AC 2011-2330: USING POSITIVE INTERDEPENDENCE AND MULTI-MODAL ASSIGNMENTS TO ENHANCE STUDENT UNDERSTANDING OF CIVIL ENGINEERING SOFT SKILLS

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Using Positive Interdependence and Multi-Modal Assignments to Enhance Student Understanding of Civil Engineering Professional Skills

Abstract

In light of shrinking curricula, broadening of technical areas, and expansion of the civil engineering body of knowledge, it can be difficult to find the necessary time and appropriate place to teach engineering professional skills such as business, leadership, public policy, and management as specified by the ABET Program Criteria for Civil and Similarly Named Engineering Programs. After a number of false-starts and failed approaches, the faculty at a small teaching university developed an effective approach to both teaching and assessing students' knowledge of these topics. This approach involved formal collaborative learning incorporated into a multi-modal assignment that included library and first-person research, case study examination, and presentation development centered around either business, leadership, public policy, or management. In the course of this assignment, students conducted one-on-one interviews with professionals, from both the private and public sectors; researched case studies for both positive and negative examples; performed literature reviews on the nature of these topics as they relate to civil engineering; prepared presentations on their topic to instruct fellow class members; and engaged with faculty members to ensure a proper level of topic coverage prior to presenting their findings formally to other students and professors. All of these experiences facilitated the capture of multiple perspectives, which in turn broadened students' comprehension of the assigned topic. At the conclusion of these presentations, a multi-faceted assessment approach was taken that evaluated the groups' final products as well each student's individual understanding of the topic. The students also completed self-assessments summarizing their role within the group and accounting for their time spent and tasks performed. The assessments indicated that collaborative learning, specifically the positive interdependence resulting from a shared goal and well-defined roles, was an effective tool leading toward the development of a broad student understanding of multiple civil engineering professional skills; further revealing that students went beyond merely explaining the basic concepts and ultimately synthesized material from multiple sources, shared it cooperatively and placed it in the context of their future careers.

Introduction

The way civil engineers are educated is rapidly changing as a result of influences from professional societies, accrediting agencies, state and institutional requirements, and an overall broadening of the profession in general. Some examples of these influences include pressures to reduce the number of credits required to graduate, a significant expansion of the body of knowledge that civil engineering students are expected to possess, the efforts made toward requiring graduate-level education for professional licensure and the resulting change in the program criteria used by ABET to evaluate civil engineering degree programs.

Technically-intensive civil engineering degree programs traditionally tended to require more credit hours to graduate than other bachelor-level programs. A 1996 survey, however, revealed "a reform movement in undergraduate CE education" with one theme being "a decrease in the number of credit hours for the undergraduate degree."[1] This trend is not singular to civil engineering and continues as recently as fall 2010 when Loyola University Chicago[2], Boise State University[3], and University of Kansas[4] all reduced the minimum number of credit hours for undergraduate degrees.

The overarching reason for these reductions is fiscal efficiency for both the schools and the students. In the fall of 2007, the Civil Engineering Department at Oregon Institute of Technology (OIT) was asked by the university's provost and president, citing pressure from various state-level agencies and individuals, to attempt to reduce the number of quarter credit hours required to graduate from 194 to 180. After many meetings and much deliberating and compromising, the curriculum was reduced to 182 quarter credit hours, a 12-credit reduction that was equivalent to removing four classes from the program. This curriculum restructuring significantly reduced the flexibility of the program to meet the needs of the students.

The Civil Engineering Body of Knowledge (BOK)[5], as developed by the American Society of Civil Engineers (ASCE), describes the knowledge and skills—both technical and professional—that are needed for professional practice. The BOK also describes how the body of knowledge can be fulfilled and how the responsibilities for fulfillment are delegated to educators, students, and professionals. The first edition of the body of knowledge (known as BOK1)[6] was published in 2004 and included 15 outcomes that defined "the knowledge, skills, and attitudes that individuals acquire through appropriate formal education and prelicensure experience." In 2008, the second edition (BOK2)[5] expanded this set of outcomes to 24. While the BOK2 groups these outcomes into three broad categories (foundational, technical, and professional), they include components such as communication, attitudes, leadership, sustainability, risk and uncertainty, and globalization in addition to technical specialization.

