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## The STEM Faculty Experience at West Point

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# The STEM Faculty Experience at West Point

By Carolann Koleci, Eileen M. Kowalski, and Kenneth J. McDonald

*At conferences or meetings, West Point faculty are often asked, “What’s it like to teach at West Point?” Previously, we reported on this question within the context of the cadet’s West Point experience and how STEM courses and opportunities are integrated. Now we turn our focus to the West Point faculty and their unique position of both educating cadets in a traditional sense and helping with the cadets’ character development. In this article, we discuss who the West Point faculty are; what is expected of each faculty member; and how faculty members within chemistry, physics, mechanical engineering, and civil engineering educate and develop future leaders of character for the U.S. Army.*

What is it like to teach at West Point?” Several reports have focused on explaining this from the perspective of the teaching methods in the classroom, the culture of character development at the academy (Matthews et al., 2020; Murray et al., 2019; Turner et al., 2010), and the experience of cadets in high-enrollment STEM classes (Koleci et al., 2021). From the faculty’s perspective, reports have focused on individual courses or instructors and their development (Homsy & Whiteman, 2000; Klawunder et al., 2002; Quadrato et al., 2005; Rabb et al., 2008; Ressler & Lenox, 1996; Ressler et al., 2004; Ruvolo, 2007). In this article, we report on who the faculty at West Point are, how they arrive at West Point, what is expected of them, and how they accomplish their mission to develop cadets as leaders of character who are prepared to be the future leaders of the U.S. Army.

## About the faculty

Most faculty at West Point are military officers, with about 27% of the faculty being civilians; about 30% of civilian and military faculty hold doctoral degrees, and all other faculty hold master’s degrees (United States Military Academy, 2018). Military faculty are officers of multiple ranks, ranging from captain (4 to 10 years of military service) to brigadier general (more than 30 years of service; Army-Portal.com, 2010). Officers must be on active duty in the Army for a minimum of 4 years (United States Military

Academy, 2020c) to be selected 3 years in advance of arriving to teach at West Point. Officers must be accepted into a graduate program to complete a master’s degree in their field of interest, for which the Army will pay for their tuition. After completing a master’s degree, the officer (typically a captain or major) comes to West Point as a “junior rotator,” spending 2 to 3 years teaching in an academic discipline and mentoring cadets on what to expect once they are commissioned as officers in the Army. Once finished with their rotation at West Point, the junior rotators are reassigned to new positions and duty stations in the Army.

Some of these officers are subsequently selected to return to West Point to serve in one of three senior roles: senior rotators, Academy professors, or Professor, United States Military Academy (PUSMA). Senior rotators return to graduate school to earn their doctoral degree and then teach at West Point for another 2 or 3 years. These officers (typically lieutenant colonels with more than 16 years of service; Army-Portal.com, 2010) serve as mentors for not only cadets but also junior faculty who are still early in their careers. Academy professors also have these responsibilities, but they may remain at West Point for the remainder of their military careers. These professors’ longer time on the faculty allows them to serve in leadership roles or committee assignments where multiyear availability is helpful. Senior rotators can also apply to become Academy professors, and both senior rotators and Academy professors can

apply to become a PUSMA if a position opens. Being a PUSMA, a U.S.-Senate appointed position, allows a senior officer to remain at West Point until the age of 64. These officers usually serve as department heads or deputy department heads, but they may also be vice deans or the dean of the academic program (United States Military Academy, 2020a).

The remaining faculty at West Point is made up of civilians. Civilian faculty were first introduced at West Point in 1994 (National Defense Authorization Act for 1993, 1992). Civilian faculty at West Point have several categories, similar to a traditional college or university. There are tenure-track faculty, visiting professors, teaching and research fellows, term-appointment faculty, and adjunct faculty (United States Military Academy, 2020b). Visiting professors are typically chosen from different government research facilities around the country. Term-appointment faculty are civilians who are hired to teach full time or have been hired to work on research projects and teach for a fixed amount of time. Adjunct faculty are not part-time employees but are instead faculty with duties elsewhere on the installation (e.g., the hospital) who use a small part of their time to teach or help with projects.

### The five domains

Whether military or civilian, long-term, rotating, or visiting, all faculty at West Point are expected to contribute in five domains. West Point faculty contribute to the traditional three domains of teaching, scholarship, and service, in addition to the domains of cadet development and faculty development (United States Military Academy, 2018). The teaching and scholarship domains include expectations that are similar to those of other primarily undergraduate institutions. The service domain includes expectations that each faculty member will work to enhance or sus-

tain the Academy. For example, faculty can serve on committees, work on Academy-wide projects, or improve the Academy's external relationships via work with professional societies, educational activities, and social organizations.

