AC 2007-2036: TEACHING THE BOK ? CHALLENGES FOR FACULTY AND PROGRAMS

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Teaching the BOK- Challenges for Faculty and Programs

Abstract

In February 2007, the Second Edition of Civil Engineering Body of Knowledge (BOK) for the 21st Century was released for review by the American Society of Civil Engineers. The revised BOK uses an outcome-based approach and Bloom's Taxonomy of Educational Objectives to define what should be taught to and learned by tomorrow's civil engineers. The 26 outcomes – 16 technical and ten professional, collectively prescribe the necessary depth and breadth of knowledge, skills, and attitudes required of an individual aspiring to enter the practice of civil engineering at the professional level in the 21st Century. Central to achieving the BOK is the university-level education and those who teach the BOK are critical to this education. The ten professional outcomes which include leadership, teamwork, communication, history and heritage, professional and ethical responsibility, and life-long learning, can present challenges to some programs since they fall outside the traditional teaching roles of faculty. Colleges and universities will need to adjust their programs to educate and train faculty to teach the BOK. The authors draw on their experience serving on ASCE's Second Edition of the Body of Knowledge Committee, ASCE's Committee on Academic Prerequisites for Professional Practice Committee, and as the Director of the Center for Teaching Excellence at the United States Military Academy. This paper discusses the non-traditional faculty model in the Department of Civil & Mechanical Engineering at the United States Military Academy and how we've modified our program and educated our faculty to teach the BOK. Many of these modifications including faculty education and training programs can easily be adapted to colleges and universities across the country.

Introduction

For many decades in the United States, the reformation of civil engineering education has been discussed and debated. The American Society of Civil Engineers is leading the charge in reforming engineering education. First released in October 1998, ASCE's Board of Directors passed a revised version of Policy Statement (PS) 465 in 2004 that states, "*The ASCE supports the attainment of a Body of Knowledge for entry into the practice of civil engineering at the professional level.*"[1] The focus of the revised policy is knowledge centric. ASCE defines the Body of Knowledge (BOK) as "The knowledge, skills, and attitude necessary to be a licensed professional engineer."[1]

The first edition of the ASCE BOK (BOK-1) was published on January 12, 2004 and it listed 15 educational outcomes for civil engineers.[2] These included 11 outcomes modeled after ABET Criterion 3 (a-k) outcomes[3] and four outcomes specific to civil engineering. The levels of competence in BOK-1 recognition, understanding, and ability became problematic as the BOK was examined for assessment and mapping the outcomes into existing curriculum. The Levels of Achievement Committee was formed to address the levels of competence. The committee recommended using the six levels of cognitive development in Bloom's Taxonomy of Educational Objectives as the levels of achievement (rather than levels of competence) in the BOK.[4]

The BOK was also recognized as a living document that requires periodic revisions as the civil engineering profession adapts to a changing environment. ASCE received many comments from a broad range of constituents regarding the content of the BOK report. With the new recommendations for levels of achievement and with the numerous comments from constituents, it was clear that a Second Edition of the Body of Knowledge was required.

BOK-2

The Second Edition of the Body of Knowledge Committee was formed in October of 2005 and was charged with producing an improved Second Edition of the BOK (BOK-2) report in response to recent stakeholder input and other developments in engineering education and practice. After detailed review of the first edition, comments received about the first edition, recent literature from the National Academy of Engineering (including *The Engineer of 2020*[5], and *Educating the Engineer of 2020*[6]), and various reports from other committees of the Committee on Academic Prerequisites for Professional Practice (CAP[3]), the committee started with a clean slate and addressed the central question "What should this Body of Knowledge include and at what level should be achieved for entry into the professional practice of civil engineering?"

Currently, BOK-2 consists of 28 outcomes grouped into foundational, technical and professional outcomes.

