Industrial and STEM Partnership Creates Engineering Student Leaders

Bruce DeRuntz, Rhonda Kowalchuk, & John Nicklow
Southern Illinois University Carbondale

ABSTRACT

Students, universities and industry are all struggling during these economically challenging times. Students face rising tuition costs, universities face a reduction of state funding, and industry has a looming shortage of future technical leaders. Developing industrial and government partnerships to support the development of America's future technical leaders has become imperative. The Southern Illinois University Carbondale's (SIUC) Leadership Development Program (LDP) meets many of these pressing problems.

The LDP has received over $1 million dollars from corporate sponsors and the National Science Foundation's STEM program to attract and develop engineering technical leaders. The program has grown steadily over the past five years and has amassed a long list of student, university and industry accomplishments that confirm the program's value.

The value of creating a student LDP resides with the principle stakeholders: companies, students, government, and the university. The corporate sponsor has hired 15 graduates, achieved an impressive retention rate and attests to the difference it makes with its hires. Students receive leadership training and a tuition waiver. Government is achieving its goals of producing more students in the STEM field and the university is able to attract more and higher quality students through the program's incentives.

Keywords: STEM, Conference Proceedings, Leadership, Training

INTRODUCTION

In its broadest perspective, the STEM initiative is about jobs for the American people. Delving into this analysis a little deeper, STEM is about sustaining or growing the United States economy, maintaining national security and sustaining the standard of living. Of course achieving these objectives are all predicated upon the US having a highly technically educated workforce, capable of developing innovative products and processes. The President and the National Science Foundation's (NSF) STEM initiative is a full-on response directed to a shortfall of college graduates in the technical fields.

Examining a sample of data from the period of 1985-2005 illustrates that there was not a significant change in total number of undergraduate and graduate students enrolled in engineering majors (NSF, 2008). While this relatively flat statistic may suggest that students graduating from STEM majors are holding their own, the US Bureau of Labor statistics is projecting an 11 percent increase in the demand for engineering professionals between 2008-18 (Bureau of Labor Statistics, 2010). More specifically, the US Bureau of Labor Statistics (2010) makes the following forecast for industrial engineers.

Industrial engineers are expected to have employment growth of 14 percent over the projections decade, faster than the average for all occupations. As firms look for new ways to reduce costs and raise productivity, they increasingly will turn to industrial engineers to develop more efficient processes and reduce costs, delays, and waste. This focus should lead to job growth for these engineers, even in some manufacturing industries with declining employment overall. Because their work is similar to that done in management occupations, many industrial engineers leave the occupation to become managers. Numerous openings will be created by the need to replace industrial engineers who transfer to other occupations or leave the labor force.

The National Association of Colleges and Employers salary survey (NACE, 2009) gives further evidence of the ongoing need for engineers. Their report presents data indicating that graduates with a

Bachelor's degree in engineering received the highest starting salary offers. This statistic coupled with basic supply and demand market principles confirms the ongoing shortage of new engineers entering the marketplace.

While it is a widely recognized that the United States is in need of an increasing number of STEM graduates, a greater crisis looms over a shortage of technical leaders. In his book *Where Have All the Leaders Gone?* Lee Iacocca (2007) focuses on the issue of a leadership shortage in the United States. He considers this core issue to be the greatest challenge facing the US and goes on to say.

Name me an industry leader who is thinking creatively about how we can restore our competitive edge in manufacturing. Who would have believed that there could ever be a time when 'The Big Three' referred to Japanese car companies? How did this happen, and more important, what are we going to do about it? (p.13)

Further evidence of this growing need was validated in a recent meeting with one of the world's largest heavy equipment manufacturers. The senior executive told me that his company has forecast the need to hire 14,000 future technical leaders over the next decade to meet their growing sales demands. He went on to say that human resource development in the technical ranks was one of the company's highest priorities.

A great opportunity to fulfill the STEM mission has presented itself if key stakeholders from industry and academia can work collectively. These two giants can create successful technical leadership development programs that can bring about a paradigm shift in the way technical leaders are created. This vision has already been put into motion and the results are impressive.

