

# Moving toward a Trans-disciplinary Approach in the Land Grant System: A Case Study<sup>1</sup>

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## Abstract

The complexity of problems facing contemporary society requires an approach to knowledge creation that synthesizes solutions from multiple disciplinary perspectives. Traditional disciplinary structures functioning individually can inhibit the integration and application of useful knowledge. In response, many funding agencies and some universities have promoted multi-disciplinary collaboration and even interdisciplinary approaches, where faculty from different disciplines work together as a unit. This article takes the discussion a step further by examining the evolution of the Community Development and Applied Economics (CDAE) department at the University of Vermont. It provides an illustrative case study of a move beyond interdisciplinarity into transdisciplinarity, where faculty coheres as a team in teaching, researching, identifying and solving problems. The experience of this department suggests that the development of a transdisciplinary approach is not easy or simple. It cuts against the grain of the traditional culture of the Academy, which continues to incentivize and place high premiums on traditional disciplinary structures. The article concludes with an examination of the difficulties experienced in the building of a transdisciplinary program. It reveals the importance of maintaining openness to the stakeholder participation and collaboration that is vital in attracting scholars and students accustomed to the security of orthodox disciplinary identities.

## Introduction

The university environment has historically been deeply entrenched in disciplinary segregation. Economists, for example, are housed in economics departments, sociologists in sociology departments and engineers in engineering departments. Universities have traditionally been composed of "silos" of faculty focusing on a single academic discipline. These faculty teach in their discipline, do research in their discipline, publish in peer reviewed disciplinary journals, and belong to discipline specific associations.

This state of academic affairs overlays the emerging reality that the pursuit and application of knowledge is growing more untraditional, dynamic, global, and adaptive. The rise of new disciplines such as cybernetics, systems thinking, chaos and complexity, "constitute a somewhat fuzzily defined academic domain that touches virtually all traditional disciplines, from mathematics, technology and biology to philosophy and the social sciences." (Heylighen et al., 1993).

Human beings, and the societies in which they function, are by definition dynamic and continually evolving. Increasingly, academics hear that "multidisciplinary," "interdisciplinary," or "transdisciplinary" scholarship is the wave of the future. To cite one recent example, the International Commission on Sustainable Development practice has stated that "the interwoven challenges of sustainable development—from extreme poverty and disease control to climate change and ecosystem vulnerability—can only be resolved by leveraging knowledge and skills from a range of disciplines." (Report from the International Commission on Education for Sustainable Development Practice, 2008)

More generally Requests for Proposals from funders such as the United States Department of Agriculture, the National Institutes of Health, and the National Science Foundation regularly include language that requires, or at least strongly suggests, multi or inter-disciplinary approaches to solving societies' problems. Yet in most cases, for example, the social scientists on the team concentrate on social aspects of a problem, while the natural scientists concentrate on the natural or physical science aspects.

A multi, inter, or even transdisciplinary approach to scientific inquiry meets with resistance in the academy due to traditions, disciplinary identities, turf battles and outmoded incentive structures. This article discusses the path that one academic department - Community Development and Applied Economics (CDAE) at the University of Vermont - has taken to vitiate barriers both within the Academy

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and between it and the external community. The article also posits lessons learned and a vision for the future. Challenges remain however, including developing an appropriate incentive and rewards structure for transdisciplinary scholarship when the Academy remains largely structured along disciplinary lines. Relatedly, careful attention must be paid to ensuring rigorous and appropriate peer review, especially in the Reappointment, Promotion and Tenure process.

Outlining the process and highlighting pitfalls and triggers to success in CDAE's case may help other departments struggling with the same issues. Insight can be gained into how to move forward breaking down artificial and outmoded silos, and how to work effectively toward creating new knowledge that provides solutions to the increasingly complex problems facing society. The department is still evolving and, given the dynamic nature of current global problems, will continue to do so.

This article is organized in three parts. First, it presents a conceptual framework of the issues under discussion, including definition of the various terms, and integrates into the discussion some of the relevant literature. Second, it outlines some of the history of CDAE as a case study that is relevant to the transdisciplinary concept. Third, it presents lessons learned and suggests ways to cultivate transdisciplinary perspectives.