Table 1. BOK-2 Outcomes

FOUNDATIONAL OUTCOMES	TECHNICAL OUTCOMES	PROFESSIONAL OUTCOMES
1. Mathematics	7. Mechanics	19. Communication
2. Physics	8. Materials	20. History & Heritage
3. Chemistry	9. Breadth in Civil Engineering Areas	21. Globalization
4. Breadth in Basic Science	10. Engineering Tools	22. Professional & Ethical Responsibility
5. Humanties	11. Engineering Problem Recognition & Problem Solving	23. Public Policy
6. Social Sciences	12. Design	24. Business & Public Administration
	13. Experiments	25. Teamwork
	14. Contemporary Issues & Their Relationship to Engineering	26. Leadership
	15. Risk/Uncertainty	27. Life-Long Learning
	16. Sustainability	28. Attitudes
	17. Project Management	
	18. Technical Specialization	

Each outcome has a specified level of achievement that must be met to fulfill the Body of Knowledge. The levels of achievement are based on Bloom's Taxonomy of Education Objectives and are defined in Table 2 below.[7] The Levels of Achievement Subcommittee Report contains a complete discussion on the levels of achievement and Bloom's Taxonomy.[4]

Table 2. Levels of Achievement

Level of Achievement	Definition[7]
Knowledge	The ability to recall previously learned material.
Comprehension	The ability to grasp the meaning of material. This may be shown by translating material from one form to another (words to numbers), by interpreting material (explaining or summarizing), and by estimating future trends (predicting consequences or effects).
Application	The ability to use learned material in new and concrete situations.
Analysis	The ability to break down material into its component parts so that its organizational structure may be understood.
Synthesis	The ability to put parts together to form a new whole.
Evaluation	The ability to judge the value of material for a given purpose.

In addition to setting the final level of achievement, the committee also addressed the level of education at which each outcome should be achieved. Table 3 lists the current BOK profile which shows both the final level of achievement and the level of education where each level should be achieved. The "B" represents the portion of the BOK fulfilled through the Bachelor's degree. The "M/30" represents the portion of the BOK fulfilled through the Master's degree or equivalent and the "E" represents the portion of the BOK fulfilled through pre-licensure experience.

Table 3. BOK Profile (as of March 2007)

Foundational		1 Knowledge	2 Comprehension	3 Application	4 Analysis	5 Synthesis	6 Evaluation
1	Mathematics	B	B	B			
2	Physics	B	B	B			
3	Chemistry	B	B	B			
4	Breadth in Basic Science	B	B	B			
5	Humanities	B	B	B			
6	Social Sciences	B	B	B			
Technical		**1 Knowledge**	**2 Comprehension**	**3 Application**	**4 Analysis**	**5 Synthesis**	**6 Evaluation**
7	Mechanics	B	B	B	B		
8	Materials	B	B	B			
9	Breadth in Civil Engineering Areas	B	B	B	B		
10	Engineering Tools	B	B	B	M/30		
11	Engineering Problem Recognition & Solving	B	B	B	M/30		
12	Design	B	B	B	B	B	E
13	Experiments	B	B	B	B	M/30	
14	Contemporary Issues & Their Relationship to Engineering	B	B	B	E		
15	Risk/uncertainty	B	B	B	E		
16	Sustainability	B	B	B	E		
17	Project management	B	B	B	E		
18	Technical specialization	B	M/30	M/30	M/30	M/30	E
Professional		**1 Knowledge**	**2 Comprehension**	**3 Application**	**4 Analysis**	**5 Synthesis**	**6 Evaluation**
19	Communication	B	B	B	B	E	
20	History and Heritage	B	B				
21	Globalization	B	B	B	B		
22	Professional & Ethical Responsibility	B	B	B	B	E	E
23	Public policy	B	B	E			
24	Business & Public Administration	B	B	E			
25	Teamwork	B	B	B	E		
26	Leadership	B	B	B	E		
27	Life-long learning	B	B	B	E	E	
28	Attitudes	B	B	E			

As the number of "B" coded cells in the profile indicate, university-level education is critical to achieving the BOK. A key component of the university-level education is the faculty- those who teach the BOK. The ten professional outcomes which include leadership, teamwork,

professional and ethical responsibility, history and heritage, communication, and life-long learning, can present challenges to some programs since they fall outside the traditional teaching roles of faculty.

