continued through the slide deck reviewing PEOs, student outcomes, and assessments.

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- b. Prof Liberatore asked about the bump in Cadet signups for The Chemical Engineering major, especially Class of 2027. Dr. Biaglow suggested the change is due to Chemical Engineering faculty in CH101, Cadets seeking a challenge, and Cadets hearing the department is supportive. Mr. Shipe offered his own experience to back up the idea that Chemical Engineering instructors in CH101 are an excellent recruiting tool. Dr. Nagelli suggests the addition of bio-engineering courses generates interest. Prof Daniel recommends we survey our new majors to understand interest in Chemical Engineering versus BioEng courses. Prof Daniel asks about how our research differs from other departments. Dr. Nagelli discusses the 4-year span of research opportunities for our students. Prof Schultz asks about demographics of students signing up for the major, she recommends we implement a survey to capture the “why” of students signing up for the major. Mrs. Tanev agrees on the value of a survey. Dr. Biaglow suggests it may help with the ABET self-study.
 - c. At 08:47, Dr. Biaglow explained the assessment (coursework embedded indicators) of student outcome to the board. He briefed this portion according to the slide deck. Mr. Shipe asks how often the Student Outcomes are changed by ABET, Dr Biaglow says it is every few years or longer.
 - d. COL Dietrich suggests that safety should be more emphasized in the student outcomes. Prof Liberatore points out that safety is mentioned in 2x student outcomes which is more frequently than nearly any other word. Dr. Biaglow points out that the FEE assesses safety and our students score well in that section.
 - e. Prof Liberatore asked about the drop in performance in Mass and Energy Balances course for cadets. Dr. Biaglow highlights that we assess outcomes based on the outcomes at the end of the program, not based on each semester’s GPA.
 - f. Prof Krishnamoorthy asked if we could add percentages of B- or less to each course on the GPA graph. Mrs. Tanev asked to add similar information to the Program Averages slide on Page 13. Dr. Biaglow stated that we would try to accommodate those requests.
 - g. At 09:05, Dr. Nagelli continued to brief the Program Assessment and Objectives slides starting at slide 18.
 - h. (Slide 20) Prof Schultz suggested using post FEE survey question 4 and comparing negative responses to the question with overall failure rates in those years. Mrs. Tanev asked if we track graduates who re-take and pass the FEE after graduation. She also asks for more data/survey questions in the packet, specifically for FEE information. Dr. Biaglow agrees.
 - i. Review of by-category performance on the FEE led to many clarifying questions about how we are using the data to inform course/program development. Dr. Biaglow and Dr. Nagelli highlighted efforts by the program to address areas of concern and showed evidence of progress in several categories. Dr. Biaglow identified “Solids Handling” as an area to address. Prof Daniel highlighted her own programs experience with math shortfalls post-COVID. She suggests that focusing on math will help improve several other areas as well.
 - j. Dr. Biaglow reviewed last year’s mission statement and program objective changes prior to bringing in Cadets for the board members to hold discussions with.
4. Advisory Board Survey: Survey Part 1 was introduced and completed at 13:09.
- a. Feedback from CDT panels: Cadets enjoyed separations with Dr. Lachance. Cadets appreciated the flexibility/freedom to take non CHXXX electives in the major. Alternatively, some Cadets felt that other departments excluded them as non-majors. More specifically, they felt that instructors in other departments gave much more

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attention to their own department majors than the Chemical Engineering students. Attention was given to helping students find the "tricks" to using Mathematica/ChemCad early. Organic Chemistry timing: sophomore year is much preferred by cadets. Feeling of life science cadets getting preference for STAP. Fluid Mechanics teaching style is observed to be different than heat and mass transfer. Enjoyed guest lectures during FEE prep course (ie. Stats professor). MC300: non-engineers bringing down the course quality. Prof Liberatore suggested to remove MC300 due to relevancy to the Chemical Engineering field.

