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## **AC 2012-3327: THE RAISE THE BAR EFFORT: CHARTING THE FUTURE BY UNDERSTANDING THE PATH TO THE PRESENT - THE BOK AND LESSONS LEARNED**

**Dr. Stuart G. Walesh P.E., S. G. Walesh Consulting**

Stuart G. Walesh, Ph.D., P.E., Dist.M.ASCE, D.WRE, and F.NSPE, is an independent consultant providing management, engineering, education/training, and marketing services. Prior to beginning his consultancy, he worked in the public, private, and academic sectors serving as a Project Engineer and Manager, Department Head, Discipline Manager, marketer, legal expert, professor, and Dean of an engineering college. Walesh authored or co-authored six books and many engineering and education publications and presentations. His most recent book is *Engineering Your Future: The Professional Practice of Engineering*, a text and reference book, published by Wiley and ASCE Press. Walesh facilitated and/or made presentations at several hundred workshops, seminars, classes, webinars, and meetings throughout the U.S. and internationally. Over the past decade, Walesh has been active in the effort to reform the education and early experience of engineers.

# **Raise the Bar Initiative: The BOK and Leadership Lessons Learned**

## **Abstract**

This paper, one in the collection of Raise the Bar initiative papers, provides a summary of leadership lessons learned (LLL) from the body of knowledge (BOK) element of the CAP<sup>3</sup> effort. The BOK concept, which first appeared within the initiative in 2001, led to defining the civil engineering BOK as the necessary depth and breadth of knowledge, skills, and attitudes (KSA) required of an individual to enter the practice of civil engineering at the professional level (licensure) in the 21<sup>st</sup> century. The BOK gradually became synonymous with the need to expand the basic education of civil engineers to include a master's degree or equivalent and to intensify the pre-licensure experience.

The BOK element of the Raise the Bar effort calls for reforming, not refining, the education and pre-licensure experience and as such offers a study in major change. Change LLL described in this paper are conduct scholarly studies, start with vision, expect and deal with set backs, apply a change model, test-drive terminology, function transparently and inclusively, persevere and practice principled compromise, recognize and leverage serendipity, and stand respectfully and thankfully on the shoulders of others.

Given that this paper summarizes LLL primarily from a decade-long major change process, it offers two potentially useful “takeaways” for the reader. The first is an improved understanding of the BOK and the second is ideas about how to lead any change effort.

**Keywords** – ABET, Body of Knowledge, BOK, change, change model, civil engineering, compromise, immovables, knowledge-skills-attitudes, KSA, leader, leadership lessons learned, LLL, licensure, movables, movers, Raise the Bar, terminology

## **Introduction**

This paper summarizes leadership lessons learned (LLL) as a result of developing the civil engineering body of knowledge (BOK) primarily for use in the U.S. The BOK is defined as the necessary depth and breadth of knowledge, skills, and attitudes (KSA) required of an individual to enter the practice of civil engineering at the professional level (licensure) in the 21<sup>st</sup> century.<sup>1</sup> It is the foundation of ASCE's Raise the Bar initiative to reform the education and pre-licensure experience of U.S. civil engineers. The BOK has gradually become identified with the need to expand the basic education of civil engineers to include a master's degree or equivalent and to intensify the pre-licensure experience.

This paper's purpose is to offer:

- Improved understanding of the BOK as a result of knowing more about the change process used to develop it. This is the paper's retrospective perspective.
- Ideas for leaders, or potential leaders, about how to affect major change in professional, community, or other areas. This is the paper's prospective perspective.

## Review of the Body of Knowledge

The aspirational Civil Engineering BOK<sup>1</sup> may be summarized as follows:

Outcome number and title	Level of achievement					
	1 Know- ledge	2 Compre- hension	3 Appli- cation	4 Analy- sis	5 Synthe- sis	6 Evalu- ation

### Foundational

1. Mathematics	B	B	B
2. Natural sciences	B	B	B
3. Humanities	B	B	B
4. Social sciences	B	B	B

### Technical

5. Materials science	B	B	B			
6. Mechanics	B	B	B	B		
7. Experiments	B	B	B	B	M/30	
8. Problem recognition and solving	B	B	B	M/30		
9. Design	B	B	B	B	B	E
10. Sustainability	B	B	B	E		
11. Contemp. Issues & hist. perspectives	B	B	B	E		
12. Risk and uncertainty	B	B	B	E		
13. Project management	B	B	B	E		
14. Breadth in civil engineering areas	B	B	B	B		
15. Technical specialization	B	M/30	M/30	M/30	M/30	E

