

New Models of Cross-Disciplinary Collaborative Education

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Abstract

This paper presents three models of cross-disciplinary collaboration. The authors argue this mode of education coupled with traditional college-based courses better prepares students for the demands of an increasingly complex and ambiguous work place. The paper details the benefits of this educational approach and suggests ways schools can integrate these pedagogies within their programs. Finally, the authors identify efficiencies that can be attained through a more systematic approach to structuring these programs.

Traditional teaching pedagogies that center learning inside the college often miss the opportunity to prepare their students for a diverse and ever increasingly complex work environment. This paper presents a model of education that builds on the strengths of college-based education augmented by substantive cross-disciplinary experiences. Using capabilities available in a major urban university, this manuscript shows models of collaborative education that leverage the functional expertise of individual colleges by creating collaborative learning environments for students that better prepare them for their professional careers.

This manuscript builds the case for the greater inclusion of some form of cross-disciplinary education in higher education. The economic, institutional and educational rationales for using this pedagogical approach are addressed. This paper then argues that despite the difficulty of creating effective collaborations, the benefits outweigh the organizational costs. We follow with features of this educational form. The major contribution of this paper is a model that shows evolving modes of cross college cooperation. For each of these forms, a detailed example is provided which illustrates benefits and limitations. Finally, we close with the strengths of this learning approach for students and challenges we encountered, for those considering this type of educational process.

Why Is Collaborative Education Needed?

Collaboration both within our higher education institutions and with external constituents is a competitive necessity. Increasingly, industry is depending on knowledge generated by higher education institutions to augment its internal efforts. With cost containment and risk management programs, firms look toward universities as a partner in their research and development programs. Research universities offer a diverse cadre of highly qualified scientists with corollary resources such as labs and student labor that can be focused on specific problems. By using this resource on a contract basis, industry can rapidly ramp-up expertise in a particular technology.

A critical enabler of effective research contracting and new technology commercialization was the Bayh-Dole Act of 1980. This legislation gave schools ownership of inventions and discoveries so they could subsequently sell that intellectual property to industry. Since 80-85 percent of university research is funded by the federal government, without this act many discoveries were not being diffused from academia into commercial products or services.

University discoveries and technologies can be a valuable basis for the spawning of new businesses. Since many radical inventions are not embraced by existing industry incumbents, opportunities exist for a new competitor with a radical approach. New entrants are not constrained by an existing customer base, manufacturing facilities or employees. They are free to challenge industry assumptions and use innovative approaches to solve customer problems. Also, since they have no customer base, new firms aren't required to make products compatible or complementary with existing offerings. Thus, the innovative ideas and technologies that emerge from new firms are not constrained by the biases brought by the current industry players.

Universities are also motivated to work with business and their economic community. School funding depends not only on tuition but also on subsidies and research. Federal, state and local entities look at an institution's capability to create and transfer technology. If a school is not a contributor to economic development, state funding is at risk.

Furthermore, communities expect that a higher education institution will give back to the community. The collaborative model described in this paper provides both an economic stimulus as well as service to local businesses or community partners.

A final but equally important reason for using this model of education is the learning experience it creates for students. Solving today's problems will require new thinking. Today's students will likely change jobs and careers multiple times in their work life. In addition, the knowledge base in most disciplines is rapidly evolving. Thus, just teaching functional knowledge isn't sufficient. However, if we develop more *critical thinkers*, people who can challenge assumptions and are proficient at leveraging their own skills as well as the skills of others, we create a workforce more adept at handling an increasingly complex and ambiguous environment.

Current education models build strong functional skill sets but generally lack multi-college interactions. While a general education model is prominent in many schools, students are rarely put in situations that require them to practice using theory to create workable solutions. Furthermore, they may never work within a team that includes students from outside their home college. The proposed cross-disciplinary model most closely replicates the work environment and processes of today's businesses and organizations and, thus, should be a prominent feature in our educational programs.

Lastly students should take risks in the forgiving environment of the academic classrooms. Creating these "real" world problem-solving situations where students can

feel the thrill of success, yet are provided a forgiving environment for failure, is also valuable. Learning to work with people with different skills, values, and problem approaches can be very difficult. These collaborative teams often create high conflict situations and must work through a norming process before they can perform useful work. In some cases, the teams are unsuccessful at achieving project deliverables. In those situations the ramifications are much less severe in a school environment versus in a real job. Let's let our students fail while in a setting where they are encouraged to learn from failure and have an opportunity to reapply their learning to follow-up efforts.

