LEADERSHIP for Manufacturing and Manufacturing-related Programs

Dr. Ronald J. Bennett, University of St. Thomas

Dr. Ronald J. Bennett is Founding Dean and Professor Emeritus of the School of Engineering at the University of St. Thomas. Prior to entering academia, Bennett held leadership positions for three decades in the appliance, electronics, medical device and knowledge engineering industries, as well as in several entrepreneurial organizations. His responsibilities ranged from R&D, engineering and manufacturing to sales, marketing and general management.

He founded the School of Engineering at the University of St. Thomas, and teaches and publishes in the areas of materials engineering, innovation, strategy, technology transfer, leadership and engineering education. His current focus is on webinars and workshops on leadership for engineers in industry and academia.

Bennett is a member of numerous scientific and professional societies, is an ABET program evaluator and commissioner.

He has a wide variety of academic publications, and is co-author with Elaine Millam of the 2012 McGraw-Hill book 'Leadership for Engineers: The Magic of Mindset.'

Dr. Niaz Latif, Purdue University Calumet (College of Technology)

Dr. Niaz Latif is the Dean of the School of Technology at Purdue University Calumet. He has also served for two years as the Dean of the Graduate School and additional two years as the Interim Associate Vice Chancellor for Research and Graduate Studies. Dr. Latif was responsible for the graduate education activities for 14 Master's Degree programs, development of new degree programs and courses. He earned his Ph.D. from the University of Missouri—Columbia and an M.S. from South Dakota State University (SDSU); both degrees are in Agricultural Engineering. He holds a B.Sc. in Mechanical Engineering from the University of Chittagong in Bangladesh. Dr. Latif has authored/co-authored numerous refereed journal articles and peer reviewed conference proceedings articles and has made national and international conference presentations. His publication record includes articles related to academic program development and assessment of academic programs. Dr. Latif was the Editor-in-Chief of the Journal of Engineering Technology.

Mr. Aco Sikoski, Ivy Tech Community College

Mr. Sikoski completed his Bachelors of Science in Electrical Engineering at the University of Kiril I Metodi in Skopje, Macedonia. He continued his education at Purdue University where he obtained his Masters of Science in Engineering. Intermittently, Mr. Sikoski has consulted for various institutions and organizations. In 1997, he started his career at Ivy Tech Community College where he has stayed until present. He served as a professor, program chair, dean, and the campus Vice Chancellor. As a program chair and dean, Mr. Sikoski was involved in developing several technology and engineering programs, including the Energy Technology and Pre-Engineering Program. Developing programs to meet industry workforce needs and student's successes are his priorities. He served as an educational co-chair and chair of the curriculum committee of the Indiana Energy Consortium. He is a member of the Executive Board of Association of Technology Management and Applied Science and a visiting team member. Additionally, he serves on the advisory boards for College of Technology at Purdue University Calumet, Purdue University North Central and the Porter County Career Center.

Mr. Steven Wendel, Sinclair Community College

Steve Wendel serves as Director of the National Center for Manufacturing Education (NCME), originally established as a National Science Foundation Center of Excellence in the NSF Advanced Technological Education Program, the NCME provides leadership development for deans, program chairs, faculty and other educational leaders in manufacturing and engineering technology. Steve is also the Director for the Project Lead The Way (PLTW) Affiliate in Ohio. PLTW-OH has grown to over 340 programs in more than 150 school districts across Ohio preparing students for STEM career and college endeavors.

Dr. Mohammad A. Zahraee, Purdue University Calumet (College of Technology)

Mohammad A. Zahraee, PhD, PE Professor and Assistant Dean for Graduate Studies College of Technology Purdue University Calumet

Mohammad A. Zahraee became Assistant Dean for Graduate Studies, College of Technology at Purdue University Calumet in 2010. He holds Bachelor Degree in Mechanical Engineering from Southern Illinois University, MS in Structural Engineering and PhD in Engineering Mechanics both from University of Illinois at Chicago. Mohammad joined Purdue University Calumet in 1989 and was the Head of the Manufacturing Engineering Technologies and Supervision Department from 1996 through 2007. He was also acting head of Electrical and Computer Engineering Technology Department from 2000 through December 2006. Zahraee served ABET from 1992 through 2010 as a program evaluator, commissioner (Accreditation Team Chair), as well as the national chair of the Engineering Technology accreditation commission of ABET during 2009-2010. He was recently elected to the ABET Board of Directors as a representative of American Society of Mechanical Engineers (ASME). A professor of Mechanical Engineering Technology, Mohammad chairs the Graduate Education Council in the College of technology, advises all incoming graduate students, and approves all graduation audits for MS students. MS in technology at Purdue University Calumet has over 150 students, the third largest enrollment for such degree.

Leadership for

Manufacturing and Manufacturing-Related Programs

abstract

Leadership Capacity Building for Manufacturing and Manufacturing-related Programs aims to build leadership capacity, enable required programmatic changes, and meet NSF ATE program goals using the manufacturing discipline as a 'common denominator'. The Four Pillars for Manufacturing Knowledge serves as the framework for incorporating rapidly evolving curricular change requirements into the project, beginning with knowledge new to the discipline and carried through to manufacturing and manufacturing-related programs accreditation criteria. Strong leaders from several related perspectives all important to this project are organized to make a collective difference.

This project intends to implement recommendations from ASEE's **Innovation with Impact: Creating a Culture for Scholarly and Systematic Innovation in Engineering Education**. The strategy, outlined by the Society of Manufacturing Engineers **Workforce Imperative: A Manufacturing Education Strategy**, is being executed through work supported by the National Science Foundation under Grant No. 1304391.

