Engineering Educators Bringing the World Together
2025 ASEE Annual Conference & Exposition
Palais des congrès de Montréal, Montréal, QC • June 22–25, 2025
Paper ID #47443

Using New Faculty Orientation in an Aeronautical Engineering Department with High Faculty Turnover and Low Levels of Experience to Produce Competent First-Year Instructors

Dr. Richard T Buckley P.E., U.S. Air Force Academy

Dr. Richard Buckley is an Assistant Professor at the US Air Force Academy Department of Aeronautics. He is the Discipline Director for the Structures and Materials discipline within the Aeronautics major. His research focuses on both engineering pedagogy and structural design and repair of aircraft.

Using New Faculty Orientation in an Aeronautical Engineering Department with Very Low Levels of New Faculty Experience to Produce Competent First-Year Instructors

Abstract

This evidence-based practice paper describes the use of both self-efficacy survey instrument and student feedback to measure the effectiveness of the New Faculty Orientation (NFO) program in an Aeronautical Engineering department. In our department, roughly 1/4 to 1/3 of the faculty leave and are replaced each academic year. New faculty often have no prior teaching experience and often have only earned a master's degree. Although relevant to the degree program, their degree may not be in the specific area required to teach the introductory Aeronautical Engineering course. To combat these challenges, we have developed an intensive month-long New Faculty Orientation (NFO) program based on a variety of published research. The unique component of this program is the amount of time spent practicing teaching in front of experienced instructors and peers. The structure, content and research basis of the NFO program is described in this paper. In this study, post-NFO measures of instructor self-efficacy were collected using the College Teaching Self-Efficacy (CTSE) Scale and results are presented. CTSE survey results showed that the new faculty rated themselves confident in instructional planning (3.69/5.0), instructional delivery (4.22/5.0), classroom management (4.38/5.0) and assessment (3.93/5.0). Practice teaching lessons in front of peers and experienced instructors, comprising three weeks of the four-week program, was universally described by participants as the most useful component of the program. The CTSE instrument was useful for both identifying topic areas that should be covered in a new faculty program, and for evaluating where the program may have weaknesses. Student ratings of new instructor effectiveness and fostering of an inclusive classroom climate were also collected through Academy-level anonymous end-of-course feedback. Student ratings of effectiveness (5.64/6.0) were slightly higher than the Academy average (5.44/6.0) for the new instructors that participated in the NFO program. This leads us to conclude that the NFO program is effective at producing competent new instructors within the context of this department and Academy. However, the small sample size makes it difficult to generalize the results to a larger population.

Background

The department of Aeronautics within the United States Air Force Academy (USAFA) faces the combined challenges of extremely inexperienced new faculty that make up a large proportion of the department. Roughly 1/4 to 1/3 of the faculty leave and are replaced each academic year due to rotations in military assignments. New faculty often have no prior teaching experience or have not taught at the college level. Many new Instructors have only earned a master's degree and, although relevant to the degree program, their degree may not be in the specific area required to teach the introductory Aeronautical Engineering course. In collaboration with the institution we have developed an intensive month-long New Faculty Orientation (NFO) program based on a variety of published research (see Table 2 for an exhaustive list). The program aims to prepare new faculty to be effective instructors as well as to refresh the specific technical content in preparation for their first semester teaching. This orientation involves classroom instruction on elements of teaching and three or four sessions of practice teaching for each new faculty member. The unique component of this program is the amount of time spent practicing teaching.

New faculty observe or practice-teach nearly the entire semester's content for the course they will be teaching during their first semester, Introduction to Aeronautical Engineering.

The Academy is a four-year undergraduate-only institution with the dual mandates of producing graduates with a Bachelor of Science and commissioning these graduates as officers in the United States (US) military. The total student population is roughly 4000 students with graduating classes typically slightly under 1000 students. Demographic information for the student body, Academy faculty, and department faculty is shown in Table 1.

Table 1. Students, Academy faculty, and department faculty demographic information [1].

	Students	Academy Faculty	Department Faculty
Male	72%	64%	94%
Female	28%	36%	6%
White	64%	94%	88%
Hispanic	11%	4%	3%
Multi-Ethnic	7%	2%	0%
Black or African American	7%	0%	0%
Asian	7%	0%	6%
Unknown	2%	0%	3%
International	1%	0%	0%
Native Hawaiian or Pacific Islander	0%	0%	0%

The Academy faculty consists of permanently assigned civilians, temporarily assigned civilians, and military faculty. The permanent civilian faculty constitutes roughly 30% of the total faculty and are assigned to long-term positions. This group has earned PhDs in their area of expertise and serves as subject matter experts and long-term continuity within their respective departments. Temporarily assigned civilian faculty vary in numbers by department and are similar to adjunct faculty at other universities. The active-duty military faculty are assigned to three-year tours serving as instructors. First-time military instructors are typically junior officers with a master's degree and less than five years of experience. These faculty will be referred to as "new faculty" throughout this paper. A smaller percentage of the military faculty (roughly 4-5%) will go on to earn a PhD and return to their department for a second, 3-year tour of duty. This second tour typically begins 6-8 years after their first assignment concludes. These faculty will be referred to as "returning faculty" throughout this paper. As a result of this structure, roughly 1/3 of the military or 20% of the faculty population rotates out and are replaced every year.

