Military Leadership for Engineers: A Comprehensive Look at Leadership from Army Doctrine to Engineering Course Work

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Abstract

Engineers and engineering educators realize that engineering is a team effort and leadership is inherent to a team's success. Engineering project completion from ideation to implementation requires engineers to provide influence in an often-complicated group of multi-disciplinary professionals. In other words, leading is inherent to success as an engineer. ABET recognizes this reality with student outcome number five where students must demonstrate, "an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives."

Because engineering has traditionally not been considered a leadership profession, many engineers and engineering educators may be unfamiliar with, or even averse to leadership principles and processes. One profession that may be a resource for leadership principles and insight is the Profession of Arms, and more specifically, the U.S. Army. Officers and soldiers are often referred to as leaders and as an organization, the Army maintains a high degree of public confidence. Unfortunately, less than one percent of the U.S. population serves in the military and recently, there are concerns that the Army is becoming a family business; many of those serving come from families with a record of service. As a result, engineers and engineering educators may be unfamiliar with or misperceive the principles of leadership within the Army because 1) they have no affiliation with the Army or 2) they have gained a perception of military leadership through what they see in Hollywood.

The purpose of this paper is to provide a comprehensive overview of Army leadership through the lens of the United States Military Academy at West Point (West Point). Leadership principles, education, and training are reviewed from guiding doctrinal principles through an institution-level leader development system, and into specific coursework that focuses on leader development. Finally, the paper situates these leadership principles in the capstone design experiences of students: a venue within undergraduate engineering education where leadership is often addressed. The goal of this paper is to make more explicit how leadership works within the Army and West Point, to give engineering educators additional tools and models that they may consider in developing engineering leadership programs and processes within their own institution.

Introduction

As the engineering profession continues to emphasize leadership as an integral part of engineering practice, many engineering leadership programs and courses have developed across the United States and North America more broadly [1]. Because engineering has traditionally not been considered a leadership profession, engineering leadership has not gained traction as a legitimate field of study, and practicing engineers may even be averse to leadership principles and processes [2]. Engineers and engineering educators may have to look external to the profession for leadership developmental principles. One profession that may be a resource for leadership principles and insight is the Profession of Arms, and more specifically, the U.S.

Army. Military officers are often referred to as leaders (e.g., [3]) and as an organization, the U.S. Military remains one of the most trusted among adults in the United States [4].

Engineers and engineering educators, however, may be unfamiliar with or misperceive the principles of leadership within the U.S. Army. As of 2016, less than one percent of the U.S. population currently serves in the military [5] and less than 10% of the U.S. population has any form of military service [6]. Recently, there are concerns that the Army is becoming a family business [7]; across the military services, approximately 80% of new recruits come from a family where at least one relative has served [8].

The purpose of this paper is to provide a comprehensive overview of Army leadership through the lens of West Point. The goal of this paper is to make more explicit how leadership works within the Army and West Point, and to give engineering educators additional tools and models that they may consider in developing engineering leadership programs and processes within their own institutions.

Background

A brief review of ASEE papers published in the last five years indicates that engineering leadership development programs and courses may look toward the U.S. Army and the military more broadly in addition to industry for examples of leadership and leader development. Leadership models used in these programs may pull from U.S. Army leadership doctrine (e.g., [9]). Veterans and currently serving military members are often consulted in the development of engineering leadership programs (e.g., [10], [11]). Faculty in these programs may be veterans (e.g., [12]). The University of Texas at El Paso's E-LEAD program bases its model directly on the leadership development model of The United States Military Academy [13]. Paradoxically, educators exploring engineering leadership [1] may overlook military colleges because leadership is fully integrated into these programs, and the perception may be that leadership is not explicitly addressed.

The context of this paper is one of these overlooked military colleges: West Point. Whether the cadets at West Point enter the Academy from enlisted service or civilian life, they are all 18-24 years of age and struggle with many of the same social and societal issues of their civilian college counterparts. Carved into granite at West Point and memorized by every cadet, the mission of the Academy is: "To educate, train, and inspire the Corps of Cadets so that each graduate is a commissioned leader of character committed to the values of Duty, Honor, Country and prepared for a career of professional excellence and service to the nation as an officer in the United States Army" [14, p. 2]. The creators of West Point, namely George Washington, Thomas Jefferson, Henry Knox, and John Adams, sought to create an institution capable of providing a disciplined and competent officer corps that remained under civilian control. Cadets would be citizen-soldiers, hailing from across the nation and selected by elected political representatives. America had relied on the expertise of many foreign army officers during the Revolutionary War, particularly in the realms of engineering and artillery. West Point would accrue and disseminate the nation's expertise in these fields and supply the leadership necessary to command militia forces if needed, thus being an economical answer to many questions surrounding national defense [15]. West Point still serves much the same purpose, though the

education and leader development process have changed significantly since the Academy's founding in 1802.

Today, West Point is a four-year, highly selective, accredited institution of higher education where each graduate earns a Bachelor of Science degree with the option to specialize in 36 academic majors and 15 minors. Engineering continues to play a prominent role at West Point, and all cadets are exposed to engineering principles as a part of the academic program. Engineering majors include Chemical, Civil, Electrical, Environmental, Mechanical, Nuclear, Systems Engineering, Engineering Management, and Engineering Psychology. Engineering minors include Aeronautical, Systems, and Engineering Management. Those cadets that do not major in engineering must take a three-course engineering sequence in the areas of Cyber, Electrical, Environmental, Infrastructure, Nuclear, or Systems Engineering [16]. This core engineering sequence ensures all cadets are exposed to the technical problem-solving methodology inherent to engineering practice, and which has direct parallels to military decision-making methodology. A full description of these parallels is beyond the scope of this paper. On the day of graduation, all graduates are commissioned as officers in the U.S. Army in the grade of Second Lieutenant. All graduates are required to serve a total eight years in a combination of active duty and the Army's Inactive Ready Reserve (IRR), typically consisting of five years on active duty and three years in the IRR.

