Strategic Alliances May Become Key Success Factors for Enhanced Experiential Learning: A Conceptual Framework for Implementation

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Abstract

Higher Education is confronted with the challenge of providing new and improved methods for delivering experiential learning opportunities for engineering undergraduate students. Our current article suggests coaching points based on two decades of capstone projects that have successfully promoted economic development in the region we serve, while simultaneously creating integrative opportunities for MBA and MS Engineering Technology Graduates to demonstrate mastery of the subject matter. Recently we extended our alliance to a cross-disciplinary partnership between the College of Business and Technology and the College of Education. Our cross-disciplinary graduate student team addressed a highly nonlinear technology-education-business issue in a political scenario and recommended mutually beneficial solution paths.   During the 2015 Annual ASEE Conference, a glaring need was revealed for enhanced experiential learning methodologies, and following a review of relevant literature, recent results of our applied research have identified a gap that can be closed. This gap is particularly acute at the graduate level where experiential learning is often critical in demonstrating mastery of the subject matter. Further research is necessary to refine the needs in engineering at the undergraduate level. However, it is anticipated that mutually beneficial strategic alliances will contribute to improved learning outcomes for undergraduate engineering students as well.
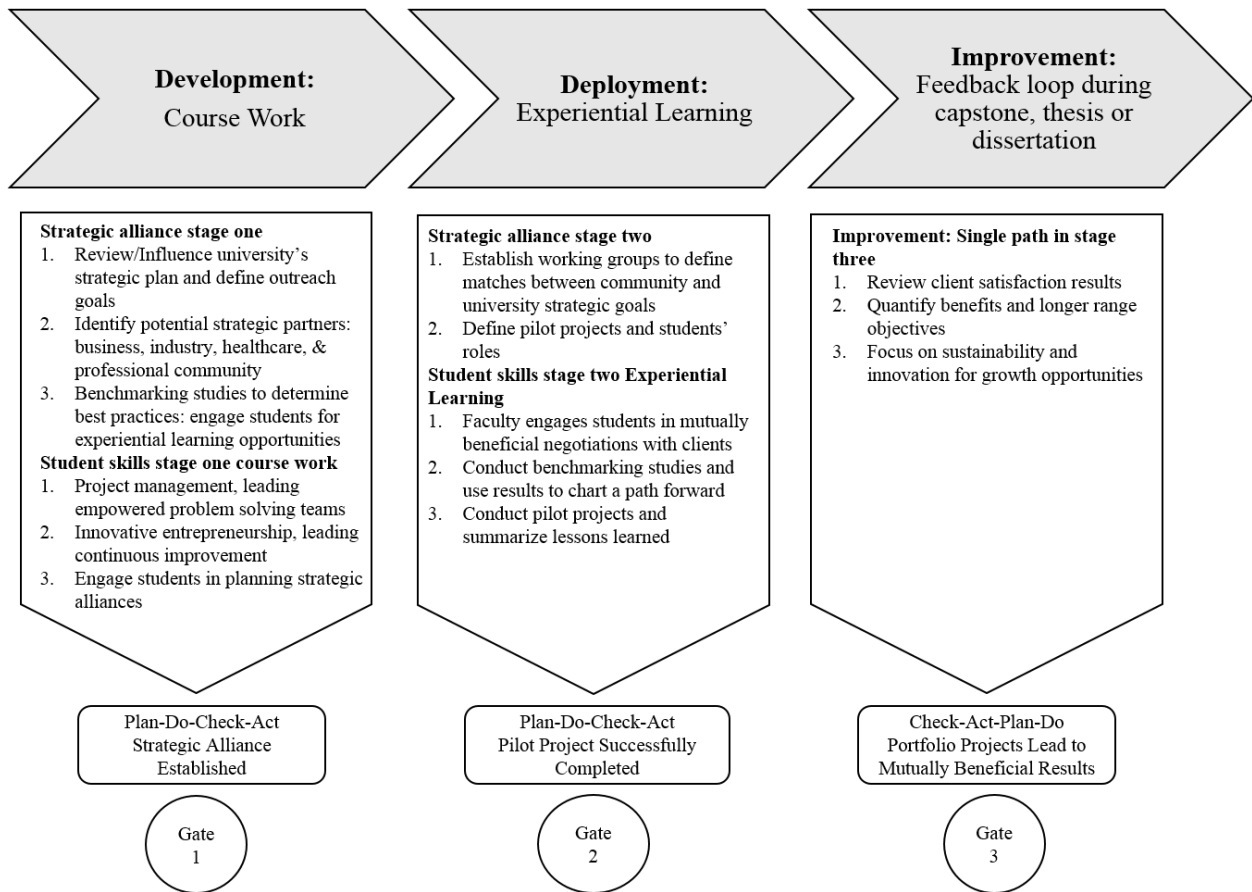
Introduction