BACKGROUND

The SIUC's College of Engineering's LDP has achieved excellent growth and success in just its first five years. Its success has been recognized by industry groups such as The Gordon Foundation and Best Practices Institute (http://www.bestpracticeinstitute.org). Each of these groups has requested a book chapter or case study to highlight the success of the SIUC's program. Additionally, the sponsoring company and its CEO continue to champion the program. The program is projected to continue its student growth and will have 18 students enrolled in the program in the 2012-2013 academic year.

In 2006, Advanced Technology Services (ATS) CEO, Dick Blaudow, donated $250,000 to SIUC's College of Engineering to establish a leadership development program that would benefit all parties involved. This program was created with the intent and direction of supporting his alma mater, providing financial and career opportunities for students, and developing future leaders for the sponsor's company and our country. The scholarship offers the hard working community college transfer students: $18,000 toward the cost of two years of tuition, a summer internship with the ATS, an opportunity for a fast-track career, and early leadership training and development. The early success of this program has inspired key stakeholders to expand the LDP model to more students, majors and sponsors. The National Science Foundation has recognized the potential of this program and has funded $600K towards its outreach to more students. Their investment is funding 30 scholarships over the next three years (2010-2013). Additionally, the Mr. Blaudow made a follow-up donation of $76,000 to the program, four years after his initial investment and has invited the College of Business to participate with their students.

Perhaps because of its uniqueness on a college campus, the LDP is often mistaken as a scholarship program because of its generous scholarship offerings. To be clear; it is a human resource development program that requires much more commitment and management than coordinating the allocation of scholarships. The LDP should be more closely identified with top SIUC scholarships because of the challenging program requirements and the commitment by recipients. Recipients are required to make measurable progress towards developing their leadership skills, take extra classes on top of an intensive engineering curriculum, assume leadership roles in Registered Student Organizations (RSO), lead service projects throughout the year, develop and attend leadership workshops, participate in weekly workouts, complete a summer internship, and maintain a 3.0 GPA. All of these activities for the current 15 students are overseen and coordinated by the program director, requiring 10-20 hours per week.

A university's primary mission is to provide education for students and outreach services for the public and businesses. To expand the success of that mission, universities realized they could capitalize on their talent resources to generate more revenue and invest in programs that attracted business partners. Today, it is commonplace for the best universities to invest in research parks, centers of excellence and provide matching funds for grants. Universities make these investments because the comprehensive financial returns they receive make it an attractive business proposition.

The LDP is not unlike any of the profitable programs across the campus. The return on investment of this program has been extraordinary. Other prominent universities have realized the value of technical leadership programs and have made commitments to support their programs. A few examples include: MIT Engineering Leadership Program, The Iacocca Institute at Lehigh University, Tufts Engineering Leadership Program, University of Colorado Engineering Leadership Program, University of California San Diego Engineering Leadership Center, UC Berkley Engineering Leadership Professional Program, and the Miami University Lockheed Martin Leadership Institute.

The LDP has realized many benefits for its stakeholders in a short time. A few of those benefits include: Students receive generous financial assistance, advanced career placement, industry internships, leadership training and experience, increased student performance, including increased graduation rates, higher GPAs, and leadership recognition. The College receives multiple prestigious scholarships to offer, trained student leadership in most of the College of Engineering's 14 RSOs, prestige of having one of the few technical leadership programs in the country, significant funding for their RSOs, ability to attract high caliber students, national recognition at student competitions, greater student body participation in RSOs, tutoring support of the student body, larger and more successful service projects, stronger relationships with community college partners, and long-term industry relationships. The University receives strengthened relationship with the industry and proven student leadership model that can be expanded across the campus. Finally, industry receives future technical leaders that will allow them to meet their strategic objectives.

Project Goals

The goals associated with the LDP have evolved to meeting the needs of the financial sponsor. The corporate sponsor sought to attract graduates into their company, realize a financial return from intern six sigma projects and recognize a high degree of leadership potential in the program graduates. The early success realized by the corporate sponsor led the way to successfully win an NSF STEM grant to expand the program.

