An Innovative Approach to Multi-Disciplinary Education: The Integration of Arts, Business and Engineering

ABSTRACT/INNOVATION SUMMARY

The challenges that face businesses and other organizations are truly multi-dimensional, though are often not treated as such. Problems of a significant degree of complexity involve issues of technology, functionality, design, and aesthetics, issues which most business faculty and students have little if any training in, but are nonetheless critical to finding complete solutions to complex problems. The more skill sets and perspectives that can be brought to bear on a complex problem, the greater the likelihood for a solution that takes all relevant issues into consideration.

The program described herein brings together students from *three* separate academic disciplines to address complex real world sponsored projects. Students from the schools of the arts, business and engineering are joined together in teams and assigned the responsibility of completing a semester-long project. In addition to the project itself, the students receive formal training in self-assessment, team building, presentation skills, and innovation in general. The culmination of the project is a formal presentation at the end of the semester to the top management of the company or organization sponsoring the project.

One of the unique features of the program is that the focus is not on taking classes in other academic disciplines. The program is structured so that students learn to truly *integrate* the skills and perspectives of the three disciplines. Having students from different schools utilize their unique training on real world problems has proven an excellent way for the entire team to learn how knowledge and skills can be combined in a productive and innovative manner. This is a truly innovative program that, to the best knowledge of the author, is the only program of its kind available today.

Feedback from both students and sponsors has been overwhelmingly positive. A survey of past and current students indicates that this course is viewed as far superior to the "typical" class on every measure, in spite of the fact that the course is considerably more demanding in terms of time, effort, and pressure than the courses they are used to. The sponsors are especially drawn to the program. They recognize that arts, engineering, and business are all vital to addressing the projects they bring to the program, and have stated a high degree of satisfaction with the results. One of the best indications of sponsor satisfaction is that there are numerous "repeat customers", i.e., those who have sponsored more than one project.

Faculty likewise benefit from the program. Aside from the satisfaction of working with highly motivated students on meaningful projects, the program offers the opportunity for cross-disciplinary research on a variety of topics. These topics can range from research into the effectiveness of multi-disciplinary team-based education in general, to topics that arise from the projects themselves.

INTRODUCTION

The program and course described in this paper were born out of the observation that problems facing business, government and non-profit organizations are many-dimensional, but often addressed from a single dimension. Schools of business address commercial aspects, schools of engineering address technical aspects, and schools of the arts address aesthetics and design. Each approach is valid and useful. However, each approach by itself ignores the other important aspects of the problem. For example, when students trained in business principles tackle an issue, they focus on the skills they have learned relevant to finance, marketing, operations, and so forth. Not being trained with an engineer's eye for technology and function, or an artist's eye for the role of design, appearance, and aesthetics, they are likely to miss these key aspects. For business and engineering students, especially, the tremendous impact that appearance, design, shape, color, and aesthetics in general have on the success or failure of a product or service is often not apparent. Given the two disciplines' focus on hard numbers and technical skills, it is not surprising that business and engineering students would see their connection with each other, but without a closer look, not see their connection with the arts. This helps to explain why there are many joint business and engineering programs at both the undergraduate and graduate level, but none that include the arts. A closer look shows that no business or engineering process is absent of an artistic element and that failure to consider the artistic element is likely to result in an incomplete solution.

Ultimately, this program and the course are about finding truly innovative solutions to complex real-world problems. The program is unique in that it brings together students from *three* separate academic disciplines (arts, business and engineering), joins these students in cross-disciplinary teams, and assigns them to complex sponsored projects. The sponsors include for-profit corporations, non-profit foundations, and government entities. This is certainly a very unique program, which is clearly differentiated when compared to other university programs. By working together with students and faculty from diverse disciplines on real world problems, the expectation is that students will be more likely to find innovative solutions, and the results have more than borne out this expectation.

The major educational objectives of this program and the project course which is at its center are as follows:

1. To develop students' abilities to work effectively with, and appreciate the skills and perspectives of those from other academic and technical backgrounds. In this program, the focus is on students from arts, business, and engineering though there is increasing interest from students in the humanities and sciences.