Cadets develop over a 47-month experience through a program called the West Point Leader Development System (WPLDS) [14]. The entire living-learning environment is structured to provide cadets with leadership opportunities and help them relate their experiences to personal development as leaders and future officers in the Army. Military and civilian faculty at West Point have a unique opportunity to develop students in their respective disciplines while immersed in a leadership laboratory. This dynamic may be opposite from the experiences of faculty at more traditional institutions where leadership is taught within a discipline-specific environment.

The stereotype of military leadership is that of the authoritarian dictating stern orders from above, and automaton soldiers obeying without question. Hollywood's common portrayal of the military leader has propagated this image, but the reality is that even the harshest of combat conditions require deeply human connections between the leader and the led. Researchers in the leadership field recognize this, and often turn to the military for inspiration.

Early leadership research followed the model of Thomas Carlyle's [17] "Great Men" studies in focusing on a leader's individual characteristics. Rapid industrialism and the rise of a professional manager class in the late 1800s created the market for leadership theory that moved beyond heroic idealism, generating rational managerial coordination. With a focus on leadership stemming from the proper administration of large bureaucracies, many studies drew upon the railroad industry and the military. In translating these studies for the private sector, a focus on rigorous process and accountability led to the scientific management school of thought, as exemplified by Frederick Taylor [18]. Under scientific management, the leader is an engineer of the organization, and directs the further division of labor and rationalization of the workplace [19].

Following World War II, much leadership research shifted toward human relations such as Elton Mayo [20], followed by Maslow's [21] characteristics of the self-actualizer and hierarchy of needs. Much of the field's foundational research into transactional and transformational leadership styles (and the related Full Range Leadership Model) stem from military studies [22]. Bass [23] formulated the core of charismatic leadership theory through his comparison of combat and support leaders operating in extreme conditions.

Leadership has more recently become viewed as a process of reciprocated influence: a social construction that relies on relationships between leaders and followers and not requiring a formal hierarchical position [24]. DeRue and Ashford [25] present a theory that is based on informal and formal leaders and followers claiming and granting the roles of leader and follower to one another. This "collective endorsement" leads to being seen in the social environment as a leader or a follower, which DeRue and Ashford [25] use to support their theory that the more a leader or follower is collectively endorsed, the more those images will be reinforced and the stronger those images will become. These most recent academic approaches to understanding leadership inform and coincide with the Army's current leadership doctrine.

Methods

This paper uses a case study approach to explore leadership principles and associated developmental strategies for undergraduate mechanical engineering students. The authors examine guiding documents at three echelons: Army, Institution, and Academic Department (Table 1) to draw connections between Army leadership theory and mechanical-engineering-specific developmental opportunities for undergraduate engineering students. The case considered in this study is the Mechanical Engineering Division of the Department of Civil and Mechanical Engineering at West Point. By situating mechanical engineering specific developmental experiences into the larger institution and Army framework, the authors seek to elucidate the comprehensive breadth of curricular and co-curricular activities encompassed by West Point's leader development model. *The goal of this work is to 1) provide engineering educators with a framework to harness existing developmental experiences at their home institution toward engineering leader development, and 2) identify potential gaps in existing programs that may be re-considered to bolster engineering leader development.*

Table 1: Source Documents for this study

Echelon	Guiding Documents
Army	• Army Doctrine Publication (ADP) 6-22 [26] • Field Manual (FM) 6-22 [27]
Institution	• Developing Leaders of Character: West Point [14]
Academic Department	• Military Leadership (PL300) Course Guide • Intro to Mech Engineering (ME201) Course Notebook • Mechanical Engineering Design (ME404)/Mechanical System Design (ME496) Course Notebook

Army Leadership Doctrine

Army Doctrine Publication (ADP) 6-22, entitled *Army Leadership and the Profession,* describes the role of leaders, defines leader attributes (character, presence, and intellect), explains core competencies (leads, develops, and achieves), and differentiates the responsibilities of direct, organizational, and strategic leaders. The Army defines leadership as "the activity of influencing people by providing purpose, direction, and motivation to accomplish the mission and improve the organization," [26, p. 13].

Developed through decades of experience and supported by research, the Army's leadership requirements model informs leaders of the competencies and attributes needed to succeed in the profession. Importantly, the Army defines the leader as "anyone who by virtue of assumed role or assigned responsibility inspires and influences people by providing purpose, direction, and motivation to accomplish the mission and improve the organization," [26, p. 13]. Any organizational member, regardless of rank, can be an effective leader if she possesses the intellect, presence, and character (attributes) to lead, develop, and achieve (competencies).