This paper provides an overview of the project including goals, objectives, activities and anticipated deliverables. It also describes the leadership program model that has been developed based on the work of Ron Bennett and Elaine Millam, and information in their book **LEADERSHIP for ENGINEERS: The Magic of Mindset**. A summary of baseline data gathered from participants that will inform program improvement opportunities for manufacturing and manufacturing-related programs is incorporated. Additionally, lessons learned by the project team to date along with insights from participants in the 2013 cohort are shared.

background

Advanced manufacturing is a matter of fundamental importance to the economic strength and national security of the United States.[1] **A National Strategic Plan For Advanced Manufacturing**, February 2012, outlines a federal strategy for advanced manufacturing that seeks to achieve five objectives:

> <u>Objective 1:</u> Accelerate investment in advanced manufacturing technology, especially by small and medium-sized manufacturing enterprises, by fostering more effective use of Federal capabilities and facilities, including early procurement by Federal agencies of cutting-edge products.
> <u>Objective 2:</u> Expand the number of workers who have skills needed by a growing advanced manufacturing sector and make the education and training system more responsive to the demand for skills.
> <u>Objective 3:</u> Create and support national and regional public-private, government-industry-academic partnerships to accelerate investment in and deployment of advanced manufacturing technologies.

Objective 4: Optimize Federal investment in advanced manufacturing by taking a portfolio perspective across agencies and calibrating accordingly.
Objective 5: Increase total U.S. public and private investments in advanced manufacturing R&D.

Seven (7) related findings are presented in an Education and Workforce Development (3) Annex. The need for expanding the number of workers with needed skills (Objective 2) is reinforced by numerous recent reports including the Society of Manufacturing Engineers (SME) white paper, **Workforce Imperative: A Manufacturing Education Strategy,** which begins by stating that "Manufacturing education is in crisis."[2] Evidence provided to support this statement indicates that despite a consistently high United States unemployment rate for several years, – as many as 600,000 manufacturing jobs have gone unfilled because of a shortage of skilled workers. The paper then cites a dozen references indicating that the roots of this crisis begin with a serious shortage of workers educated in Science, Technology, Engineering and Mathematics (STEM).

A summary of recommendations provided by SME suggests that the crisis can be solved by educators, industry, professional organizations and government working together to:

1. Attract more students into manufacturing by promoting the availability of creative, high-tech jobs and giving students a strong STEM foundation.
2. Articulate a standard core of manufacturing knowledge to guide the accreditation of manufacturing programs and certification of individuals.
3. Improve the consistency and quality of manufacturing curricula to better prepare students for manufacturing employment.
4. Integrate manufacturing topics into STEM education, so that more students are exposed to manufacturing concepts.
5. Develop faculty that can deliver a world-class manufacturing education in spite of a growing number of challenges.
6. Strategically deploy existing and new resources into STEM and manufacturing education programs.

The paper then goes on to present expanded information for each of the six (6) recommendations within their strategy. For example, related to recommendation 5 - To develop faculty that can deliver an excellent manufacturing education, the paper states that educators must:

- Keep up to date on using new technologies.
- Work with industry to understand current technical needs and update curriculum.
- Collaborate with industry, professional organizations and government on projects such as design-and-build competitions and mentorships of both students and faculty.
- Research, publish and participate in manufacturing journals and conferences.
- Share best teaching practices, especially when it comes to alternative teaching methods, through appropriate continuing education programs for instructors at all levels. This includes in-service days and conferences, among other examples.

The SME Center for Education, established in 2009 under the direction of Bob Mott and currently led by Ron Bennett, was instrumental in producing this report. Additionally, the SME Center for Education with input from Mott, Bennett, and others in the Manufacturing Education Research Community are to be credited with the development of what is now recognized as the

Four Pillars of Manufacturing Knowledge.[3] Providing a visual model of fundamental knowledge required for manufacturing practitioners, the Four Pillars can be used to help update manufacturing curricula. The model is based on previous work done by the Society of Manufacturing Engineers in the Certified Manufacturing Technologist (CMfgT), Certified Manufacturing Engineering (CMfgE) Certification and Lean Certification body of knowledge documents. Additionally, both ABET and the Association of Technology, Management, and Applied Engineering (ATMAE) have or are aligning their respective accreditation criteria for all Manufacturing and Manufacturing-related programs with the framework of the Four Pillars of Manufacturing Knowledge.