The purpose of this applied research is to: 1) Explore the use of technology to increase the operational efficiency and strategic effectiveness of engineering education; 2) Suggest a conceptual framework for promoting collaboration between individual communities within a region to improve the quality of Science, Technology, Entrepreneurship, and Experiential Learning despite shrinking budgets; 3) Suggest ways to embed the resulting methodology in Engineering Management Programs to promote discontinuous improvements in workforce readiness; and 4) Illustrate the framework with discontinuous changes that have occurred that will lead to pilot projects throughout the region we serve. Throughout this article a stage-gate approach is given with coaching points that have been helpful in overcoming the challenges of competition between communities.

The conceptual framework is given in Figure 1 and consists of three main segments or phases: development, deployment, and improvement. Important measurable goals and objectives are shown in the framework. The importance of strategic alliances is emphasized in the early stage during the Plan-Do-Check-Act feedback loops that provide non-linear improvement opportunities. The importance of experiential learning in achieving the professional development growth in students at all levels is a common theme. The need for mentoring, especially among our first generation college students, is a critical success factor in the cultural transformation of parents and communities. Although not explicit in the framework, there is a blending of art and science. For example, in the specific application discussed in this article,

the students creatively and artfully used technology to solve the distance learning challenge. At times, they recommended using older, non-real-time presentations of internet-based material in order to provide secure timely information to students without internet access at home. The challenge was further exacerbated by the wide range of infrastructure available throughout the rural communities we serve: from zero availably to one gigabit per second. These considerations became significant during the Experiential Learning at gate 2, item 2, shown in Exhibit 1.

Figure 1:

Strategic Alliances for Enhanced Experiential Learning: A Conceptual Framework for Implementation

Development: Course Work	Deployment: Experiential Learning	Improvement: Feedback loop during capstone, thesis or dissertation
Strategic alliance stage one 1. Review/Influence university's strategic plan and define outreach goals 2. Identify potential strategic partners: business, industry, healthcare, & professional community 3. Benchmarking studies to determine best practices: engage students for experiential learning opportunities **Student skills stage one course work** 1. Project management, leading empowered problem solving teams 2. Innovative entrepreneurship, leading continuous improvement 3. Engage students in planning strategic alliances	**Strategic alliance stage two** 1. Establish working groups to define matches between community and university strategic goals 2. Define pilot projects and students' roles **Student skills stage two Experiential Learning** 1. Faculty engages students in mutually beneficial negotiations with clients 2. Conduct benchmarking studies and use results to chart a path forward 3. Conduct pilot projects and summarize lessons learned	**Improvement: Single path in stage three** 1. Review client satisfaction results 2. Quantify benefits and longer range objectives 3. Focus on sustainability and innovation for growth opportunities
Plan-Do-Check-Act Strategic Alliance Established	Plan-Do-Check-Act Pilot Project Successfully Completed	Check-Act-Plan-Do Portfolio Projects Lead to Mutually Beneficial Results
Gate 1	Gate 2	Gate 3

Relevant Literature

Higher education's consensus that federal mandates of 120 credit hours for our BS Engineering students coupled with the need for enhanced professional development skills poses significant challenges for our current methods of education of students at all levels. The Panel presentations and discussions at the 2015 ASEE Conference underscored these points.[1] We were encouraged by this session and feel that the conceptual framework offered here may help close the gap identified.