## Conceptual Framework

Becher and Trowler's study of academic culture provides an excellent account of the manner in which academic disciplines are created, erect boundaries, set parameters, and essentially self regulate. These disciplines socialize members into their own "disciplinary communities" (Becher and Trowler, 1989) to form the basis of their own "cultural frames" (Geertz, 1983) for viewing the natural and/or social world, for defining standards of practices, and outlining acceptable and non-acceptable analytical frameworks through which to judge the quality of its scholarship. In the Academy, disciplines are structured as "departments." Departments have long been the fundamental organizing structure in the academy, for understandable reasons. They respond to the human desire to rationalize and organize intellectual inquiry, and provide a commonality of experience and focus for this work. Academic disciplines, thus, are reified within higher education bureaucracies through the departmental structure. Academic disciplines are also shaped through disciplinary associations, conferences, and peer reviewed journals. All of these factors form the basis on which faculty develop their discipline-specific identities and research agendas.

According to William D. Schaefer, professor of English and former executive vice chancellor at UCLA, "Departments have a life of their own. [They are] insular, defensive, self-governing, (and) com-

pelled to protect their interests because the faculty positions as well as the courses that justify funding those positions are located therein" (Barr and Tagg, 1995, p. 19).

The constraints of disciplinary knowledge are well known. Specialization, in any form, tends to reduce problems into parts, leading to gross reductionism in the worst cases. Disciplinary specialization may lead scholars to view all problems through that particular disciplinary lens, failing to take into account the frequently inherent multi, inter or transdisciplinary nature of the problem. In these cases, the old edict holds true: "To every hammer, every problem is a nail." When problems call for the synthesis of different social, natural and physical sciences, the complexities that arise out of such inquiries can lead to frustrations, confusion, or assertions from academics that such questions fall outside the purview of their expertise.

In the early 1990's Ernest Boyer called upon the Academy to reconsider how it approaches, views and rewards scholarship. He noted the evolving nature of the Academy; how it is being called upon to not only discover new knowledge, but to apply and integrate it as well. In essence, he critiqued the tendencies toward compartmentalization that the traditional disciplinary department structure tends to foster (Boyer, 1996). Such compartmentalization creates serious challenges for those looking to apply and integrate knowledge.

The notion that the Academy has a role to play in the application of knowledge has long standing roots in the land grant legislation passed during the latter part of the 19th Century. It is not a coincidence that Justin Morrill's legislation was justified in terms of making higher education more relevant and accessible to more citizens. The land grant mission, first common to only the identified public universities, has now become a core standard in many higher education institutions' mission statements. Although some academics such as Stanley Fish (1995; 2004) believe in the need for a "firewall" between academia and society at large, the role of higher education has nonetheless been firmly rooted in the development of informed citizens. Higher education is now viewed as having a civic mission that calls for the institutions to not only educate citizens, but partner with industry, government, and non-governmental organizations to address pressing social, cultural, environmental, and economic needs. It is with this confirmation of higher education's active involvement in a wider system or environment that the contemporary discussions of multi, inter and transdisciplinarity have emerged.

## A Disciplinary Continuum

Although the terms "multidisciplinary," "interdisciplinary," and "transdisciplinary" are often used interchangeably, each of these terms implies a different and subtle, but important, blending of disciplinary knowledge. This blending can be viewed

in terms of a continuum that runs from a maintenance of disciplinary frames, standards and identities on one end, to the submersion or dissolution of disciplinary frames, standards and identities on the other. Drawing on definitions found in the literature, we suggest that multidisciplinary is associated with the former and transdisciplinarity with the latter, with interdisciplinarity situated somewhere in the middle.

Multidisciplinary refers to the existence of different disciplines addressing a particular subject from the perspective or frame of that discipline. One can inform and be informed by other disciplines, but disciplinary identity and integrity is maintained. Multidisciplinary refers to a collection of people from different fields, working in a parallel fashion on an issue (Wickson et al., 2006). Multidisciplinary projects or research, "... is thematically oriented... [in which] several research programs are only contributing to a given theme from a clearly disciplinary perspective" (Balsiger, 2004, p. 412). In multidisciplinary initiatives, disciplinary autonomy is retained (Wickson, et al., 2006).