BOK-1: Four Characteristics of Civil Engineering Educators

The ASCE Body of Knowledge Report from 2004 (BOK-1) discussed four characteristics of civil engineering educators. Civil engineering faculty should be scholars and effective teachers, have practical experience and be positive role models for students.[2] In essence, these traits directly relate to the BOK-2 outcomes and therefore faculty members should fulfill the BOK in order to teach it. As the BOK requires attainment of levels of achievement for technical outcomes, as scholars, faculty should acquire and maintain a level of expertise in the subjects they are teaching and have practical experience. As effective teachers, faculty members must demonstrate good communication and leadership skills. As role models, civil engineering faculty members must demonstrate professional and ethical responsibility, positive attitudes and be life-long learners.

USMA Faculty Model

The United States Military Academy has a unique mission and consequently a unique faculty model. The mission of the United States Military 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.*[8]

This mission clearly indicates that the Academy provides more than an education; it also offers a demanding four-year program in moral-ethical, physical, and military professional development.

The U.S. Military Academy enjoys a committed faculty with diverse backgrounds and experiences who are uniquely able to educate and inspire cadets.[8] The faculty is led by a combination of senior military officers and experienced civilian educators, both of whom provide strong connections to the higher education community as well as the long-term stability required in a highly connected and interdisciplinary academic program. The largest segment of the faculty is the rotating military faculty: successful, mid-career officers with recent military leadership experience and masters degrees from the nation's top graduate schools. By virtue of their recent leadership experience in the U.S. Army where most commanded 100-soldier companies, these officers serve as military role models for the cadets. Their recent graduate school experience also provides a fresh enthusiasm and updated technological savvy and constitutes a valuable resource for the institution. Although some civilian faculty are hired at the associate professor level and work with the senior faculty, most new civilian faculty are hired at the assistant professor rank. In their unique role, they learn the art of teaching, provide specialized knowledge in their discipline, and enrich the curriculum.

To guide in the efforts and to provide criteria for academic promotion, the faculty members organize their activities into five domains: teaching, scholarship, service, junior faculty development and cadet development. The faculty manual explicitly states that "above all, effective teaching is the primary obligation of the USMA faculty."[8] However, scholarly pursuits, such as research and professional writing, are essential activities for the faculty. Research can be conducted in both technical areas or in education. Service includes activities such as serving on faculty committees, serving on professional society committees and participating in professional organizations as well as service in the community. Both inside and outside the classroom, faculty members are expected to contribute to cadet development by being professional role models- as scholars, disciplinary professionals and military officers. The senior faculty is specifically charged with developing junior faculty into effective teachers, guiding scholarly pursuits and mentoring professional development.

The contribution in each domain varies with each faculty member and is primarily a function of their role and position within the department. There are no set percentage contributions for each domain or by type of faculty member. For example, a new rotating military faculty member is not expected to contribute to the development of other junior faculty, whereas the director of the mechanics group, who is directly responsible for seven junior faculty members, would be expected to contribute heavily to this domain. Each semester, faculty members meet with their supervisor and set realistic goals in each of the five domains. These goals are based on both department requirements and on individual preference. Periodic counseling is conducted throughout the semester and these goals are then evaluated at the end of the academic year. Civil engineering departments could adopt a similar model within the constraints of the university.

Although the institutional mission and faculty model at USMA is unique, there are four major areas or resources in which we are leveraging to better address the BOK—external resources, department resources, integration of the BOK into the curriculum, and assessing the BOK in the curriculum. Many of these resources, faculty education and training programs, and techniques can easily be adapted in civil engineering programs or departments across the country.

External Resources

The major emphasis is not only on who should teach the BOK but how the BOK should be taught. There are several external resources available to civil engineering programs and departments that can be leveraged to improve how the BOK is taught. These resources include the Excellence in Civil Engineering Education (ExCEEd) Teaching Workshop and university level centers for teaching excellence (or similarly named organizations).

Student learning is optimal when faculty members effectively engage the students in the learning process and create a positive classroom atmosphere. The ExCEEd Teaching Workshop sponsored by ASCE is one method by which engineering educators can learn more about teaching engineering and improve their teaching abilities. After eight years with workshops held at West Point, Northern Arizona University, and the University of Arkansas, over 400 educators from 191 universities have graduated from ExCEEd.