Furthermore, the workplace skills identified as necessary revealed opportunities for improvement in the region we serve — www.workreadycommmunities.com.[2]

Exhibit 1:
Strategic Alliances for Enhanced Experiential Learning Output Metrics for Each Stage

Gate 1
1. Outreach goals aligned with alliance partners
2. Metrics defined for mutually beneficial outcomes
3. Experiential student learning outcomes meet course objectives
4. Alliance relationships established

Gate 2
1. All alliance members benefit from relationships
2. Non-linear real-world problems have solution paths forward
3. Students demonstrate mastery of the subject matter for specific degrees
4. Improvements have action plans identified
5. Pilot project successfully completed

Gate 3
1. Cross-disciplinary teams functioning well
2. Multiple innovative project conducted in parallel
3. Binary milestone facilitate follow-on projects
4. Metrics and results contribute to accomplishment of goals
5. Portfolio projects lead to mutually beneficial result

In our region, the need for project management, problem solving and teamwork will become even greater with increased mobility, big data, and cloud computing that will dominate educational approaches and shop floors in manufacturing facilities alike. Experiential learning is also emphasized in the current body of knowledge. Robert et al.[3]; Lindkvist and Norberg[4]; Abe[5]; Li and Armstrong[6]; and Konak et al.[7] provide specifics. Although there is consensus that our current programs have an experiential earning gap; the manner of closing this gap may provide an opportunity for improvement. We also note the growing emphasis of strategic cooperation between public school districts.

Cooperation among public school districts varies greatly from state to state. Some states are silent on the subject, some encourage cooperation, and others mandate it by legislation. One example of legislated cooperation is the Boards of Cooperative Educational Services (BOCES) of New York State. In 1948, the New York State legislature created BOCES to provide shared educational programs and services to school districts. There are 37 BOCES, incorporating all but nine of the state's school districts. BOCES partner with districts to provide a broad range of services. For BOCES to offer a service it must be requested by two or more school districts and approved by the New York State commissioner of education. Some of BOCES programs are instructional or direct instruction in classroom settings. These include instruction services and professional development, career and technical programs for high school students, related services for students with disabilities, and literacy programs and employment training for adults. The remaining programs are non-instructional support services that help school districts reduce costs. This permits some districts' resources to directly serve students. Examples of

support services include: management services, regional information centers, and state networks (http://www.boces.org).[8]

New Hampshire codifies guidelines for cooperation among school districts in its Title XV Education (Chapter 195) laws. The purpose of this chapter is to increase educational opportunities within the state by encouraging the formation of cooperative school districts which will each: be a natural social and economic region, have an adequate minimum taxable valuation, and have a number of pupils sufficient to permit the efficient use of school facilities within the district and provide improved instruction (http://www.gencourt.state.nh.us).[9]

The Cooperating School Districts of Greater Kansas City (CSDGKC) is a co-op of 28 school districts working together through regional cooperation. CSDGKC was setup as a resource for current educational trends and evidence based practices that support student learning. Their stated purpose is to support continuous improvement of resources and services (http://www.CSDGKC.org).[10]

In the early 1980s, the New Jersey School Boards Association (NJSBA) joined with the state League of Municipalities to produce a report called "The Art of the Possible." The publication listed shared services between school districts and municipalities. In 1995, NJSBA completed another study illustrating a wide array of shared services in New Jersey's school districts, producing tax savings, freeing limited funds for the classroom, and improving services (http://www.njsba.org).[11]

Education plus is a nonprofit organization that provides a variety of services to member school systems in Missouri. It is a multipurpose organization that provides educational programs and services to member school systems (http://www.edplus.org).[12]

Many states have formal or informal agreements for cooperation among school districts or systems. Some provide for indirect cooperation through a third-party vendor that acts as an agent for the cooperating school districts. One example of more direct cooperation between school systems is between Sullivan County (TN) Schools, Kingsport City Schools, and Bristol City Schools. In September 2015, the three Tennessee school systems announced a formal agreement of collaboration. The collaboration is designed to create a plan that will optimize space and resources, use tax dollars more efficiently, and maximize programs and education for all schools in Sullivan County. The plan, titled "Together for Tomorrow: Partnering in Education to Expand Opportunities for all Students," would close some schools, repurpose the space of some, convert some to a different type of school, and renovate others. It would be implemented in three phases over 15 years and will conclude in 2029 (http://www.heraldcouri er.com/news).[13]