The STEM grant aims to achieve a two and one half-year graduation rate (i.e., four and one half years after beginning at the community-college level) of at least ninety percent. Support activities for scholarship recipients will build upon existing student support programs (i.e., peer mentoring, minority support programs, and tutoring). The intellectual merit of this project is the determination as to whether retention, graduation, and job placement rates of students attracted to engineering and technology can be increased by providing financial support and by implementing student support and leadership programs. The broader impact of the project is an increase in the breadth of social and economic backgrounds of students graduating in engineering and, thus, of prepared individuals entering the job market.

METHODOLOGY

Evaluation Design

The evaluation design for the NSF funded project includes both qualitative and quantitative methods to assess the success of the LDP. Ongoing evaluation of the program includes the following assessment tools: (a) Student Leadership Practices Inventory (SLPI) (Kouzes & Posner, 2006); (b) Grit Scale

(Duckworth et al., 2007; Duckworth & Quinn, 2009; Jaeger et al., 2010); (c) self-report surveys (e.g., gather preliminary student data, examine the impact and attitudes toward the program, and assess students experiences in the program); and (d) student performance data (e.g., retention status and GPA). Each year a peer comparison group is identified from the current cohort of transfer students and asked to complete the SLPI, the Grit Scale, and a self-report survey during their first year of studies and the SLPI at the end of their second year of studies. The scholarship program group completes the SLPI, the Grit Scale and a self-report survey at the start of their first year, at the start of their second year, and at the end of their second year of studies.

Instruments

The SLPI consists of 30 items with "six statements to measure each of The Five Practices of Exemplary Student Leadership" (Kouzes & Posner, 2006, p. 6). The Five Practices include (a) Model the Way (finding your voice, setting the example); (b) Inspire a Shared Vision (envisioning the future, enlisting others); (c) Challenge the Process (searching for opportunities, experimenting and taking risks); (d) Enable Others to Act (fostering collaboration, strengthening others); and (e) Encourage the Heart (recognizing contributions, celebrate the values and victories) (pp. 11-16). The scores for each of the Five Practices range between 6 and 30. The internal consistency of the Five Practices varies from .68 (Model the Way) to .80 (Encourage the Heart) (p. 83).

The Grit Scale (Duckworth et al., 2007; Duckworth & Quinn, 2009; Jaeger et al., 2010) consists of 17 items measuring 4 subscales and *Grit* is defined as "perseverance and passion for long term goals" (Duckworth et al. 2007, p. 1087). The four subscales include (a) Ambition; (b) Perseverance of Effort; (c) Consistency of Interest; and (d) Brief Grit. In addition, there is a Total Grit score that has shown an internal consistency of .77 to .85 across studies (Duckworth et al., 2007). The scores for each subscale are averaged across their respective items and can range between 1 and 5.

Participants

Scholarship recipients must meet requirements regarding citizenship, major, academic potential or ability, and financial need that are outlined in Section III.C of the S-STEM Program Solicitation. For students that meet these requirements, selection of first-year scholarship recipients were based upon (a) financial need; (b) community-college cumulative grade point average (GPA); (c) an essay that outlines their career goals; and (d) a personal interview. The essay was used to evaluate the student's motivation, time and resource management and communication skills. Applicants were ranked using these criteria, and the students with the highest rankings were awarded available scholarships. In the event a student declined the scholarship or becomes ineligible, an alternate will be selected from a list of runner-ups. Peer comparison students were selected based on being admitted to the College of Engineering (COE) as a transfer student in the respective fall semester with a *Junior* classification and a transfer GPA of 3.00 or greater. The GPA criterion was lowered to 2.75 or greater to increase the sample size for the peer comparison group in 2011 from 10 to 15 students.

Tables 1 and 2 contain demographic characteristics for the LDP Cohort and Peer comparison groups. The majority of students were White males. The choice of engineering major was dispersed with the exception of the 2011 peer group (i.e., 60% of students are Civil Engineering majors). The median age of students was identical across groups (see Table 2).