- b. Cadet Feedback on Program Objectives: The Cadets were not familiar with the program objectives. Cadets are concerned about being prepared for grad school. Board suggests Cadets are prepared for higher level academic success. Concern about long term success metrics. Prof Daniel recommends bringing back alumni to guest lecture about their civilian jobs. Create USMA Chemical Engineering Alumni LinkedIn page. AIChE annual USMA Chemical Engineering meetup event.
5. Board Discussed Program Objectives:
 - a. Mission Statement and Program Objectives were discussed and edited with new draft available in slides.
 - b. Vote by board on newly revised program objectives: Unanimous in favor.
 - c. All faculty present, also voted on newly revised program objectives: Unanimous in favor.
6. New Department name discussion:
 - a. Prof Liberatore: asked how many graduates per year are graduated by each program. Nobody had the exact numbers on hand, but approximately LS~30-36; Chemical Engineering- see numbers published elsewhere; Chem~15
 - b. Multiple board members expressed support for separate departments for Chemical Engineering and Chem/Bio. Dr. Biaglow indicated that recent USMA level department changes likely prevent any additional changes to departments in the near future.
 - c. Some names:
 - i. Chemistry, Chemical Engineering, and Life Sciences (CCELS/"See-Cells")
 - ii. Chemical and Biological Sciences and Engineering (CBSC)
 - iii. Vote: Unanimous vote in FAVOR of question "Does the name need to be changed?" both above suggestions recommended and endorsed.
7. Redesign of Unit Operations Lab
 - a. Prof Liberatore asked what the staffing of the lab is? Dr. Biaglow answered that Mr. Mathew is our 1x lab tech to support the course in addition to the two assigned instructors.
 - b. Prof Daniel: Distillation Column to separations? Dr Biaglow indicated the issue would be the ratio of students (40) to the equipment (1) and the ensuing logjam.
 - c. Prof Daniel: Can we split the course into multiple courses? Dr Biaglow wondered whether we could replace MC300 with an introductory course for processes and unit operations.
 - d. Dr. Nagelli summarized ideas as follows:
 - i. Drop units into other courses as labs
 - ii. Familiarize students with the units in earlier courses
 - iii. Remove some of the units
 - iv. Add a 1.0 credit hour course for juniors
 - v. Making Unit Ops a 2 semester course
 - e. Prof Daniel asks if we plan to expand beyond 43 cadets?
 - f. General Discussion regarding larger class sizes and scalability of program:
 - i. We do not have graduate students to help with course load

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- ii. Can the department use Junior Rotators in a TA/Grad student role?
 - iii. Autograding/automated processes to reduce workload.
- 8. Final comments were made by Dr. Nagelli.
- 9. At 15:25, the remaining time was returned to the board to complete their survey.
- 10. A lab facility tour was provided following the meeting
- 11. The POC for these minutes is the undersigned at enoch.nagelli@westpoint.edu.

ENOCH A. NAGELLI
Program Director, Chemical Engineering

Summary and Minutes of the Chemical Engineering Advisory Board Meeting on 11-12 April 2024

The advisory board was asked to comment on various aspects of the curriculum, the meeting content, and any other issues that they would like to raise. The survey questions are underlined and in bold font below, followed by responses of individual members. A summary in red font appears at the end of each section.

Based on the assessment data or on your personal opinion, is there a course that the program should add to the curriculum?

Dietrich: Basic software (programming) possible 1 credit for 1st year or early so that they are set up for success.

Liberatore: More lab time before senior year. Math and computing courses could be modernized but hard to change at that level. How relevant are statics and circuits to their work in the Army? Many ChE programs have dropped one or both courses. How is FE course grading done? Can grading be more flexible?

Tanev: One of the points raised by cadets was that some additional training on programs like Mathematica and CHEMCAD would be helpful maybe along with intro to computing/IT.

Shipe: Some cadets expressed interest in a software intro course such as for CHEMCAD or Mathematica, to spend less time learning the basics during implementation and are able to more quickly move into application. Possibly early introduction to the Unit Operations Lab.

Daniel: Cadets suggested a 1-credit or 2-week module on software that they need for courses and might not know already (MATLAB, Mathematica, Python).

Theising: The cadets expressed interest in a course (low credit hour) which would instruct them on interaction with CHEMCAD and Mathematica. They thought that getting that knowledge up front may be more beneficial than slowly accumulating those skills in current coursework. It may not be possible, but it would be great if it could be incorporated into CY105.