In contrast, interdisciplinarity is defined by the National Academy of Sciences as "A mode of [inquiry] by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice" (National Academy of Sciences, 2004, p. 39). Klein and Newell define interdisciplinarity as "a process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession" (1997, p. 2). We often find interdisciplinarity associated with problem-solving or problem-focused research. This association dates back to the 1940's, when the notion of interdisciplinary problem-focused research was used to address pressing needs in the agricultural and defense-related fields (Klein, 2004, p.4).

Today, we find interdisciplinary inquiry in the Land Grant system in areas such as community development, public policy studies, and environmental studies. A variety of traditional academic disciplines thus rely on, or make contributions to, the evolution of interdisciplinary studies. All of these interdisciplinary areas emerge in response to a perceived need, be it to, create and implement effective public policies, to ensure that diverse perspectives and frameworks get applied to the study of social phenomena, or because of changes in organizations. In these cases, "one discipline needs the other, or brings new insights to the other" (Francois, 2006, p. 618).

The recent development of the transdisciplinarity concept represents a step beyond both multidisciplinary and interdisciplinarity. "...

[Transdisciplinary] researchers go beyond a linear application of a static methodology and aims for an evolving, dynamic, or responsive methodology that is iterative and an ongoing part of the research process" (Wickson et al., 2006, p. 1,051). Transdisciplinary scholarship is pursued with less concern for the sanctity of disciplinary knowledge, compared to inter or multidisciplinary. By loosening the reins on disciplinary thinking, transdisciplinary approaches may be viewed, in Nicolescu's words, as "... the science and art of discovering ridges between different areas of knowledge and different beings" (Klein, 2004; qtd. in Wickson et al., 2006, p. 1053). In essence, transdisciplinary approaches seek to fill the gaps that exist between disciplines that have yet to be filled by and through interdisciplinary inquiry.

Transdisciplinary scholars view the process of identifying these gaps as an iterative one that often implies entering into partnerships outside the Academy. The lines between the Academy and the "real world" are understood as being necessarily permeable. It is through the Academy's constructive interaction with its external environment that new needs, problems and gaps emerge. Transdisciplinary initiatives must maintain some form of relevance to the external actors of this environment. Transdisciplinarity may be understood, metaphorically, as a process of composting that leads to the creation of fertile soil in which new knowledge and applications may be cultivated.

### Case Study

The Community Development and Applied Economics (CDAE) departmental mission statement reads, "CDAE supports sustainable local and international communities through interdisciplinary research, education, and outreach that serve the public interest." Community development is an inherently interdisciplinary field. The department's commitment to pursuing themes that address problems associated with community development is woven through its teaching and scholarship. CDAE has three undergraduate majors – Community International Development, Community Entrepreneurship, and Public Communication – and graduate degrees in Community Development and Applied Economics and Public Administration. All are interdisciplinary in nature.

CDAE faculty represent many academic disciplines, including neoclassical and ecological economics, rural sociology, communication, political science, international affairs, public administration, graphic arts, small business and entrepreneurship, and adult education. Some CDAE faculty maintains their identities as members of their "home" discipline. They may publish in disciplinary journals, attend disciplinary conferences and/or continue to play roles in their home departments. However, all CDAE faculty focus in their teaching and research on themes that require more than their one discipline to

adequately address. In addition, CDAE undergraduate students take core courses rooted in these academic disciplines, but learn to apply an interdisciplinary lens to themes that cut across all of the courses.

The department also maintains a commitment to transdisciplinarity with the variety of service-learning and applied research projects undertaken by faculty and students. Ongoing projects include technological assistance for small-scale sugar producers in Honduras, a market analysis of Vermont's organic food industry, evaluating the economic impact of the non-profit sector on the Vermont economy, and coordinating the Burlington Winter Festival. The department maintains an association with the Center for Rural Studies and the Extension System, which link the department to external partners. It is through such undertakings that new knowledge is created, integrated and applied. This process is rooted in the notion of sustainability, a concept that serves as the, "underpinning [of] a growing demand for research that takes into account... complex contexts and interactions between natural and social systems" (Wickson et al., 2006, p. 1047).

Figure 1 provides a cone shaped illustration of how CDAE views its multi, inter and transdisciplinary identity.