What Is Collaborative Education?

Collaborative education in this paper is a process where students and faculty from two or more colleges are brought together for a common educational experience. Teams work on “real world” partner-supplied problems. Partners can be either internal or external to the organization and typically advise the team throughout the process. A well-defined project gives students an applied problem and requires cross-disciplinary expertise. Finally, these projects must be assessed from several perspectives. Students should demonstrate functional competency as well as the capability to integrate and leverage knowledge from their teammates. Outcomes for partners should be evaluated based on the agreed upon goals set with the team. It's important that all parties benefit in order for these educational processes to be sustained on a reoccurring basis.

Structuring these collaboratives is not an easy process. One of the major challenges is creating an environment where all the involved parties—students, faculty, and partners—are committed to the project. To achieve this goal, several organizational processes must be in place. First, a common curriculum helps facilitate commitment. By this we mean, creating courses with *common* meeting times, location and course requirements so students and faculty can work together on a regular and reoccurring basis. It is imperative to the pedagogy that students have overlapping class times and common work areas so that they can work together in a face-to-face manner. Moreover, courses in each college must have similar requirements so students are equitably rewarded for the time and effort they devote to the course. Cross-listed courses among multiple colleges, particularly those at the junior and senior levels, are not typical. As these collaborations become institutionalized, a coherent set of “common” courses that fit within each student's program of study is a necessary component of successful collaboration.

Second, these courses must also have faculty involvement from each of the participating colleges. Multi-disciplinary faculty participation brings diverse expertise to the projects as well as validates the need for knowledge integration. In the early stages of creating such collaboratives, faculty champions often work on these projects outside of their normal workloads because of the educational value they bring to the students. However, if these programs are to be viewed as critical educational experiences they should be valued similar to other teaching efforts and over the long term be included in the regular workload.

Faculty that participate in these programs must also bring an appreciation and interest in applied problem-solving. Teachers with industry experience can help students apply functional tools to address sponsor projects. Attracting this type of faculty member may require new recruiting models as well as reappointment and promotion criteria. Teachers who bring unique teaching competencies and use those skills to create teaching innovations such as these collaborations should be highly valued within our higher education institutions.

Another component of successful collaboration is maintaining a supply of relevant, real world projects. This requires development of processes to identify and assess projects and their sponsoring organizations. Suitable projects must have reasonable goals that are achievable given the skills, time, and resource constraints. Faculty experienced with working on these projects are often best positioned to assess the viability of new project ideas.

Part and parcel with developing a supply of projects is creating a set of project sponsors. Sponsors can be either internal or external to the organization. Potential sponsors should be vetted based on a number of criteria. Any sponsor should bring a project that has meaningful outcomes to the sponsor. If a project is of limited interest to the sponsor, it will not be motivated to work with the student team. Potential sponsors must also be flexible and willing to accept a set of project outcomes that are realistic given the students' expertise, time, and resources. Setting unreasonable objectives will result in an unsatisfactory and frustrating experience for everyone involved. Sponsors must be willing to assist teams on a regular basis and in a timely manner; in many cases, the teams will need data that only the sponsoring organization can provide.

It is important to realize that both parties (university and partners) in the collaboration will be interested in claiming any intellectual property that emerges (Table 1). The university believes it has both a right and an obligation to protect new ideas that result from faculty and student work. Similarly, when a partner brings a project idea and actively contributes to the team, they assume some right to ownership as well. To reduce the likelihood of these unhealthy conflicts, negotiation of ownership should be conducted before the project begins. Creating these agreements is complicated because outcomes are uncertain and their value is difficult to assess. Despite these difficulties, any agreement with external partners must address how rights to team outcomes are assigned, realizing that disagreements in this area can slow down collaborations.

A final component of successful collaboration is creation of appropriate assessment tools. Since these collaboratives have non-traditional course objectives and pedagogies, typical testing instruments are not appropriate. Assessment tools that focus on individual contributions and learning, team work, and project outcomes vis-a-vis goals are needed. Student journals, team and self assessments, design reviews, business plans and customer presentations are a few of the evaluation tools used. Team members, course faculty and sponsoring partners should all contribute to the assessments.

Table 1: Reasons Why Working with Universities is Challenging.