Cadet development is a domain closely tied to the mission of West Point: to educate, train, and inspire future leaders of character for the U.S. Army. To accomplish this mission, special emphasis is placed on engaging with the cadets inside and outside the classroom to provide as many formal and informal opportunities for mentorship as possible. These conversations give the cadets many different points of view and opportunities for self-reflection. Cadet development contributions of a faculty member can often take the form of being an academic advisor or a mentor for an extracurricular team, club, professional society, or sport. Faculty serving as advisors or mentors attend home meetings or competitions and accompany the cadets to external meetings or competitions, getting to know the cadets and making themselves available as mentors to the cadets.

Faculty development is the last domain to which faculty are expected to contribute, and this domain is closely tied to the military nature of West Point. Most of the military faculty at West Point rotate through assignments and leave West Point after a few years. Because of this personnel rotation, the turnover rate for instructors at West Point is approximately 30% every year (Hampton et al., 2004). Additionally, some new faculty will teach a course different from their major field of study; for example, it is not uncommon to have former math majors or nuclear engineering majors teach introductory physics. Due to such a large turnover of faculty and academically diverse backgrounds, each academic department hosts a 4- to 6-week summer workshop for new

faculty to introduce Academy policies and give new faculty practice with teaching. Incoming faculty work with a mentor to prepare and teach classes to their peers and experienced faculty. After each class, the experienced faculty provide written and spoken feedback to the new faculty. These workshops help new faculty develop disciplinary expertise, showing them how topics link to one another, and they also develop teaching expertise so new faculty feel prepared when the semester begins. Summer workshops for faculty development have been described in more detail in other publications (Alford & Gandolfo, 2004; Conley et al., 2000; Hampton et al., 2004; Hanus & Evans, 2001; Homsy & Whiteman, 2000; Quadrato et al., 2005; Wong et al., 2006).

Faculty development continues during a variety of formal programs and informal opportunities during the academic year. Within departments, some formal programs include research seminars and teaching discussions. Additionally, each department maintains a mentorship structure such that anyone new to a role has someone as a mentor—for example, course directors are responsible for mentoring less-experienced faculty teaching their course, and course directors have course supervisors or program directors as their mentors. Along with the formal mentoring structure, informal mentoring opportunities are supported by assigning each new faculty member to an office so they are near experienced faculty teaching the same course or the same discipline. Furthermore, as is typical at many schools, faculty often have one-on-one conversations with colleagues as questions arise.

In addition to programs within departments, the Academy has a formal faculty development option called the Master Teacher Program (United States Military Academy, n.d.), which is open to faculty of all experience levels and disciplines. Over 4 semes-

ters, participants discuss and reflect on learning, teaching, pedagogy, and assessment. The program culminates with participants completing a classroom research project and earning their Master Teacher certificates.

## STEM teaching at West Point

STEM faculty at West Point manage courses using a similar structure regardless of the department, course, or number of enrolled cadets. With this in mind, we will describe the structure of STEM education at West Point in the context of high-enrollment introductory courses because they best illustrate the STEM education structure. It should be noted, however, that upper-level courses within the major with lower enrollment do still operate under the same administrative framework, but due to the numbers of cadets and fewer faculty teaching the course, they would operate analogously to upper-level courses with lower enrollment at similar higher education institutions.

Each department has faculty with varying levels of teaching experience, from those who may be completely new to teaching to those having 3 or more years of teaching experience. Regardless of experience level, there

are similar course loads and responsibilities among all faculty teaching in large-enrollment, introductory STEM courses. A typical teaching load is three or four sections that meet two or three times each week. Each section has a maximum class size of 18 cadets, which means the number of sections, and in turn the number of instructors, for each subject is much larger than the number of instructors for corresponding courses at other schools, which have one instructor per section in an auditorium. Additionally, some faculty teach advanced versions of each course, which often requires different teaching approaches to challenge the cadets in introductory classes who have shown a greater proficiency in math. Table 1 shows the total enrollment, the number of sections, and the number of instructors for introductory physics and introductory chemistry courses, both standard and advanced, as well as a basic engineering course, Fundamentals of Engineering.

With a large number of sections and instructors, teamwork among the faculty plays a vital role in the functioning of these large-enrollment, introductory STEM courses. A typical introductory STEM teaching team

consists of a course director, an assistant course director, and instructors.

Course directors manage the course and its team of instructors and are responsible for developing the course schedule, the syllabus, and common assessment tools such as homework, quizzes, tests, finals, and laboratories that every instructor will use. Additionally, course directors meet with the entire team of faculty to summarize upcoming material, discuss common points of confusion or misconception, review grading rubrics, suggest possible class demonstrations and activities suitable for upcoming topics, and review any necessary administrative concerns, such as scheduling and logistics for the administration of upcoming exams. Assistant course directors are assigned to help course directors with completing all of these tasks. Course directors and assistant course directors also teach one or two sections within the course.