Table 1: Demographic Characteristics of LDP Cohort and Peer Comparison Groups

		2010 Cohort (*n* = 10)		2011 Cohort (*n* = 8)		2010 Peer (*n* = 20)		2011 Peer (*n* = 15)	
Characteristic	**Response**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Gender	Female	2	20%			4	20%	3	20%
	Male	8	80%	8	100%	16	80%	12	80%
Ethnicity	American Indian/Alaska Native								
	Asian/Pacific Islander					3	15%		
	Black (not Hispanic)	2	20%						
	Hispanic/Latino(a)					1	5%		
	White (not Hispanic)	8	80%	8	100%	16	80%	13	87%
	Other								
	Not Available							2	13%
Major	Civil Engineering (CE)	1	10%			1	5%	9	60%
	Computer Engineering (CEGR)	1	10%	2	25%	1	5%		
	Electrical Engineering (EE)	2	20%	1	13%	6	30%	1	7%
	Engineering Technology (ET)			1	13%				
	Industrial Technology (IT)	5	50%	2	25%	4	20%	2	13%
	Mechanical Engineering (ME)	1	10%	1	13%	4	20%	2	13%
	Mining Engineering (MNGR)			1	13%	2	10%		
	Undeclared Engineering					2	10%	1	7%

Table 2: Descriptive Statistics on Age for LDP Cohort and Peer Comparison Groups

Group	*n*	Min/Max	Median	Mean	*SD*
2010 Cohort[a]	10	20/30	20	21.40	3.13
2011 Cohort[b]	8	20/23	20	20.63	1.06
2010 Peer[a]	20	19/27	20	20.65	1.66
2011 Peer[b]	15	19/34	20	22.93	4.95

Note. *SD* = Standard Deviation;
[a]Age was computed as of 09/01/2010; [b]Age was computed as of 09/01/2011

FINDINGS

Retention and GPA

Table 3 contains the retention status as of the end of spring 2012 semester. In the 2010 Cohort, 3 students left the LDP but remained enrolled in the COE and one student left the university after their first semester. Of the 6 students retained in the LDP, 4 graduated in spring 2012, one will graduate in the summer 2012, and one will be returning to graduate in the fall 2012 semester. For the three students retained in the COE, two graduated in the spring 2012 semester and one will be returning in the fall 2012 semester. The two-year graduation rate from engineering for the 2010 cohort is 6 out of 10 (60%) with an anticipated 2 ½ year graduation rate of 9 out of 10 (90%).

In the 2011 Cohort, one student switched majors after their first semester. The remaining 7 students will be returning in the fall 2012 semester as part of the LDP. In the 2010 Peer comparison group, one student switched majors in their second year and one student left the university after their second year for academic reasons. Graduation data is not yet available for this group of participants. In the 2011 Peer comparison group, one student left the university in their first semester and one student left the university after their second semester for academic reasons.

Table 3: Retention Status of LDP Cohort and Peer Comparison Groups

Group	Retained in LDP	Retained in COE	Switched Majors	Left University	Total
2010 Cohort	6	3		1	10
2011 Cohort	7		1		8
2010 Peer	N/A	18	1	1	20
2011 Peer	N/A	13		2	15

Note. LDP = Leadership Development Program; COE = College of Engineering; N/A = Not Applicable

Table 4 contains descriptive statistics for semester GPAs for the LDP and Peer comparison groups. Noteworthy is that all groups maintained an average semester GPA above 3.00. However, the LDP 2010 Cohort compared to their peer counterparts maintained a minimum GPA above 2.0 with less variability among individual GPAs (i.e., smaller standard deviation) with the exception of spring 2012.

Table 4: Descriptive Statistics on GPA for LDP Cohort and Peer Comparison Groups

Group	Semester GPA	*n*	Min/Max	Median	Mean	*SD*
2010 Cohort	fall 2010	10	2.54/4.00	3.48	3.40	0.53
	spring 2011	9	2.07/4.00	3.20	3.21	0.63
	fall 2011	7	2.38/4.00	3.60	3.39	0.53
	spring 2012	6	2.20/4.00	3.25	3.19	0.79
2011 Cohort	fall 2011	8	2.40/4.00	3.52	3.37	0.61
	spring 2012	7	2.22/4.00	2.86	3.05	0.68
2010 Peer	fall 2010	20	1.42/4.00	3.47	3.20	0.74
	spring 2011	20	1.92/4.00	3.38	3.18	0.70
	fall 2011	20	1.00/4.00	3.09	3.05	0.72
	spring 2012	19	1.50/4.00	3.15	3.15	0.65
2011 Peer	fall 2011	14	1.50/4.00	3.59	3.39	0.65
	spring 2012	14	1.60/4.00	3.27	3.26	0.71

Note. *SD* = Standard Deviation.