As a consequence of the Academy mission, there is a heavy emphasis on teaching and learning. A well-established Scholarship of Teaching and Learning (SoTL) program has been in place since the early 2000s. This office hosts an annual new faculty orientation every summer before the fall semester begins. This program focuses on integrating new faculty into the mission of the Academy. There are high-level introductions to key teaching concepts, such as learning outcomes and connecting with students. This amounts to less than 12 hours' worth of training and group discussions. All new and returning faculty are required to participate in this program during the summer they first arrive. Participation in subsequent summers is not required.

The culture of the department is one focused on "exceptional execution of the teaching mission." Student rankings of Department faculty in end-of-course feedback consistently rank about 5% higher than those of the Academy larger faculty. The challenge becomes stark; 20% of the department faculty each year has little or no prior teaching experience, many have only earned a Masters' degree and may not have the depth of knowledge needed to teach the undergraduate course they are assigned to teach, yet they are expected to perform at a very high level almost immediately.

In response to the challenge described above, a new faculty orientation program (NFO) was developed in the early 2000's to train the new faculty. It is unclear from historical documents if the NFO and SOTL programs were started together. The goal of the program is to produce faculty prepared to teach and enthusiastic about the art and science of teaching. It is led by one or more experienced senior faculty members each summer. New and returning military and civilian faculty are required to attend this intensive training program prior to their first semester teaching in the department. The program runs for four weeks, full-time.

The program is grounded in research and updated regularly. It contains three main components: motivation to teach well, education about effective teaching and learning, and practice teaching to an audience of peers and experienced instructors.

The stated objectives of the department NFO program:

- Learn what the Department's "high standard of teaching excellence" looks like
- Learn and apply theories of teaching and learning
- Improve teaching skills
- Learn and practice teaching assessment skills
- Develop a passion for teaching
- Get to know colleagues with whom they will be working
- Expose new faculty who have never taught before to as much of their first course as possible before they face students for the first time

The program consists of five Blocks of instruction. Blocks 1 through 4 last one day each, between six and eight hours of instruction and discussion. Instruction is primarily a short presentation followed by a facilitated discussion. A brief description of each Block is covered below. A detailed list of topics covered and the references used to develop each topic are shown in Table 2. Block 5, Practice Teaching, makes up the remaining three weeks of the program.

Block 1, "Motivation to teach well," is covered on the first day of instruction. Block 1 includes findings that show that undergraduate students leave STEM programs primarily because of poor teaching. We follow with a discussion of what we as instructors can do to avoid the pitfalls of poor teaching. We review in detail effective teaching principles pulled from several sources and augment the discussion with personal experiences from the class. We provide selected readings from each of these sources to the NFO participants. We discuss the 2-dimensional model of teaching with interpersonal rapport and intellectual excitement on perpendicular axes developed by Lowman [2]. The goal of this section is to motivate participants to strive to become "teaching exemplars" [2]. We introduce differences between learning styles of students and the preferred teaching styles of STEM instructors along with the challenge this creates. We also cover the

EXCeed teaching model and the specific model instructional strategy recommended for technical courses within the department. Block 1 concludes with a discussion of how our students learn. See Table 2 for a complete list of the topics covered and references used.

Table 2. NFO instruction Blocks, topics covered, and sources used to develop the instruction for each topic.

NFO Block	**Topics Covered**	**References used**
Block 1: Motivation to teach well	Why undergraduates leave STEM	[3]
	Effective teaching techniques	[4], [2], [5], [6], [7], [8]
	Rapport and intellectual excitement	[2]
	Student vs instructor learning styles	[9]
	EXCeed teaching model	[10]
	How students learn	[11]
Block 2: Effective teaching and assessment	Bloom's Taxonomy	[12]
	Learning objectives and assessments	[13]
	Classroom organization	
	Remote teaching tools	
Block 3: Mechanics of effective teaching	Speaking and Writing	[14]
	Body Language	[15]
	Motivation and Bonus points	[16]
	Questioning Techniques	[17]
	Teacher Enthusiasm	[18] [19]
Block 4: Inclusive teaching in STEM	Allyship	[20] [21] [22]
	Safe Zone Training	[23], [24]
	Benefits of Inclusion	[25][26]
	Peer and student feedback	[27]

Block 2, "Effective teaching and assessment," is covered on the second day of the program. We start with Bloom's [12] Taxonomy and the concept of tailoring our assessments to where we expect our students to be on the taxonomy. We then transition to coordinating learning objectives and assessments, as well as the variety of assessments that instructors may use. Finally, we demonstrate classroom organization, use of white boards and other instructional technology such as Teams, Zoom, Blackboard to finish Block 2. Again, see Table 2 for a complete list of the topics covered and references used.

Block 3, "Mechanics of effective teaching," is covered on day three. We discuss and demonstrate techniques for speaking and writing clearly. We briefly cover the importance of body language and non-verbal communication for students and instructors. We cover classroom and homework motivation strategies and the use of bonus points as a motivational tool. We demonstrate and practice the various questioning techniques an instructor may choose in a mock lesson. We

conclude Block 3 with a lesson and discussion of teacher enthusiasm in the classroom. See Table 2 for a complete list of the topics covered and references used.

Block 4, “Inclusive Teaching in STEM,” is covered on day four of the program. We discuss the concept of Allyship, and how we as instructors have both power over our students as well as a responsibility to advocate for our students so that they can be successful. We discuss several case-studies highlighting the benefits of an inclusive learning environment to all students to motivate instructors to create their own inclusive classroom environment. We conclude Block 4 with a discussion of using peer and student feedback to improve our own teaching. The goal of this topic is to dispel many of the persistent myths around student feedback so that instructors will use feedback to improve their own teaching. See Table 2 for a complete list of the topics covered and references used.