In conjunction with Policy Statement 465[7] released by ASCE, the BOK2 acknowledges that the entirety of the body of knowledge cannot be achieved through undergraduate education and experience alone, and recommends that additional graduate-level education be a requirement for licensure. These movements led to a recent change in the ABET Program Criteria for Civil and Similarly Named Engineering Programs[8]. This program criteria, based upon the idea that some of the technical specialization outcomes in BOK2 would be achieved in graduate-level courses, outlines what a graduate from a civil engineering program should be able to do. One of the criteria is that "the program must demonstrate that graduates can…explain basic concepts in management, business, public policy, and leadership."[8] As such, these professional skills are expected to be taught and understood at the undergraduate level.

Diverse ways of teaching these skills in undergraduate programs have been introduced. Some of these include entire courses dedicated solely to these skills[9], requiring students to create ePortfolios[10], service learning oportunities[11], and integrating professional skills into capstone courses[12]. Due to the aforementioned reduction in credit hours and the coincidental expansion of topics to teach, the civil engineering faculty at OIT did not have space in the curriculum to develop new service learning or professional skills courses and they desired to have these skills introduced prior to entering the capstone design experience. As such, the civil engineering faculty at OIT attempted to introduce the basics of management, business, public policy, and leadership piecemeal throughout the curriculum, especially during a course on project management. However, in two separate assessments, summarized in Table 1, students revealed that they were greatly lacking in the ability to explain basic concepts of these skills. As a result, the faculty developed a specific plan for introducing, teaching, reinforcing, and assessing these important civil engineering professional skills.

Table 1: Acheivement of Outcome (l)

Outcome (l) an ability to explain basic concepts in management, business, public policy, and leadership

First Assessment: CIV 358-Project Management, Fall 2009, 15 students

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Explain Basic Concepts in Management	Essay examination	1-4 according to rubric	75% of students scoring 3 or higher	20% ≥ 3
Explain Basic Concepts in Business				87% ≥ 3
Explain Basic Concepts in Public Policy				100% ≥ 3
Explain Basic Concepts in Leadership				100% ≥ 3

Second Assessment: Juniors, Spring 2010, 18 students

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Describe the role of a manager in civil engineering	Essay questions	1-4 according to rubric	75% of students scoring 3 or higher	11% ≥ 3
Explain what is involved in running an engineering business				72% ≥ 3
Explain what public policy is and how it relates to civil engineering				72% ≥ 3
List qualities of effective and ineffective leaders				94% ≥ 3

Summary

First Direct: **Met 3/4 Criteria**
Second Direct: **Met 1/4 Criteria**

Level of Achievement: **D**

Teaching and Assessment Methods

Department faculty members devoted a great deal of time to determining how to address the students' poor understanding of these professional skills. Ways to teach and assess management, business, public policy and leadership were discussed in multiple department meetings, an Industrial Advisory Council meeting, and at the department's fall retreat. Many suggested conducting a workshop in either the senior project or project management courses. There was so little time, however, in each of these quarter courses to devote an extended period of time to these topics and still cover all the remaining material. As such, the faculty members discussed ways to tie the topics to a course but have the students do extensive work outside of the classroom. Ideas included interviewing professionals, gathering case studies, and conducting literature reviews—all of which are active learning methods as opposed to passive listening. Ultimately, having decided that each of

these activities had value, the faculty members decided to have students do each of them. A positive interdependence model was introduced wherein students each performed individual tasks that were integral pieces of the larger assignment.

The faculty members were interested in moving away from a subject-based learning model and toward a more active learning approach. In this case, a collaborative learning model was selected with the motivational aspect of positive interdependence at its core. Positive interdependence is a requirement of group projects in that all members must complete their individual tasks successfully in order to realize a positive result[13]. The intent of the assignment was to encourage group discussion outside of class that would result in a cohesive presentation of the primary topic, taking into account various perspectives.

For this specific assignment, 24 students enrolled in a junior-level project management course were broken into four groups of six. Each of the four groups was assigned one of the four topics: management, business, public policy, and leadership. The students were required to prepare a presentation to give to their peers in the class. Each member of the team was responsible for a specific portion of the presentation with the specific, individual assignments listed below.