SLPI and Grit Scale

Figure 1 contains the average scores for each of the Five Practices of the SLPI for (a) the 2010 LDP Cohort (*n* = 7) at the beginning of year 1 (Yr1), at the start of year 2 (Mid), and at the end of year 2 (Yr2); and (b) the 2010 Peer (*n* = 12) comparison group during their first year (Yr1) and at the end of year 2 (Yr2).

Examining the SLPI scores in terms of percentiles (based on nationwide completion of the SLPI by students) has shown “that a “high” score is one at or above the seventieth percentile, a “low” score is one at or below the thirtieth percentile, and a score that falls between those ranges is considered “moderate.” (Kouzes & Posner, 2006, pp. 34-35). All scores fall in the *moderate* range with the following exceptions: (a) the 2010 Peer (Yr1) group score for the Challenge subscale is *high*; (b) the 2010 Cohort (Yr1) group score for the Enable subscale is *high*; (c) the 2010 Cohort (Yr1) group score for the Challenge subscale is low; (d) the 2010 Cohort (Mid) group scores for the Model, Inspire, Challenge, and Encourage subscales are *low*; and (e) the 2010 Cohort (Yr2) group scores for the Model, Inspire, and Encourage subscales are *low*.

An interesting finding is the drop in SLPI scores for the 2010 Cohort and the similarity in pattern from the start of their second year (Mid) to the end of their second year (Yr2). Similarly, the 2010 Peer comparison group also showed a drop in SLPI scores. Students complete the SLPI themselves throughout the program, during that time their education and experiences enlighten them as to what it truly takes to be a leader (per The Leadership Challenge workshop training and LDP). By the conclusion of their training and leadership experiences most of them have become “humbled” leaders who feel that there is so much more they need to do to become competent leaders that have earned the trust of their team. An improvement to this data collection methodology would be to conduct a 360 evaluation of the future leaders by their peers and program director (just been implemented in the spring 2012). One shortcoming of this approach would be the lack of data attainable at the start of the student's program because none of their peers or director would know them well enough to evaluate them and establish an absolute beginning baseline...more like a mid-training baseline.

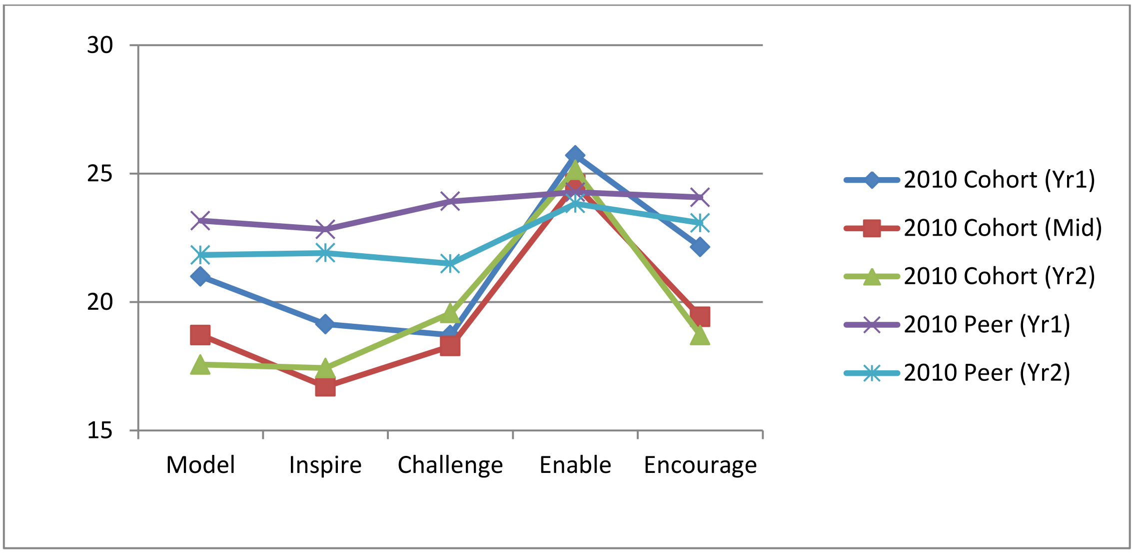

Figure 1: SLPI Mean Scores for Leadership Development Cohort and Peer Comparison Groups