Block 5: Practice Teaching, rounds out the remainder of the program, lasting an additional 3-4 weeks. All new faculty are assigned to teach multiple lessons from the Introduction to Aeronautical Engineering course they will be teaching in the following semester. Experienced faculty are brought in as observers and to act as students. All participants, new and experienced, provide both written and verbal feedback after each lesson. Experienced instructors will also “demo teach” individual lessons of the same course. These experienced instructors are selected to show a variety of teaching styles. For example, one instructor may use primarily PowerPoint for their lesson, another may primarily use the whiteboard, another may use a more blended approach or a flipped classroom. These experienced instructors also teach the more challenging lessons in the course so that participants can see options for how these lessons might be taught during their first semester.

New faculty typically teach 3-4 lessons and observe their peers practice teaching as well. This provides the new faculty the opportunity to try ideas, fail, correct, and try again before they face their first day of class with “real” students. The result is that, by the end of the new faculty orientation program, new instructors have seen the entire course that they will be teaching during their first semester. The returning faculty practice teaching a similar number of lessons from whatever course they are assigned to teach the following semester. We conclude the program with participants writing their own teaching philosophy. Participants are also asked to find experienced faculty mentors for both technical and teaching mentorship.

The Introduction to Aeronautical Engineering course is a 300-level course taught to the entire student body. This course is well established and is led by an experienced course director. During the semester all new faculty have the opportunity to audit an experienced instructor’s class before they teach their own class, normally the following day. This provides additional opportunities for observing and technical review prior to teaching the same content. Typically, after their second or third semester, new faculty will move on to teach other, higher-level courses in their specific area of expertise.

Methodology

New and returning faculty who participated in the department NFO over the past three years (2022, 2023, and 2024) were surveyed. The survey was administered following the summer 2024 NFO program. Four participated in the NFO program during summer 2022, six during summer

2023, and eight during summer 2024. Participants who participated in previous years were asked to recall and answer survey questions based on how they felt immediately after they participated in the NFO program. Demographic data for those participating in the survey is shown in Table 3. The breakdown of prior college-level teaching experience for new faculty participants is shown in Figure 1. Returning faculty were excluded from this data because they are not the focus of this study.

Table 3. NFO participant demographic information.

Active-Duty Military	15 (83%)
Civilian	3 (17%)
New Instructor	14 (78%)
Returning instructor	4 (22%)
Highest degree earned	
Masters	11 (61%)
PhD	7 (39%)
Gender	
Male	16 (89%)
Female	2 (11%)
Self-Reported Race	
Caucasian	15 (83%)
"Ethnically Vague"	1 (6%)
Asian/Pacific Islander	1 (6%)
Hispanic	1 (6%)

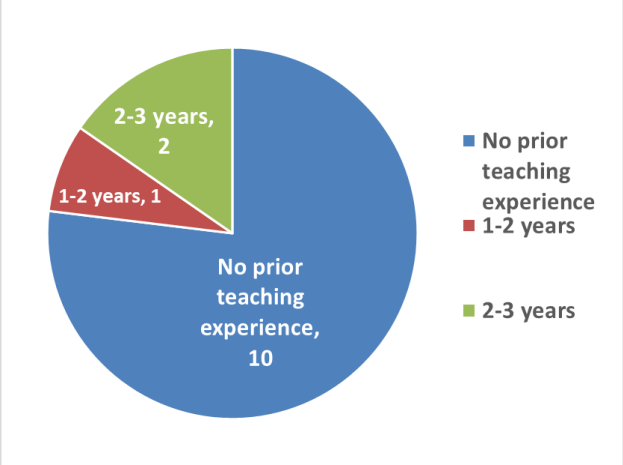

Figure 1. Years of prior college-level teaching experience for new faculty participants in the NFO program.

Until recently, no measurement of "program success" was undertaken. Beginning in 2022, a program was initiated to measure the effectiveness of the department NFO program. This program focuses on two aspects: self-efficacy of NFO participants (i.e. do they think they are prepared to be effective teachers) and student ratings obtained through end-of-course feedback.

Measurement of Instructor Self-Efficacy

In 1993 Bandura described self-efficacy as the beliefs we have about our ability to perform the actions required to achieve specific outcomes [28]. Tschannen-Moran, Woolfolk Hoy, & Hoy defined Teacher-efficacy as "the teacher's belief in his or her capability to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context" [29]. For this study, we reviewed several instruments attempting to measure self-efficacy of teachers [30], [31], [32]. We chose the College Teaching Self-Efficacy (CTSE) [30] Scale developed and validated by Siwatu, Page and Hadi in the Department of Educational Psychology, Leadership, and Counseling at Texas Tech for this study because it was developed specifically for college instructors and the survey questions most closely matched the skills we would like our instructors to possess.

Siwatu and Hadi [30] divided self-efficacy questions into four broad categories of instructional planning, instructional delivery, classroom management, and assessment. In their original paper

they recommended allowing survey takers to rate each statement on a 100-point scale to enable greater gradation of each question. A 100-point survey instrument was not available to us, so we used a 1-5 Likert scale shown in Table 4. This is the only difference from the original survey instrument. This change was not validated by statistical analysis and does introduce limitations to the effectiveness of the survey. The survey was administered in the Fall of 2024 to all three cohorts with the instructions to "rate how confident you were in your ability to successfully accomplish each of the tasks listed below *when you first completed New Faculty Orientation* (most recently)."