### Professional

16. Communication	B	B	B	B	E	
17. Public policy	B	B	E			
18. Business and public administration	B	B	E			
19. Globalization	B	B	B	E		
20. Leadership	B	B	B	E		
21. Teamwork	B	B	B	E		
22. Attitudes	B	B	E			
23. Lifelong learning	B	B	B	E	E	
24. Professional and ethical responsibility	B	B	B	B	E	E

Key:

B

Portion of the BOK fulfilled through the bachelor's degree

M/30

Portion of the BOK fulfilled through the master's degree or equivalent (approximately 30 semester credits of acceptable graduate-level or upper-level undergraduate courses in a specialized technical area and/or professional practice area related to civil engineering)

E

Portion of the BOK fulfilled through the pre-licensure experience

As illustrated, entry into the practice of civil engineering at the professional level (licensure) requires fulfilling 24 outcomes to the appropriate levels of achievement and doing so by completing a bachelor's degree and a master's degree, or approximately 30 acceptable credits, and acquiring pre-licensure experience. The table is a synopsis of the BOK. For a detailed BOK description, refer to the second edition BOK report,<sup>4</sup> and see Appendix I, Body of Knowledge Outcome Rubric, and Appendix J, Explanations of Outcomes.

## **Conduct Scholarly Studies**

In the context of the Raise the Bar movement, the BOK is first mentioned in the 2001 report *Engineering the Future of Civil Engineering*.<sup>2</sup> While noted in that report, the BOK was neither defined nor developed. However, reform participants decided to explore bodies of knowledge and in, 2003, produced the white paper "Moving Toward a Civil Engineering Body of Knowledge for the 21<sup>st</sup> Century."<sup>3</sup> Key observations:

- With the exception of engineering, major professions and/or their professional associations (e.g., architecture, Certified Public Accountants (CPAs), law, and Project Management Institute (PMI)) view BOKs as essential for a profession and each has articulated its BOK.
- BOKs typically refer to knowledge and skills and some also include attitudes (e.g., CPA, PMI, architecture).

The reason for sharing this part of the BOK history is to stress the need to include scholarly studies in a major change effort. This is LLL1. The afore-mentioned white paper is just one of many BOK-related scholarly works undertaken by volunteers over the past decade. The results of some of these efforts appear as Appendix A in the second edition of the BOK,<sup>4</sup> and include these topics: attitudes, Bloom's Taxonomy, globalization, humanities and social sciences, public policy, and sustainability. Examples of other BOK-related topics studied over the past decade include accreditation criteria and the accreditation process, the former prohibition against dual-level accreditation, and risk and uncertainty.

Call it "scholarly work" or getting our data and information "ducks in a row," either way those who undertake major change projects need to conduct broad and deep studies. Don't assume too much. "It ain't so much the things that we don't know that get us into trouble," according to humorist Josh Billings, "it's the things we know that just ain't so." Determine what others have done in related efforts, why and how they did it, and what they achieved. Obtain this information not necessarily to mimic others, but rather to learn from their experiences.

## **The Vision Thing: Start With One**

Recall the 1988 U.S. Presidential campaign when candidate George H. W. Bush was reported to have referred to "the vision thing" when asked about moving away from short-term campaign objectives and giving attention to the big picture.<sup>5</sup> While recognizing the importance of "the vision thing," the Raise the Bar process fell short of making optimum use of vision. Consider the following chronology of selected major ASCE documents:

- 2004: *Civil Engineering Body of Knowledge for the 21 Century*<sup>1</sup>

- 2007: *The Vision for Civil Engineering in 2025*<sup>6</sup>
- 2008: *Civil Engineering Body of Knowledge for the 21<sup>st</sup> Century—Second Edition*<sup>4</sup>
- 2009: *Achieving the Vision for Civil Engineering in 2025*<sup>7</sup>

Ideally, from the BOK perspective, the second and fourth reports, and the vision work they represent, should have been in the first and second position followed by the two BOK reports. That is, the BOK reports and the underlying efforts should have been viewed as means to help achieve Vision 2025. Critics of the Raise the Bar initiative, and especially its foundational BOK element, expressed legitimate concern about the absence of an explicit, over-arching civil engineering vision. Interestingly, ASCE did initiate a vision effort in 2002 but decided to defer it until the National Academy of Engineering completed its “The Engineer of 2020” project.