Figure 2 contains the average scores for the Grit Scale for (a) the 2010 LDP Cohort (n = 7) at the beginning of year 1 (Yr1), at the start of year 2 (Mid); (b) the 2011 LDP Cohort (n = 8) at the beginning of year 1 (Yr1); and (c) the 2010 Peer (n = 12) comparison group during their first year (Yr1).

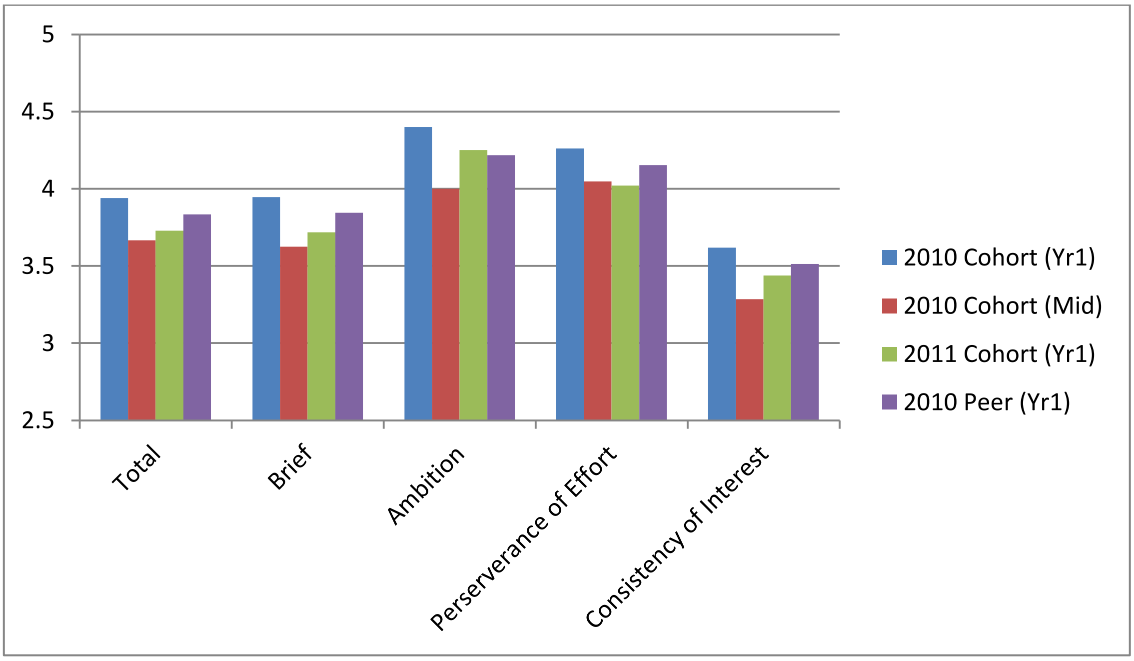

Figure 2: Grit Scale Mean Scores for Leadership Development Cohort and Peer Comparison Groups

Although the SLPI and Grit Scale are measuring different constructs, the drop in Grit scores for the 2010 cohort (Yr1 to Mid) mirrors the drop in scores for the Five Practices of the SLPI. The lowest subscale scores for the Grit Scale occur for the Consistency of Interest subscale, yet remain above the mid-point of the scale that ranges from 1 to 5. These results are consistent with those found by Jaeger et al. (2010) for engineering majors.

To assist in interpreting the Grit Scale, Table 5 compares the results for the Total scale score to previously published studies (see Table 2 from Duckworth et al., 2007 and Table 1 from Jaeger et al., 2010). These results show that our engineering transfer students are grittier than engineering freshmen and Ivy League undergraduates and are more similar to West Point Cadets in terms of overall Grit. Not surprisingly, it takes perseverance and passion (i.e., grit) to become an engineer.