Table 4. Likert scale used for self-efficacy survey responses.

1	Strongly Disagree
2	Disagree
3	Neither Agree nor Disagree
4	Agree
5	Strongly Agree

Questions on the Self-Efficacy Survey

All questions were phrased beginning with "Rate How confident you are in your ability to successfully accomplish each of the tasks listed below." Each task is related to teaching. The survey questions are shown in Appendix A, Table 6 along with the question designator from Siwatu, Page and Hadi [30].

Qualitative feedback from NFO participants was also collected. The survey questions presented were:

"What part of NFO was the most useful for you in becoming an effective instructor?"
"What part of NFO was least useful for you in becoming an effective instructor?
"Do you have any other feedback on DFAN NFO you would like to share?"

Participants were able to submit a free response to these questions.

Student feedback, especially anonymous feedback, has been found repeatedly to be a reliable source of data on instructor effectiveness [27] and to correlate highly with ratings by faculty peers, administrators [11], alumni and graduating seniors [27]. For these reasons, we looked at student ratings for NFO participants each semester for five semesters after participating in the program.

We examined student feedback, obtained from the Academy-wide end of course (EOC) survey to determine if there was a correlation between instructor self-efficacy and student perceptions of instructor effectiveness. We did not have access to the development of these survey questions, so a best-fit approach was taken using the existing EOC survey instrument.

The EOC survey contains the following questions:

1. The course activities (e.g., assigned readings, lectures, discussions, labs, projects, etc.) were effective in helping me accomplish the learning goals of this course.
2. In this course, the graded events (e.g., Tests, papers, projects, etc.) provided the opportunity for me to demonstrate my accomplishment of the course learning goals
3. In this course, I received feedback that improved my ability to meet the course learning goals.

4. Overall, this course is:
5. I gave my best possible effort to learning in this course.
6. On average, for every hour I spent in this class, I spent ___ hours outside of class completing work in this course (including studying, reading, writing, doing homework or lab work, etc.
7. The instructor created a respectful, engaging learning environment for students.
8. Overall, my instructor is:
9. Please identify what you consider to be the strengths of the instructor. (free response)
10. What are one to three specific things about the course that could be improved to better support student learning? (free response)

The first six questions in the student EOC survey focus on course design and student effort. Since course design is not a responsibility for first-semester instructors, these question responses were not examined. Similarly, student self-assessment of effort and time spent is not relevant to the effectiveness of the NFO program. We focused on student responses for questions 7 and 8 because they directly address instructor performance.
Student responses were recorded on a 6-point Likert scale that varied by question. The Likert scale evaluations for questions 7 & 8 are shown in Table 5.

Table 5. Likert scale used for Academy end of course feedback responses.

Likert Rating	Question 7: The instructor created a respectful, engaging learning environment for students.	Question 8: Overall my Instructor is…
6	Always	Excellent
5	Very Often	Very Good
4	Often	Good
3	Sometimes	Fair
2	Rarely	Poor
1	Never	Very Poor

Results & Discussion

Because the focus of this study is on improving the teaching abilities of new faculty, responses of returning faculty are not presented. Results of the self-efficacy survey are show in Figure 2 through Figure 5. The data is segmented by the four main factors described in the survey: instructional planning, instructional delivery, classroom management and assessment.

Figure 2 shows the average of all responses to each instructional planning question in the CTSE survey.

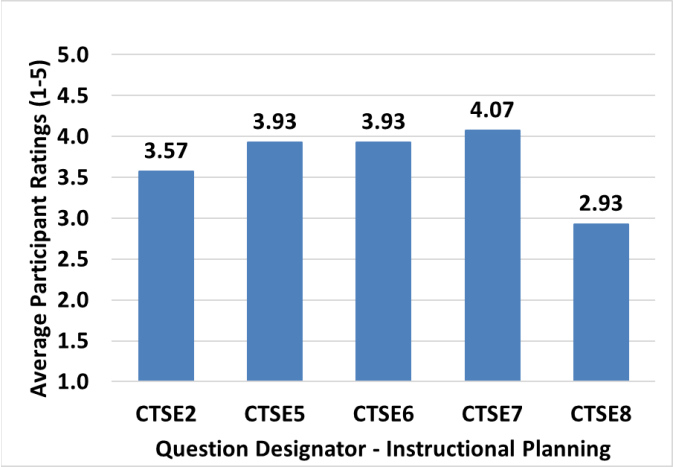

Figure 2. New faculty responses to the CTSE survey questions measuring self-confidence in instructional planning. The text of each CTSE question is shown in Appendix A, Table 6.

New faculty appear to be relatively confident across all questions related to instructional planning, with an average self-efficacy rating of 3.69/5.0 and standard deviation of 0.41. However average scores were lower than in the three other broad categories (instructional delivery, classroom management, and assessment). Confidence in their ability to develop appropriate learning goals, CTSE2 (3.57/5.0), identify appropriate instructional activities, CTSE5(3.93/5.0), identify appropriate types of assessments, CTSE6 (3.93/5.0), and identify appropriate course material, CTSE7 (4.07/5.0) are all high. This may indicate effectiveness of the NFO program, or it may also indicate over-confidence that comes from a relative lack of teaching experience.

There is a marked drop among all participants in confidence in their ability to use a course management system, CTSE8 (2.93/5.0). This identifies a gap in our NFO program and a key content area where improvements can be made to future offerings. Specifically, we will be adding a session on navigating Blackboard, uploading course materials, online grading and the use of Gradescope in Introduction to Aeronautical Engineering.