The workshop focuses on basic skills and includes seminars addressing the following topics:[9]

- Principles of effective teaching and learning
- Learning styles
- Communication Skills
- Learning objectives
- Class organization and course organization
- Development of interpersonal rapport with students
- Teaching with technology
- Classroom assessment techniques

During the first few days of the six-day seminar, ExCEEd faculty mentors present high-quality demonstration classes to supplement the seminars. During the latter half of the workshop, participants apply what they have learned by preparing and teaching three actual classes in a small-group setting. This collaborative "learn by doing" format ensures that participants will make substantive improvements in their teaching skills by the end of the course.[9] The ASCE Website, http://www.asce.org/exceed/ , provides detailed information on the program and the application process.

Although the ExCEEd Teaching Workshop has limited seats for each session each year, civil engineering departments could consider sending one or more educators to the workshop and the then having the program graduates share their experiences and information with fellow faculty members.

Universities may also have centers for teaching excellence (or similarly named organizations) that could serve as an excellent department external resource. At USMA, we have the Center for Teaching Excellence (CTE) whose purpose is to enhance cadet intellectual development through high quality faculty development programs.[10] Its mission is three-fold:

- provide consultation and resources to faculty
- conduct educational research & development
- serve as a conduit for educational information

The CTE hosts brown-bag seminars on teaching related topics. These seminars are held once a month and as the name indicates are held during lunch to facilitate scheduling. Participants bring their lunch and in a large-round table format listen to a presentation on various aspects of teaching. Group discussion follows the presentation. Recent presentations and topics included

- "Pedagogical Implications of Tablet Computing: "Drawing" Tablet pcs into the Classroom"
- "Use of Individual Response Cards (Clickers) and Tablet PCs to Improve Classroom Interaction and Cadet-Centered Learning"
- "Learning should be fun! Cadet-Made Games as Teaching/Learning Devices"
- "Promoting More Effective Classroom Discussions"
- "Student Preparation: The When, Why & How"
- "Getting the Most from Student Feedback"

Our Center for Teaching Excellence also executes the Master Teacher Certificate Program. The two-year, interdisciplinary program is "anchored in the belief that teaching and learning are inextricably linked—that faculty members are learners as well as teachers, and students are teachers as well as learners."[10] The program is designed to be a learning experience for everyone involved and its mission is "to develop the competencies and skills of USMA faculty members for the dramatically changing academic workplace of the 21st century." [10] The program involves monthly small-group discussion sessions, a formative review of classroom teaching, and reflective activities. Participants are provided with:

- a pedagogical framework that will provide a basis for planning, implementing, and reflecting on their teaching and learning activities;
- a repertoire of skills that will allow participants to operate in a variety of different teaching situations;
- the ability to review and assess their teaching critically and revise it appropriately;
- techniques for helping learners acquire important discipline-related skills and knowledge;
- the ability to assess students' learning throughout the program of instruction.