1. Interview a public-agency professional
2. Interview a private-sector professional
3. Research a positive-outcome case study
4. Research a negative-outcome case study
5. Perform a literature review
6. Assemble the individual portions into a seamless presentation

Students were allowed to self-select their groups and their individual responsibilities. They were given two weeks to complete their assignments and prepare their presentations. The 20-minute presentations were given during two class periods and each was followed up with a short, multiple-choice assessment to gauge student understanding. Figures A-1-A-5 in the appendix show the assignment given to the students and the quizzes used in the assessments.

Positive interdependence was encouraged by the structure of the assignment, which provided for a single group grade based on the presentation of the topic. The individual assignments included a role for one of the group members to prepare a seamless presentation of the individual portions, ultimately acting as the group leader. This structure was clarified and emphasized in classroom discussions during the two weeks allotted to complete the assignment.

Initial Results

Table 2 summarizes the results of the quizzes that each of the students took immediately after the presentations. The data, unfortunately, revealed that students were still lacking in a basic understanding of two of the professional skills: management and business. These results quantified a number of problems that were encountered throughout the process: namely inadequate research on the part of the individual students and presentations that were clearly a disjointed conglomeration of individual efforts without significant discussion or synthesis. Despite being instructed and reminded to review the presentations as a group and with a faculty member prior to presenting to peers, the final products were still incomplete and did not adequately address the material. In some cases,

concepts were even misrepresented, which caused confusion even after attempts by instructors to address the shortcomings during the question-and-answer portion of the presentation.

All of this suggests that the students did a poor job preparing their presentations, a conclusion that was supported by an analysis of the data summarized in Table 2. An analysis of variance (ANOVA) was conducted on the data and revealed no significant differences ($F(3,12)=0.337$, $p=0.800$) between any of the means. This suggests that the students who presented each topic did no better on that topic's quiz than the students who were listening to the presentation.

Table 2: Summary of Assessment Results

	Average Scores				Passing Data	
	Presentation Groups				Possible	*Percent
Quizzes	Management	Business	Pub. Policy	Leadership	Points	Passing
Management	14.75	14.80	14.20	14.00	19	62%
Business	11.88	12.20	11.80	9.33	15	71%
Pub. Policy	11.63	12.60	11.60	9.33	15	79%
Leadership	7.50	8.40	7.60	7.67	10	83%

Average quiz scores on a topic by the group that presented that topic are highlighted

* Percent of students scoring at or above 75%

Reinforcement and Reassessment

After evaluating these subpar results, the instructor reviewed the presentations and quizzes with the class emphasizing the importance of the professional skills in engineering. He and the students discussed the details of the presentations and clarified definitions and fundamental concepts for each of the four topics. A follow-up assessment was conducted wherein the instructor asked essay questions on the midterm exam addressing each of these four topics again. Specifically, students were asked to provide complete essays on the following.

1. Define public policy. Provide three examples of public policy that civil engineers must consider in running an office or designing for a construction project.
2. Discuss at least three elements required to have a successful business in engineering. Why is each one important? Are they all required or is one sufficient for success?
3. Identify at least three qualities of a good leader and three qualities of a bad leader and identify how these qualities might affect an engineering design.
4. Managing a project requires many considerations. What are the three primary considerations in the management of any project and how does each impact the other?

The essays were scored according to a rubric developed by the instructor and shown in Figure 1. The results of this follow-up assessment, shown in Table 3, were considerably better and benchmarks were met in every area.

Table 3: Summary of Follow-up Assessment

Performance Criteria	Assessment Methods	Measurement Scale	Minimum Acceptable Performance	Results
Explain Basic Concepts in Management	Essay Exam	1-4 According to rubric	75% of students scoring ≥ 3	100% ≥ 3 (46% = 4)
Explain Basic Concepts in Business				100% ≥ 3 (88% = 4)
Explain Basic Concepts in Public Policy				88% ≥ 3 (67% = 4)
Explain Basic Concepts in Leadership				92% ≥ 3 (75% = 4)

Conclusions

A multi-pronged approach was taken to teaching civil engineering professional skills to undergraduate students. This active learning, positive interdependence model required students to work independently on individual tasks but also as a cohesive group on assembling their efforts into a holistic presentation. Unfortunately, the activity did not produce the desired results without significant intervention from the instructor. Following are possible reasons for this and suggestions on how to improve in the future.