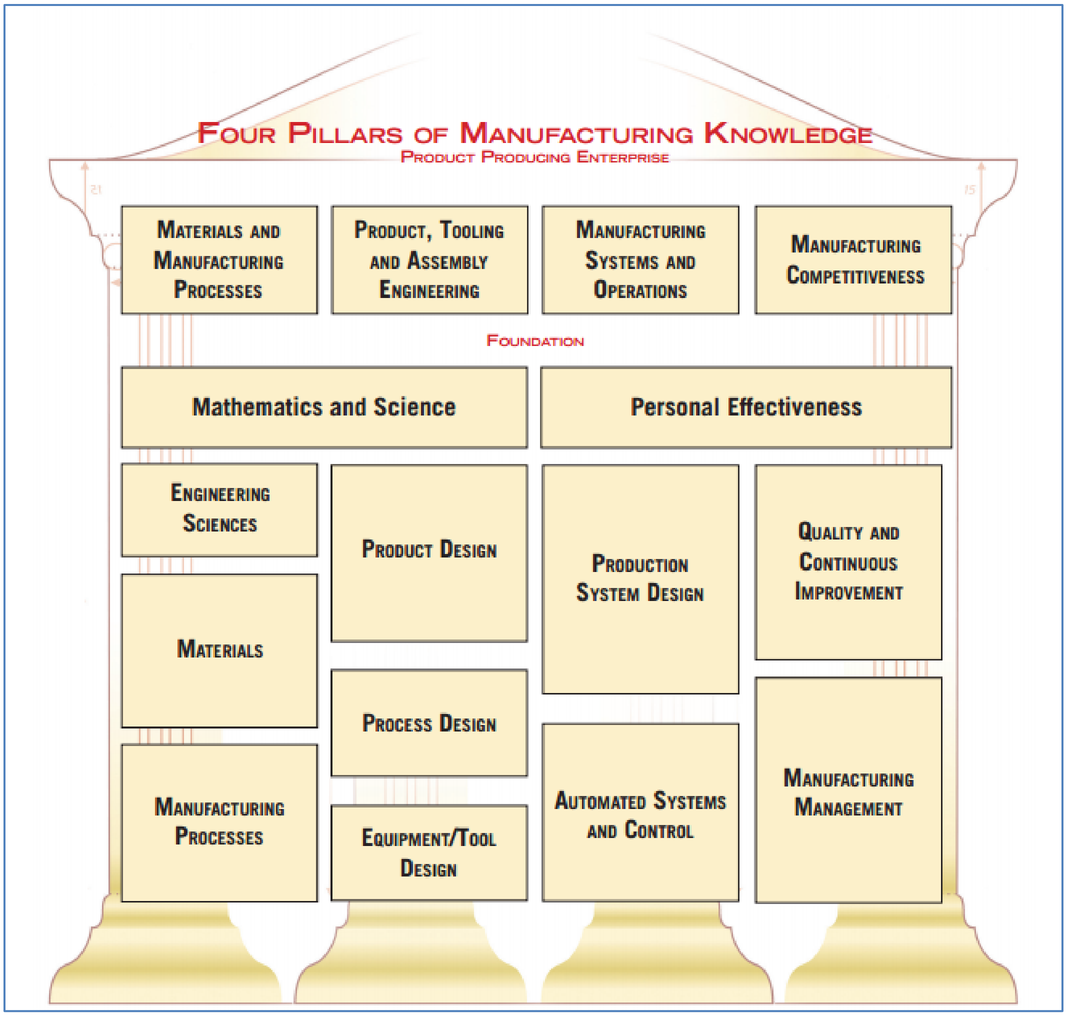

Figure 1 - SME Four Pillars[3]; Overview Version

Both ABET (Criterion 4. Continuous Improvement)[4] and ATMAE (7.19 Outcome Measures Used to Improve Program)[5] require that programs continuously improve. Beginning with knowledge new to the discipline and carried through to manufacturing and manufacturing-related programs accreditation criteria, the Four Pillars for Manufacturing Knowledge can serve as the framework for incorporating rapidly evolving curricular change requirements into curriculum and providing a framework for overall program improvements.

purpose

Perceived common problems (opportunities for improvement) facing manufacturing and manufacturing-related programs include:

- Students do not enter manufacturing and manufacturing-related career pathways due to misperceptions that they lead to dirty, dangerous, dead end jobs.
- Industry needs advanced manufacturing technicians, but there are few applicants for open jobs, and most applicants do not have the required skill sets.
- Community colleges offer manufacturing and manufacturing-related pathways, but do not produce enough advanced manufacturing technicians to meet industry demand.
- Leaders of community college manufacturing and manufacturing-related educational programs could benefit from collaborative leadership development to strengthen programs to meet new accreditation criteria.

The goal of this NSF leadership capacity building project is to provide leadership development based on advancements reported in the current manufacturing and engineering education literature for (A) community college manufacturing faculty members, chairs, and related deans and (B) master teachers from high school high school pre-engineering programs. The PI, Co-PIs, and partners from across the country have designed the following project objectives:

1. To provide a comprehensive 100-hour leadership capacity building program for three cohorts of instructional leaders.
2. To provide expanded pre-college outreach focused on manufacturing careers.
3. To disseminate information and resources to postsecondary faculty members and high school teachers.

Primary Project Deliverables include:

1. Faculty leadership development workshop models for manufacturing education in post-secondary and secondary institutions
2. Prepared effective leaders of manufacturing and manufacturing-related instructional programs
3. Prepared effective master teachers in high school pre-engineering feeder programs
4. Adoption of manufacturing curriculum aligned with the Four Pillars of Manufacturing

scope / method

The scope of the project includes both manufacturing and manufacturing-related programs with a focus on engineering technology programs. Since it is anticipated that high school leader attendees will be familiar with Project Lead The Way® (PLTW) curriculum, The PLTW engineering design and development process is used as the methodology for outlining development of the faculty leadership development programs aimed at better preparing effective leaders and aligning curriculum with the Four Pillars. The steps of this process include:

1. Define and Justify Problem
2. Generate Multiple Solutions
3. Select and Develop Solution
4. Construct and Test Prototype

5. Reflect and Evaluate
6. Present Results

1. Define and Justify Problem

The problem was to develop a leadership development program based on the work of Bennett and Millam, Felder, Brent and Prince, ASEE, SME, NAE, and others. Given that the target audience includes program and faculty leaders as opposed to future faculty or early career faculty, leadership development incorporating action learning on real challenges/opportunities was determined to serve as the central focus of the program.

2. Generate Multiple Solutions

The first potential solution was presented in our original NSF proposal and was summarized as

- Convene a five-day workshop at Sinclair Community College where Cohort 1 and Cohort 2 would develop program expansion plans and Cohort 3 would develop a plan to expand pre-college manufacturing awareness.