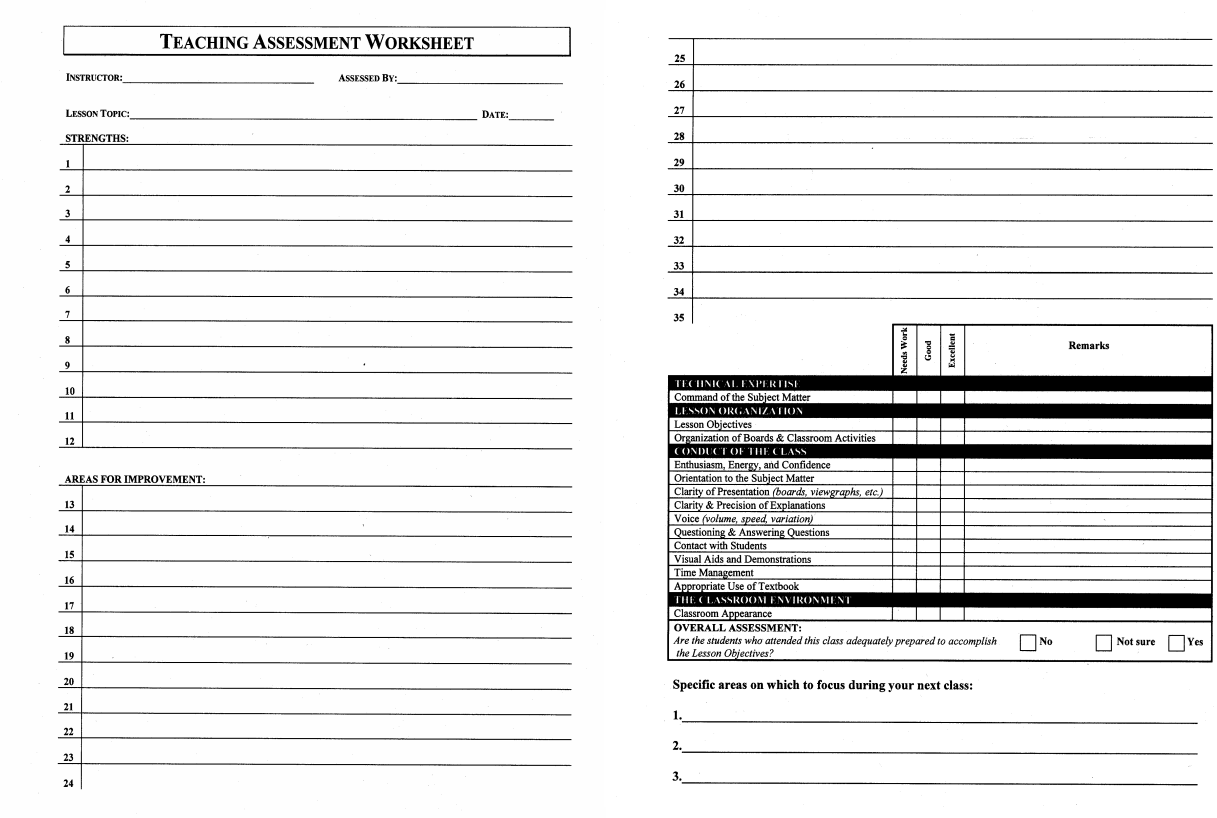
Although not mandatory, our Civil and Mechanical Engineering Department highly encourages participation in the program, especially for our newer faculty. We feel that it is a great external resource that our instructors can use to develop as teachers. More information on the CTE can be found at http://www.dean.usma.edu/centers/cte/.

Department Resources

As the name implies, our rotating faculty teach for usually three years and then move on to a new assignment. With this high turnover, our department must conduct new instructor orientation each year. Our Instructor Summer Workshop (ISW) starts in mid-June of each year and prepares our new faculty to teach in the fall semester. The workshop includes formal instruction in teaching techniques and theory, demonstration classes given by senior faculty, and seven practice classes performed by the new instructors. These practice classes give the new faculty the opportunity to acquire and practice teaching techniques.

Although most civil engineering departments would not have the need for a full workshop each summer for new faculty, some type of assimilation program should be implemented to bring new faculty on board. A solid mentorship program to include some instruction on teaching techniques and a few practice classes could easily be implemented.

Central to our teaching instruction in ISW and to our strong commitment to teaching excellence are teaching assessments. Differing from an evaluation which is usually more formal and used primarily in rank ordering, an assessment is primary aimed at identifying both areas for improvement and strengths. The assessment form is depicted in Figure 1. During ISW each demonstration and practice class is assessed by senior faculty members and by other new instructors.



TEACHING ASSESSMENT WORKSHEET

INSTRUCTOR:_____ ASSESSED BY:_____

LESSON TOPIC:_____ DATE:_____

STRENGTHS:

1
2
3
4
5
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8
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AREAS FOR IMPROVEMENT:

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	Needs Work	Good	Excellent	Remarks
TECHNICAL EXPERTISE				
Command of the Subject Matter				
LESSON ORGANIZATION				
Lesson Objectives				
Organization of Boards & Classroom Activities				
CONDUCT OF THE CLASS				
Enthusiasm, Energy, and Confidence				
Orientation to the Subject Matter				
Clarity of Presentation *(boards, viewgraphs, etc.)*				
Clarity & Precision of Explanations				
Voice *(volume, speed, variation)*				
Questioning & Answering Questions				
Contact with Students				
Visual Aids and Demonstrations				
Time Management				
Appropriate Use of Textbook				
THE CLASSROOM ENVIRONMENT				
Classroom Appearance				

OVERALL ASSESSMENT:
Are the students who attended this class adequately prepared to accomplish the Lesson Objectives? ☐ No ☐ Not sure ☐ Yes

Specific areas on which to focus during your next class:

1._____

2._____

3._____

Figure 1. Teaching Assessment Worksheet

During the academic year, the civil engineering faculty members are required to attend at least three different classes taught by three different instructors. These classroom visits foster an exchange of ideas among faculty members and provide assessment to the instructors. Senior faculty members also visit classes and provide assessment to faculty members under their charge. The exchange during these assessments is vital to the continued improvement of teaching in our department.