Assigning a single individual the task of assembling the information into a presentation may have allowed the work to be completed discretely and remain compartmentalized. Perhaps making the entire group—as opposed to a single individual—responsible for the information synthesis would have produced a better result. This course of action will be taken during future implementations.

Conversations with students suggested that they did not take the assignment very seriously. With proper weight, in terms of a percentage of the course grade, given to the assignment and with additional emphasis from the instructor, perhaps students will take the assignment more seriously in the future.

Additional discussion was necessary. In this study, the additional discussion with the instructor was done after the fact. In future offerings, a single lecture will be devoted to briefly defining and covering the topics as well as discussing resources, expectations, and ground rules.

It was also apparent that presenting two topics during one 50-minute period did not allow enough time for sufficient coverage. In future implementations, each topic will be given an entire class period to allow for more elaborate presentations and discussions.

Ultimately, the faculty members still feel that the positive interdependence model is an excellent way to approach these complicated professional topics and that with more time and emphasis given to the project, students will produce a holistic, collaborative presentation that will be valuable to them and their peers.

	4	3	2	1
Explain Basic Concepts in Management	Student identifies three reasonable considerations in management and answers question completely	Student identifies three reasonable considerations in management but answers question incompletely	Student identifies at least two reasonable considerations in management	Student identifies less than two reasonable considerations in management
Explain Basic Concepts in Business	Student identifies three elements required to have a successful engineering business and answers question completely	Student identifies three elements required to have a successful engineering business but answers question incompletely	Student identifies at least two elements required to have a successful engineering business	Student identifies less than two elements required to have a successful engineering business
Explain Basic Concepts in Public Policy	Student accurately defines public policy and provides three correct examples	Student accurately defines public policy and provides less than three correct examples	Student does not accurately define public policy but provides three correct examples	Student does not accurately define public policy and provides less than three correct examples
Explain Basic Concepts in Leadership	Student identifies three qualities of a good leader and a bad leader and answers question completely	Student identifies three qualities of a good leader and a bad leader but answers question incompletely	Student identifies at least two qualities of a good leader and a bad leader	Student identifies less than two qualities of a good leader and a bad leader

Figure 1.Scoring Rubric for Student Midterm Essay Questions.

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13. Smith, K., Sheppard, S., Johnson, D., & Johnson, R. (2005). "Pedagogies of engagement: classroom-based practices." *Journal of Engineering Education,* ASEE, 94(1), 87-101.

Appendix

Course Assignment and Quizzes

Oregon Institute of Technology
CIV 358 – Project Management
Fall 2010

As they progress through their careers, many civil engineers find themselves doing more than just engineering. Many end up owning their own business or management the business affairs of a public agency. Engineers are responsible for writing and implementing the codes, standards, and public policies that govern our field. Almost all professional engineers will end up managing projects and acting as leaders for junior engineers.

As such, a basic **understanding of the principles of business, public policy, leadership, and management** is an essential part of your education. Thus, your first assignment in this course will be to develop a presentation on one of these four topics to present to the class. For this project, you will break up into four groups, one for each topic. Each person in your group will have a specific assignment as detailed below:

1. One member will perform **background/library research** using at least four legitimate sources to define your topic and explain how it is applied in a civil engineering context.
2. Another member of your group will **interview an industry professional** from the **public sector** about the topic.
3. One member will also **interview an industry professional** but this one should be from the **private sector**.
4. One group member will summarize a **positive case study** of your topic (for example: how did a particular public policy lead to a successful outcome).
5. Another group member will also summarize a **case study** but with a **negative** result (for example: show how a specific leader with poor leadership skills resulted in a negative outcome).
6. The final member of your group will **summarize** and compile all of this information to develop a seamless 10-minute presentation that will be reviewed by a Civil Engineering Department faculty member the day prior to your presentation.
7. The seventh member on one team will work with all teams to ensure consistency and quality of the presentations.

Groups will **present** during the third week of the term with the Public Policy (Dr. St.Clair) and Management (Dr. Riley) groups presenting on October 13 and the Business (Dr. Lindgren) and Leadership (Prof. Thaemert) groups presenting on October 15. Any number of group members may participate in the presentation. Five minutes will be allowed for questions.