	<u>University</u>	<u>Industry</u>
Intellectual Property (IP) Rights	Want to own IP rights	Want to own IP rights
Value of IP	This could be the next "Google!"	I have to invest \$\$\$ up front
Public Domain	"Publish or Perish"	If you publish, we "perish" (lose)
Decision Makers	Very bureaucratic	Very bureaucratic
Who can say no?	The professor, the tech transfer office, the business office, lawyers, etc.	Business leader
Who can say yes?	???	Business leader
Value of time	Lots of meetings	Time is money

Evolving Modes of Collaboration

At the University of Cincinnati, we have used several approaches toward setting up and implementing these collaborations. They vary, in part, because of the programs they support and the frequency of their occurrence. We describe three types of collaborative programs: ad hoc, reoccurring and institutionalized. In addition, we characterize when they are used as well as the strengths and weaknesses of each. After describing each form, we provide an example based on programs we have developed at our institution. Table 2 shows a summary of the features of each collaborative form.

Ad Hoc Collaborations. These collaborations often emerge episodically and opportunistically when a sponsoring organization needs help solving a problem. The industry contact often works with a faculty sponsor who then assembles the student and university resources. The faculty member will spend significant time securing participation by relevant colleges and negotiating agreements between the university and the external partner. Moreover, she or he will work to find appropriate classes, juggle class times, find work spaces, and manage the relationships. Preparing for these programs is a daunting task especially since each collaboration is unique and faculty are relative novices in understanding what is needed to create and manage these types of programs. Given the idiosyncratic nature of ad hoc collaborations and the planning hurdles, sometimes assembling all the appropriate resources is not possible. One of the toughest issues is finding students and faculty that can work and meet simultaneously together. In situations where cross-disciplinary collaboration can't occur during overlapping class periods, a

consulting model of participation may be used. In this approach, students acting in this mode meet with the project team on some frequency to provide expertise and analyses in a needed area. The consulting team will not have the benefit of working regularly with the team, but be available to provide functional expertise.

Table 2: Evolving Modes of Cross-Disciplinary Collaboration

Types	Ad Hoc	Reoccurring	Institutionalized
Description	Episodic, unplanned, opportunistic	Course embedded in single college; multi-college requirement not systematized	On-going set of clients bring project set. Partners, faculty, and students recruited for participation but systems in place to “routine-ize” processes.
Curricular Development	Independent study courses or co-curricular activity	Independent study courses developed for reoccurring courses	Embedded in each college’s curriculum and programs of study
Type of Student Interaction	Consulting relationship	Consulting or collaborative	Translational
IP Considerations	Negotiated for the activity	Standard template developed by the sponsoring discipline(s)	A membership model where member companies receive an array of services and products.
Partner (Client) and Faculty/Student Recruitment	Typically driven by client needs Managed by the faculty champion	Shared set of expectations between faculty champion and clients based on history of working together. Informal cross-college relationships are key to recruiting students and faculty.	Develop and use a partner recruitment, expectations, and outcomes management system. Structured relationships with partner colleges.
Resources	Intensive time requirement for faculty to set-up and manage. Institution’s resources not typically recouped.	Set-up and management time reduced due to reoccurring nature of projects.	Faculty and institution set-up agreements that result in short- and long-term benefits for all parties (faculty, students, and companies). Client participation payments cover reoccurring costs. IP assignments and rights negotiated in advance.

A second challenge for ad hoc projects is working with university contract officers and the project sponsor to create a project agreement. This contract must specify the contribution of each participant and how ownership of any intellectual property will be distributed. Often this is the first time a faculty member has worked with the University's intellectual property and legal offices. Each of these offices has its own obligations to the University and state concerning how agreements are structured and managed. Faculty facilitators will be challenged to create a satisfactory agreement that meets everyone's requirements in a timely manner.

Finally, once the collaboration is set-up, the thorny process of implementing the program begins. This, too, represents new territory for most faculty. The pedagogy it is not centered on assessment of content delivered by the instructor—the basis for traditional courses. Rather students must use team skills to build solutions to customer problems. The problem statement provided by the sponsor must be translated into customer and technical requirements and in many cases modified by the project team. The teams must then find relevant data to address the problem statement. Furthermore, these classes are frequently held in a studio environment which is only common in design or performance-based courses. Summing up all these differences makes for a very radical course design for both students and faculty.