Consider Vision 2025, which follows:<sup>6</sup>

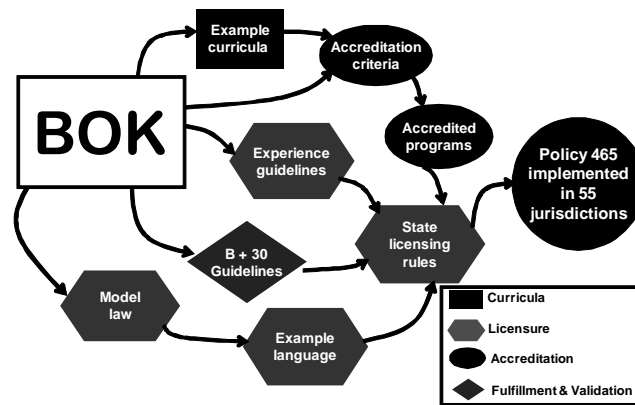
**Entrusted by society  
to create a sustainable world and  
enhance the global quality of life,  
civil engineers  
serve competently, collaboratively, and ethically as  
master:**

- **planners, designers, constructors, and operators of society’s economic and social engine—the built environment;**
- **stewards of the natural environment and its resources;**
- **innovators and integrators of ideas and technology across the public, private, and academic sectors;**
- **managers of risk and uncertainty caused by natural events, accidents, and other threats; and**
- **leaders in discussions and decisions shaping public environmental and infrastructure policy.**

Achieving this aspirational and comprehensive vision will require major efforts within civil engineering, including reform in the preparation of civil engineers, that is, in their education and pre-licensure experience. Fortunately, the sub-optimal timing of the ASCE visioning and Raise the Bar efforts did not have a major negative impact on either. Nevertheless, LLL2 is start with a vision, that is, major change efforts are much more likely to be successful if aligned with an explicit vision for the relevant organization and its stakeholders.

### **Expect and Deal With Set Backs**

Engineers know how to plan—how to identify and link the steps needed to achieve an objective. Consistent with that tradition, Raise the Bar leaders developed a plan, part of which is shown in the following figure, to develop the BOK and use it to achieve the ultimate objective which is to implement ASCE Policy Statement 465 in 55 licensing jurisdictions.



Simply stated, engineers strive to effectively and efficiently achieve their objective. However, as observed by Scottish poet Robert Burns, and translated into standard English, “The best-laid schemes of mice and men go often askew” (Wikipedia 2011).

“Going askew” happened often during development and initial use of the BOK. For example, the Committee on Academic Prerequisites for Professional Practice (CAP<sup>3</sup>) secured an opportunity to speak to members of the Engineering Deans Council (EDC) during their luncheon at the 2003 ASEE conference. And I was the designated speaker. Shortly after beginning to speak, I realized that the audience was much more interested in eating the food they were being served than in listening to engineering education reform ideas I was serving. My inability to engage the audience was a personal set back. This setback resulted, in part, from the assumption that this group of education leaders would naturally be interested in an education reform idea, although not necessarily be open to it.

Much more seriously, the reform effort subsequently experienced some related set backs. In 2006, the EDC formally opposed removing the prohibition on dual-level accreditation.<sup>8</sup> Furthermore, in 2010 the Executive Committee of the EDC stated “we do not believe that the NCEES [National Council of Examiners for Engineering and Surveying] current Model Law (August 2009) that would require a bachelor’s degree in engineering plus either 30 additional credits or master’s degree in engineering as a prerequisite for licensure as a professional engineer (BS + 30) is in the best interests of our students, the engineering education enterprise, or the engineering education profession in the U.S.”<sup>9</sup>

The preceding is shared in this paper to emphasize that personal and group set backs are inevitable when major change is undertaken. Set backs need not become road blocks—learn from them. View set backs as opportunities to examine and possibly revisit assumptions and revise the tactics needed to move the change effort forward. To continue the EDC account, the Raise the Bar effort persisted and, in 2007, ABET eliminated the prohibition on dual-level accreditation and the Model Law changes stand. In summary, LLL3 is expect and deal with set backs.