Numerous other options were discussed and variations of those options were considered at the kick-off meeting for the project. Bennett and Millam have utilized several different formats for delivery of their leadership curriculum material which was originally designed for engineering graduate students. A key benefit for engineering graduate students taking a series of semester long courses was the additional time to absorb the material according to Bennett. Time for application and reflection of leading and learning learned attributes being introduced was deemed to be critically important. Additionally, the project development team wanted to better be able to incorporate findings and material from other sources (Felder, Brent and Prince, ASEE, NAE) as originally proposed. Program formats considered include variations on

- Workshops
- Seminar Series
- Consulting and Mentoring
- Learning Community

Incorporating webinars and spreading the program over time was proposed in order to incorporate additional material.

3. Select and Develop Solution

The selected approach and development of the Leadership & Learning Collaborative for Manufacturing and Manufacturing-Related Programs project was to spread the 100 hours of development activity across an academic year. The initial 2013-14 program includes:

- Two (2) Webinars
- Two (2) Face to Face Workshops
- Inclusion of an ‘Industry Day’

This blended approach will enable positive aspects of various program formats to be realized while minimizing the negative aspects that have been identified and outlined by Felder, et.al. in their recent paper **Engineering Instructional Development: Programs, Best Practices, and Recommendations**[6]. The outline presented in their section on Faculty Development Program Structures and brief comments on how this project was developed follows:

Development programs typically fall into four categories that we aim to blend: 1) Workshops, 2) Seminars, 3) Consulting, Mentoring, and Partnering Arrangements, and 4) Learning Communities. A primary disadvantage cited for a single workshop format is that a one-time event is not likely to have a lasting effect. This program will incorporate two workshops coupled with ASEE events on the calendar. The intent is for workshops in subsequent years to tie directly with ASEE venues beginning with the ETLI Conference held in October, the CIEC Conference in February as well as the ASEE Annual Conference held in June each year. Instead of adding seminars to the program, two (2) webinars are included. Webinars will enable participants to understand the structure of the program along with requirements and expectations of participating in the cohort. Another component of the program might best be described as a 'collaborative arrangement' rather than consulting, mentoring or partnering as noted by Felder, et. al. Consulting and mentoring imply an expert-novice relationship. Though the Co-PIs involved with the project are certainly well informed, many of the anticipated participants are also recognized as experts both at their respective institution and in the broader engineering technology academic community. Collaborating with participants will more closely align with the partnering description mentioned above. Insights will be shared by Co-PIs with any immediate gains happening at the participants' home institution. It is expected that long-term gains may result from this collaboration as the Co-PIs assemble 'lessons learned' and best practice information. The term *learning community* doesn't seem to resonate strongly in the engineering technology community. The project hopes to realize benefits attributed to learning communities through both the development of lessons learned and working with a cohort of individuals over the academic year.

4. Construct and Test Prototype

The 2013-14 Leading & Learning Collaborative
Leadership Capacity Building for Manufacturing and Manufacturing-Related Programs

- Webinar I: September 27, 2013 (1 hour)
    - Presented overall structure, including an introduction to the Four Pillars of Manufacturing Knowledge, and requirements of the program participants
- Webinar II: December 13, 2013 (2 hours)
    - Launch of the 100 hour leadership capacity building program with a clear, understandable roadmap for leading and learning experiences.
    - Presented self-assessment overview completed by potential participants
    - Presented and connect background and reading assignments for the workshop
        - SME Workforce Imperative
        - SME Four Pillars of Manufacturing Knowledge
        - ASEE Innovation with Impact
        - Leadership for Engineers: The Magic of Mindset
    - Presented Bennett and Millam Leadership Model
    - Assignments outlined for the cohort
        - Prior to Webinar 2
            - Self-assessment
            - Readings
        - Before 3-day workshop

Personal and program assessment
Readings
Before 2-day workshop
Program improvement and expansion plan
Personal leading and learning plan
After June workshop
Project assessment
Student performance data

Three-day workshop:	February 8-10, 2014	Atlanta, GA
Two-day workshop:	June 13-14, 2014	Indianapolis, IN

The three-day workshop to be held in Atlanta, GA on February 8-10, 2014 is being finalized as of the writing of this paper. The tentative agenda includes topical headings such as:

DAY1

- Setting the Stage
- Workforce Imperative: Why the change is required
- Four Pillars—The Guide for my Organizational Plan
- Innovation with Impact—what, how does this fit with overall outcomes?
- Introduction to Leadership: What it is/what it is not
- DVD: Leadership the Art of Possibility
- Review of Integrated Model of Leadership: Who am I as a leader today?
- Strengths Finder Results
- Myers Briggs TYPE & Learning Style Assessments
- Other relevant assessments to consider
- Day 1 Wrap Up and Reflection
- An experiential team exercise

DAY2

- What have I learned thus far?
- The Creation of my Personal Leadership Development Plan
- Coaching One Another
- Personal Change → Organization Change
- Creating the Culture—a Leader's Role
- Incorporating Innovation with Impact
- Review and Summary of what is evolving…
- Day 2 Wrap Up and Reflection
- Creativity Exercise for Organizational Plans

DAY3

- The Creation of the Organizational Plan (Program Expansion / Improvements)
- Beginning Steps—Outlined by groups
- Finalizing of both plans—individual leadership plans & organizational plan
- Share personal plans with group along with 2-3 clear goals/commitments
- Finalize plans for Action Learning Process
- Skeletal plans for implementing the program expansion plans back home
- Mentors/Mentee Groups—How to use effectively
- Celebration of Successes!