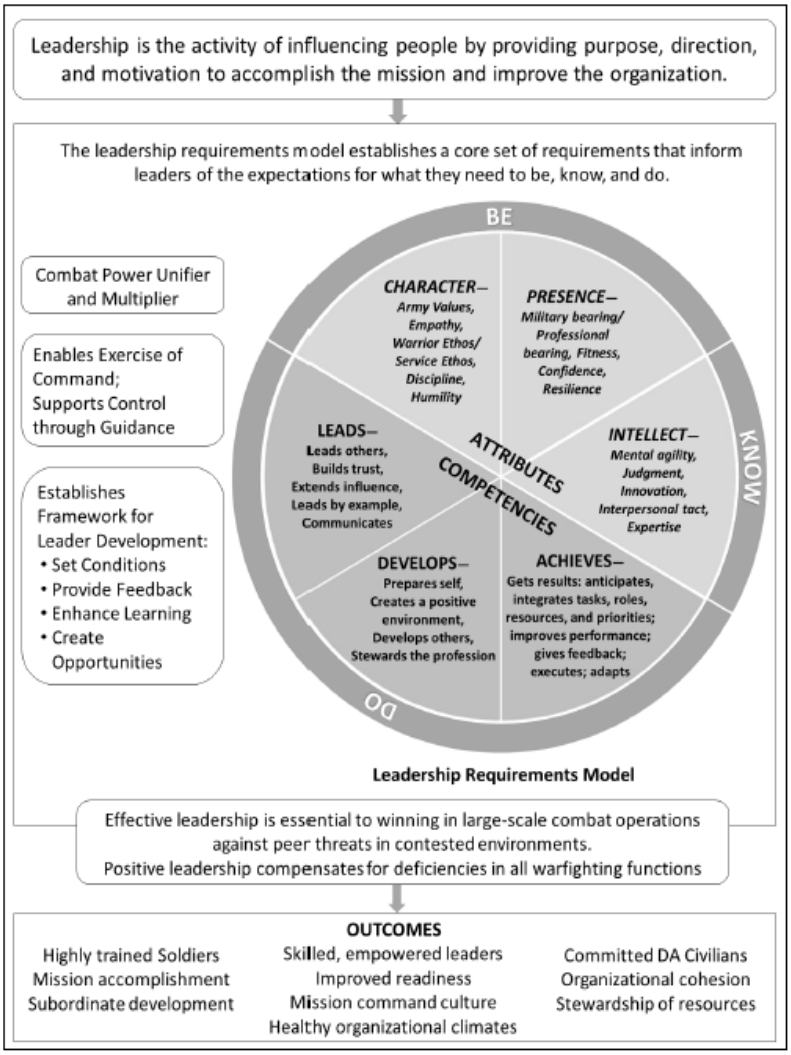

Figure 1: ADP 6-22 Logic Map [26, p. 9]

Figure 1 visually displays the leader requirements model and highlights the Army's *Be, Know, Do* framework which resonates with college students. Attributes (*Be* and *Know*) are longstanding characteristics of the individual, refined through experience and reflection, while competencies (*Do*) are learned skills developed through training and education. West Point's approach to leader development aligns with Army doctrine but has adapted over decades to maximize the time and resources available to create leaders of character.

Institution Leadership Development Framework

In 2010, West Point's Superintendent ordered a review of the Academy's Cadet Leader Development System (CLDS). Developed and implemented from 1986-1991, CLDS was designed to "guide and integrate all developmental activities over the four-year cadet experience," [28]. Academy leadership in 2010 sought a system that could better guide decision making about programs, curriculum, and any other developmental process needed in a university and military training program. The desired end state was a revised CLDS that included a larger portion of the West Point community. The newly named West Point Leader Development System aligned with Army leadership doctrine and served as a functional means of carrying out the West Point mission.

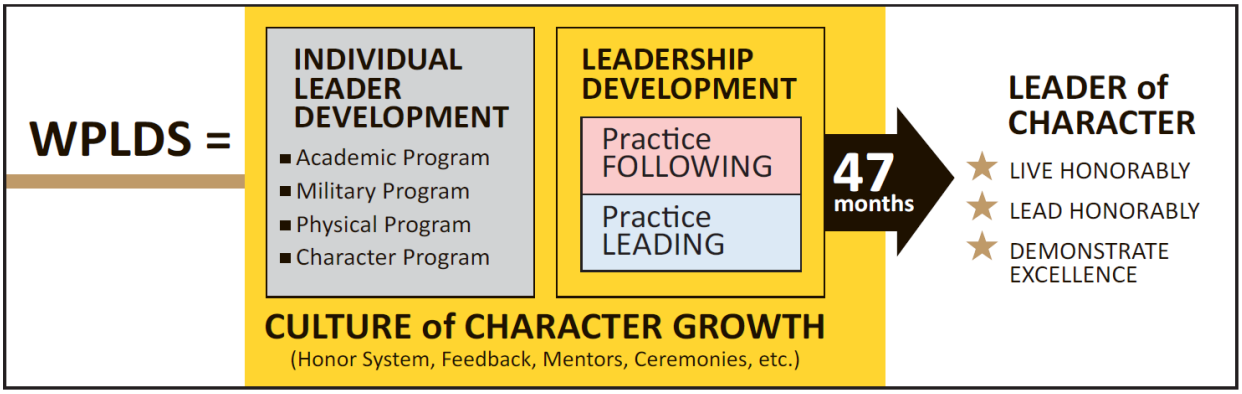

Figure 2: WPLDS Model [14, p. 9]

Figure 2 shows the current framework of WPLDS. The system is a 47-month experience that combines individual development within four programs (academic, military, physical, and character) with progressive leadership development experiences where cadets simultaneously practice following while progressively practicing leading greater numbers of fellow cadets. A comprehensive accounting of developmental experiences for cadets over their 47-month experience is shown in Appendix A. Cadets live within a military organizational structure consisting of 36 cadet companies of approximately 150 cadets each. These companies may be considered co-ed living-learning communities where all four class years are represented. Within this organizational structure, cadets are assigned increasing levels of responsibility throughout the 47 months from the rank of cadet private (follower only) up to Brigade First Captain who is responsible for the 4400-person Corps of Cadets. All of this development is immersed in a culture of character growth. This culture is heavily influenced by the cadet honor code which simply states that, "a cadet will not lie, cheat, or steal, or tolerate those who do" [14]. All members of the Academy (staff, faculty, and coaches) are a part of the culture of character growth which is a community of reflective practice that reinforces WPLDS and all members

model both character and leadership. The goal of WPLDS is leaders of character who 1) live honorably, 2) lead honorably, and 3) demonstrate excellence. A full description of these goals is addressed in Table 2.