Faculty members are also required to maintain a teacher portfolio. The purpose of the teacher portfolio is the continuous improvement of teaching. The portfolio provides a formal means to document growth as a teacher by including a personal teaching philosophy, a list of teaching goals for each semester, and a reflective essay for each semester on teaching performance. The portfolio is developed in consultation with a teaching mentor.

To emphasize great teaching, civil engineering departments or programs may also consider hosting department level teaching awards. Our department hosts two Outstanding Teaching Awards each year. Since we have a high turnover of junior faculty, we have one award for faculty members with two or less years of teaching experience and a different one for those with three or more years experience. Faculty members are nominated and a committee reviews the nominations, reviews the nominee teacher portfolios and then conducts classroom visits for assessment to determine the winner. In addition, the CTE hosts an academy-wide teaching award.

Integration into the Curriculum

We examined the BOK and developed strategies to integrate the outcomes into our curriculum. The technical outcomes are often less difficult to integrate, so the main focus of this discussion will be some of the professional outcomes. As with most programs, we are constrained by the number of courses we can require and offer, so simply adding courses to address each new outcome, was not feasible or appropriate. Examples of possible ways to integrate six of the professional outcomes are discussed below.

Leadership

The BOK-2 states that upon graduation from a baccalaureate program, an individual must be able to apply leadership principles to direct the efforts of a small, homogeneous group**.** Leadership can be taught and learned and the formal education process has the potential to make a significant impact on teaching leadership principles and developing leadership attributes.[11] We are fortunate at USMA in that our mission statement requires us to develop leaders of character. We have a required junior-level course on leadership and our cadets live in a military-structured environment and are assigned leadership roles within that structure. However, without a required course or structure to develop leadership skills, there are numerous examples of leadership opportunities in the undergraduate program. Students can lead design teams in courses and can have leadership roles in the capstone design. Leadership opportunities also exist in organizations such as ASCE Student Chapters, student competitions, civic organizations, honor societies, athletic teams, student government, fraternities and sororities, etc. The key is to encourage students to take leadership roles either in classes required for the civil engineering major or in organizations in which they belong.

Teamwork

The BOK-2 states that upon graduation from a baccalaureate program, an individual must be able to function effectively as a member of an intra-disciplinary team which is defined as a team consisting of members within the civil engineering discipline. Although we are also fortunate at USMA to have our cadets living in a military organization that fosters teamwork from the first days that the cadets arrive, there are numerous opportunities for students to work in teams at any university and in the civil engineering program. Examples include students working in teams for design projects and laboratory exercises within a course and especially during a capstone design experience. The development of the ability to function as a member of a team may not be limited to the classroom or even to engineering. Additionally, students should seek opportunities and faculty members should encourage students to work as members of team in a myriad of other activities, such as student government, civic and service organizations, employment opportunities, etc.

Communication

Effective communication is a critical skill for civil engineers and the BOK-2 states that upon graduation from a baccalaureate program, an individual must be able to organize and deliver effective verbal, written, virtual, and graphical communications. Some programs have specific

courses on technical writing to address the written communication portion. Others have mandatory computer aided drafting or design type courses to address the graphical communication portion. We do not offer a separate course in either and after a recent review of our program, are beginning to better integrate the communication outcome into our curriculum. Our first engineering course, CE300- Fundamentals of Engineering Mechanics and Design, taking during the second semester of sophomore year, now features an integrated technical writing component focused on presentation of engineering work. The textbook, A Guide to Writing as an Engineer, 2nd Ed. by David Beer and David McMurrey is a required text. Cadets will use this guide as a reference for all courses in the civil engineering program. We also have writing assignments and presentations in various courses to include our hydrology and hydrologic design course and structural analysis, as well as the capstone design. We have introduced a new course in site civil design and integrated graphical communication. Many of these techniques can be readily adapted to any program.