2. To give students hands-on experience with finding innovative solutions to sponsored "real-world" projects. This is unlike what most have been used to, as most courses involve classroom vs. actual situations.

3. To improve students' abilities to work in teams in general.

4. To develop students' communication skills, especially their ability to make a convincing presentation to their sponsors, faculty, and fellow students.

The number of students who have participated in or are currently participating in the project course is shown in Table 1. All who have participated so far are undergraduate juniors and seniors. As shown in the table, business students have been the most prevalent group, but there has been and continues to be a strong level of participation from arts and engineering students as well. Given the success of the class and the interest it has generated, students in the humanities and sciences have begun to join in the program, and the plans are that more will be participating in the future.

Table 1: Project course participants by academic discipline.

Academic Year	Arts	Business	Engineering	Humanities & Sciences	Totals
2009-2010	8	16	10	0	34
2010-2011	9	17	10	1	37
2011-2012	14	17	11	3	45
Totals	31	50	31	4	116

RELEVANT LITERATURE

While there are numerous programs at both the undergraduate and graduate levels that combine engineering and business, as far as the author can determine, there are no other programs aside from the one described in this paper that bring together the three disciplines of arts, business, and engineering in a formal way. Therefore it is not surprising that there is no literature on the subject. There is, however, literature that is relevant to issues discussed in this paper, a sampling of which is provided in Table 2.

Of particular interest is the article by Park et al. (2009) which addresses the impact of multi-knowledge individuals on the performance of cross-functional new product development teams. Based on their study, they found that incorporating individuals with skills in more than one area had a positive impact, both in product innovativeness and on the time efficiency of new product development. This supports the idea of the cross-functional project teams described herein in that the students who participate are introduced to the skills of the other academic disciplines, and have the opportunity to further develop these skills throughout the course of the project.

Other aspects of the project course that are addressed in the literature are client-sponsored projects and the issues of working in teams. Gorman (2011), Bove and Davis (2009), and Heriot et al. (2008) all report that "real life" student consulting projects are viewed favorably by the students who participate in them. However, Bove and Davis caution that client-sponsored projects require a level of commitment and attention well beyond that which is required for the typical college class.

Sung and Choi (2012), Reinig et al. (2011), Hasan and Ali (2007) Van Der Vegt and Bunderson (2005) and Koppenhaver and Shrader (2003), are among the many studies that have investigated issues related to working in teams. Though each of these studies draws its own conclusions, there are two conclusions that are prevalent in such studies. First, students generally look upon teams as a positive learning experience, and second, that there are many factors that contribute to team performance.

The crux of the relevant literature is three-fold. First, there is evidence that teams that have persons with multiple skills are likely to result in more innovative solutions, and solutions that are delivered more quickly. Second, client sponsored projects are very rewarding, but at the same time, very challenging. They require a high level of commitment from students, faculty, and sponsors, and must be taken seriously by all involved. Finally, working in teams can lead to superior results, but is also challenging. Both students and faculty need to know something of their own personalities and how to effectively work with others and sponsors need to recognize that their level of commitment has a direct bearing on the outcome of the project.

Table 2: Sampling of relevant literature.

Study	Summary findings
Bove and Davis (2009)	Students view client-sponsored research projects very favorably, but they require a high level of commitment from both instructor and client
Gorman (2011)	Students involved in a capstone course that involves a consulting project find the experience both rigorous and highly valuable
Hasan and Ali (2007)	Group efficacy has positive impact on team performance, but group cohesion does not
Heriot et al. (2008)	A case study of the use of student consulting projects as part of an operations management course
Koppenhaver and Shrader (2003)	Team motivation and instability are of particular importance in determining a team's performance
Park et al. (2009)	Multi-knowledge individuals have a positive impact on product innovativeness and new product development
Reinig et al. (2011)	Students are generally favorably disposed to a specific team-based learning method
Richmond et al. (2008)	Explores the role of an integrated service learning project both in multiple courses in the same semester, and across semesters
Sung and Choi (2012)	Team knowledge utilization is positively related to team creativity which is in turn related to team financial performance
Van Der Vegt and Bunderson (2005)	Various findings are reported concerning the impact of diversity on team performance