Table 2: West Point Outcomes and Associated Actions [14, p. 6]

WPLDS Outcome	Associated Actions
1) Live Honorably	• Taking morally and ethically appropriate actions regardless of personal consequences. • Exhibiting empathy and respect towards all individuals. • Acting with the proper decorum in all environments.
2) Lead Honorably	• Anticipating and solving complex problems. • Influencing others to achieve the mission in accordance with the Army values. • Including and developing others. • Enforcing standards.
3) Demonstrate Excellence	• Pursuing intellectual, military, and physical expertise. • Making sound and timely decisions. • Communicating and interacting effectively. • Seeking and reflecting on feedback.

As part of their formal instruction in leadership concepts in their third-year, cadets are exposed to West Point's leadership development model. An understanding of the Leader Development Model (Figure 3) helps frame the general leadership course and their current place in the progressive WPLDS. Optimally, a cadet has personal readiness for development, thus strengthening the leader identity as developmental experiences continue (engineering group participation, intramural athletics leadership, leader responsibility for younger cadets, etc.). New capacities and knowledge are gained primarily from formal instruction. Reflection, often guided by mentors and leadership faculty, maximizes the developmental gains from current and past leadership experiences. This model informs the leader development approach of mechanical engineering cadets where team-based engineering leadership experiences bookend their formal instruction in leadership theory.

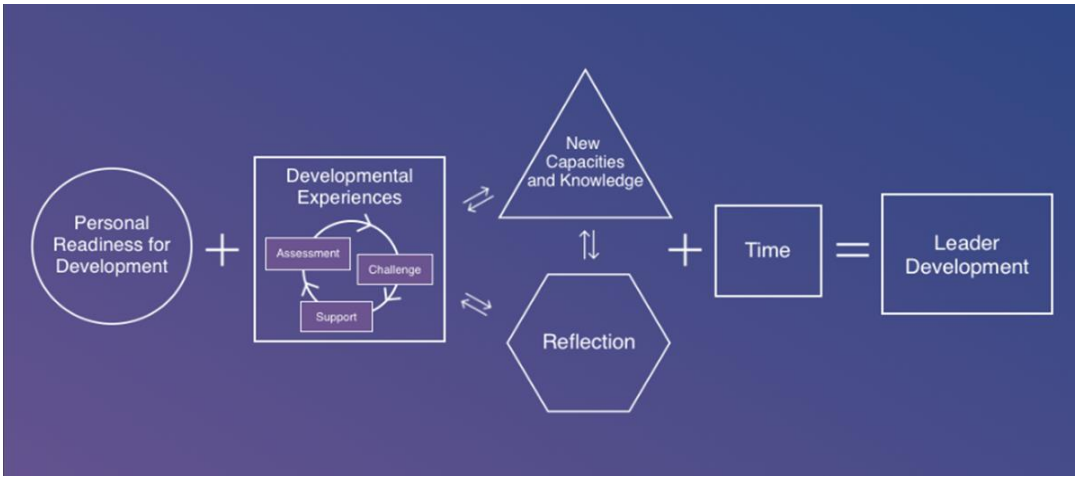

Figure 3: The Leader Development Model (West Point Leadership, 2018) [29]

Of note, the 'support' portion of the leader development model is often facilitated by formal and informal mentors of cadets. Throughout the 47-month experience, cadets are immersed in a culture of mentorship consisting of routine interaction with more experienced cadets and Army officers. The cadet mentorship experience starts the first semester as cadets transition from 'New Cadets' to 'Plebes' (first-year/Fourth Class) at the end of cadet basic training. Each 'Plebe' is assigned to a second-year cadet Team Leader. For the second-year cadet, this is a first opportunity at a formal leadership role. For the first-year cadet, this is an initial exposure to a formal cadet mentorship relationship. For officer mentorship, first-year cadets are given the option to sign up for West Point's sponsorship program, where cadets are paired with Army officer families. This gives cadets initial exposure to the life of an Army family and provides the opportunity to develop relationships with Army officers in a social setting. For staff, faculty, and coaches, cadet mentorship is an integral part of assignment to West Point. Cadet Development is one of the five pillars of faculty excellence.

Engineering and Leadership Coursework

Consistent with the transition from CLDS to WPLDS where all staff, faculty, and coaches reinforce the cadet developmental process, the Department of Civil and Mechanical Engineering (D/C&ME) at West Point sees its primary mission as developing leaders, in alignment with the institution's mission statement. The department's mission statement is clear:

> "The mission of the Department of Civil and Mechanical Engineering is to educate, develop, and inspire agile and adaptive leaders of character who design and implement innovative solutions and win in complex environments as trusted Army professionals" [30].