Study Setting

East Tennessee State University has expressed a strong desire for community outreach. Early in 2014, two of our community partners, mayors from the fifth and sixth largest counties of the 95 total counties in our state, asked for our help discerning the ramifications of today's highly competitive distance learning environment. Fortunately, two of our senior faculty members whose colleges and departments' professional service goals were strategically well aligned with this specific request were able to respond positively. We agreed to establish a cross-

disciplinary graduate student team with the required skills. The timing was such that several technology graduate students were taking their capstone class, and this request was strategic and integrative in nature. The mayors presented the real-world challenge: how can we use technology to enhance the operational efficiency and strategic effectiveness of our K-12 programs in our counties? A specific goal of this effort was to improve the "soft skills" that our regional employers feel are lacking in our high school and college graduates. These "soft skills" are the same professional development skills that were discussed so vigorously during last year's conference. One significant obstacle to the project was the utilization of dissimilar information technologies by the counties. The students, however, responded positively to this challenge and generated two innovative, complementary solutions. The mayors congratulated our students on their outstanding performance and requested a follow-up project team for the Fall 2015 semester to focus on operational effectiveness recommendations.

Conceptual Framework

The conceptual framework given in Figure 1 is comprised of three major segments: development, deployment, and improvement. We will focus on the first two in some detail, because launching such partnerships has been elusive. See the Association for Global Business 2014 Conference Proceedings that discusses the gap in necessary workforce skills in some detail.[14] Hopefully our Conceptual Framework given in Figure 1 makes a contribution by providing guidelines that fill this void. Pilot projects will be implemented during our spring semester in 2016, and the feedback loop will be completed based upon the outcomes received. We are optimistic about our approach because we have achieved success with sustainability and innovation projects in business and industry. Our initial results and findings are encouraging. Our path forward should ensure that the entire education supply chain is validated.

Illustrating the Conceptual Framework

Benchmarking studies are important for three important reasons: first, they provide metrics and best practices for organizations to improve performance; second, they are excellent teaching and learning methods for graduate students; thirdly and perhaps most importantly, they engage students in a meaningful way in which the students are able to make outstanding contributions to both the education and technology based business communities. Reference is made to stage one, item 3 and stage two, item 2 under Student Skills stage two, item 2 under Experiential Learning. This finding that we stumbled upon, has become a key to the sustainability of our strategic alliances; because they foster mentoring and lead to outcomes that benefit everyone. Adoption of a higher order system, such as the National Baldrige framework (2014)[15] amplifies these outcomes because improvements occur in both processes and results.

When we were looking for a top school system to benchmark against, we realized we were fortunate enough to have one in our region: The Kingsport City School System.

We felt this was a very strong school system to use as a benchmark for numerous reasons. See their website for specifics:[16]

In 2015, Dobyns-Bennett High School was named one of the Best High Schools in the country by *U.S. News and World Report* and made the 2015 America's Most Challenging High Schools list published by *The Washington Post*.[16]

Dobyns-Bennett was named one of the top high schools in the nation by *The Daily Beast* for effectively producing college-ready graduates in 2013 and 2014. This is the ninth time Dobyns-Bennett High School has been named a top school by *The Daily Beast* or *Newsweek*. It ranked in the top 3% in the nation.[16]

Superintendent Dr. Lyle Ailshie was a member of AASA (The National School Superintendents Association) Executive Committee and was also named as one of the top national "Technologists, Transformers, and Trailblazers" by the Center for Digital Education.[16]

Dobyns-Bennett was named one of the top high schools in the nation by *Newsweek*, the *Washington Post* and by *U.S. News and World Report* in 2013. Dobyns-Bennett's High School Robotics Team ranked in the top 3% of world rankings in 2014.[16]

Three KCS students were named National Merit Semifinalists. Kingsport City Schools made the 2014 College Board's 5th Annual AP District Honor Roll listing (and is only one of eight districts in Tennessee named).[16]

Kingsport City Schools was awarded the 2014 Achievement Award in the annual Excellence in Tennessee Recognition Program by the Tennessee Center for Performance Excellence (TNCPE). The TNCPE deploys a Baldrige Based approach to organizational learning.[17] The students had the third highest SAT scores in Tennessee.[16]