INNOVATION

There are two aspects of this program that are especially unique and innovative. First, it involves the collaboration of students and faculty from *three* separate disciplines: Business, engineering and the arts. Second, the focus is on the *integration* of the disciplines in developing innovative solutions to corporate and government sponsored real-world projects, not on the discipline-specific skills themselves. The end result is a union of skills and perspectives from art, business, and engineering, and based on the

feedback from sponsoring organizations, the end results are superior to those that involve a one-dimensional approach. This interdisciplinary and collaborative approach corresponds to a concept focused on the development of "T-shaped people", which has received attention in the popular press, e.g., Marshall (2012), as well as in the literature (Park et al. 2009). The idea is that a person's skill set may be represented in the shape of a "T" wherein the vertical component represents in-depth skills and abilities, while the crossbar is indicative of cross-disciplinary skills and abilities. T-shaped people are those who are deep in one disciplinary area, e.g., arts, business, or engineering, but whose skills are augmented with broad knowledge of other disciplines. These cross-disciplinary skills and abilities are not limited to technical skills, such as proficiency in financial analysis, print making, or hydraulics. Some of the skills most valued by employers are not specific to any academic discipline, but include the ability to speak and influence others, to function well in teams, and to think critically. The program puts special emphasis on these skills. For example, faculty members from the university's theater department are brought in who have developed an innovative program to improve presentation and speaking skills. They go far beyond basic Powerpoint guidelines, are extremely well received by the students and faculty, and provide insights that the students are not likely to gain from any other venue.

Students are also given specific instruction and guidance in ways to improve the effectiveness of a team. This includes the administration of a personality assessment inventory similar to Meyers-Briggs. From this assessment inventory, students learn something of their own strengths and weakness relative to teamwork, as well as how to better work with others whose personality and working styles are different.

A review of existing programs indicates that programs of study that combine business and engineering are relatively common. And yet, based on program descriptions, these programs do not generally represent a true *union* of disciplines, in that the approach of most joint programs is to require classes in engineering, and classes in business. Students are exposed to the principles of both disciplines, but not on their integration, that is they do not necessarily get practical instruction and experience in how the two disciplines truly relate to each other.

In the approach described in this paper, students are exposed to principles not particular to their own discipline, that is, business students are introduced to elementary engineering and arts topics, engineering students to art and business topics, and so forth. But more importantly, each student in the program participates in an extensive project that involves students from other disciplines working on a semester-long project provided by a "real world" sponsor. Students get first-hand experience in the multi-dimensional nature of real world problems, the importance of incorporating different skill sets, and what it is truly like to work in an interdisciplinary environment.

In a world that is changing rapidly on all fronts, the importance of innovation is hard to overstate. Hamel (2012), for example, posits that innovation is the sole maintainable strategy if an organization is to create value for itself over the long term, i.e., innovation is the key to long-term survival. For academic institutions, innovation is all the more important as universities should be leaders in innovation, not followers. Yet universities and the schools within them can be as out of touch and stuck in their ways as any other organization. From the standpoint of educating students, it is not enough to find new ways to

teach old subjects, but rather to be at the forefront of whatever innovation is necessary to prepare students for the many challenges they will face.

The program and course discussed herein promote true innovation. The focus is not on teaching arts or business or engineering in a better way, but on teaching how they relate to and complement each other, and how used together, better and more innovative results can be expected.

IMPLEMENTATION

The centerpiece of the program is the project course, the stated learning objectives of which are:

(1) Gain an appreciation for interdisciplinary innovation.

(2) Learn product innovation tools and techniques.

(3) Develop teamwork and team management skills.

Candidates for participation in the project course are screened prior to their selection. Desirable characteristics are solid academic performance, the manner in which students express themselves in the course application, and a stated desire to work with students from other backgrounds and disciplines. No one criterion outweighs the others, but experience has taught that the best fit is a student who has a solid level of academic achievement, and is motivated to learn how to work more effectively with those with other backgrounds and skills.