5. Reflect and Evaluate

Lessons Learned will be compiled and documented for the project by the Co-PI team. Additionally, the Mentors/Mentee Groups—How to use effectively, scheduled for the 3 day workshop will allow the cohort and Co-PI team to collaboratively determine a best approach for reflection and evaluation of efforts across the country.

6. Present Results

Results to date include the development of the program model presented above. Additionally, a Self-Assessment completed by potential program participants as criteria for being selected to participate in the program is being compiled with aggregate preliminary information presented. Background information was gathered about potential participants. Following established selection criteria, the Co-PI team invited thirty-six (36) participants from nineteen (19) different states representing twenty-six (26) different institutions to participate in the 2013-14 cohort. Fifteen (15) 2-year associate degree programs and nineteen (19) 4-year baccalaureate degree programs are represented.

Responses to the second survey question provide insight to the types of manufacturing or manufacturing-related programs represented. Over 60% of the programs describe themselves as engineering technology as shown in Figure 2 below.

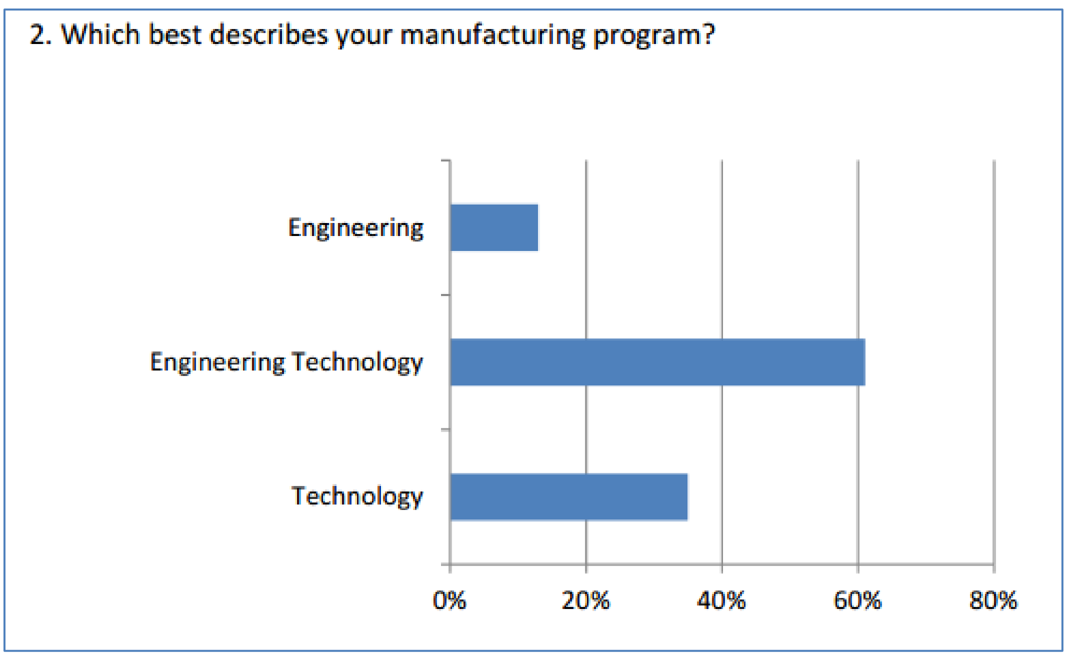

Figure 2 – Type of Manufacturing Program

Questions 3 – 5 gathered additional background information with responses providing insight into the types of degrees offered, program options and program focus. The majority of respondents represented baccalaureate degree programs while less than 40% of the programs represent a manufacturing degree. All respondents indicated that their programs serve as preparation for industry.

Questions 6 – 7 sought to determine the types of collaborative relationships programs have within the college or university and with industry and employers. Responses are represented graphically below in figures 3 and 4.