A central role of faculty is helping teams manage themselves. Given the diverse nature of these project teams, conflicts often arise. Team members bring different perspectives of the problem and assessments of the value of potential solutions. For example, engineers focus on the technical dimensions of the problem, designers on the functionality and user interface, and business students on the cost and price. The instructor must assist the teams in learning to find compromises that don't sacrifice critical requirements of its members. These cross-disciplinary studio classes are challenging for students, too. While many have worked on teams within their major, engaging with such a diverse team is new. Dealing with peers that bring new views and values can be both a source of exhilaration and extreme frustration. Team members must learn how to appreciate the contribution of others and leverage that new information into a superior solution. This is not a comfortable task, and students often feel frustrated at their inability to make progress. Moreover, time pressures contribute to an already tense situation. As the course progresses, teams often direct their frustrations toward the faculty who are expected to help them solve team issues. This makes facilitation of these projects even more challenging for faculty. While students conceptually understand the benefits of this type of learning environment, it may take them some time to truly appreciate the experience. Given the demands of these organizational forms, it should be clear why ad hoc programs place extraordinary pressures on faculty. As noted, students are uncomfortable in this environment and are challenged to produce results in a timely fashion. They are also held accountable to a sponsoring organization, one of which could be a potential employer or reference. In these courses, faculty must learn new pedagogies to effectively facilitate these projects. In addition, they must use different assessment approaches. All these course management tasks are layered on top of administering a client or sponsoring partner relationship. In many cases, faculty would like to maintain a continuing relationship

with a partner, or at the very least, want the University to be well-reflected by the project team, so they feel pressured to insure the team deliverables are met. Despite the superiority of this learning approach, one can certainly understand why a faculty member might be reluctant to engage in an ad hoc collaboration and astounded if they do more than one!

Reoccurring Collaborations. In this model, reoccurring collaborations are projects that happen on a regular and predictable basis. They are usually embedded in an existing program or curriculum so occur each time the course(s) is offered. Course pedagogy is based on multi-disciplinary teams that work on sponsor-based projects.

In this model, some learning is retained and leveraged across projects. For example, faculty relationships across colleges can be developed over time. Once these relationships are developed, supporting faculty can become partners in the collaboration. As a faculty partner, they can contribute in multiple ways to the project. First, they can assist in co-teaching. As noted earlier, an effective cross-disciplinary collaboration needs the voice of multiple perspectives, not just a single college perspective. The partner faculty can also be a liaison within their college to find students or courses to participate in the project. Ideally, after a few project groups, the liaison will facilitate an on-going source of students from these reoccurring programs. This will require that a curricular option be found that satisfies a program requirement in the supporting student's major or minor. Finding a course option that can be adjusted to overlap with the project team's course time and day is a major challenge. Thus, creating an on-going supply of students from other programs is a major opportunity for reoccurring collaborations.

Another potential opportunity for reoccurring collaborations is the ability to create a set of on-going projects and sponsors. Since the program has a cycle of repeatability, project sponsors can time their needs with course offerings. In addition, these same set of sponsors can develop familiarity with the program, the capabilities of the students, and the requirements on their part necessary to support the teams. With each project, sponsors gain more experience with the benefits and challenges of this learning tool. Moreover, each time a sponsor has a positive experience, they become advocates for the program and recruit new projects (and sponsors) for the program.

Finally, these repeating collaborations can also reduce the transaction cost of developing agreements with external partners. College faculty that have experience with the collaborations will be familiar with the legal processes as will returning project sponsors. Indeed, as the institution becomes more knowledgeable, templates can be created that define key parameters and then used to accelerate the agreement process.

Course management and student assessment can be "routinized" in this mode. Faculty facilitators gain experience teaching in this format and using tools to help students manage team processes. Furthermore, they can become more proficient in assessing student learning and fine tuning techniques for providing feedback to the teams.

Notwithstanding these benefits, even the reoccurring collaborations have challenges. Most of the organizational synergies described above are predicated on the relationships between key faculty across these colleges. If or when faculty depart, develop other interests, or no longer have time to pursue these collaborations, many of the noted synergies can be lost. A similar case can be made for the project sponsors. While it is unlikely all these changes will occur at once, it is apparent that the faculty sponsor for these reoccurring collaborations must be constantly maintaining relationships and developing new ones.

Institutionalized Collaborations. When organizations gain sufficient expertise with this form of collaboration and are convinced of the benefits of this educational model, they may develop systems that facilitate sustainability. System development in four areas can expedite the use of these collaboratives: (1) cross curricular courses and faculty relationships, (2) partner recruitment and management system, (3) intellectual property template, and (4) a resource model. Each is briefly described.

One of the time consuming processes in collaboration is providing a regular source of students and faculty from supporting colleges. In an institutionalized mode, supporting colleges can create a set of approved courses that meet at a common day and time. Once a set of courses are available, student's can routinely plan for them in their program. The upfront time of creating cross-curricular classes is significant, but once created can greatly facilitate the availability of faculty and students from supporting programs.