Table 3: Mechanical Engineering Major Template, Class of 2023 (2nd to 4th year)

21-1	21-2	22-1	22-2	23-1	23-2
MA205 Calculus II (4.0)	PY201 Philosophy (3.0)	**PL300** **Leadership** **(3.0)**	EE301 Circuits (3.5)	ME480 Heat Transfer (3.5)	LW403 Law (3.0)
PH206 * Physics II (4.0)	EV203 * Physical Geography (3.0)	MC311 Thermal-Fluid Sys I (3.5)	MC312 Thermal-Fluid Sys II (3.0)	MC380 Eng. Materials (3.5)	**MX400** **Officership** **(3.0)**
CH102 Chemistry II (4.0)	ME370 CAD (3.0)	MC306 Dynamics (3.0)	SS307 Intl Relations (3.0)	**ME404** **ME Dsn** **(3.5)**	HI302 Mil Art (3.0)
ME201 **Intro to ME** **(3.0)**	SS202 Pol Sci (3.0)	MA364 Engr Math (3.0)	ME403 Manuf/Mach Dsn (3.5)	MC486/XE472 Dynamic Sys Elect (3.0)***	**ME496** **Capstone** **Dsn** **(3.5)**
LX20_ Foreign Lang (4.0)	LX20_ Foreign Lang (3.5)	MA206 Prob & Stats (3.0)	ME Tech Elect (3.0)	ME Tech Elect (3.0)	STEM Elect** (3.0)
MC300 Statics/Strengths (3.0)	MC364 Mech of Mat (3.5)	SS201 Economics (3.0)			

The department accomplishes its mission through its civil and mechanical engineering programs. This paper focuses on only the mechanical engineering program within the department. In general, students enrolled in the mechanical engineering major typically begin taking courses in their major in the beginning of their second year because the students do not declare their major until the spring of their first year. An example curriculum is shown in Table 3 below. In a review of course material, five courses were identified that had course objectives that were directly related to leadership development (bold in Table 3).

Of the four courses, ME201, ME404, and ME496 are all taught within the D/C&ME. These courses bookend PL300, which is taught by the Department of Behavioral Sciences and Leadership (D/BS&L). The fifth course, MX400, is the cadets' military program capstone course that focuses on officership within the Army. Because of the military-specific nature of this course, a full description is beyond the scope of this paper. ME201 is an introduction to mechanical engineering course, similar to a discipline-specific first-year engineering course at other universities. ME404 and ME496 comprise a year-long capstone design experience where cadets work in a team to design an engineering solution to a problem for an external client. Sequencing team-based design experiences across ME201 and ME404/496 affords mechanical engineering majors an opportunity to practice leadership in a team-based engineering environment, receive formal education on leadership related theories and skills in PL300, and then have a second chance to practice leadership-related skills in a technical engineering context. These environments force the students to both practice leading and practice following across the duration of the engineering project. Table 4 provides a crosswalk of leadership related course objectives and assignments inherent to D/C&ME courses. The formal assessment of leadership development in D/C&ME is currently addressed at the course level and currently not assessed holistically because of the institution level emphasis placed on leader development. An in-depth of leader development assessment is beyond the scope of this paper and an area of future work for the authors.

Table 4: D/C&ME Course Leadership Crosswalk

Course	Course Objective	Leadership Related Assignments
Intro to Mech Engineering (ME201)	**Operate as an effective leader or team member on a project team.**	• Deliverable #11: Team Charter • Deliverable #19: Peer Review and Reflection
Mechanical Engineering Design (ME404)	**Operate as an effective leader or team member in a multi-disciplinary project team**	• Team Charter • Peer Review
Mechanical Systems Design (ME496)	**Work effectively within a multidisciplinary design team in a professional and ethical manner.**	• Peer Review (x 2) • Reflective Essay

ME201 Engineering Leadership Experiences

Within the first semester of their mechanical engineering curriculum, cadets are encouraged to develop their leadership skills in a half-semester long engineering design challenge during the ME201 course. The design challenge spans the final 22 of 40 lessons and requires cadets to work on a team of three people to design and prototype a solution to a soldier-inspired design problem. Cadets are assigned to teams by the instructors but self-nominate a needs statement for the project based on their own soldier experiences, often during cadet basic training. As a part of the course, there is one leadership-related lesson of instruction for cadets which reviews basic principles of team behavior, team charters, and project management. The lesson occurs prior to the start of the design challenge.

To ensure the ME201 cadet teams begin the teaming experience with a solid foundation, all teams must develop and submit a team charter as a graded assignment. The chartering assignment forces the teams to address 1) team member strengths and weaknesses, 2) team member roles, 3) problem statement, 4) key milestones and dates, 5) knowledge management, 6) team meeting plan, 7) consultation with sponsors/collaborators, 8) conflict resolution, and 9) team endstate. As part of the chartering process, the team is asked to identify whom will lead the team and the leaders of any specific sub-functions for the team. Throughout the project, and consistent with the department's mission statement, faculty serve as team mentors who not only advise the technical portion of the project, but set conditions for the team to provide leadership, similar to the framework set forth by [31]. Faculty remain attentive throughout the teaming process to scaffold leadership (and followership) behaviors across the team members to encourage cadet ownership of the project consistent with the Leader Development Model described above.

Toward the end of the project experience, cadets must complete a peer-review and reflection assignment. The peer review simply asks the cadets to divide a monetary bonus ($10K) among the members of the team based on his or her contributions to the team's success. An equal distribution of the bonus equates to each team member getting 100% of points for the assignment. Any differential in bonus assignment across the team corresponds to an associated increase or decrease in assignment points for the team members. This process provides an anonymous evaluation mechanism for all team members to rate the contributions of each team member to the project.