Schultz: The cadets requested a 1-credit course to onboard them with the software they use. Ability to validate at a late time to enable students to take Organic Chemistry II or Physical Chemistry II. Some cadets felt the chemistry was not prevalent in the curriculum.

DeForest: Based on feedback (and data) our fluids class needs an overhaul. The cadets mentioned that it is heavily focused on derivations and not application which makes it difficult to demonstrate and apply the knowledge. The data indicates we consistently under-perform in this area as well.

Krishnamoorthy: None. I feel you offer a comprehensive, well-rounded program given your cadet time/credit hour constraints. This is reflected in your FE exam pass rates (in comparison to national averages).

R&A: Cadets are interested in a short computing course earlier in the curriculum.

Do you have any suggestions to improve the advisory board meeting for next year?

Dietrich: Instructors outside department should be at cadet review/feedback so they directly hear feedback.

Liberatore: No time for holistic review of the whole curriculum (and what can move semesters or be eliminated). No time to understand a day in the life of a cadet, see more of campus, etc.

Tanev: Would be interesting to see survey questions in survey given to cadets after taking the FE exam. Great meeting, well-organized!

Shipe: The discussions were good, but I'd like more time with the Cows as they give feedback to the earlier side of the program. Possibly some time with the Yuks, too.

Daniel: This is my first one and I thought it got me up to speed quickly.

Theising: The smaller group panels were great. We could consider making it a more structured "speed dating" approach.

Schultz: More table available for informal interactions over lunch.

DeForest: Dinner at cadet mess hall? None of the board have seen a dinner or anything of West Point's unique culture. If not that, maybe at the Firstie Club but something uniquely West Point. [Biaglow note – Similar comments last year.]

Krishnamoorthy: No. Very well run. I liked the format/schedule.

R&A: (1) Invite instructors from outside the department. (2) Provide survey monkey FEE survey questions. (3) More interactions with Cows and Yuks. (4) More interactions outside the department to experience the West Point culture. (5) Consider enhanced interactions with cadets such as "speed dating" approach.

Please add any additional comments that you would like to make below.

Dietrich: Repeated feedback that non-ChE course instructors do not seem to care as deeply about those outside their major track.

Liberatore: Cadets wanted our contact info. I think we would be able to approve sharing a photo roster with cadets containing our professional contact info. I am happy to help regarding MEB, thermo, or faculty development or educational development areas.

Tanev: It sounds like it would be helpful to see if the department can work with the registrar to help with class scheduling for cadets that come in knowing they want to do ChE, to potentially allow them to take Gen Chem 1&2 in Plebe year so organic chem can be taken in Yuk year vs. Cow year when they are so busy.

Shipe: It would be fun to be able to have lunch with the cadets in the Mess. I remember sometimes we would have guests and it created interesting discussions among the cadets and guests.

Daniel: They would like more “real life” examples in courses like MEB. They like how Seps does that. Universally felt taking Organic Chemistry in sophomore year is necessary. Asked for secondary validation point after major selection. Guest lectures are cool. The reason you have a large class is that they strongly advocated for ChE at recruiting – they made it a point to promote your department! They really love ChemE! (smile-face emoticon).

Theising: Professor Liberatore mentioned his university’s Chem Eng program no longer requires the equivalent of MC300 or EE301. Not necessarily advocating we drop those courses, but if they don’t have much applicability to the FEE, I think that option should be on the table. Consider capping enrollment (at least in short/medium time frame).

Schultz: No comment. There is a strong sense of belonging by the cadets, that is a strength of the program. Complaints about course material & delivery are generally outside the department and should be worked with to improve those experiences. The statics course was singled out as not needed & relevant info covered in other courses.