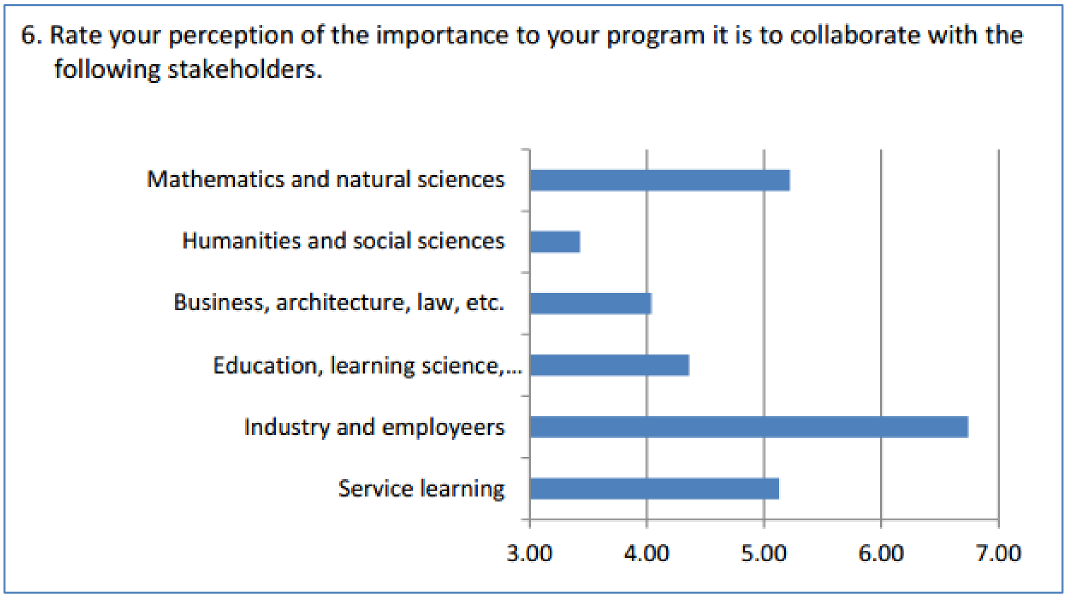

Figure 3 – Perceived importance to collaborate

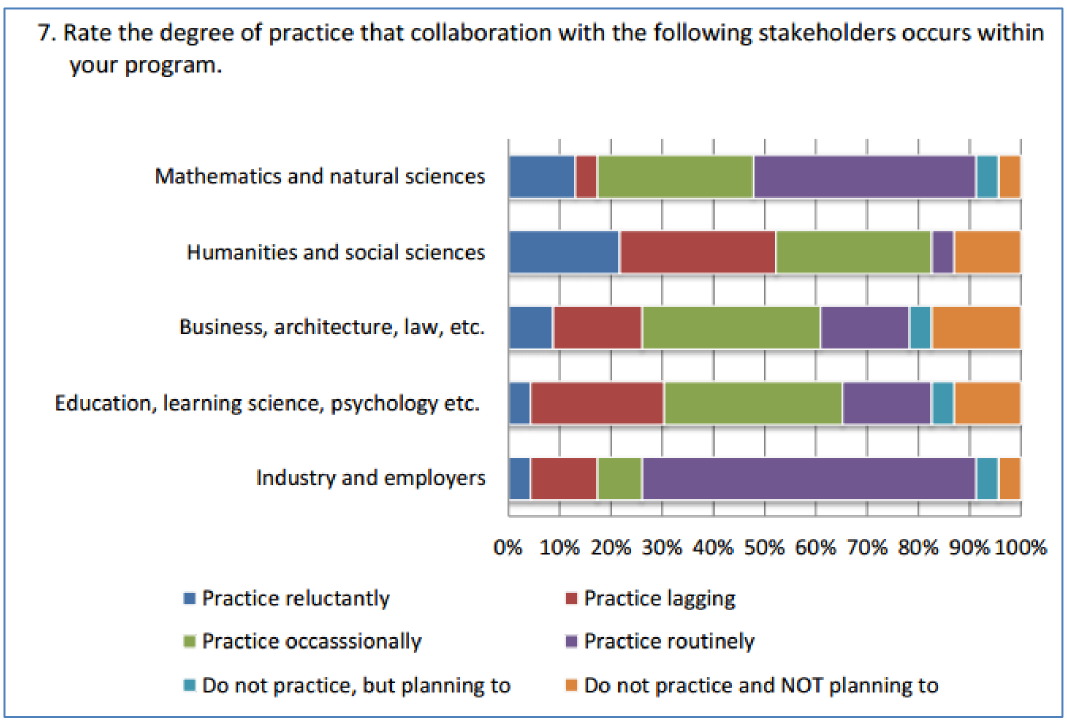

Figure 4 – Degree of collaboration practice

Questions 8 – 9 addressed various pedagogical approaches within the program. Again, the perception of importance as well as the degree of practice were gauged for Traditional Lecture, Team Projects, Case Studies, Collaborative Activities, Problem-Based Activities, Subject-Based Activities, Online or Distance Learning as well as Universal Design for Learning. Responses are represented graphically below in figures 5 and 6.