This preliminary engineering teaming experience gives a taste of what it is like to lead and follow within a technical engineering project. In addition to the engineering leadership experiences inherent to the design project, an associated goal is to create personal readiness for leader development within the cadets as they have time reflect on the success or failure of the team. This readiness for development is answered in short order by further leader development through formal military leadership coursework which follows in the next academic year in the form of a military leadership course.

PL300 Military Leadership Coursework

West Point's foundational leadership course, titled PL300: Military Leadership, resides in the D/BS&L. This department traces its origin to a letter from General Dwight Eisenhower to West Point Superintendent Maxwell Taylor requesting formal instruction at West Point in order to "awaken the majority of cadets to the necessity of handling human problems on a human basis and do much to improve leadership" [32, p. 13]. During World War II, Eisenhower had witnessed West Point graduates approach leadership challenges with "empirical and ritualistic methods," and he recognized the need for leadership instruction drawing from the academic fields that currently reside in D/BS&L. In line with the more modern approaches to understanding leadership, PL300 focuses on developing student leaders with a strong academic background in a variety of leadership theories.

Cadets take PL300 in their third year at the academy; they have engaged in enough leadership experiences to spur meaningful reflection, yet still have a year or more of developmental time to practice employing new knowledge gained from PL300. Course content is structured around individual, group, and organization levels, and draws from the disciplines that study human behavior: individual psychology, social psychology, organizational psychology, management, and sociology. Instructors recognize that effective leadership is an art but acquiring a working knowledge of these academic fields is an important part of preparing the artful leader.

The purpose of PL300 is to develop students' capacity to integrate developmental experiences, new knowledge, and reflection to lead organizations more effectively in a complex world. To this end, PL300 has three goals:

1. Cadets learn to apply knowledge from the behavioral, organizational, and sociological sciences to understand, explain, predict, and influence human behavior in organizations. Students demonstrate the ability to apply a broad array of scientific knowledge to specific leadership situations, enabling them to better understand what is happening around them, explain it to other people, make reasonable predictions about expected outcomes, and take actions intended to increase performance while improving their organization.

2. Cadets are inspired to own their own development, and to life-long learning in topics pertaining to leadership and organizational effectiveness. Students realize the breadth and depth of knowledge accessible, but not yet known to them. They demonstrate individual and collective curiosity, seeking to gain additional knowledge and apply it as commissioned leaders of character, throughout a career of professional excellence and service to the nation.

3. Cadets will reflect on their leadership and become better, more self-aware leaders. Self-awareness is critical to being a leader of character. Students develop a better sense of who they are, their strengths, weaknesses, values, and purpose, as well as their biases and tendencies.

Students enter PL300 with their own relevant and meaningful experiences and perspectives. The course challenges them to better integrate their developmental experiences with new knowledge and reflection to lead people and organizations more effectively in a complex world.

Cadet performance on the mid-term and final exams constitute the most direct assessments of the degree to which PL300 succeeds in educating cadets to apply knowledge to understand, explain, predict, and influence human behavior in organizations. In both exams, cadets apply their knowledge of applicable theories and concepts to an in-depth case study. The case typically takes the form of a carefully selected feature length film. Selected films often dramatize historical events, and depict actual leaders, followers, and teams confronting complicated leadership challenges, relevant to important personal, individual, and organizational outcomes.

Table 5: PL300 Military Leadership Course, Lessons and Theories

Lesson	Lesson Topic	Major Theories / **Assignments** (in bold)
Block I: Preparing Yourself To Lead		
1	Introduction	
2	Leader Development	Leader development model
3	Character and its Development	Strengths and virtues; character development model
4	Authentic Leadership	Authentic leadership
5	Perceptions and Biases	Perceptual processes, attribution errors, biases; self-concept
6	Decision Making	Rational, naturalistic, and ethical decision making
7	Resilience	Strength model of reslience
8	Emotional Intelligence	Emotional intelligence / **Journey Line due**
9	Integrative Case Study 1	Case study incorporating all of Block I
Block II: Leading Others		
10	Cross-Cultural Competence	Cross-cultural competence (cultural-general, cultural-specific)
11	Developmental Communication	Positive developmental communication; counseling
12	Motivation (Theories)	Content, situational, and process theories of motivation
13	Motivation (Goal Setting)	Goal setting theory
14	Power & Influence	Bases of power and influence tactics
15	Power & Character	Power differentials; impacts of power
16	Transformational Leadership	Full-range leadership model; transformational leadership
17	Toxic Leadership	Destructive leadership, toxic triangle / **Self-Assessment due**
18	Integrative Case Study 2	Case study incorporating all of Block II
19	Mid-term Exam	Exam testing Block I and II material
20	Guest Speaker	
21	Principled Negotiation	Seven elements of principled negotiation
Block III: Leading Teams		
22	Team Dynamics & Effectiveness	Team effectiveness model (TEM)
23	Developing Cohesive Teams	Team development, cohesion, and effectiveness
24	Managing Conflict	Conflict management process; conflict handling styles
25	Organizational Justice	Three dimensions of organizational justice
26	Organizational Culture & Change	Schein's multi-level theory; leading change framework
27	Socialization	Socialization processes / **Leadership Philosophy Paper due**
28	Integrative Case Study 3	Case study incorporating all of Block III
29	In Extremis Leadership	Characteristics of effective in extremis leadership
30	Wrap-Up / Exam Review	Preparation for the final exam testing all course material

Cadet performance on PL300's reflective writing assignments constitutes our best, most direct assessment of the degree to which PL300 succeeds in prompting cadets to reflect on their leadership, and become better, more self-aware leaders. The Journey Line (JL) assignment requires cadets to clearly, concisely, and compellingly answer the question "Who am I?" Success on the JL requires cadets engage with a mentor, reflect on their life experiences, and articulate their core values, and purpose in life. Successful cadets demonstrate reflection, increased self-awareness, and an ability to think about their core values and purpose in the context of the leadership-relevant theories and concepts studied in PL300.