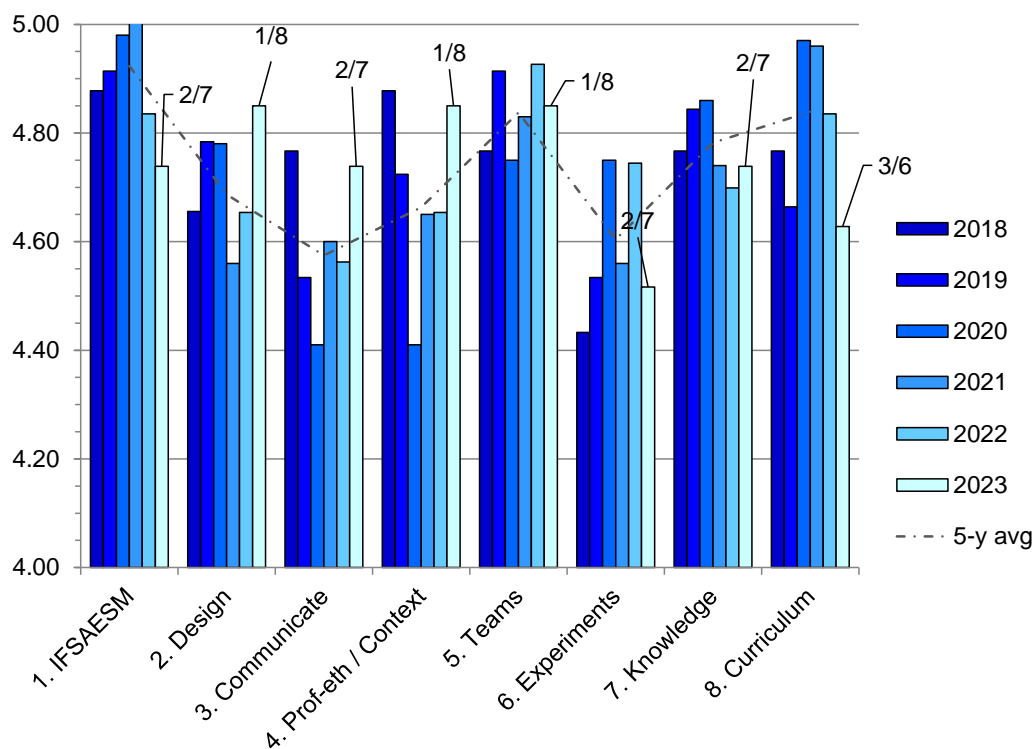
DeForest: Establish a ChemE reunion event where successful graduates can connect with cadets. Assist with networking.

Krishnamoorthy: Perhaps consider replacing Mathematica with MATLAB/Python and integrate it (use it) throughout the curriculum as appropriate. This way: (1) Cadets are not at a disadvantage when introduced to MATLAB in mechanical engineering design courses. (2) It gives them some coding/programming experience. (3) If your curriculum evolves to introduce cadets to AI/ML methodologies in the future they will benefit from the readily available frameworks in MATLAB/Python environments. This will also align it with “new and emerging technologies” portion of your modified mission statement.

R&A: Comments are diverse. (1) consider removing or revising MC300 and EE301. (2) Consider MATLAB/Python as a replacement for Mathematica. (3) Additional validation opportunities are desired. (4) Allow organic chemistry in second year. (5) More networking opportunities are desired.

Advisory Board Student Outcomes (SO) Survey Results:

The chemical engineering advisory board is asked to rate performance of cadets on student outcomes (SOs) based on data presented to the board at the advisory board meetings. Advisory board responses for AY2018 to AY2023 are shown in the figure below, including data from the most recent advisory board meeting on 11-12 April 2024. Data for AY2024 is not available until after the advisory board meeting in spring of 2025. Data labels are response frequencies for responses of 4 or 5 (# of 4s / # of 5s) on the 1-5 Likert scale used in the survey. For example, in outcome 1 IFSAESM, 7 out of 9 board members responded with a 5 and there were two 4's, so the label is 2/7. The five-year average is the dotted line. Relative lows are seen in outcomes 6 and 8. The survey questions are below the figure.