Once selected, participants are divided into teams of five to eight students, depending upon the topics available, and the preferences and majors of the students enrolled in the course. The process of assigning students to teams is as follows. After being briefed on the goals and objectives of each project, students are asked to rank their preferences from one to as many projects as are available. The final decision on assignments to projects rests with the faculty. The primary consideration is to have an even mix of arts, business, and engineering students on each team. While the “ideal” team would have two students from each of the three schools, this is not always possible, but in any case, there will be at least one student from each school on each team. While students do not always get their first preference, most are assigned to projects that are first or second on their priority list. A mix of male and female students in each group is encouraged, but to date, there have been instances when groups have been entirely female. This is the occasionally unavoidable consequence of giving first preference to area of expertise and student preference, not the gender mix of each group. Experience indicates, however, that the performance of the single gender groups is no different than that of the mixed-gender groups.

Concurrent with assignment to a team, each student is briefed on issues of confidentiality and intellectual property. Aside from impressing upon them the seriousness with which these issues are treated, it also serves as an introduction to what will be, for many of them, an important and relevant

concern throughout their careers. Once briefed, each student is asked to sign non-disclosure and confidentiality agreements as required by the sponsor of their particular project along with documents indicating that they agree to abide by the intellectual property guidelines established by the university, and if appropriate, the sponsor.

Within the first two weeks of the semester, each student team meets with its sponsor to begin the semester-long project. This meeting marks the first step in the development of the "project charter", the guiding directive for the project, which is negotiated and developed over the next few weeks. The process begins with the sponsor's description of what is being sought from the team. The following are summaries of the project statements provided by two sponsors for projects the author was directly involved in:

1. "Develop a user friendly customer (on-line) interface tool for our customers that can be used for scheduling, recording maintenance activities, ordering spare parts, maintaining inventory, differentiating between levels of service, and calculating maintenance costs".

2. "There are several components to this project including product design, the assembly process of the product, financial and resource analysis related to assembly and importation, and the impact (of the team's proposal) on overall business operations".

Other information provided includes what the sponsor expects in the way of "deliverables", milestone events, and the contact person(s) on the sponsor side. The student team then begins research on the project in earnest to determine the degree to which the team can meet the needs of the sponsor. Typical at this stage is an investigation of the environment within which the company or government entity operates, as sponsors include for-profit corporations, non-profit foundations, and government organizations. Answering questions such as who are the sponsor's major competitors and the state of the environment in which they operate are a necessary part of background research. The team will also begin researching the specifics of the project. For example one of the project statements above involved manufacturing the product in a foreign country, and importation to the primary market, the United States. This raised a host of supply chain related issues which were completely new to most of the members of the team. Very practical issues arise, such as how you manage offshore manufacturing, and deal with the language, cultural, and legal challenges of operating in a foreign country. Students in the project also had to familiarize themselves with the rules surrounding tariffs, as the amount of the tariffs varied considerably depending upon whether products were shipped whole or as components to be assembled in the U.S., and whether or not they were sent as part of the same shipment, or as separate shipments.

As part of negotiating the project charter, sponsors may host the student team for an on-site facilities tour. The purpose of this meeting is to provide students with a more detailed discussion as well as have students meet with other organization experts to build a stronger understanding of the project problem. Within approximately the first four weeks, the team will make a formal presentation to the sponsor, and based upon the sponsor's feedback, the project objectives and milestones are agreed upon.

During the semester, the team is expected to have weekly meetings with their faculty mentor(s) and at least two meetings per month with the sponsor, which may be either face-to-face or by telephone. Aside from the presentation to formalize objectives and milestones, two other formal presentations are required: A mid-term project status review and a final presentation at the end of the semester.