Table 5: Descriptive Statistics of Grit Total Scale Score Across Studies

Group/Study	*n*	Mean	*SD*
2010 Cohort (Yr1)	7	3.94	0.20
2010 Cohort (Mid)	7	3.67	0.48
2011 Cohort (Yr1)	8	3.73	0.62
2010 Peer (Yr1)	12	3.83	0.44
Engineering Freshmen[a]	374	3.55	0.49
Ivy League Undergraduates[b]	138	3.46	0.61
West Point Cadets in Class of 2010[b]	1308	3.75	0.54

Note. [a]see Table 1 in Jaeger et al., 2010; [b]see Table 2 in Duckworth et al., 2007

SUMMARY

The first cohort of students began the two-year training program in 2007 and completed it in 2009. Since that time, there have been three cohorts of students graduate from the program. The tangible and intangible rewards associated with a successful leadership program are numerous and many will not be recognized for years to come. It has been our experience that the more successful the program becomes the more opportunities that are presented. The achievements of the program have been divided into the groups that represent the major stakeholders: student, university, industry and NSF.

The following is a partial list of awards or accomplishments the SIUC LDP has achieved.

Student Leadership Achievements: 3.3 Cumulative GPA at graduation, four recipients of the Illinois Technology Foundation's "50 for the Future", three recipients of the Outstanding Senior Awards in the College of Engineering, Presidents in nine student organizations, raised over $30K for other student organizations, two national robotic championships, established three new student organizations, placed sixth in NASA's Great Moon Buggy design competition, first place in two campus-wide blood drives, and led over 30 university and community service projects.

University Achievements: Best ATMAE student chapter in the nation, best student organization award for the university, 100% graduation in 2 years, over $325,000 donated from sponsor for scholarships, awarded $600,000 National Science Foundation grant for the expansion of the program.

Industry Achievements: Delivered over $1M in six sigma cost savings during the internships, signed 12 out of 13 students to work for corporate sponsor in the three graduating cohorts of the program, early positive indicators of LDP's success.

NSF Achievements: 100 percent graduation rate and a 92 percent career placement rate

SUGGESTIONS FOR BEST PRACTICES

Every program of this nature will experience successes and disappointments. It is important to realize that lessons that can be learned from a disappointment. Suggestions can be divided into three groups, program development, student leadership development and industry partnership.

For improving the development of the program; first, it is suggested to lengthen the student's participation to three years. It has been observed that the mastery of leadership skills increases greatly in the second and third years for students. Second, program directors should consider developing a team building week that will unite all of the incoming and present students the week before the school year starts. Third, while NSF or corporate financial funding can often be generous, it is equally important to secure university support so the program is truly valued by all stakeholders.

For improving student leadership development; first, most of the best learning occurs through experiences or failures. The LDP students realized most of their best learning by serving as a student organization president or leading an applied project. Second, having upper classmen mentor younger students accomplishes two goals. One, it develops the younger students faster by giving them a steady stream of experienced feedback and two, it teaches the older students how to give constructive feedback for developing the maximum potential in someone else. Third, it was determined that using service projects to learn how to lead a team, coupled with a structured evaluation system was a very effective method for accelerating a young leader's development.

For improving industry sponsorship; the easiest way for a corporate sponsor to contribute to the program is to donate money. While this is an important element to making the program operate, providing meaningful internships, career planning within the sponsoring company, and conducting professional development seminars for the students have shown to produce the greatest benefit for the sponsor to achieve its objectives.

CONCLUSIONS

The SIUC LDP will be graduating its fourth cohort of future technical leaders in May 2012. From all indications, the program is gaining acceptance, momentum and success. A couple of prime indicators are the award of an NSF STEM grant, additional financial support from the sponsoring company, addition of a second corporate sponsor, and the many positive endorsements by the key stakeholders.