Systems that assist in the recruitment and management of clients can also enhance this collaboration mode. Finding qualified new clients can be a time-consuming process especially when a regular source of projects is needed. Collaborative organizers can spend inordinate amounts of time preparing and presenting sales information to educate potential clients on the benefits of this educational approach. Professional sales approaches tend to impress clients and inspire confidence in the collaborative team's ability to perform. Standardized presentations, Web sites and sales teams can be built and used. Systematic capturing of client success stories can validate the productivity of this collaborative form. Moreover, information systems can be developed to track and monitor client work.

A major time component of collaboration is developing a working agreement between the parties. With reoccurring collaborations a template can be developed that assigns rights to work outcomes and details the responsibilities and resource contributions of each party. Since these institutionalized collaborations bring a performance history, they can use that experience to simplify contract details.

A final opportunity for institutionalized collaborations is pre-planning for resource needs. Space, material, labor, and system resources are needed to support team efforts. Groups need common space to meet and work. Teams require materials and resources for assessing customer needs and prototyping solutions. Faculty and colleges must be compensated for course and client work. Staff supports the marketing, sales, and implementation of the project work. If an institutional collaboration approach includes

a funding model for infrastructure support, these organizational forms are more likely to be sustained.

Collaboration Case Studies

In this section we present an example of each of the collaboration modes described previously. These examples more fully illustrate the nature of how collaborations emerge, are managed, and assessed. These cases also show the extent of cross-disciplinary collaboration and the types of systems needed to effectively manage them.

Solar Decathlon Project (Ad Hoc Collaboration)

This program was sponsored by the Department of Energy and each participating school was charged with building an 800 square foot single family home that was totally powered by solar energy. A primary goal of the program was to demonstrate the use of solar power to cost-effectively provide the power needs of a home. Team entries were evaluated across ten parameters representing design, engineering, cost, and market fit. Twenty schools worldwide were selected to be a part of this competition and the project extended over an eighteen-month period. It culminated in a display of all the homes on the Mall in Washington, D.C. for the final competition.

The University of Cincinnati's participation was championed by an architecture student who was committed to sustainable design. He proposed the project to his College and garnered support for the program. His faculty in Architecture and Design then recruited participation by other colleges: engineering, business and later arts and sciences. Each of these colleges provided one or two faculty who worked with the project team and recruited student participants. Students from numerous classes across the university conducted projects for the program. Other students worked on the program in a co-op role. Overall, more than 250 students contributed to the project as well as numerous other stakeholders: existing and new donors, our graduates, technical consultants, and community partners committed to "green" design.

This was no small project. The material costs alone totaled about \$300,000 and most of it was raised by students, colleges, and development officers. Adding labor costs at market rates, this home would have had a price tag of more than \$425,000.

The intellectual property agreement for this project was relatively easy to construct because the DOE brought an existing template. Having run this competition numerous times previously, this government agency was well familiar with the dynamics of working with a university. Furthermore, they insisted on assigning all the IP rights generated by the team to the University. Despite all these advantages, the intellectual property agreement took months to resolve. Both parties need time to review all the details of the agreement as well as assess proposed changes. University general counsel offices are busy so adding a new contract with a partner with whom the school has no experience was time consuming.

This project represented a comprehensive design, test, and build cycle for the project team. This would be one of the few times students would be asked to complete a full cycle of innovation. This required the team search for innovative technologies that were leading edge yet “ready” to be implemented in a very short two-year time frame. All technology options had to be prototyped and tested to insure an efficient yet workable solution was reached. The technology selection had to consider the target market for the house, market needs, and price parameters. After the house was designed, the students built it. In the building process they had to correct design flaws within the context of the existing structure. Finally, the house was transported, re-assembled, and displayed in Washington, D.C. In D.C. the team received expert feedback on their design and implementation. This truly created a translational educational opportunity.

All faculty champions participated in the project largely outside of their normal teaching requirements. In some cases faculty were able to embed the project within the curriculum of existing courses. When courses didn’t fit the project needs, faculty advised students on their own time. The core faculty team met with the student team at a minimum on a weekly basis and this time requirement ramped up significantly around project deliverable deadlines, during construction, and the exhibition period in Washington, D. C. Most of the faculty effort on this project was work beyond regular teaching responsibilities and occurred because these instructors were committed to this learning pedagogy and the objectives of the design project.