The Leadership Philosophy Paper (LPP) requires cadets to clearly, concisely, and compellingly answer the question, "How will I lead?" Success on the LPP requires cadets engage with a mentor and reflect on the leader they aspire to be, and the leadership they will hold themselves accountable to provide. Successful cadets demonstrate reflection, increased self-awareness, and an ability to think about their personal beliefs in the context of the leadership-relevant theories and concepts studied in PL300. Table 5 provides an overview of the course's lesson topics, associated leadership theories, and the timing of major graded events (shown in bold text).

The timing of PL300 within the 47-month experience coincides with a cadet's transition from mostly follower roles to a majority of leadership roles. Cadet at this point are beginning to lead more than a single individual and may be responsible for organizations of up to 150 people within their companies.

ME404/496 Engineering Leadership Experiences

The culminating engineering leadership experience for mechanical engineering cadets at West Point is their capstone design project. This project spans two semesters and is encompassed by the courses Mechanical Engineering Design (ME404) and Mechanical Systems Design (ME496). Starting in ME404, mechanical engineering cadets are assigned to a capstone design project team consisting of five to seven other cadets. Over half of these projects are multi-disciplinary, collaborating with one or more other academic departments within the Academy. Across the two-course sequence, the cadets review the design process first taught in ME201 and apply the design process to an externally sponsored engineering design problem primarily for organizations within the Department of the Army or Department of Defense.

The team chartering process sets the tone for leadership experiences within the capstone design sequence. The chartering process in ME404/ME496 is a bit more rigorous than ME201 and includes a requirement for a team offsite. This team offsite poses a series of reflective questions that allow the teams an opportunity to understand its members before developing the team charter. The charter itself follows a similar structure to ME201. Topics addressed are: 1) team name, 2) team member contact information, 3) team leadership, 4) team logo, 5) initial problem statement, 6) key milestones and dates, 7) knowledge management plan, 8) team meeting plan, 9) consultation with sponsors/collaborators, and 10) team organizational chart. The major difference in the chartering of the capstone design teams is how leadership is addressed within the team. Unlike ME201 which requires the team to specify whom will lead the team, ME404 requires the team to identify people responsible for the following: 1) Project Management, 2) Solid (CAD) Modeling, 3) Product Testing, 4) Financial Management, 5) Logistics Management, 6) Manufacturing, 7) System Integration. In this way, and consistent with Army leadership doctrine, these responsibilities allow cadets the opportunity to provide leadership for the team in the specified areas. This approach is consistent with emerging recent research indicating that leadership of capstone design teams is more shared than hierarchical (e.g. [33], [31]). Similar to ME201, faculty mentors advise both the technical and leadership aspects of the entire team experience and remain assigned to the team from start to finish. They remain observant of leadership experiences within the teaming process and remain ready to support the cadets in their growth as leaders.

Capitalizing on the Leader Development Model taught in PL300, the ME404/ME496 sequence increases the number of evaluation touch points for cadets and enables the reflection process. The peer review process is similar to that described for ME201 above, giving cadets multiple evaluations of their contributions to team success throughout the project. Evaluations are solicited from the team members at the end of both ME404 and ME496 as well as at the 1/3 point of ME496. The spacing of these three evaluations give the cadets an ability to course-correct in their level of engagement in the team to ensure they are contributing effectively. Cadets in ME496 are also required to submit a reflective essay at the end of the project which asks cadets to relate their experiences with the design process and their teaming process to their future careers as Army officers. The essay assignment prompts the reflection portion of the West Point Leader Development model taught in PL300 and allows the cadets an opportunity to grow in their leadership as a result of the year-long teaming experience.

Conclusion

Army leadership doctrine describes leadership as an influence process that accomplishes a mission and improves an organization. Anyone in the Army may engage in this process based on their assumed or assigned role. This doctrinal approach is developed within the 47-month West Point Leader Development System at West Point. Cadets engage in structured individual leader development (both following and leading) through the Academic, Military, Physical, and Character programs. The entirety of the student experience is surrounded by a culture of character growth. Within the academic program, this paper has described the engineering leadership development sequence orchestrated by the mechanical engineering division of the Department of Civil and Mechanical Engineering. This progression provides two salient developmental experiences for the explicit purpose of developing leadership skills within mechanical engineering students. These developmental experiences bookend purposeful leadership coursework to create personal readiness for gaining leadership knowledge, imparting that knowledge, and then providing additional developmental opportunities to practice that knowledge.

This paper provides insights into the structure of a very purposeful 47-month leader development model that may be used as a guide for engineering leadership development. We suggest the following points for consideration:

1) Provide students with a clear definition of engineering leadership so they have a solid foundation for development. Consider the Army's *Be/Know/Do* framework as a starting point.
2) Reflect on how student experiences at your institution map to the leader development framework described above… capitalize on what currently exists and integrate those experiences.
3) Provide a progression of leadership responsibility. Practicing following and practicing leading go hand-in-hand. Good leaders are good followers first.
4) Early leadership experiences provide a personal readiness for leadership development. Provide those experiences early in the developmental process, prior to rigorous leadership coursework.