Figure 3. shows the average of all responses to each instructional delivery question in the survey.

New instructors with little or no prior teaching experience rated themselves relatively high, averaging 4.22/5.0 for all questions on instructional delivery with a standard deviation of 0.42. There is a notable drop in self-efficacy for CTSE 21, which deals with instructional accommodation for students with special needs or disabilities. This topic is not one that is covered during the NFO program and again highlights a spot where improvements can be made in the future.

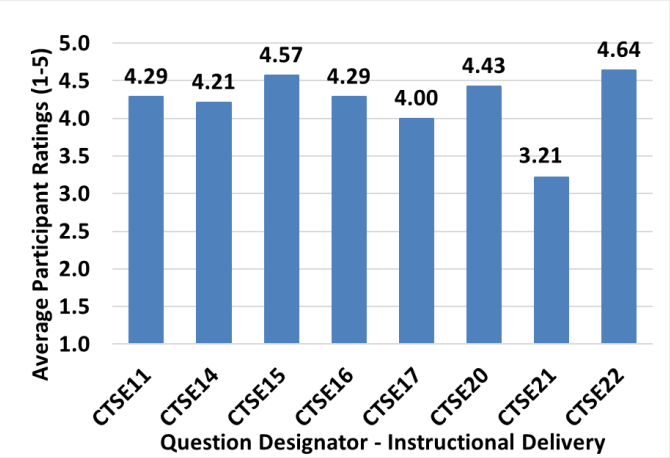

Figure 3. New faculty responses to the CTSE survey questions measuring self-confidence in instructional delivery. The text of each CTSE question is shown in Appendix A, Table 6.

Figure 4 shows the average of all responses to each classroom management question in the survey.

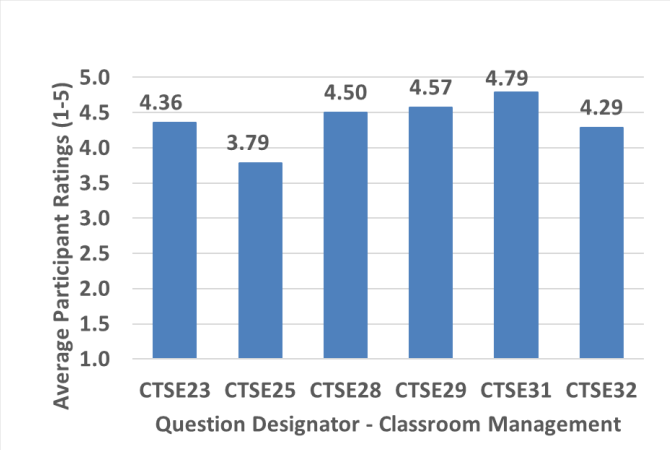

Figure 4. New faculty responses to the CTSE survey questions measuring self-confidence in classroom management. The text of each CTSE question is shown in Appendix A, Table 6.

Confidence in classroom management is again high, across all questions averaging 4.38/5.0 with a standard deviation of 0.31. The only notable outlier among this set was CTSE 25, designing activities that assist students in developing relationships with their peers. More detailed work will have to be done to understand why responses to this question were lower.

Figure 5 shows the average of all responses to each classroom management question in the survey.

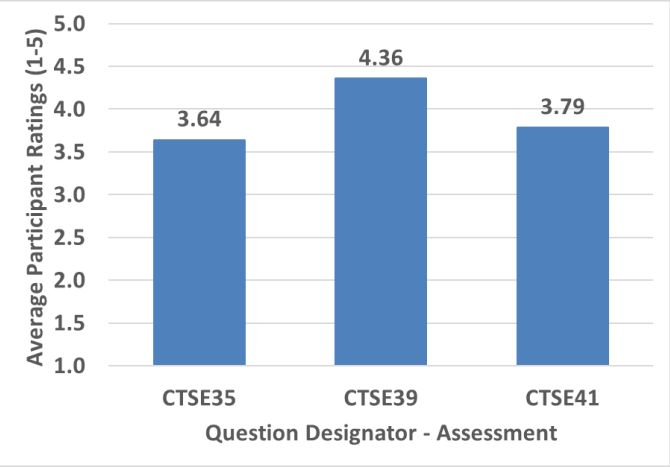

Figure 5. New faculty responses to the CTSE survey questions measuring self-confidence in classroom assessment. The text of each CTSE question is shown in Appendix A, Table 6.

Responses to survey questions on assessments were lower than all the previous broad categories with the exception of instructional planning, averaging 3.93/5.0 with a standard deviation of 0.31. Results for these three survey questions are relatively uniform. New instructors show slightly less confidence in their ability to create new assessments (CTES35), and to use assessments to make instructional decisions (CTSE41).

Even though the primary purpose of this study was to measure instructor self-efficacy and compare it to student ratings, we also examined responses to the three qualitative questions administered along with the CTSE survey and characterized them in terms of broad themes. Returning faculty responses were included in this section, increasing the sample size to 18.

We found one single theme in responses to the question, "What part of NFO was the most useful for you in becoming an effective instructor?" Every new faculty participant responded that either observing others' practice lessons and/or the practice teaching, along with feedback, was most valuable.

In response to the question, "What part of NFO was least useful for you in becoming an effective instructor?" responses were more mixed.
Responses included: the Academy level new faculty orientation program (5/18), the pace of work during department new faculty orientation (2/18), use of the learning management system (2/18), and the readings provided for each lesson (2/18).