EFFECTIVENESS AND BENEFITS

Evaluating the effectiveness on student learning is an important component of any educational program. As part of that effort, students who were either enrolled in the project course at the time of this study or have taken the course in the past were asked to respond to a survey, the purpose of which was to gauge their opinion of the project course relative to the other courses they have taken. For each of the fifteen questions on the survey, students were asked to compare their experience in the project course relative to the majority of other courses they have completed at the college level. An example question is, "Relative to my other classes, I learn skills outside of those in my major." Students were asked to rate their experience on a seven-point scale by choosing one of the following options: "Much less than", "Considerably less than", "Somewhat less than", "No difference", "Somewhat more so", "Considerably more so", and "Much more so". Students were also given a "Not applicable" option. Therefore a response of "Much more so" would indicate that the skills learned outside of the major would be much more than the typical class, whereas a response of "much less so" indicates that the project course fell short of other courses on this measure. The fifteen items on the survey are shown in Table 3.

Table 3: Items on the student survey.

Item Number	Item Wording
1	Relative to my other classes, the faculty encourage my individual development
2	Relative to my other classes, the faculty provide useful guidance
3	Relative to my other classes, I get to know faculty on a personal level
4	Relative to my other classes, I am motivated to work in this course
5	Relative to my other classes, this class is a positive experience
6	Relative to my other classes, this class contributes to my professional development
7	Relative to my other classes, this class is of interest to employers
8	Relative to my other classes, this class is important to me in securing employment
9	Relative to my other classes, this class challenges me
10	Relative to my other classes, I learn skills outside of those in my major
11	Relative to my other classes, I learn how to work with individuals from other disciplines
12	Relative to my other classes, I am satisfied with this class
13	Relative to my other classes, I recommend this class to other students
14	Relative to my other classes, this is an innovative course
15	Relative to my other classes, I am better grounded in my discipline as a result of this course

The online survey was sent to 100 students. Thirty-nine of these students replied to the survey so the response rate was exactly 39%. The results of the survey are summarized in Table 4. The table indicates the number of students in each of the three academic disciplines who responded, and based on the scale of one to seven, with 1 corresponding to "Much less than", 4 to "No difference", and 7 to "Much more so", the numerical average by academic discipline for each of the fifteen items. For example for item 4, "I am motivated to work", the average was 6.15 for arts students, indicating that the average was between "Considerably more so" and "Much more so". The average for business students for the same item was somewhat larger at 6.75. The column labeled "P-Value" shows the results of a single factor analysis of variance (ANOVA) performed using the Data Analysis tool pack of Excel.

As shown in Table 4, the course is viewed much more favorably over all fifteen items relative to the other courses they have taken. All averages for all fifteen items are greater than five, with the majority greater than six, or in the range of "considerably more so" to "much more so". For example, relative to the typical course, student respondents indicate that they become better acquainted with the faculty, that the course is of interest to employers, that it is a more innovate course, and one that allows them to learn skills outside of their majors.

Table 4: Summary of responses by academic discipline.

	Item	Arts N=13	Business N=16	Engineering N=10	P-Value
1	Faculty encourage development	5.38	6.44	5.90	.0905
2	Faculty provide guidance	5.62	6.31	5.70	.1874
3	I get to know faculty	5.46	6.60	5.70	**.0306**
4	I am motivated to work	6.15	6.75	6.00	.0953
5	A positive experience	6.00	6.50	6.10	.4194
6	Contributes to professional development	5.85	6.69	6.60	.0987
7	Of interest to employers	5.38	6.33	6.00	.1642
8	Important to securing employment	5.15	5.81	5.70	.3764
9	The class challenges me	5.77	6.69	5.40	**.0049**
10	Learn skills outside my major	6.00	6.69	6.30	.2066
11	Learn to work with other disciplines	6.08	6.81	6.50	.1876
12	Satisfied with class	5.62	6.60	6.00	.0895
13	Would recommend class	6.23	6.81	6.30	.2259
14	Course is innovative	5.85	6.63	6.30	.2065
15	Better grounded in my discipline	5.25	6.06	5.10	.1089