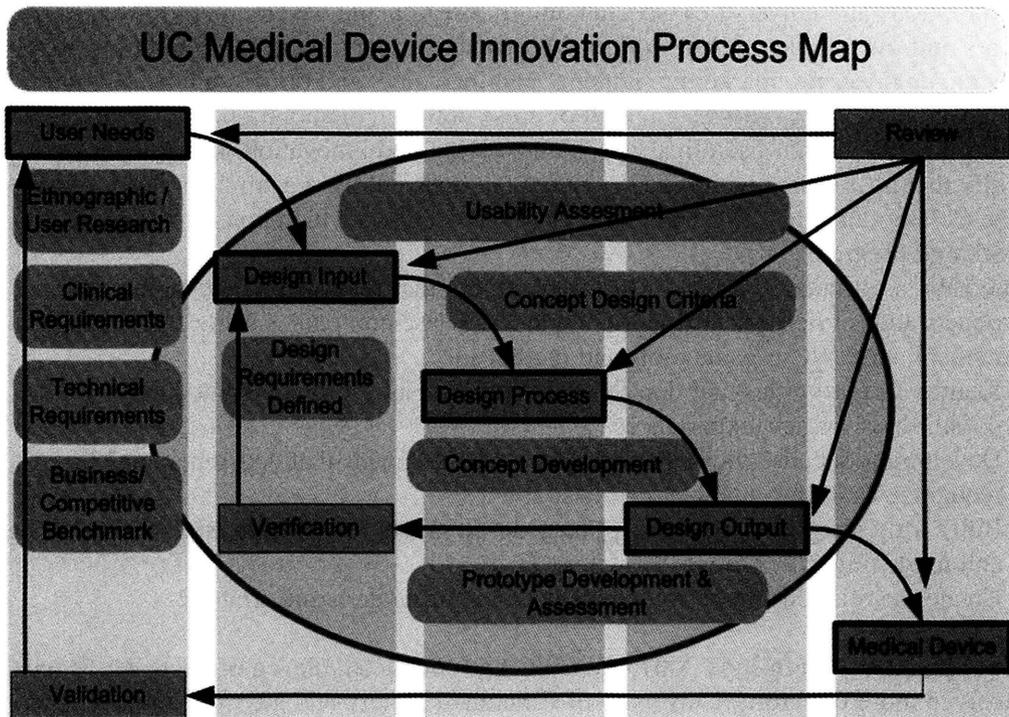
Team dynamics, like most collaborations, at times were turbulent. Each functional group brought a different idea as to what was valued by the panel of judges and how well the design and technology choices would satisfy those requirements. Conflict was a daily part of team processes and was moderated by successfully reaching certain milestones. Student learning was assessed several ways. Work on the project that was embedded in an existing course was evaluated in the course requirements. Regular feedback was provided by the project itself. When a system was built, it either worked or it didn’t. When things didn’t operate as planned, students reworked it until a new solution was created. The overall program was assessed by the DOE competition. That process provided teams feedback on their attainment of project goals as compared to the other teams in the competition. At the end of the program, the faculty facilitators conducted a retrospective analysis and offered suggestions for future programs of this type.

Medical Device Innovation & Entrepreneurship Program (A Reoccurring Collaboration)

The mission of this program is to prepare students as successful entrepreneurs and leaders within the medical device industry and to promote the regional economy by assisting physician innovators in the early stage development and commercialization of innovative medical products. This collaboration involves students and faculty from the colleges of engineering, medicine, business, design and nursing.

Each year during the winter and spring quarters, third-year students participating in the program survey the clinical community for problems that are readily solved. Students are encouraged to observe clinical practice and are trained in problem definition including ethnography and FDA design control practices (Exhibit 1). As a result of these efforts there is typically a new network of friendly practitioners who are willing to work with student teams and a bank of problems with the business, design, and engineering opportunity more clearly defined.

Exhibit 1: Medical Device Process Map



Students return to their respective discipline curriculum for further in-depth study prior to a larger collaboration in their senior year which comprises the full thrust innovation model of the program. During this year, student teams are provided resources necessary to solve clinical problems and to prove their solutions are valid through functional prototypes and subsequent testing in appropriate lab settings (e.g., animal, cadaver). This effort fulfills all of the students' curricular needs for a capstone experience.

Students are provided a choice of projects to work on and are placed on teams through careful faculty review with student motivation as the primary filter. Each year a limited number of industry-sponsored projects are completed which fund the entire program. These sponsors participate as a team leader and are involved with the student teams on a weekly or bi-weekly basis. This close partnership allows for better communication as required with more challenging design problems in medical device design.