End of Course Student Feedback
Average student response to end-of-course feedback is shown in Figure 6 and Figure 7, For the charts shown, each set of columns left to right represents student ratings in successive semesters. Column 1 represents the first semester teaching, 2 the second semester teaching, etc.. The values in parentheses on the horizontal axis represent the sample size of new instructors (N=) in each semester. Sample size for this data set is for the new faculty only. It should be noted that first and second semester teacher ratings are all for the Introduction to Aeronautics courses. New faculty often move on to discipline specific courses in their 3rd and subsequent semesters, so the

feedback may be for a different course. However, the feedback questions examined are instructor-specific, not course-specific.

The data presented in Figure 6 represent average student responses to EOC survey question #7, "The instructor created a respectful, engaging learning environment for students." Responses for both new and returning instructors ranged between 5 (Very Often) and 6 (Always) and mostly above the Academy average of 5.44. There is a notable dip in semester 4. This may correspond to the transition of the new faculty from the introduction "Fundamentals of Aeronautics," to other more demanding and technically rigorous courses. However, the decrease in sample size from semesters 1 (N=12) to semester 5 (N=1) is so large that it is difficult to draw any conclusions on long-term effectiveness from this data. We examined student feedback for individual instructors by semester and it was determined that the dip after semester 3 is an artifact of the small sample size for semesters 4 (N=3) and 5(N=1). Individual instructor ratings did not drop in these semesters, but the overall average dropped because the sample size was so small. We also conducted a two-tailed t-test comparing student feedback in "Fundamentals of Aeronautics" to feedback in higher-level courses. The resulting p-value of 0.05 rejects the null hypothesis and suggests that this change in feedback is due to something different about the two courses.

The data in Figure 7 below represents average student responses to the EOC survey question #8, "Overall my instructor is..." All responses range above 4 (Good), and below 6 (Excellent).

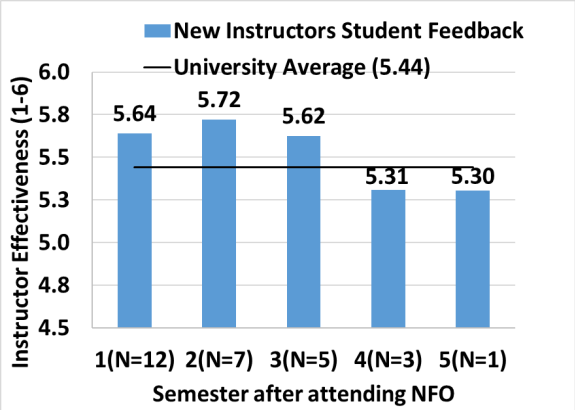

Figure 6. Average student responses to the end of course feedback question 7, "The instructor created a respectful, engaging learning environment for students." for successive semesters after attending the NFO program. The value in parentheses represents the sample size for each semester.

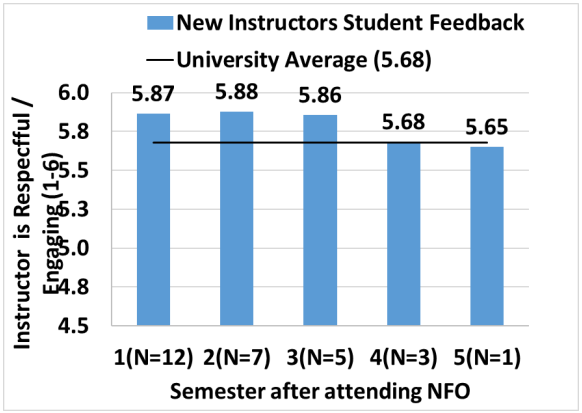

Figure 7. Average student responses to the end of course feedback question 8, "Overall my instructor is…" for successive semesters after attending the NFO program. The value in parentheses represents the sample size for each semester.

A similar pattern exists with new instructors rating higher than the Academy average of 5.68/6.0 for the first three semesters, followed by a drop in the 4th and 5th semesters. Again, this corresponds to the transition of the new faculty from the introduction "Fundamentals of Aeronautics," to other more demanding and technically rigorous courses. As mentioned previously, the decrease in sample size from semester 1 to semester 5 makes it impossible to

draw a meaningful conclusion about the effectiveness of the NFO program over time. Student feedback was examined for individual instructors by semester. It was determined that the dip after semester 3 is an artifact of the small sample size for semesters 4 and 5. We also conducted a two-tailed t-test comparing student feedback in "Fundamentals of Aeronautics" to feedback in higher-level courses. The resulting p-value of 0.09, while higher than the previous question, still and suggests that this change in feedback is due to something different about the two courses.

A correlation analysis was done between each question in the CTSE survey and each of the student ratings. No two variable combinations had greater than a low correlation, with the highest pair showing a correlation index of 0.33. A similar check was done taking the average CTSE score for each participant in the four categories of instructional planning, instructional delivery, classroom management, and assessment. No combination produced an index greater than 0.33 indicating a weak correlation. This tells us that, while the CTSE instrument is useful in measuring self-efficacy of new instructors, in this case it is not a predictor of student feedback in any way.