At the base of the cone are Multidisciplinary Core Courses—drawing from the range of disciplinary

backgrounds of CDAE faculty and providing a strong liberal arts background for students. Applied learning is more directed and dependent at the base level. Students are provided with disciplinary knowledge and frameworks and are guided by faculty in the introduction of how these frameworks may be applied to problem solving.

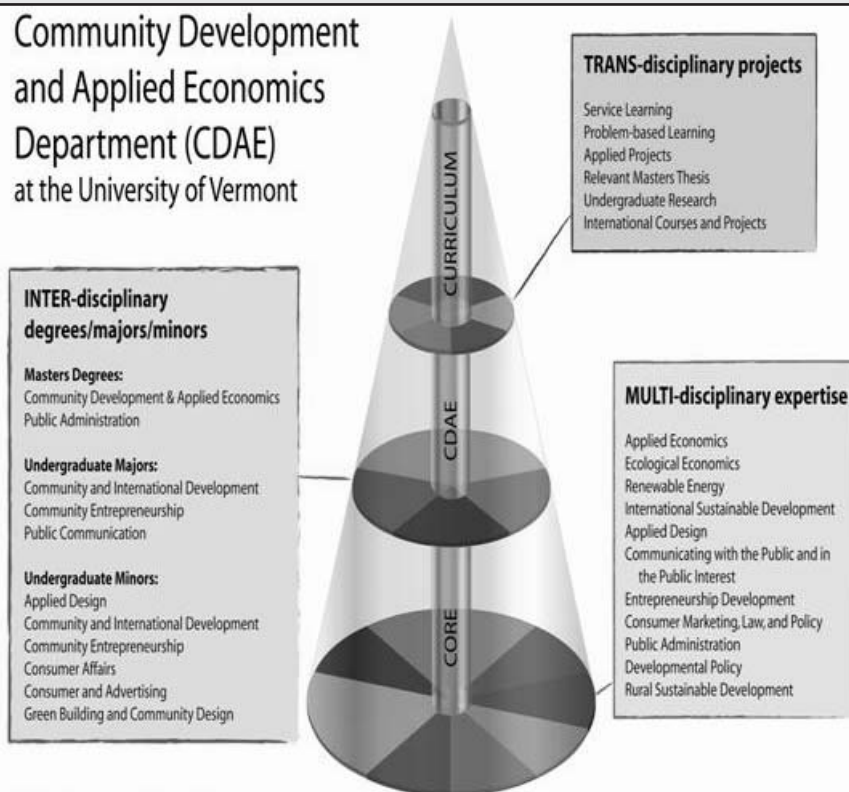
In the middle layer of the Cone are our Interdisciplinary Majors and Graduate Degrees: Community International Development, Community Entrepreneurship, Public Communication, Community Development and Applied Economics, Public Administration. All of these majors and graduate degrees may be understood as applied degrees, in that graduates from these areas will enter into occupations in the private, public and non-profit sectors with skills, attitudes and knowledge that have been shaped by disciplinary, multi, inter and transdisciplinary frameworks. These majors and degrees are offered under the assumption that, "... the art of being a professional is becoming the art of managing complexity" (Klein, 2004, p. 4).

At the tip of Cone are Transdisciplinary Projects, which include service-learning, problem-based learning, applied projects, relevant master's thesis, undergraduate research, international courses and projects. The top level of service learning or program activity represents the achievement of interdependent activity. Students, faculty, and community partners work to achieve synergy. After achieving this level, students are ready to take on transdisciplinary endeavors with less guidance from faculty and faculty embrace a problem solving approach to research.

### Moving Up the Cone

The path taken by CDAE and its earlier iterations has not been linear, nor without pitfalls. CDAE was merged from three departments in the College of Agriculture and Life Sciences (CALS) in 1994: Agricultural and Resource Economics (ARE), Merchandising, Consumer Studies and Design (MCS), and Vocational Education and Technology (VET). All three departments had a long history in the college and offered a wide range of programs. For example, ARE offered one major in agricultural economics with five concentrations in small business

**Figure 1. Community Development and Applied Economics Curriculum Illustration**



management, food marketing and agribusiness, farm business management, international agriculture, and the rural economy. MCSD had three majors in merchandising, consumer studies, and design and VET offered two majors in occupational and extension education and home economics education. When the three departments merged into CDAE, all the programs in the three departments, except the home economics education major, were combined into one major, community development and applied economics, with three concentrations in consumer economics, international development and agricultural economics, and small business. The home economics education major became an interdisciplinary program in the college. This scenario is not unlike those at many Land Grant institutions across the U.S.