"The technical leadership program in manufacturing is integral to ATS' future growth and development of our leaders. The program has met and exceeded our expectations and initial goals. We are fortunate to have such a unique program to feed our future pipeline and are able to hire based on results versus just their interview. " Jeff Owens, President, Advanced Technology Services

"The LDP has been the most beneficial student development and corporate sponsorship I have ever been associated with as a college dean. The program continues to exceed the goals and expectations I have set for it." John Warwick, College of Engineering

"Program has greatly impacted not only my career but also my outlook on life. Through this experience, I have learned about the impact I can make in business and my community. " Nick Turnage, LDP Graduate

From the NSF's perspective, the primary objective of the project is to achieve a two and one half-year graduation rate of at least ninety percent. For the 2010 Cohort, 6 out of 10 students remain in the Leadership Program and 3 students remain enrolled in the COE. Thus, the retention rate of ninety percent has been achieved if we broaden the definition to include students retained in the COE. For the 2011 Cohort, 7 out of 8 students (88%) remain in the Leadership Program. The 2-year graduation rates will be available upon completion of the spring 2012 semester. A goal of the project is to determine the impact of providing financial support and implementing a leadership program on retention, graduation, and job placement rates. Ongoing evaluation of the project will assess these rates and the broader impact of the program.

FUTURE WORK/RESEARCH

The success of the program has generated a lot of interest with the primary stakeholders. The authors believe that they have developed a successful model that can be expanded across campus to benefit STEM majors first, followed by other interested colleges. Research could be conducted to study the LDP model's success as it is applied to these different fields.

Perhaps the greatest opportunity for future research is already underway with the LDP's corporate sponsor, ATS. From the very beginning of the program, ATS insisted that a longitudinal study be conducted with the new hires that graduated from the LDP. While a program evaluation is scheduled for year 5 of the program, the researchers do not anticipate being able to determine any significant findings in the graduate's careers until year 10. Additionally, conversations have begun with the College of Business as they now expressed the need for business-minded technical leaders.

The last promising opportunity for future research requires a macro research project that would bring together a consortium of the technical leadership programs at universities. This consortium could use their collective experience from their training programs and sponsor outcomes to develop a best practices guide that would become the curriculum for STEM funded leadership programs.

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AUTHORS INFORMATION

Bruce D. DeRuntz is a Professor in the College of Engineering at Southern Illinois University Carbondale (SIUC) where he teaches classes in leadership, quality and project management. He received his B.S. in Industrial Technology from Eastern Illinois University, his M.S. in Manufacturing Systems from SIUC and his PhD in Workforce Education and Development from SIUC. In 2006 he was appointed the Director of SIU's Leadership Development Program (LDP). His research interest is in identifying the critical interpersonal characteristics that are found in technical leaders. He is a Fellow with the ASQ and the Editor of the *Quality Management Forum*. Email: bruce@siu.edu

Rhonda Kowalchuk is an Associate Professor of Educational Measurement and Statistics in the Department of Educational Psychology and Special Education at Southern Illinois University Carbondale (SIUC). She received her B.A. (Hons., 1990), M.A. (1993), and Ph.D. (2000) from the

University of Manitoba, Canada. She joined SIUC in 2004 and prior to that she worked at the University of Wisconsin Milwaukee. Her research interest focuses on the performance of statistical procedures when applied to data that do not satisfy the assumptions underlying these procedures. A goal of her research is to provide recommendations to improve the quality of data analyses. Other research related activities involve working as a statistical consultant. She teaches courses in Research Methods, Inferential Statistics, Multiple Regression, Experimental Design, Program Evaluation, and Survey Methods. Email: rkowal@siu.edu

John W. Nicklow currently serves as the Provost and Vice Chancellor for Academic Affairs at Southern Illinois University Carbondale (SIUC). Dr. Nicklow received B.S. and M.S. degrees in Civil Engineering from Bucknell University (PA) in 1993. In 1998, he earned a Ph.D. in Civil Engineering from Arizona State University (AZ) and began his career as an Assistant Professor at SIUC. He was promoted to Professor and assumed the position of Associate Dean on a permanent basis in 2007. In his role as Associate Dean, he was responsible for the academic affairs of 1,300 undergraduate and graduate students, including recruitment and retention efforts, student support services, minority engineering, and academic advisement. He led a series of new, student retention initiatives, including an Engineering Residential College, a multi-tiered mentoring program, and a new first-year experience course for engineering majors. Email: nicklow@siu.edu