Short **quizzes** on the topic will immediately follow each presentation and will be taken by everyone in the class.

Each individual will submit a **brief narrative** of your work: who you contacted, resources you referenced, how long you spent on tasks. This is similar to the time accounting one would do at a consulting firm.

Your grade on this project will reflect your individual input, your group's overall presentation, and your scores on the quizzes.

Figure A-1. Professional Skills Assignment

Name: _____

1. The "big three" items that must be managed in any project (as identified by the interviewees) are:

    1. _____

    2. _____

    3. _____

2. Management concepts can be applied to both projects and personnel. Which of the following is shared between these two applications?
    (a). Equipment tracking
    (b). Communication
    (c). Life cycle costing
    (d). Materials specification

3. Which of the following does *not* describe an aspect of management?
    (a). Planning
    (b). Organizing
    (c). Controlling
    (d). Stalling
    (e). Directing

4. What possible roles could a civil engineer have regarding management? Choose all that apply.
    (a). Engineers integrate aspects of a heavy infrastructure project
    (b). Engineers know where to get information and resources
    (c). Engineers monitor the construction of their designs to ensure quality and performance
    (d). Engineers collaborate with an office and outside their firm/entity to ensure the best possible product in the least amount of time for the least cost
    (e). Engineers provide management services to subcontractors
    (f). Engineers have no business in the management realm

5. Which of the following statements about management is *not* true? Choose all that apply.
    (a). Task definitions should be broad and estimates difficult to provide
    (b). Resources should be handled carefully to ensure efficient use
    (c). Milestones are set only as a guide and are not intended to be met
    (d). The manager performs all tasks himself with only occasional assistance from others

6. What level of ability are you expected to have regarding management when you graduate with a B.S. in civil engineering from OIT?
    (a). Be able to spell management
    (b). Be able to explain basic concepts
    (c). Be able to direct a small team of your peers
    (d). Be able to step into a mid-level management position and manage effectively within the first week of working

Figure A-2. Management Assessment Quiz.

7. Where are you most likely to develop the majority of your management skills with respect to civil engineering?
   (a). At home
   (b). At college
   (c). On the job
   (d). At graduate school
   (e). At continuing education seminars after graduation

8. Engineers involved in the public and private sectors identify which aspect of management as the most difficult?
   (a). Budgeting
   (b). Estimating
   (c). Scheduling
   (d). Communicating
   (e). Recruiting
   (f). Executing

9. What one aspect of management was most critical to both the success of the positive case study and the failure of the negative case study that were presented?
   (a). Coordination, organization and division of labor
   (b). Budgeting and cost control
   (c). Design tracking and monitoring
   (d). Time management and scheduling

10. Which of the following are poor qualities for a manager to have?
   (a). Decisiveness
   (b). Dereliction
   (c). Leadership
   (d). Reliability
   (e). Forgetfulness
   (f). Trustworthiness
   (g). Organization
   (h). Inflexibility

Figure A-2 (cont). Management Assessment Quiz.

Name: _____

1. According to the Hoffman Construction Company project manager interviewed for the business presentation, what principles of business most affected his job? Choose all that apply.

(a). Cost estimating
(b). Project scheduling
(c). Contracting
(d). Claims management
(e). Personnel management
(f). Coordination, organization and division of labor

2. In the negative case study described in the business presentation, what key business failure(s) led to the bankruptcy of Stone and Webster? Choose all that apply.

(a). Poor construction cost estimates
(b). Lack of understanding of politics in operating countries
(c). Taking on projects beyond its core capabilities
(d). Poor materials specification

3. The "big three" business principles that define a successful engineering firm are:

a. _____

b. _____

c. _____

4. Which of the following personnel are responsible for the business aspects of a civil engineering firm?

(a). Senior managers
(b). Business owners
(c). Project managers
(d). Entry level engineers
(e). All of the above

5. What minimum level of ability are you expected to have regarding business operations when you graduate with a B.S.C.E. from OIT?