In some cases, such as introductory physics, there may also be a laboratory course director who is responsible for the same tasks as a course director but only for the laboratory portion of the course. The laboratory course director also meets with the entire team of faculty to review and discuss the upcoming laboratory, explain possible points of confusion, review the laboratory grading rubric to ensure consistent grading among all sections, and discuss any remaining administrative concerns relevant to the labs.

For the most part, instructors are responsible for teaching the material to the bulk of the cadets enrolled in a course. Because the expected content covered in an introductory STEM course is set by the course director and should be uniform across all standard and advanced sections, instructors are given flexibility in terms of structuring their class and how the material is taught. Instructors are encouraged to use the “Thayer method” of instruction

**TABLE 1**

**Course enrollment breakdown for introductory physics, chemistry, and engineering courses for fall 2020.**

Course		Total enrollment	Number of sections	Number of faculty
Introductory Physics	Standard	453	26	10
	Advanced	144	8	3
General Chemistry	Standard	567	34	13
	Advanced	93	5	3
Fundamentals of Engineering		308	18	9

*Note.* Introductory physics and engineering courses are capped at 18 cadets per section, but sections of chemistry may be slightly larger to accommodate enrollment.

(Capps et al., 2018; Connors, 2001; Ertwine & Palladino, 1987; Geher, 2014; Shell, 2002; Sloop et al., 2010), in which cadets are expected to do all requisite readings and assignments before coming to class. Once in the class, some instructors use interactive laboratory demonstrations (Sokoloff & Thornton, 1997; Wieman & Gilbert, 2014); some encourage team problem-solving that involves sending groups of cadets to chalkboards to solve different problems; and others use guided inquiry to build conceptual understanding and motivate application of STEM concepts. Beyond these common practices, instructors are encouraged to explore innovative ways to build conceptual mastery for a given class.

Instructors are responsible for grading their own sections' homework, quizzes, and laboratory reports. Tests for these high-enrollment classes may have a few multiple-choice, short-answer, and fill-in-the-blank questions, but the majority of questions involve problem-solving. To grade these tests, the entire team of course directors and instructors will divide into small groups, with each assigned to grade one problem on the exam for all students in the entire course.

### Character development

With a low cadet-to-faculty ratio at West Point, cadets have the opportunity to be not only educated but also mentored by their instructor. This opportunity is central to West Point's mission of developing cadets into leaders of character. In fact, it is common for an instructor to discuss various personal and professional topics that may pertain to a cadet's future experiences inside and outside the Army while discussing a typical STEM topic. Character development opportunities such as these are at the instructor's discretion with regard to when, where, and how frequently such classroom discussions occur.

For formal character development,

instructors are typically assigned to mentor approximately six cadets during periodic development reviews (PDRs) each semester. The purpose of the PDR is to provide the cadet an opportunity to understand his or her professional development as a future Army officer. Topics such as character, presence, intellect, leadership, professional development, and achievement are evaluated by the instructor, and the cadet shares examples pertinent to each of these areas. The instructor is then able to offer a perception of traits exhibited by the cadet that enable such core leader competencies to be performed with greater effect (United States Military Academy, 2015).

In some cases, a cadet goes above and beyond what is expected either in or out of the classroom. In such situations, any faculty member may opt to write a positive Cadet Observation Report (COR). In other situations, a cadet may be deficient in an area or may have exhibited behavior that is outside the guidelines of professional conduct; for these sorts of situations, any faculty member will write a negative COR. CORs formally document outstanding or deficient cadet behavior, which is particularly useful when cadets are considered for military leadership roles or are the subject of disciplinary action (United States Corps of Cadets, 2020).

### Summary

What is it like to teach at West Point? Whether military or civilian, all faculty contribute to the five professional pillars of West Point: teaching, scholarship, service, faculty development, and cadet development. Faculty perform myriad professional duties, many of which are integral to West Point due to the unique blend of military training and higher education.

The small cadet-to-faculty ratio within large-enrollment, introductory STEM courses affords instructors the opportunity to know and grow

with their community of learners and enables the learner to easily approach the faculty to resolve any misconceptions, solve problems, and engage in leadership and character conversations. Small class sizes also allow STEM instructors to continuously assess cadet work so they have up-to-date information on how to tailor in-class instruction based on cadet performance.

Teamwork among the faculty plays a vital role in the functioning of large-enrollment, introductory STEM courses. The routine meetings led by the course directors give instructors an overview of topics to come and also enable instructors to share their teaching and mentoring experiences and strategies with one another. This steady mode of communication and effective rapport among all instructors assigned to the STEM course creates a close-knit community of educators who support, sustain, and develop one another. As the Army is an organization concerned about and committed to its people, West Point also creates the unique opportunity to strengthen ties within its community of learners and teachers.

### Note

*The views expressed herein are those of the authors and do not purport to reflect the position of the United States Military Academy, the U.S. Department of the Army, or the U.S. Department of Defense.*

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