### Apply a Change Model

Change leaders must recognize natural, initial, and widespread resistance to major changes and plan accordingly. Nicole Machiavelli, the Italian politician and writer, explained opposition to change as follows:<sup>10</sup>

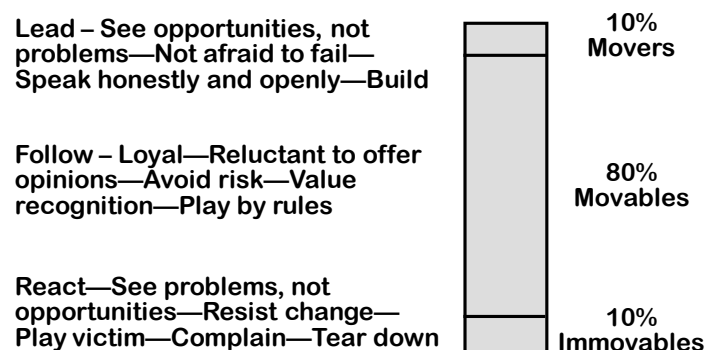
*There is nothing more difficult to plan,  
more doubtful of success, nor more dangerous to manage  
than the creation of a new system.  
For the initiators have the enmity of all who would profit  
by the preservation of the old institutions and  
merely lukewarm defenders in those who would gain  
by the new one.*

Note, in particular, his mention of the initial “enmity” of many who oppose change contrasted with the only “lukewarm defenders” of change. Effecting major change is difficult. Nevertheless, the leader in us wants change—we are dissatisfied with the present situation and can see a better one.

Why do many of us resist change? The possibility of change causes each of us to compare the way things are to the way things could be. We contrast the familiar and comfortable with the unfamiliar and uncomfortable. I believe that most of us, at the cognitive level, can see and weigh the “pros” and “cons” of a proposed change, especially if thoughtfully presented. However, even if the “pros” outweigh the “cons” at the cognitive level, we fear, at the emotional level, how we are going to get from here to there. The unknown trip is scary! Therefore, when faced with change, we often revert to fear and other emotions, not reason.

Given the challenges of change, an operational change model that recognizes basic human behaviour can help us lead change. Presented here is a simple model<sup>11</sup> that is consistent with the BOK experience. Applying a change model is LLL4.

Begin by putting members of the group that would be affected by the proposed change into one of the three categories illustrated in the following figure, that is, the movers, the movables, and the immovables.<sup>12</sup>



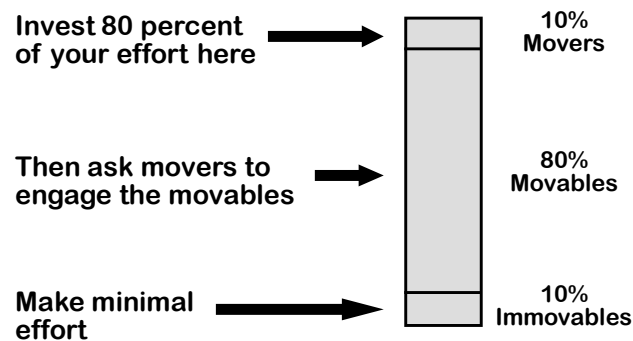
Consider each of the three categories:

- The movers, comprising roughly ten percent, are predisposed to change and to leading change.
- The movables, the large approximately eighty percent component, are predisposed to follow. They can be convinced of the need for change.

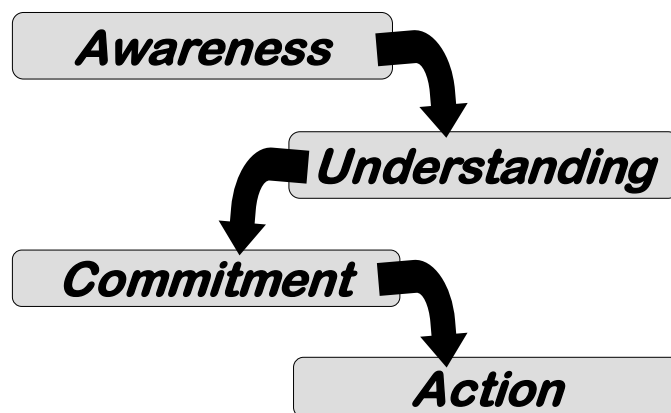
- The immovable, the remaining ten percent, tend to react and do so negatively. They are not likely to seriously consider any arguments for change. As someone said, “Some minds are like concrete, thoroughly mixed up and permanently set.”