Assistant Superintendent Dory Creech was named the First Tennessee CORE Supervisor of the Year. Last year the KCS had over ten million in scholarships offered to students in Kingsport schools. [16]

During our benchmarking process we learned how they were able to reach these accomplishments. It all started with a thorough understanding of what they wanted to do, and planning for how they would meet these ambitious goals. These accomplishments did not happen overnight, rather they were carefully planned and implemented over time. The results are just now beginning to show, and they are still continuously implementing and improving the programs. Since they had implemented the Plan-Do-Check-Act this accelerated our completion of Stage one in Figure 1; and facilitated meeting the outcomes of gate 1 in Exhibit 1 for our other alliance partners in both Washington and Sullivan Counties.

The first thing that stood out immediately, because it was so different, was how they were implementing the use of technology to benefit the students. While so many teachers in other school systems are taking away and banning students from having electronic devices in the classroom—the Kingsport school system is doing just the opposite—they are making sure every student has some form of technology in his or her hands. While most schools are discouraging internet use, they are embracing it and the ability to put information in the palm of your hand.

The KPS allocated funds to create a 1-to-1 connection for all students 6th grade and above, and they are currently working to expand that to all students. By embracing technology the way they are, they are teaching the students to be more proficient with technology. This is teaching the students data management techniques, which also makes the transition to higher learning institutes much less challenging. To help students that do not have access at home to internet, they have equipped several of the longer route busses with hotspots. This allows the students that have longer bus rides to make their time traveling back and forth to school more productive.

The way that the KPS embraces technology is only one of the many things they are doing to help make the students more successful. We observed how each school partners with a business sponsor to provide the necessary things the students lack, which they require to do well in the classroom. Each school also partners with a church in the area, where students can go after school for a snack, or help with some of their reading homework. This gives them a safe place to go until their parents get home. We believe that all the schools we have looked at could benefit from this approach.

Our students also gained experience by seeing how the city of Kingsport applies the Baldridge criteria to their program, and how it is helping them accomplish these outcomes while continuously planning for improvement. One of the most amazing aspects of these results is that they are creating them in an economically disadvantaged region (53% with 56% estimated for 2015). KCS also has the additional challenge of 21% of their students having disabilities.

They have accomplished these challenges without spending significantly more than the state average. In the 2013-2014 the Kingsport school system increased test scores in 6 of 7 reported tests/categories over 2012-13 scores. Their planning for continuous improvement is showing.

Engineering Management Teaching Implications and Path Forward

One significant observation is the importance of the benchmarking skill in establishing experiential learning opportunities. Our experience suggests that graduate students with technical backgrounds in process analysis have a latent talent in this arena. This skill may be best learned in the context of leading continuous improvement teams for engineering managers or for biomedical engineering team leaders, through systematic interaction with preceptors. The obvious benefit is that managers learn from others that have found ways to overcome problem solving challenges; thereby circumventing pitfalls or "reinventing successful processes." However, the eureka benefit is that our strategic alliance partners gain an improved competitive advantage from the best practices that our students share during interactions with our clients. The result is not only a student contribution, but also a strengthened relationship between the client mentor and students. In addition, these alliance partners are eager to participate with their time in future graduate student projects because they realize substantial benefits as well.

A brief example helps to make this truly important contribution apparent. We have developed a strategic alliance/partnership with The Center for Entrepreneurial Growth function within Tech 2020. Their mission is to commercialize technologies developed by the Oak Ridge National Labs (ORNL). Early in this relationship our graduate students were intimidated by the thought of working with the brilliant ORNL scientists developing world-class applications for cutting edge

technologies. Fortunately, our students were able to make fundamental contributions to the team by identifying and adapting benchmarked best marketing of technology practices to the commercialization process. As an outstanding result our graduate students identified a customer for a miniature CAT-scan technology and facilitated a $5 million sale to General Electric. Because this was an early success, we have continued this partnership for almost two decades. Each new graduate team starts with a benchmarking task yielding updated best practice for marketing the specific technology innovation. Invariably the students shine because they demonstrate an engineering marketing solution to a real world problem that does not have an answer in the back of a text book.