Limitations of this study

There are several limitations to this study. First, the change in the CTSE survey response from a 100-point scale to a 5-point Likert scale is not a validated change and may introduce errors. This will be addressed in future work by continuing to search for a survey instrument that allows the use of the 100-point scale. Second, the statistical sample size is small, with 17 total participants, and 12 new faculty. This small sample size makes it difficult to draw meaningful conclusions. In looking at student ratings of instructor effectiveness in subsequent semesters, the sample size decreases even more, to the point that in semesters 4 and 5 the sample sizes are N=3 and N=1 respectively. No conclusion can be drawn on the effectiveness of NFO in semesters 4 and 5 after completion. This will be addressed by continuing to collect student feedback data in future years. Third, the timing of the CTSE survey could be improved, some participants took the survey 2 years after completing the NFO program. Ideally, the survey would be administered just prior and just again just after the NFO program. This would allow the measurement of the change in self-efficacy by the NFO program. Fourth, the transition of new instructors from the Introduction to Aeronautics course higher level courses may influence overall student ratings of instructors over time. This may be a contributor to the drop in student rating seen in semesters 4 and 5. Details of this data were not available and therefore not examined. Future work will require tracking this as a separate variable. Finally, no control group was used for comparison. Without control group it is difficult to determine if the NFO program has the intended effect of increasing participants' self-efficacy and effectiveness as an instructor.

Conclusions

A deliberately planned, research based NFO has been developed with the intent of teaching inexperienced new faculty to be competent instructors. The uniqueness of this NFO program is the volume of practice teaching that participants participate in as either an instructor or observer. The CTSE [30] survey was used to measure instructor self-efficacy after participating in the NFO program. Results showed relatively high confidence levels among participants across the four broad areas of instructional planning (3.69/5.0), instructional delivery (4.2/5.0), classroom management (4.38/5.0), and assessment (3.93/5.0). Qualitative feedback indicated that Practice Teaching in front of peers and experienced instructors was the most useful portion of the

program. Student responses to two end-of-course feedback were examined. Student ratings of overall instructor performance for NFO participants averaged 5.86/6.0 in the first three semesters, which is slightly higher than the overall Academy average of 5.44/6.0. Student ratings on creating a respectful and engaging learning environment for NFO participants, an average of 5.86/6.0 was also slightly higher than the Academy average of 5.68/6.0. Because of the small sample size, no statistical conclusions can be drawn from this difference. Subsequent semesters show a drop in student ratings, however the extremely small sample size of N=3 in semester 4 and N=1 in semester 4, as well as the instructor transition from introductory to more advanced courses make it impossible to draw conclusions from this change.

The Use of the CTSE survey did highlight areas that need improvement within the NFO program. Specifically, training in using the Academy learning management system, accommodating students with special needs, assisting students in developing relationships with their peers, and adjusting instruction based on assessment results. Improved instruction in each of these areas is planned for future iterations of the program.

There were several limitations to this study. Modification of the CTSE survey response scale from 0-100 to a 5-point Likert scales was not validated. The timing of survey administration was not optimal, with up to a two-year gap between the NFO program participation and taking the survey. The limited sample size of 18 total participants over three years and lack of a control group for comparison make it difficult to draw meaningful conclusions or to generalize the results to a larger population. Future work will attempt to address each of these shortcomings.

Refences

[1] College Factual, “USAFA Demographics & Diversity Report,” College Factual.

[2] Joseph Lowman, *Mastering the Techniques of Teaching*. San Francisco, CA: Jossey-Bass, Inc., 1984.

[3] E. Seymour and N. M. Hewitt, *Seymour & Hewitt - Talking About Leaving, Why Undergraduates Leave The Sciences*. Boulder, Co: Westview Press, 1997. doi: 10.2307/2655673.

[4] W. Buskist, J. Sikorski, T. Buckley, and B. K. Saville, “Buskist - Elements of Master Teaching,” *The teaching of psychology*, pp. 27–39, Mar. 2013, Accessed: Jan. 10, 2025. [Online]. Available: https://www.psicopolis.com/psicopedia/boxpdf/teacingpsy.pdf#page=48

[5] A. W. Chickering and Z. F. Gamson, “Seven principles for good practice in undergraduate education,” *Biochem Educ*, vol. 17, no. 3, 1989, doi: 10.1016/0307-4412(89)90094-0.

[6] B. Gross Davis, *Tools for Teaching*.

[7] T. A. Angelo, “A Teacher’s Dozen-Fourteen General Research-Based Principles for Improving Higher Learning.” [Online]. Available: https://www.researchgate.net/publication/237489105

[8] Ken Bain, *What the Best College Teachers Do*. Harvard University Press, 2004.

[9] Richard M. Felder, “Learning and Teaching Styles in Engineering Education,” 2002. [Online]. Available: http://www.ncsu.edu/felder-public/ILSpage.html

[10] A. C. Estes, M. Asce, R. W. Welch, S. J. Ressler, and D. Head, “Teaching Lessons Learned The ExCEEd Teaching Model.”