An alternative set of three terms, having essentially the same meaning, is accepters, undecided, and rejecters.<sup>13</sup>

A way to work with an organization in which we want to lead change is, as shown in the following figure, to devote most of our efforts to communicating the vision and initial strategy and tactics ideas to the movers. Ask them to thoughtfully consider our ideas, refine them, and hopefully, in principle, accept them. This could require a major effort by us and them and considerable elapsed time. However, in engaging the movers, we are working with a growing, core group of forward-looking individuals. Ask the now hopefully-committed movers to, in turn, communicate with and engage the movables, possibly following the cascade concept described below. Identifying and focusing on movers (or acceptors) was used in developing and beginning to implement the BOK.



Now consider the cascading awareness-understanding-commitment-action process shown in the following figure and how to use it, initially with the movers and then with the movables. It cascades in that it flows from the top to the bottom while the number of participants becomes smaller—sometimes dramatically so—as the process proceeds. However, even so, the number of individuals remaining at the critical, last or action level is often adequate to effect change.





As noted earlier and illustrated with typical statements, on becoming aware of a possible change, many of us react in a mostly emotional knee-jerk fashion. We, as change leaders, should anticipate and gracefully tolerate knee-jerk reactions. Simply ask for understanding of what is being proposed and the reasons for it, don't necessarily ask for support. Some of the knee-jerkers will show us that courtesy. And, on understanding, a portion of them will commit. Finally, for some, that commitment will lead to action needed to advance the change effort.

AH HA! is another way of presenting the cascade process. The first "A" represents awareness, that is, we learn of a proposed change. The first "H" represents head, that is, some will understand the proposed change and its features. The second "H" is for heart in that some of those who understand will commit to supporting the change. The second "A" represents action meaning that some of the committed will act to effect the proposed change.

### **Test-Drive Terminology**

The strategy and tactics employed to achieve a goal or vision should include sensitivity to how the various stakeholders might respond to the language used to describe the change. Words that seem appropriate to change leaders may be misunderstood or even viewed negatively by others. This is exactly what happened early in Raise the Bar effort and the subsequent desire to find acceptable terminology led to increased emphasis on using the term BOK. Reflect on Mark Twain's thought, "The difference between the right word and the almost right word is the difference between lightning and the lightning bug."

In October 1998 the ASCE Board of Direction adopted Policy Statement 465, which began as follows: "The ASCE supports the concept of the master's degree as the First Professional Degree (FPD) for the practice of civil engineering at the professional level."<sup>1</sup> The intent was to gradually move toward a vision of more formal education for tomorrow's U.S. civil engineers. Unfortunately, the wording was interpreted by some practicing U.S. civil engineers to mean that their bachelor's degree was not a professional degree.

Partly because of that negative interpretation, the policy was re-worded in 2001 to read: "The American Society of Civil Engineers (ASCE) supports the concept of the master's degree or equivalent (MOE) as a prerequisite for licensure and the practice of civil engineering at the professional level."<sup>1</sup> This version seemed to diminish some of the initial negative reaction while continuing to support the vision of more formal education for U.S. civil engineers.

In 2004, the policy was refined to begin as follows: "The ASCE supports the attainment of a body of knowledge for entry into the practice of civil engineering at the professional level."<sup>4</sup> Now the specification of a master's degree or equivalent was replaced with attainment of a BOK. Finally, the acceptable terminology was achieved. Accordingly, in spite of the preceding missteps, the ASCE-led effort to reform the education and pre-licensure experience of U.S. civil engineers is moving forward. The BOK concept has proved to be an interest shared by both academics and practitioners and a common and productive forum for these two groups; both have a stake in the BOK.

The essence of LLL5: After drafting a goal or vision and beginning to work on the implementation strategy and tactics, "test drive" the language and terminology before moving into wide public exposure. For example, circulate draft text, make trial presentations, and/or use focus groups.