5) Create a cycle for challenges, support, and assessment. Leadership development is not a spectator sport. Students must wrestle with challenges to build their leader identity.
6) Encourage or force students to develop a mentor relationship with a faculty member or seasoned engineer. A mentor can foster reflection and provide the support component of developmental experiences.
7) Create opportunities for higher class-year students to interact with lower class-year students in a supportive or mentoring role. For example, partner engineering students from an advanced course with students from an introductory course. There is an opportunity to promote the leadership growth of the higher class-year students while benefitting the lower class-year students with information and encouragement.

The authors acknowledge that the program at West Point is not readily applicable at more traditional civilian colleges and universities. We do, however, believe that a resolute treatment of engineering leadership concepts, combined with the proper sequencing and scaffolding of developmental experiences, may provide engineering educators with a framework of leader development at their institutions.

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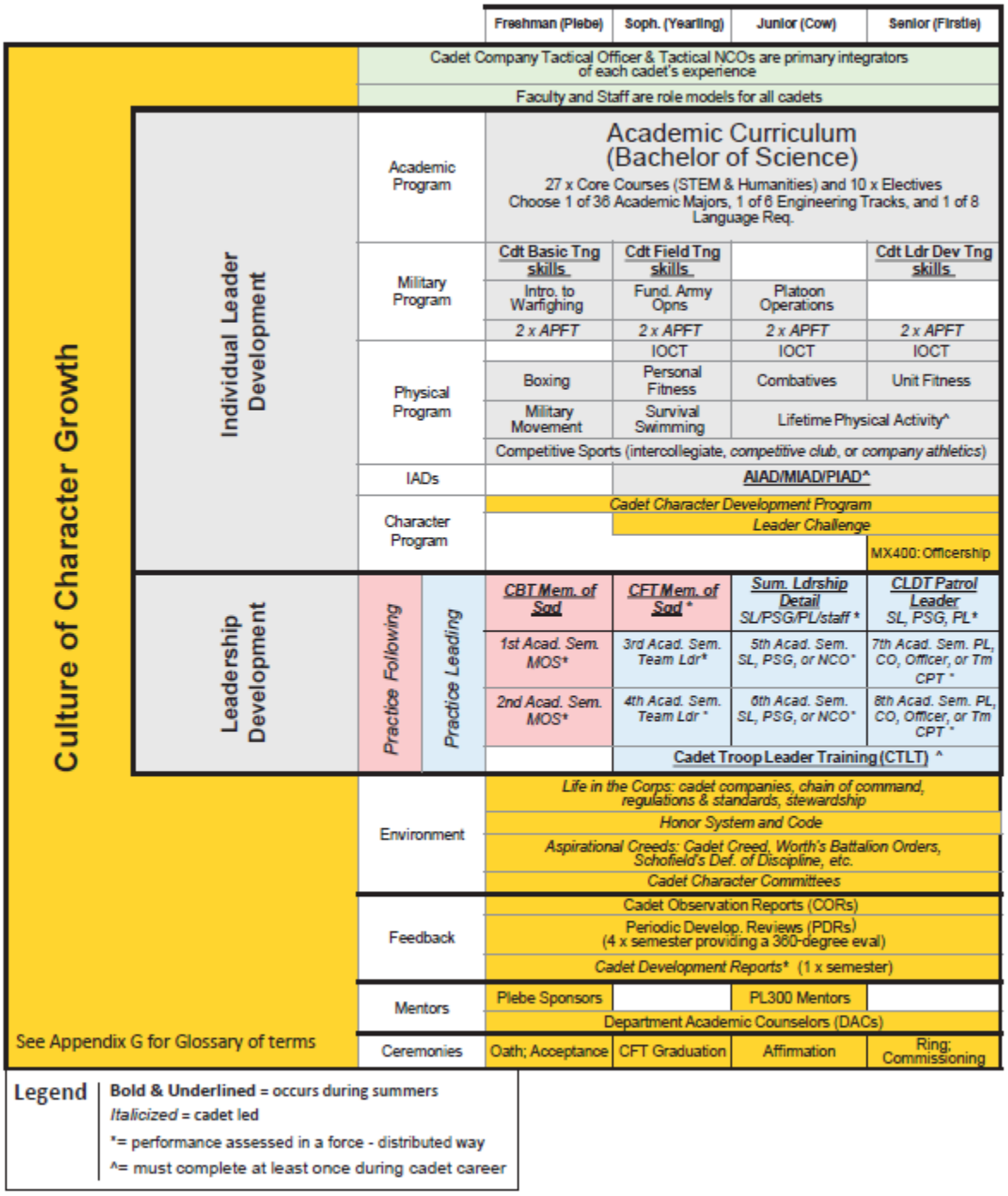
Appendix A: West Point Core Experiences [14, p. 12]



Glossary:

NCO: Non-Commissioned Officer
APFT: Army Physical Fitness Test
IOCT: Indoor Obstacle Course Test
IAD: Individual Advanced Development
CBT: Cadet Basic Training
CFT: Cadet Field Training
MOS: Member of Squad
SL: Squad Leader
PSG: Platoon Sergeant
PL: Platoon Leader
CO: Commander
TM CPT: [athletic]Team Captain