[11] Linda B. Nilson, *Teaching At It's Best, A Research-Based Resource for College Instructors*, 3rd ed. San : Jossey-Bass, Inc., 2010.
[12] Benjamin S. Bloom, Max D. Engelhart, Edward J. Furst, Walker H. Hill, and David R. Karthwohl, *Taxonomy of Educational Objectives, the classification of educational goals*. Longmans, Green and Co Ltd, 1956.
[13] K. Patricia Cross and Thomas A. Angelo, "Classroom Assessment Techniques, A Handbook for Faculty," Ann Arbor, Mi, Sep. 1988.
[14] Philip C. Wankat and Frank S. Oreovicz, *Teaching Engineering*, 2nd ed. West Lafayette, In: Purdue University Press, 2013.
[15] Patrick W. Miller, *Body Language – An Illustrated Introduction for Teachers*. Munster, Ind. : Patrick W. Miller and Associates, 2005.
[16] R. Buckley, "Exploring Motivational Tools for Homework in a Senior-Level Engineering Course," Accessed: Jan. 10, 2025. [Online]. Available: https://peer.asee.org/exploring-motivational-tools-for-homework-in-a-senior-level-engineering-course
[17] A. C. Estes, R. W. Welch, and S. J. Ressler, "Questioning: Bring your students along on the journey," *Journal of Professional Issues in Engineering Education and Practice*, vol. 130, no. 4, pp. 237–242, Oct. 2004, doi: 10.1061/(ASCE)1052-3928(2004)130:4(237).
[18] A. C. Gilmore, "Teacher Enthusiasm: A Critical Review," *Educational and Psychological Research*, 1985.
[19] Raymond J. Wlodkowski, *Enhancing Adult Motivation to Learn, A comprehensive guide for teaching all adults*, 3rd ed. Jossey-Bass, Inc., 2008.
[20] "Allyship at Work Personal Workbook," leanin.org.
[21] "What Is Allyship? Your Questions Answered," Center for Creative Leadership.
[22] J. E. [Ed] Schwarz, "Counseling women across the life span: Empowerment, advocacy, and intervention.," *Counseling women across the life span: Empowerment, advocacy, and intervention.*, 2017.
[23] "Safe Zone Ally Training: Level 2," ASEE Learning.
[24] "Safe Zone Ally Training: Level 1," ASEE Learning.
[25] Jan. Peters, *Designing inclusion into engineering education : a fresh, practical look at how diversity impacts on engineering and strategies for change*. Royal Academy of Engineering, 2018.
[26] G. M. Walton and G. L. Cohen, "A brief social-belonging intervention improves academic and health outcomes of minority students," *Science (1979)*, vol. 331, no. 6023, 2011, doi: 10.1126/science.1198364.
[27] R. M. Felder, "What Do They Know, Anyway?," *Chem Eng Educ*, vol. 26, no. 3, pp. 134–135, 1992.
[28] A. Bandura, "Perceived Self-Efficacy in Cognitive Development and Functioning," *Educ Psychol*, vol. 2, no. 28, pp. 117–148, 1993.
[29] M. Tschannen-Moran, A. W. Hoy, and W. K. Hoy, "Teacher efficacy: Its meaning and measure," *Rev Educ Res*, vol. 68, no. 2, pp. 202–248, 1998, doi: 10.3102/00346543068002202.
[30] K. O. Siwatu, K. Page, and N. Hadi, "The Development of the College Teaching Self-Efficacy Scale," *College Teaching*, 2023, doi: 10.1080/87567555.2023.2203892.
[31] M. Tschannen-Moran and A. W. Hoy, "Teacher efficacy: capturing an elusive construct," 2001.

[32] S. E. Dechenne, L. G. Enochs, and M. Needham, “Science, technology, engineering, and mathematics graduate teaching assistants teaching self-efficacy,” 2012.

Disclaimer and Public Release

“The views expressed in this article, book, or presentation are those of the author and do not necessarily reflect the official policy or position of the United States Air Force Academy, the Air Force, the Department of Defense, or the U.S. Government."

PA#: USAFA-DF-2025-127

Appendix A – Self-Efficacy survey questions on the College Teaching Self-Efficacy (CTSE) [30] Scale developed and validated by Siwatu, Page and Hadi.

Table 6. CTSE Self-efficacy questions and designators.

Designator	**Question:**
Factor 1: Instructional Planning. Rate How confident you are in your ability to…	
CTSE2	Develop appropriate learning goals
CTSE5	Identify the appropriate instructional activities (e.g., lecture, discussion) that will enable students to meet the stated learning goals
CTSE6	Identify the appropriate types of assessments that will accurately measure students' learning outcomes
CTSE7	Identify course material that is appropriate for the students enrolled in the course
CTSE8	Use a course management system (e.g., Blackboard, Canvas, Teams) to make course materials available electronically
Factor 2: Instructional Delivery: Rate How confident you are in your ability to…	
CTSE11	Use students' prior knowledge to help them make sense of new information
CTSE14	Sequence instruction (i.e., order and organize) in a manner that will maximize student learning
CTSE15	Help students relate what they are learning to real-world situations
CTSE16	Adapt instruction to meet the needs of college students
CTSE17	Modify the planned instructional sequence when students do not appear to be learning
CTSE20	Present course content in a way that fosters students' understanding of course related concepts
CSE21	Make instructional accommodations for students with special needs or disabilities
CTSE2	Provide an alternative explanation of a course-related concept when students indicate that they are confused
Factor 3: Classroom Management. Rate How confident you are in your ability to…	
CTSE23	Motivate students to remain actively engaged in learning activities
CTSE25	Design activities that will assist students in developing relationships with their peers
CTSE28	Foster an environment that encourages students to seek help
CTSE29	Provide necessary support to students who are having difficulty mastering the stated learning goals
CTSE31	Maintain a classroom climate where all students are treated respectfully
CTSE32	Communicate the expected behavior for classroom conduct
Factor 4: Assessment	
CTSE35	Create new assessments to measure student learning based on stated learning goals
CTSE39	Provide students detailed feedback about their learning performance
CTSE41	Use assessment data to make instructional decisions