The challenge for this model of collaboration is that in fact none of the participating faculty or students are *required* to work together; rather they choose to do so voluntarily with the knowledge that the collaborative model will inheritably enhance both the solution to the problem posed and the education of the students. It is based on developed relationships and mutual respect across all disciplines.

The LiveWell Collaborative (An Institutional Collaboration Approach)

The LiveWell Collaborative (LWC) is an innovative, leading edge program for corporations and universities, specializing in research and development for the fifty-years-and-over market. LWC works with industry leaders, experts in the fields of design, engineering, marketing, nursing, and medicine, and utilizes a host of young creative talent. LWC utilizes a model of cross-college collaboration that harnesses the vast potential of interdisciplinary problem-solving and innovation. It is a separate entity that is affiliated with the University, but does not have a single college home. The Collaborative has physical facilities next to campus which house team project work and program staff.

The LWC is structured around a ten-week studio that focuses on developing new products and services for member companies. These companies bring a problem statement and LWC uses its tools and methods to:

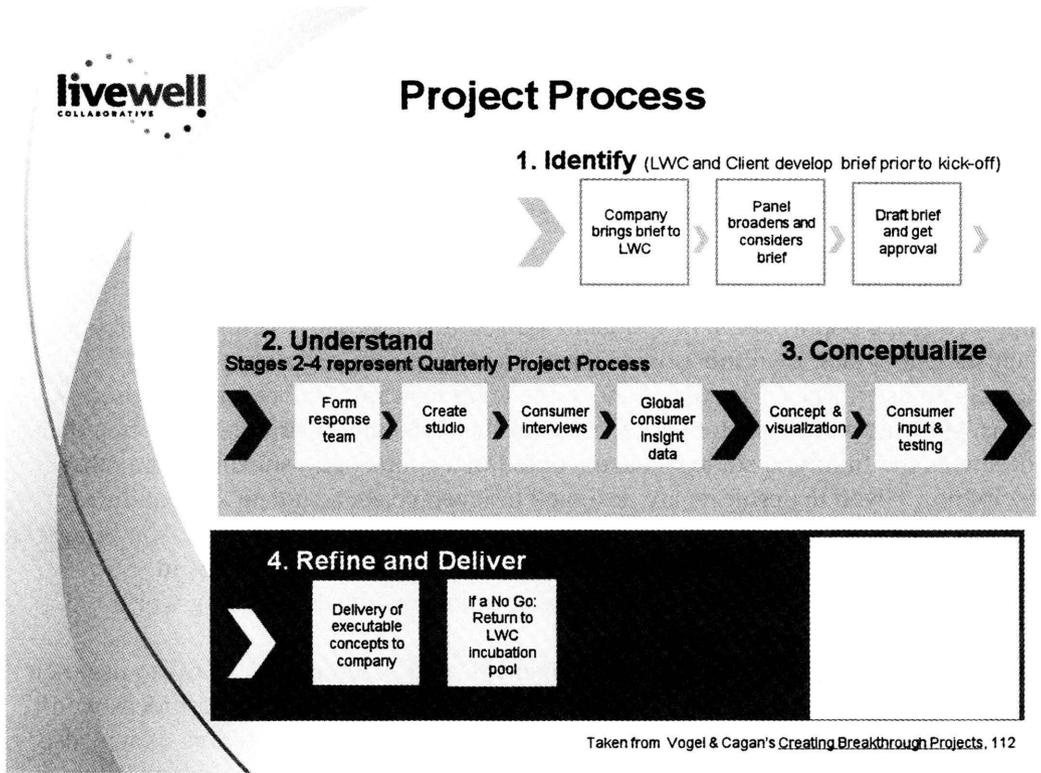
- Identify opportunities that don't simply solve existing problems but create possibilities for new experiences
- Develop products/services that have features and forms that consumers quickly recognize as useful, useable, and desirable
- Build truly integrated, interdisciplinary development teams from engineering, design, and marketing
- Create the relationship between product and corporate brand strategy

Since its formation in June 2007, the LWC has completed eleven projects which have involved more than forty University of Cincinnati faculty and advisors and over two hundred students.

The LWC gains scale economies and achieves consistently superior results in a number of ways. First, it utilizes a systematic approach to the project qualification, execution, and assessment. The process template developed by Cagan and Vogel (2002) is shown in Exhibit 2. It defines a routine for handling these projects and is a guide to both internal and external participants.