## **Function Transparently and Inclusively**

From the outset, in the spirit of communicate-communicate-communicate, the Raise the Bar movement, as exemplified by the process used to develop and begin the implement the BOK, has practiced transparency and inclusivity. More specifically, leaders of the reform movement:

- Issued agendas and minutes of meetings to anyone who expressed interest.
- Captured important decisions and products, and underlying process, in writing in the form of the aforementioned minutes, email discussions, major reports,<sup>1, 2, 3, 4</sup> and conference presentations and proceedings. Major reports were offered, at no cost, on the “CE Body of Knowledge” and “Competency-Raise the Bar” portions of the ASCE website.
- Established, for major committees, Corresponding Members status which was available to anyone who expressed interest. For example, the committee that produced the second edition of the BOK had 15 formal members and 51 Corresponding Members all of whom received meeting agendas and minutes and were invited to participate in meetings (mostly conference calls) and weigh in on any issue or topic.
- Invited critics of the BOK and/or the process being used to develop and implement it to elaborate on their views, participate in meetings, and join committees and task groups. In at least several situations, the invitations were accepted, the individuals became actively involved, and they influenced and contributed to the BOK effort.
- Sought new active participants. CAP<sup>3</sup> and BOK leaders repeatedly scanned the group of individuals in the academic and practitioner sectors who were not actively involved in the reform effort but might, based on their supportive or contrary views, be interested in joining. As opportunities arose, many individuals were invited to formally join the effort. For example, of the 15 members of the second BOK committee, only one was a carryover from the first 13-member committee.
- Met “anywhere” with “anyone.” If at all feasible, CAP<sup>3</sup> members, including members of the BOK committees, met with, made presentations to, and interacted with any person or group expressing interest.

In summary, regardless of the change that is being advocated, LLL6 is function transparently and inclusively. By applying LLL6, the core group tends to grow and does so by attracting engaged individuals with diverse KSAs which, in turn, generates more ideas and leads to better decisions.

## **Persevere and Practice Principled Compromise**

Recall LLL3, expect and deal with set backs. When experiencing set backs, especially major ones like the examples provided in discussing LLL3, we are tempted to lower or compromise our vision. Using the BOK as an example, some might argue that its aspirational aspects should be diminished, that is, “shoot lower,” as in replacing “master’s degree or equivalent” with more continuing education. Or consider the overall Raise the Bar effort. In frustration, almost anyone

could argue that the envisioned end point of implementing ASCE Policy Statement 465 in all 55 licensing jurisdictions is not realistic.

As compelling as such compromises might be in the short run, a more credible, courageous, and fruitful long-term approach is to compromise on or otherwise adjust the means being used to achieve the vision. Therefore, LLL7 is persevere and practice principled compromise.

### **Recognize and Leverage Serendipity**

Just as major unexpected set backs occur in a major change effort, such as the Raise the Bar initiative, so do major unexpected boosts. Celebrate and leverage them.

Recall that the first edition BOK was published in 2004.<sup>1</sup> Development of the BOK and advancement of the Raise the Bar effort were buoyed up by two U.S. National Academy of Engineering studies whose results were published in 2004<sup>14</sup> and 2005.<sup>15</sup> The report of the first study concluded that “...if the engineering profession is to take the initiative in defining its own future, it must...agree on an exciting vision for the future; transform engineering education to help achieve the vision...” This conclusion clearly indicated that the time had arrived for all of U.S. engineering to reform, not refine, the preparation of tomorrow’s engineers.

The second study’s report concluded: “...it is evident that the exploding body of science and engineering knowledge cannot be accommodated within the context of the traditional four-year baccalaureate degree.” The report recommended that the baccalaureate degree be considered as a pre-engineering or Engineer-in-Training degree and the master’s degree be regarded as the professional degree. This strongly reinforced, based on all engineering education, the rationale statement within ASCE Policy Statement 465 which says that the baccalaureate degree is “becoming inadequate for the professional practice of engineering.”