Benchmarking teaches both engineering management instructors and students to learn from best practices in marketing innovative technologies; not only metrics but methods. Benchmarking with Kingsport City School systems taught us the process by which they achieved their results. Understanding the methodologies enables other school systems to implement these best practices in order to improve their own performance.

Since its 1993 inception, we have provided each client with an optional satisfaction questionnaire at the conclusion the project. This has effectively served as a feedback loop enabling us to analyze and improve upon our strategic alliance methodologies. The clients have the opportunity to rate the student team's performance (1 being the lowest and 5 the highest) across seven categories. Early in the program, the mean rating (for all seven categories) of our student teams averaged below 4 out of 5. Over the last 15 years, the mean rating was calculated to be 4.91 out of 5. That translates to a 98.3% client satisfaction score. This feedback loop has resulted in an upward trend in client satisfaction. In the last decade, client satisfaction has averaged 4.98 out of 5 (99.5%). This trend is the result of our learning to better define the project scope in which the students are advised to under promise and over deliver.

Our joy is that after two decades of systematically applying the conceptual framework given in Figure 1; we have two counties in our region working together to improve the quality of our K-12 education by efficiently and effectively applying distance learning technology. This is a significant accomplishment because these counties have been competing for more than 20 years. Our next step is to prove our baseline by conducting one or more pilot projects in 2016.

References

[1]Ortiz, T., Holloway, B., Harris, M., Pluckebaum, A. and Jamieson, L. (2015). "Experiential Learning: Student Participation and Future Engagement." Presented at and published in the Proceedings of the ASEE Annual Conference & Exposition, Seattle, Washington, June.
[2]ACT Work Ready Communities. Retrieved November 30, 2015 from http:www.workreadycommmunities.com.
[3]Robert, T.G., Conner, N.W. and Jones, B.L. (2013). "An Experiential Learning Framework for Engaging Learners During Study Abroad Experiences." *NACTA Journal*, September, pp. 28-36.
[4]Lindkvist, E. Norberg, J. (2014). "Modeling Experiential Learning: The Challenges Posed by Threshold Dynamics for Sustainable Renewable Resource Management." *Ecological Economics*, Vol. 104, August, pp. 107-118.
[5]Abe, J.A.A. (2011). "Personality and Individual Differences." *Personality and Individual Differences*, Vol. 51, No. 7, November, pp. 817-822.

[6] Li, M. and Armstrong, S.T. (2015). "The Relationship Between Kolb's Experiential Learning Styles and Big Five Personality Traits in International Managers." *Personality and Individual Differences*, Vol, 86, November, pp. 422-426.

[7] Konak, A., Clark, T.K. and Nasereddin, M. (2014). "Using Kolb's Experiential learning Cycle to Improve Student Learning in Virtual Computer Laboratories." *Computer & Education*, Vol 72, March, pp. 11-22.

[8] BOCES of New York State. Retrieved September 1, 2015 from http://www.boces.org

[9] New Hampshire: Title XV Education. Retrieved September 1, 2015 from http://www.gencourt.state.nh.us/rsa/html/XV/195/195-mrg.htm

[10] Cooperating Schools of Greater Kansas City. Retrieved September 30, 2015 from http://www.CSDGKC.org.

[11] New Jersey School Board Association. Retrieved September 15, 2015 from https://www.njsba.org/news/research/shared-services.php

[12] Educationplus. Retrieved September 1, 2015 from http://www.edplus.org/

[13] Performance Highlights (n.d.). In *Kingsport City Schools*. Retrieved November 14, 2015, from http://www.k12k.com/apps/pages/index.jsp?uREC_ID=344628&type=d&pREC_ID=753622

[14] Czuchry, A. (2014). "Mutually Beneficial Corporate-University Partnerships: A Strategic Approach to Global Sustainability." Panel Discussion at the 26th Annual Association for Global Business Meeting, Orlando, Florida, November.

[15] Baldrige Performance Excellence Program, *2013-2014 Criteria for Performance Excellence*, Gaithersburg, MD: U.S. Department of Commerce, National Institute of Standards and Technology: http://www.nist.gov/baldrige.

[16] Dobyns Bennett High School. Retrieved from http://dbhs.k12k.com/

[17] Senge, P. (2006). *The Fifth Discipline: The Art & Practice of the Learning Organization*." Doubleday.