ANOVA was used to compare the mean responses of students from the three academic disciplines to determine if there were any significant differences in the responses. The ANOVA results indicate that there are only two items for which there are significant differences at the 0.05 level of confidence, which are items 3, "I get to know faculty" and 9, "The class challenges me". To explore these differences more closely, responses were compared in pairs, that is, arts vs. business, arts vs. engineering, and business vs. engineering. Pair-wise analysis of item 3 indicates no difference between arts and engineering (p-value .7035). However, the differences between arts and business (p-value =.0108) and engineering and business (p-value = .0242) are significant indicating that business students, on average,

feel that they get to know faculty more so than do arts and engineering students. Likewise, with respect to item 9, there is no difference between arts and engineering students (p-value = .5938), but the differences between arts and business (p-value = .0222), and engineering and business (p-value = .0001) are significant. While the reason is not clear, the results indicate that business students view the class as more challenging than either arts or engineering students, but as the averages indicate, all view it as more challenging than the typical class regardless of academic discipline.

Students were also invited to comment on the course in general. Typical comments include:

- "The project course is really a great program to grow and learn. I got my first job as a result. I highly recommend it to every student".

- "The project course has forced me to learn, and reinforce, different techniques and processes by experiencing their real world applications. Students have to define problems, identify their causes, and implement innovative and realistic solutions--with little direction. This goes substantially further than any in-class problem drilling or case studies that are encountered in other courses. The use of project teams in other classes does not provide students an opportunity to gain the same learning experience because, 1.) scenarios and outcomes are purely theoretical, 2.) understanding of concepts are usually tested separately (making it more difficult to realize the value/weight of integrating concepts), and, most importantly, 3.) they are not exciting. Students who register for the project course know what it entails and their decision to participate is driven by their interest. An added benefit is the pressures of serving a project sponsor".

- "I felt that the project course was invaluable in the eyes of potential employers, and helped me stand above other candidates when I was applying to jobs".

- "It was a very challenging course, but I believe it improved my skills as a leader working with others outside of my line of study".

- "Best class of my college experience...hands down".

Responses from the sponsors have also been very favorable. The following is a sampling of the feedback received from the sponsors. In each case, the comments are from the very top management of the organization:

- "(We) were extremely impressed with the results of the team's dedication, hard work and delivered results. I was impressed with each and every one of them as they represented the program well. In fact, I was so impressed with the experience that I would like to speak with you about the opportunity to partner on future projects. I don't think there is any better compliment that I can give than that".

- "The efforts the students and faculty over the semester were evident and we confirm that the (results of the project) have most definitely added great value to the future of our company".

- "It has been fascinating to work with this interdisciplinary team of students—each student bringing a unique perspective, voice, and expertise to the challenge, but ultimately combining their views to establish a collaborative approach and a multifaceted solution".

Lastly, faculty members who serve as project mentors report a high degree of satisfaction. As is the case with the students who participate in the class, there are expectations and pressures not found in other classes. The success of these projects reflects on the faculty who mentor the projects, as well as the students. In the experience of the author, the level of time and commitment is more than required of the typical class, and yet the rewards far outweigh the negatives. Working with faculty from other disciplines and groups of highly motivated students who bring a wide array of skills and perspectives to the projects is a very satisfying experience and well worth the extra effort.

TRANSFERABILITY AND IMPLICATIONS FOR EDUCATORS

This program began as an idea suggested at a meeting of faculty and administrators from different schools in the university. It took years to develop. Because this was a brand new endeavor, there was no road map, and the process of development involved considerable trial and error. At this point in time, the program is well established, though it continues to evolve and improve. Although the focus of this paper is on the project course, the course is a key element in a program at the undergraduate level, and very recently a program at the graduate level has been approved. Both involve exposure to the different disciplines, course work specifically focused on innovation, and the cross-disciplinary project course.

The program and course are unquestionably transferable. The first and most important ingredient is willingness among the different schools to cooperate and recognition of the value of such a program. The only reason the program got off the ground at this university was the level of support it received from all three of the schools involved. There were faculty and administrators in each of the schools who championed the idea and its development. In one of the schools the dean was instrumental in the development of the program and an active participant once the program was established. As in any program, top level support is a key ingredient to success.

The client-sponsored projects are a key feature of the course, and securing sponsorship is challenging, especially in today's economic climate. Sponsorship requires a substantial investment and lean times mean less discretionary income for these types of initiatives. Nonetheless, as sponsors realize that the value of what they receive is more than the investment, their confidence in the program grows. As noted previously, one significant indicator of the value of the project course is the number of sponsors who have sponsored more than one project.