The LW entity secures funds from companies that join the collaborative. Member firms have access to student studios, workshops, informatics about the over-fifty consumer and a forum for sharing knowledge to connect and develop non-competing corporations. The LWC uses its funds to compensate colleges and faculty for their work and spur course development. Project expenses and facilities are also supported through the LWC funding system.

Exhibit 2: IWC Project Process



LWC intellectual property agreements are negotiated in advance and agreed upon by all member companies. Companies pay for intellectual property in the cost of the studio. A “success” fee is paid back to the consortium if deliverables are commercialized. Resolving the value of potential intellectual property ahead of time is an important “go/no go” criterion for businesses.

Finally, the LWC has developed a support infrastructure to facilitate these projects. A center director and assistant manage the on-going client relationships. They also actively market and sell the consortium’s services to potential new member companies. Having a stable staff and office facility provides potential new clients a sense of stability and longevity of the organization.

The LW approaches does have its limitations. Since the consortium is not directly related nor supported by the university, it must continually sell client services to sustain its infrastructure. This places teaching as a secondary priority within these project teams. This may not be problematic since projects are facilitated by University faculty and student work is assessed for each studio. However, on-going care should be taken to insure that students are not just a means to an end and that they gain new skills from these experiences which enable them to be stronger contributors in the workplace.

The above examples show the evolution of collaboratives at the University of Cincinnati. Furthermore, the diversity of our approaches illustrate that numerous ways exist to successfully bring students and partners together to solve problems. We also discuss opportunities for systematizing the creation of these programs by building systems and structures that reduce recreation of the wheel for each new collaborative. In the next section, the student benefits of this pedagogy are addressed.

How Collaboratives Benefit Students

Creating experiences that enhance student learning is the primary reason for using this challenging pedagogy. Numerous benefits have been observed. Not unique to this approach is the confirmation of a student's disciplinary skills. A central contribution of each student is their own functional capabilities. The team will depend on each member to use his/her expertise to move the team forward. Unlike college-based teams, students gain a greater appreciation of the skills others bring. More often than not, this is the first time students have worked in a course with students from other disciplines. Given the projects are designed to leverage each student's capabilities, everyone gains an appreciation for mutual reliance and the value each person brings. In addition, this collaboration structure more closely replicates work teams in organizations so is a valuable step in preparing students for the working world.

Students build other skills in this environment as well. Each person learns to use their competences to persuasively communicate their ideas. They find the best ideas won't be chosen if the proponent can't articulate the reasoning for its selection. Teams also learn to efficiently divide responsibilities so work can progress simultaneously across multiple fronts. They depend on each other's contribution and hold each member accountable for his/her work. They must also have patience and be professional in their dealings within the team and with sponsors.

The studio model is a unique team process for all disciplines other than design. With this approach, students learn to identify their own functional biases, temporarily suspend their beliefs so they can re-think customer needs and potential solutions. The ideation processes helps the teams move toward superior approaches that in some cases may be counter intuitive. Even if the team chooses an incremental solution to the problem, they benefit from ideation.

Finally, students in this program learn how to produce a viable concept. They typically begin with a vague problem statement which they must transform into a set of customer requirements. After ideation and creation of solution alternatives, they use prototyping to validate their chosen product concept. Data from analysis and testing of the prototype helps the students verify their project assumptions and the solution approach they chose. This process provides a model of learning that students can apply in many situations beyond the school environment.

The Challenges and Opportunities of this Mode of Education

Conducting cross-disciplinary education programs is not for the faint of heart. These programs are time-consuming to arrange, difficult to manage, and often result in upset students who long for a more textbook approach to learning. Faculty champions who lead these efforts are under-recognized and under-rewarded for their efforts. Moreover, few outside the circle of experience with collaborative education appreciate what it takes to make these projects successful.

Despite these challenges, we predict schools will continue to explore ways to create sustainable models of collaborative education. The benefits to our students, our community, and our economic community are undeniable. In addition we are convinced this approach offers a superior way to prepare students to handle a dynamic market place where they will not only work but also be consumers.

Acknowledgements: This paper builds on two presentations. The first was presented at the University of Cincinnati in May 2008 and is titled “The Art and Science of Multi-Disciplinary Collaboration” by A. Chasser, D. Murray, M. B. Privitera, A. Welsh, and B. J. Zirger. The second presentation is titled “New Models for University-Industry Collaborations” and was given by A. Chasser, B. J. Zirger, M. B. Privitera, and C. Vogel at the CUMU Annual Conference in October 2008.

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