(a). Be able to refer all questions to a BS Management graduate
(b). Be able to conduct basic business analyses such as cash flows and rates of return
(c). Be able to run your own engineering firm
(d). Be able to explain basis concepts related to effective business strategies
(e). All of the above
(f). (b) and (d)

Figure A-3. Business Assessment Quiz.

6. Which of the following are characteristics of a successful engineering business?
   (a). Technical expertise
   (b). Sound marketing and business development skills
   (c). Good client relations
   (d). Polished written, verbal and graphical communications
   (e). All of the above
   (f). Only (a) and (c)

7. Which of the following statements about business is *not* true? Choose all that apply.
   (a). Public sector engineers do not require business skills
   (b). Private engineering firms typically hire BS Management graduates to handle business aspects
   (c). Public agencies do not earn money
   (d). Entry level engineers should concentrate on learning the technical side of the firm/agency and not concern herself with business aspects until she has earned her P.E. license

8. Which of the following are *commodities*, whose prices should be followed, according to the private sector engineering/construction project manager interviewed for the business presentation? Choose all that apply.
   (a). Windows
   (b). Structural steel
   (c). Bulk cement
   (d). Diesel fuel

9. Sound project selection criteria include: (Choose all that apply)
   (a). Profitable at a rate beyond MARR
   (b). Tasks within technical capability
   (c). Time management and scheduling
   (d). Any project that a long-term client envisions

10. Which of the following statements epitomize good business practice?
   (a). Maintenance of profits should take priority over maintenance of good client relationships
   (b). If the best technical people are placed on a engineering project, ultimately it will be successful
   (c). Diversification of services is essential to success in difficult economic times
   (d). (b) and (c)
   (e). None of the above

Figure A-3 (cont). Business Assessment Quiz.

Name: _____

1. Which one of the following most closely defines public policy? Courses of action, regulatory measures, and/or laws concerning a given topic that
   (a). are agreed upon by the general public and used as guides and/or general practices
   (b). are promulgated by a governmental entity or its representatives
   (c). a governmental agency attempts to use to exercise power or will over the general public
   (d). are developed by small but powerful interest groups

2. Under what circumstances would the International Building Code (IBC) be considered a public policy. Choose all that apply.
   (a). When adopted outright by a government agency that regulates building contraction
   (b). When revised and adopted by a government agency that regulates building construction
   (c). There are no circumstances wherein the IBC would be considered public policy
   (d). There are no circumstances wherein the IBC would not be considered public policy

3. Under what circumstance would Oregon Revised Statute (ORS) 468A, which defines air quality regulations, be considered a public policy? Choose all that apply.
   (a). When used within the state of Oregon
   (b). When used within the United States
   (c). When used within a state that has similar, but not identical, air quality regulations
   (d). Air quality regulations are not a public policy issue

4. What possible roles could a civil engineer have regarding public policy? Choose all that apply.
   (a). Engineers help write and maintain codes and standards that become public policy
   (b). Engineers are responsible for assuring that codes and standards are properly observed
   (c). Engineers are responsible for ensuring that they are knowledgeable about the latest codes, standards, regulations and other relevant policies
   (d). Engineers can be held liable when codes, standards, regulations, and other relevant policies are not observed
   (e). Engineers have no business in the public policy realm

5. Which one of the following statements about public policy is not true?
   (a). It is often failure driven
   (b). It is often the criteria by which civil projects are designed
   (c). In most circumstances relating to civil engineering, it is meant to ensure the safety, health, and welfare of the public
   (d). In matters related to civil engineering, it is often decided upon without the advice or counsel of engineers

6. Suppose you are designing an interchange for an interstate highway, which jurisdictional agencies would have policies, regulations, laws, codes, or standards with which you might need to be concerned? Choose one.
   (a). Local (city or county)
   (b). State
   (c). Federal
   (d). All of the above

Figure A-4. Public Policy Assessment Quiz.