Beginning in 2005, Raise the Bar participants made appropriate reference to the NAE findings and also cited reform support and actions offered by other organizations such as:

- ABET: Approved changes to the Program Criteria for Civil and Similarly Named Engineering Programs (civil engineering program criteria) and approved changes to General Criteria for Masters Level Programs (masters level criteria).<sup>4</sup>
- AAEE: Published *Environmental Engineering Body of Knowledge*<sup>16</sup>
- NCEES: Modified the licensure Model Law to require education beyond the bachelor’s degree<sup>17</sup>
- NSPE: Adopted supportive Professional Policy No. 168, Engineering Education Requirements,<sup>18</sup> which supports formal education beyond the bachelor’s degree and Position Statement No. 1752, Engineering Education Outcomes,<sup>19</sup> which advocates that the education of engineers who on are a licensure track include basics of leadership, risk and uncertainty, project management, public policy, business, and sustainability principles.

Those who lead change are typically optimistic. Accordingly, they embrace LLL8: Recognize and leverage serendipity.

### **Stand—Respectfully and Thankfully—on the Shoulders of Others**

Regardless of a change effort’s vision and/or the energy of its leadership, the scholarship that is integral to that effort (see LLL1) will inevitably reveal that the change initiative builds on the work of others. This is LLL9, and the last lesson learned during the development and initial implementation of the civil engineering BOK. Be respectful of and thankful for the earlier—sometimes decades or more—work of others.

Consider these examples which are relevant to the Raise the Bar program:

- 1918 Mann report:<sup>20</sup> Offer a common curriculum for the first two or three years, give more attention to values and culture, simultaneously teach theory and practice, and promote cooperative education.
- 1928 Wickenden report:<sup>21</sup> Limit engineering education to four years, reduce technical specialization at the undergraduate level, and add economics and liberal arts.
- 1955 Grinter report:<sup>22</sup> Increase emphasis on science and mathematics.
- 1965 Walker report:<sup>23</sup> Strengthen liberal education, base engineering curricula on engineering science, improve analysis-synthesis-design ability, encourage industry-government-university cooperation, make the bachelor’s degree a general engineering degree, and establish the “master’s degree in an engineering specialty” as the “basic professional degree for engineers.”
- 1985 NAE report:<sup>24</sup> Offer broad engineering education, stronger non-technical education, exposure to realities of the work world, personal career management, and greater management skills.
- 1974-1995 ASCE Education Conferences: The 1995 conference recommended professional degrees (more formal education), integrated curriculum, faculty development, and practitioner involvement.

### **Other Lessons Learned**

This paper highlights nine LLL as a result of contemplating the process used to develop and begin the implementation of the civil engineering BOK. The LLL reflect insights provided by a decade of various Raise the Bar activities and the author’s other change experiences. Clearly, choices were made in writing this paper in that other LLLs could have been shared. In the spirit of trying to be helpful, the following LLLs are noted, but not discussed:

- Proactively plan, conduct, and follow-up on meetings.
- Meet frequently, mostly electronically, as needed to maintain the change group’s momentum.

- Encourage individuals to “put in writing” their ideas, concerns, suggestions, objection support—partly to encourage them to more thoroughly articulate their thoughts and partly to facilitate sharing and discussion.
- Seek participants who have personal and interpersonal skills such as time management, goal setting and achieving, organizing, delegating, listening, writing, and speaking.
- Practice honesty (tell the truth) and integrity (keep promises).

## Summary of Lessons Learned

As noted at its outset, this paper summarizes LLL from or illustrated by the decade-long Raise the Bar effort with emphasis on the process used to develop and begin to implement the civil engineering BOK. The hope is that these LLL will provide readers with an improved understanding of the BOK and/or offer ideas about how to lead any change effort. The nine LLL are:

1. Conduct scholarly studies
2. Start with a vision
3. Expect and deal with set backs
4. Apply a change model
5. Test-drive terminology
6. Function transparently and inclusively
7. Persevere and practice principled compromise
8. Recognize and leverage serendipity
9. Stand respectfully and thankfully on the shoulders of others

A review of this list, informed by the discussions in this paper, may suggest that the LLL are mostly common sense. Perhaps, at least in that each LLL is easy to understand. However, experience teaches that common sense does not necessarily translate into common practice. Knowing something and using it are not the same. Knowledge is not power; knowledge applied is power. Applying the LLL offered in this paper requires self and organizational discipline. In my view, the Raise the Bar effort has embraced discipline and will continue to do so.

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