History & Heritage

One of the new professional outcomes is history and heritage and to fulfill the BOK at the undergraduate level, an individual must be able to explain contributions of significant individuals, events, and developments that occurred in the history of civil engineering and the impact they have on the profession. Since the level of achievement for this outcome is only at the comprehension level, fulfillment should not be difficult. Many instructors are probably already introducing history and heritage in their courses. Examples of opportunities to include history and heritage in an undergraduate civil engineering program include providing historical vignettes on the people who developed key equations, background and field trips to historical landmarks, written and oral presentations on various aspects of the history and heritage of civil engineering, and other creative, exciting ways to explore the history and heritage of civil engineering. Poster and pictures of historical events and people can also be displayed in the classrooms and in the department areas. All of these activities can be embedded into courses and many programs may just need to take credit for what they already probably do.

Professional & Ethical Responsibility

Another professional outcome that can be integrated throughout the curriculum is professional and ethical responsibility. At USMA, our cadets are required to take over 70 hours of education in professional and military ethics where they discuss honor and integrity issues, leadership and officership. To focus on the civil engineering professional standards and ethics, each civil engineering major in our program takes a mandatory one-credit hour senior seminar course taught by an endowed chair with years of practical engineering experience. The course content includes discussion on professional standards, the ASCE Ethics Standards of Professional Conduct, the National Society of Professional Engineers Code of Ethics and professional registration and practice. Cadets in our professional development course write an essay on professional ethics for the annual ASCE Daniel W. Mead Contest.

Life-long Learning

One of the more difficult outcomes to address is life-long learner which at the undergraduate level requires students to describe the skills required for life-long learning, demonstrate the ability for self-directed learning, and develop their own learning plan. Independent study projects and open-ended problems within the course already in the curriculum that require additional knowledge that is not presented in a formal class setting are examples of ways to provide opportunities for self-directed learning in an undergraduate program. Programs can also assess student work requiring professional goal-setting or reflection on the value of life-long learning. Student participation in professional development activities, such as professional society membership, community service, and preparation for the Fundamentals of Engineering exam are also examples of life-long learning.

Assessing the BOK

To be formally integrated and then assessed, the civil engineering program outcomes must be mapped into the BOK and corresponding ABET criteria. Our civil engineering faculty met recently during a periodic assessment process to revise our program outcomes based on BOK-2. The revised Civil Engineering Program Outcomes for USMA are listed in Table 4.

Table 4. USMA Civil Engineering Program Outcomes

1. Design civil engineering components and systems.
2. Demonstrate creativity, in the context of engineering problem-solving.
3. Solve problems in the structural, construction management, hydraulic, and geotechnical discipline areas of civil engineering.
4. Solve problems in math through differential equations, calculus-based physics, and general chemistry.
5. Design and conduct experiments, and analyze and interpret data.
6. Function effectively on multidisciplinary teams.
7. Describe the roles and responsibilities of civil engineers and analyze the issues they face in professional practice.
8. Use modern engineering tools to solve problems.
9. Write effectively.
10. Speak effectively.
11. Incorporate knowledge of contemporary issues into the solution of engineering problems.
12. Draw upon a broad education necessary to anticipate the impact of engineering solutions in a global and societal context.
13. Are prepared and motivated to pursue continued intellectual and professional growth—both as Army officers and as engineers.
14. Explain the basic concepts of management.
15. Explain the basic concepts of business and public policy
16. Are leaders of character.

Perhaps the greatest challenge with the BOK-2 is not the integration but the assessment of outcomes throughout the curriculum. To "capture what we do" in our program, we have developed and starting using embedded indicators. As the name indicates, an embedded assessment relies on data that is already being collected within the normal course of the academic program. We initially started the process with a capstone design course for non-engineering majors[12] and then expanded it to our capstone design course for civil engineering majors.[13,14] We have expanded it across our civil engineering program where each required civil engineering course captures data specific to one or more of our program outcomes.[15] Although currently we only examine courses within our program for embedded indicators, we are considering how we can expand the assessment and capture the education our cadets receive in other required courses in other departments.

Conclusion

Although USMA has a unique mission and faculty model, many of the programs and techniques that we use can be implemented in any civil engineering department or program at most any university. Creativity and innovation are keys to success in incorporating the BOK into the civil engineering program.

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