Coordination is also a challenge. There must be common space for the teams to meet in, and the teams must have the tools necessary to complete their projects. The schedules of faculty and students from three schools must be taken into consideration as well as the schedules and needs of the sponsors. In this university a director's position has been established. The director has overall responsibility for the

program, including development of curriculum, selection of students, participation in the instruction process, promotion of the program, and recruitment of sponsors.

The faculty who participate in the program must have a desire to expand their horizons and work with colleagues and students outside of their academic discipline. Challenges faced by faculty include the pressures of client-sponsored projects. The faculty mentor's reputation, as is the university's, is on the line. Faculty mentors must be willing to let the student teams do their work, and understand that they will make mistakes in the process. At the same time they must ensure that the results of the project will meet the needs of the sponsor, so a significant challenge is to know when to step in and when not.

Such a program would not, at the current time, be appropriate for non-tenured faculty whose focus needs to be on research within their own academic discipline. But for tenured faculty, the program creates opportunities for both applied and cross-disciplinary research. First, the projects that sponsors bring to the program involve issues that lend themselves to research on a broader scale. Second, if students can benefit from taking a multi-disciplinary approach, then so can faculty. Research that involves multiple perspectives and academic disciplines is likely to yield more relevant and complete results than research that does not. At the current time, an issue is availability of journal outlets for cross-disciplinary research and the degree to which such scholarship is recognized and rewarded within the faculty member's school and academic discipline.

In summary, establishing such a program is not without its challenges. But the experience at this university is that the rewards to students, faculty, and sponsors have been well worth the effort.

REFERENCES

Bove, L.L., & Davies, W.M., (2009). A case study of teaching marketing research using client-sponsored projects: Method, challenges, and benefits. *Journal of Marketing Education*, 31(3), 230-239.

Gorman, M.F. (2011). Student reactions to the field consulting capstone course in operations management at the University of Dayton. *Interfaces*, 41(6), 564-577.

Hamel, G. (2012). *What matters now*. San Francisco: Jossey-Bass.

Hasan, B., & Ali, J. (2007). An empirical examination of factors affecting group effectiveness in information systems projects. *Decision Sciences Journal of Innovative Education*, 5(2), 229-243.

Heriot, K.C., Cook, R., Jones, R.C., & Simpson, L. (2008). The use of student consulting projects as an active learning pedagogy: A case study in a production/operations management course. *Decision Sciences Journal of Innovative Education*, 6(2), 463-481.

Koppenhaver, G.D., & Shrader, C.B. (2003). Structuring the classroom for performance: Cooperative learning with instructor-assigned teams. *Decision Sciences Journal of Innovative Education*, 1(1), 1-21.

Marshall, D. (2012). The shape of things to come: Size, form and mass in innovation-capable cultures, [available at http://collaborativeinnovation.org/2012/01/shape-of-things-to-come/, accessed April 1, 2012].

Park, M.H-J., Lim, J.W., & Birnbaum-More, P.H. (2009). The effect of multiknowledge individuals on performance in cross-functional new product development teams. *Journal of Product Innovation Management*, 26(1), 86-96.

Reinig, B. A., Horowitz, I., & Whittenburg, G.E. (2011). The effect of team-based learning on student attitudes and satisfaction. *Decision Sciences Journal of Innovative Education*, 9(1), 27-47.

Richmond, W., Banerjee, D., & White, B.J. (2008). Integrating curriculum across courses in the same semester and across semesters using a service learning project. *Decision Sciences Journal of Innovative Education*, 6(2), 509-513.

Sung, S.Y., & Choi, J.N. (2012). Effects of team knowledge management on the creativity and financial performance of organizational teams. *Organizational Behavior and Human Decision Processes*, 118(1), 4-13.

Van Der Vegt, G.S., & Bunderson, J.S. (2005). Learning and performance in multidisciplinary teams: The importance of collective team identification. *Academy of Management Journal*, 48(3), 532-547.