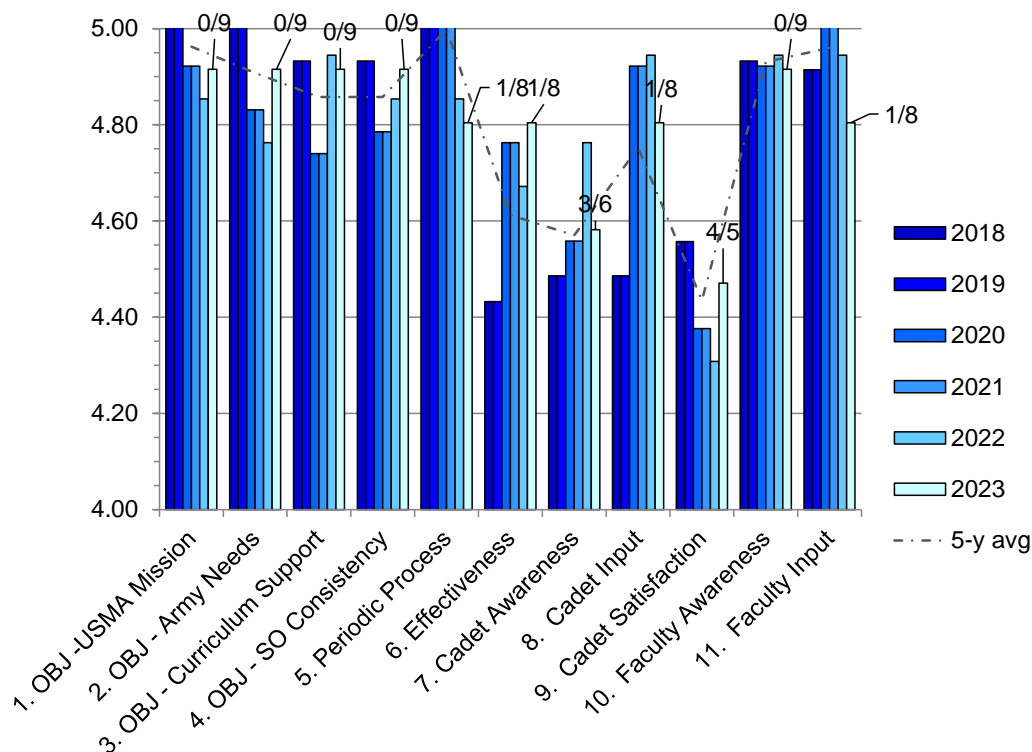
Survey Questions:

1. The cadets in the program are able to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. The cadets in the program are able 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. The cadets in the program are able to communicate effectively with a range of audiences.
4. The cadets in the program are able 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. The cadets in the program are able 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. The cadets in the program are able to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.
7. The cadets in the program are able to acquire and apply new knowledge as needed, using appropriate learning strategies.
8. The cadets in the program have attained a thorough grounding in and working knowledge of the chemical engineering curriculum.

Advisory Board Program Educational Objectives (PEO) Survey Results:

The primary task of the advisory board is to assess the program educational objections (PEOs) of the chemical engineering program. A survey was administered to the board after a series of targeted activities involving the cadets and after a presentation of the PEOs by the program director. Advisory board responses to the program survey for AY2018 to AY2023 are shown in the figure below, including data from the most recent advisory board meeting on 11-12 April 2024. As before, data for AY2024 (this year) is not available until after the advisory board meeting in spring of 2025. Data labels are response frequencies for responses of 4 or 5 (# of 4s / # of 5s) on the 1-5 Likert scale used in the survey. For example, in question 1, which pertains to the consistency of the PEOs with the USMA mission, 9 out of 9 board members responded with a 5 and there were no scores of 4, so the label is 0/9. The five-year average is the dotted line. Relative lows are seen in cadet awareness of PEOs and cadet satisfaction with courses.



Survey Questions:

1. The program objectives are consistent with the USMA mission.
2. The program objectives are consistent with the needs of the Army.
3. The program curriculum supports the program objectives.
4. The student outcomes are consistent with the program mission and objectives.
5. The program has a process for periodically assessing the achievement of its student outcomes.
6. The survey methods used by the program are effective.
7. The cadets in the program are aware of the program objectives.
8. The cadets are given an opportunity to provide their opinion about the program objectives.
9. The cadets are satisfied with the courses in the program.
10. The faculty are aware of the program objectives.
11. The faculty are given an opportunity to provide their opinion about the program objectives.