7. Which of the following statements best describes how licensure is a public policy issue? Choose all that apply.

(a). Professional engineering licenses are issued under the jurisdiction of individual states and allow an engineer to practice professionally in that state alone
(b). Professional engineering licenses are issued under federal jurisdiction and allow an engineer to practice nationwide
(c). Most jurisdictions require that a licensed engineer take responsibility for (sign off on) civil projects
(d). In most cases, licensure is not a public policy issue

8. Which one of the following statements explains the interrelationship between public policy and civil engineering?

(a). Civil engineering projects are very large and need to be regulated to maintain scope
(b). Civil engineering projects are often in the public domain and thus should be regulated by public policy
(c). Civil engineering projects are of the size and scope such that if completed improperly can be dangerous and are thus regulated to protect the public
(d). Civil engineering projects are of the size and scope such that errors are not uncommon and, as such, regulations act as a system of checks

9. Which one of the following stages in the structural design process is not a public policy issue?

(a). An engineering intern uses the governing building code to design the structure
(b). The licensed engineer of record reviews the design
(c). The design is reviewed by the jurisdiction's building official
(d). The engineering intern and/or the licensed engineer of record perform periodic inspections throughout construction to ensure that the structure is being built according to the design

10. Which one of the following courses of action is likely to have the most positive impact on public policy?

(a). Becoming active in your profession and continually improving your skills and knowledge such that, as a leader in the field, you will be asked to help shape civil engineering policies
(b). Writing to your state legislators about civil engineering policies
(c). Whining to anyone who will listen about spotted owls and sucker fish
(d). Becoming familiar with the codes, standards, and regulations that govern your designs

Figure A-4 (cont). Public Policy Assessment Quiz.

Name: _____

1. Leadership is most closely defined as which of the following actions or traits? Choose all that apply.
   (a). Ordering people around
   (b). Exerting social influence by which one person can enlist the aid and support of others in the accomplishment of a common task
   (c). Committing employees to contribute their best efforts to the purpose of the organization
   (d). Is the same function as management

2. Which one of the following verbs is *not* associated with leadership activities?
   (a). Motivate
   (b). Direct
   (c). Prosecute
   (d). Facilitate

3. In an engineering project setting, leadership may involve interaction with which of the following entities? Choose one.
   (a). Junior engineers, draftspersons, and lab technicians
   (b). Project owner's representative(s)
   (c). Plan reviewer(s)
   (d). Designers, owners, regulators and members of the public

4. What possible roles could a civil engineer have regarding leadership? Choose all that apply.
   (a). Directs and monitors the design team and reviews plans and specifications
   (b). Prepares a detailed cost estimate
   (c). Establishes a positive tone in public meetings
   (d). Communicates clearly and regularly with the owner's project manager

5. Which one of the following statements about leadership is true?
   (a). It is applicable in every facet of professional endeavor
   (b). It is apparent from the title on one's business card
   (c). It depends on one's ability to speak extensively in public
   (d). It is only exhibited by the most senior members of management

6. Leadership is exercised in which of the following settings? Choose one.
   (a). Individual workload planning
   (b). Private consulting firm
   (c). Public agency
   (d). All of the above

Figure A-5. Leadership Assessment Quiz.

7. Which of the following statements best describes how licensure is a leadership issue? Choose all that apply.

(a). Licensure sets the example and standard for designers who are striving to become professional engineers in their own right
(b). Licensure is only required to increase personal income
(c). Most jurisdictions require that a licensed engineer take responsibility for (sign off on) civil projects
(d). In most cases, licensure is not a leadership issue

8. Which one of the following statements best explains the interrelationship between leadership and civil engineering?

(a). Civil engineering projects are not large enough to need management oversight
(b). Civil engineering projects are often sufficiently large enough to require multi-disciplinary teams to achieve the work, throughout which public safety must be held paramount
(c). Civil engineering projects may be dangerous
(d). Civil engineering projects may require extensive regulator interaction to achieve project approval

9. Which one of the following stages in a floodplain delineation process is not an example of positive leadership?

(a). The staff engineer determines that all reported hydraulic parameters are consistent with jurisdictional standards
(b). The licensed engineer of record reviews the design
(c). The project manager lobbies the agency reviewer for relaxed floodplain-rise criteria
(d). The principal engineer grants the design team a half-day off with pay for achieving a successful design submittal ahead of schedule

10. Where are successful leaders most commonly found? Choose one.

(a). Regularly reviewing the design and/or construction team's efforts on-site
(b). Behind a large desk in the corner office
(c). Playing golf with the next client prospect
(d). Shuttered in a cubicle with the lights off

Figure A-5 (cont). Leadership Assessment Quiz.