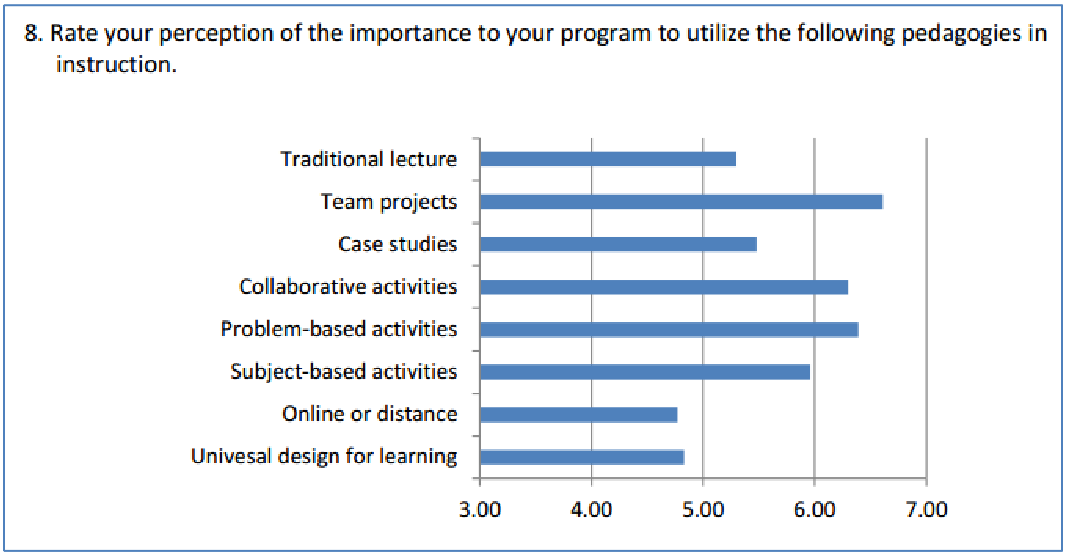

Figure 5 – Perceived importance

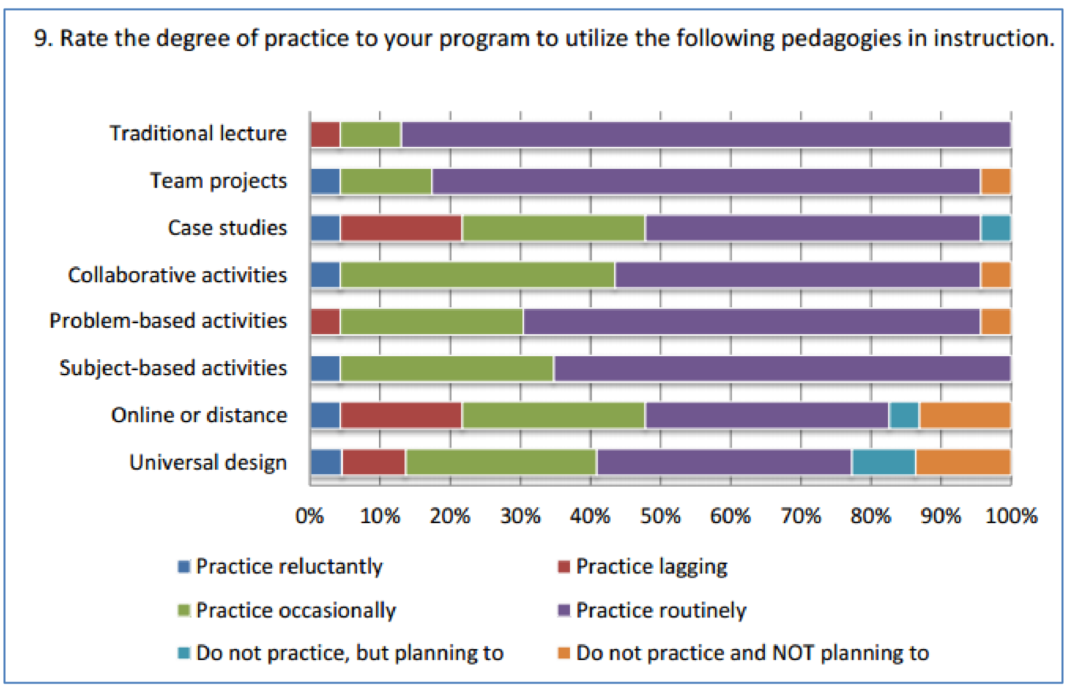

Figure 6 – Degree of practice

Questions 10 – 11 addressed Program Development and sought to gather a listing of resources thought to help make programs more attractive to students as well as both challenges and opportunities within programs. Categories were developed that represent areas where it is thought resources would be helpful in making programs more attractive to students and include: Marketing, Technology, Curriculum & Pedagogy, Industry Internships and Certification along with another, catch-all category of time & money.

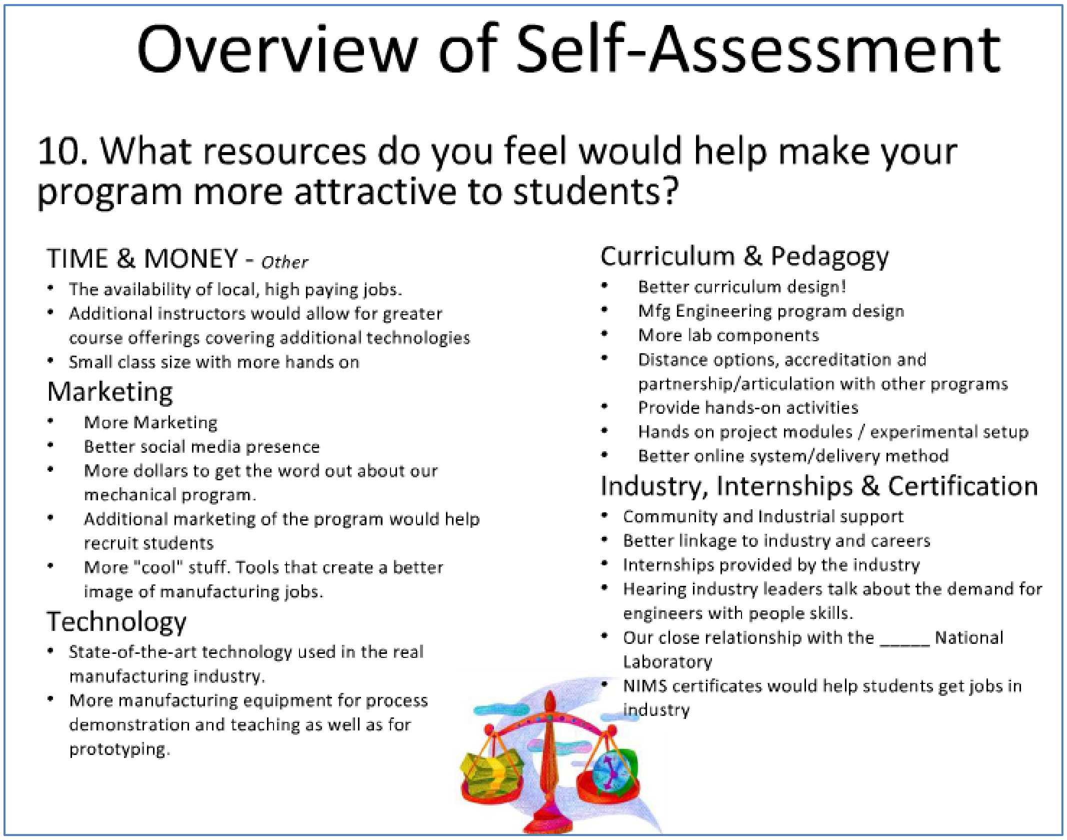

Figure 7 – Resources that would make programs more attractive to students

Numerous opportunities and challenges were identified that will serve as a starting point for the workshop. Common issues will be addressed collaboratively and individually for participant programs. Leading and learning plans developed and implemented by mid-career participants who are the faculty and administrative leaders within their respective programs are best positioned to implement *innovation with impact* for their programs. Recommendations identified in the 2012 ASEE report –figure 8 below:

RECOMMENDATIONS FOR CREATING A CULTURE FOR SCHOLARLY AND SYSTEMATIC INNOVATION IN ENGINEERING EDUCATION: GOING FROM *INNOVATION* TO *INNOVATION WITH IMPACT*

1. Value and expect career-long professional development programs in teaching, learning, and education innovation for engineering faculty and administrators, beginning with pre-career preparation for future faculty.
2. Expand collaborations and partnerships between engineering programs and (a) other disciplinary programs germane to the education of engineers as well as (b) other parts of the educational system that support the pre-professional, professional, and continuing education of engineers.
3. Continue current efforts to make engineering programs more engaging and relevant, and especially expand efforts to make them more welcoming.
4. Increase, leverage, and diversify resources in support of engineering teaching, learning, and educational innovation.
5. Raise awareness of the proven principles and effective practices of teaching, learning, and educational innovation, and raise awareness of the scholarship of engineering education.
6. Conduct periodic self-assessments within our individual institutions to measure progress in implementing policies, practices, and infrastructure in support of scholarly and systematic innovation—innovation with impact—in engineering education.
7. Conduct periodic engineering community-wide self-assessments to measure progress in implementing policies, practices, and infrastructure in support of scholarly and systematic innovation—innovation with impact—in engineering education.

Figure 8 – ASEE Innovation with Impact[7] - Recommendations

The **Innovation with Impact**[7] report developed their Top Five Challenges and Opportunities as shown in figure 9 below:

TABLE 1
Top Five Challenges and Opportunities

Challenges

Faculty	Count	Chairs	Count	Deans	Count
Resources	46	**Resources**	36	**Resources**	19
Rewards	37	**Rewards**	29	**Workload**	17
Workload	36	**Workload**	27	**Rewards**	16
Awareness of Innovations	18	Tech. Research Emphasis	13	Innovation Not Valued	12
Assessment of Innovations	18	Changing the Curriculum	12	Resistance to Change	10
		Awareness of Innovations	12		

Opportunities

Faculty	Count	Chairs	Count	Deans	Count
Faculty Development	16	Faculty Commitment	24	**Rewards**	21
Rewards	15	**Faculty Development**	18	Changing the Curriculum	18
Industry & Entrepreneurship	12	Awareness of Innovations	15	Collaborating with Others	15
STEM Centers	10	Innovative Pedagogy	15	**Faculty Development**	14
Resources	7	**Rewards**	12	Instructional Innovations	14
Changing the Curriculum	7				

Figure 9 – ASEE Innovation with Impact[7] - Top Five Challenges and Opportunities

Faculty Development and Rewards are listed as a Top Five response across the board by faculty, chairs and deans. The work completed by ASEE incorporated responses primarily from engineering programs. Do these same challenges and opportunities rank as high for engineering technology programs?

conclusion

Program development along with cohort selection and confirmation for this project has thus far presented both challenges and opportunities. Preliminary feedback from participants indicates that a blended learning format is preferred and more effective than a single workshop event. The challenge will lie in making program improvements that produce better outcomes for participants while balancing the demands on participant time when career-long professional development in teaching, learning, and education innovation for engineering faculty and administrators is not necessarily highly valued or universally expected. The Co-PI team will continue to incorporate program improvements with this in mind.

Cohort recruitment, selection, confirmation and engagement through program completion must also be refined. Though a relatively large group of potential participants attended the first webinar, the actual number of participants in the 2013-14 cohort was below the original target. Clear expectations regarding program objectives and outcomes, early advertising and recruitment of participants along with better enumeration of program benefits will help in cohort development. It is also expected that information provided by the 2013-14 cohort to potential future participants will be extremely helpful. Research findings, dissemination of lessons learned and best practices being implemented at programs involved with the project will also be useful.

Readers of this paper are encouraged to consider application for the 2014-15 cohort and begin planning now to create a team of peers to participate and improve the odds of being selected for participation in the project. Leaders of manufacturing and manufacturing-related programs should be forwarding information about the opportunities for both higher education and K-12 leaders and faculty.

Lessons learned from the development of this pilot program will be presented at the 2014 ASEE Conference. Additionally, updates regarding the two face-to-face workshops along with the status of programs participating in the project will be presented and ultimately determine if the project will truly serve as an example of work that is innovative and will make an impact for manufacturing and manufacturing-related programs.

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[1] A National Strategic Plan For Advanced Manufacturing, Executive Office of the President National Science and Technology Council, February 2012
[2] Workforce Imperative: A Manufacturing Education Strategy Society of Manufacturing Engineers, SEP 2012
[3] Four Pillars of Manufacturing Knowledge, Society of Manufacturing Engineers, 2011, SME.org/FourPillars
[4] CRITERIA FOR ACCREDITING ENGINEERING TECHNOLOGY PROGRAMS Effective for Reviews During the 2013-2014 Accreditation Cycle
[5] ATMAE Outcomes Assessment Accreditation Handbook – Team Worksheets: 01/14/2013
[6] ENGINEERING INSTRUCTIONAL DEVELOPMENT: PROGRAMS, BEST PRACTICES, AND RECOMMENDATIONS, Felder, Brent, Prince, Journal of Engineering Education, 100(1), 89 –122 (2011)
[7] Innovation with Impact: Creating a Culture for Scholarly and Systematic Innovation in Engineering Education, American Society for Engineering Education (ASEE), 2012