The merge to become one department was a decision by the college and university administration with very limited discussions at the department level. While faculty members moved into the same building, there was uncertainty about the future of some programs under the new structure. What program elements, and people associated with them, would “win” and become established? Conversely, which programs and people would “lose” and face loss of identity or even jobs? The faculty members' gut reaction was to hunker down and seek to reinforce whichever of the silos provided them with their primary source of self-identification. For the next ten years the department faced many challenges. Physically becoming a single department was the easy move. Integrating various disciplinary and department cultures, expectations, and finding common goals, by contrast, have been more long-term and on-going processes.

During those ten years, a chair came and went, several faculty members retired or found employment elsewhere, three majors were developed from a single departmental major, research productivity fell, and several new faculty members were hired (and some left prematurely). By the seventh year, the open question existed whether this “new” department could even survive, let alone thrive.

The first attempt to instill new leadership was through the hiring of a department chair from another university. The decision to hire an outsider was made in the belief that it would be useful at a time of change to bring in a fresh voice and perspective. But the idea of transdisciplinarity was not yet an explicit or common goal among faculty in the newly configured department. And the highly directive leadership style of the newly hired chair proved not to foster the participatory ethic necessary for faculty to understand the purpose and benefit of collaborating with colleagues representing other disciplines. This impeded the ability of the department to reach out across disciplinary lines and eventually warranted the choice of a different style of leadership.

To give the department a window of opportunity to regroup, the Dean of the College appointed an interim chair from within the College. This was risky,

as the individual could have been perceived as a partisan bringing to the position a pre-existing agenda, but this scenario did not play out. The chair understood how to relate to and work within the larger university context. She understood the context in which the department was seeking to construct its identity and its resultant needs. This chair also had a healthy respect for the disciplinary “homes” of faculty in the department and allowed them the opportunity to flourish in both their disciplines and the department.

There were a number of changes and realignments that occurred to facilitate the transition from a traditional disciplinary-oriented department into one that is transdisciplinary. As often occurs during times of change, not everyone was comfortable with what began to transpire. Some faculty, for example, preferred to stay within traditional disciplinary environment. One did not make the original move to the department and, instead, joined another department in another College on campus. Others retired or gained positions at other universities in traditional departments. The remaining faculty were much more open to developing a shared identity and committed to working together in a transdisciplinary manner.

The new chair was selected out of the existing faculty that had been merged. She gradually won over the remaining faculty through her strong leadership, charisma, and commitment to unifying the department. She encouraged faculty to begin teaching, researching, and publishing together. In addition, she also forged new ties with the College leadership, gaining support, recognition, and, ultimately, new resources.

Reflecting its “Applied” emphasis, the department began to focus on incorporating project- and service-based learning into the academic curriculum. These initiatives were both locally-based and in developing countries, especially in Central America and the Caribbean. This created a dynamic in which department faculty worked toward a common goal which transcended disciplinary divisions. Faculty found that a common focus on solving a problem proved to be stimulating and motivating. It brought them together in a collaborative and positive-sum fashion. To cite just one example, one department member developed an academic course that combined with fieldwork to address the challenges of development in the Caribbean island of St. Lucia. Combining his expertise in consumer issues with another faculty member's focus on energy conservation, they developed a segment of the course relating to the distribution of compact fluorescent light bulbs which resulted in both academic and applied developmental value-added.

In 2002, the MPA Program, an interdisciplinary graduate program, was transferred from the College of Arts and Science Political Science Department to CDAE. This decision was made by the University Provost who recognized the growth and potential of CDAE. On a national scale, there are very few MPA

programs attached to a College of Agriculture and Life Sciences, indicating the uniqueness of CDAE in a Land Grant University. Since 2002 the MPA program has enjoyed a renaissance, with a stable administrative leadership and infusion of new resources ultimately leading to an increase in the number of students and cooperative faculty members.

A new, mutually productive atmosphere began to permeate the department. In-fighting and uncertainty about the future diminished. Scholarly publications have increased, as has externally-generated research funding. New synergies created by the existence of the department resulted in the establishment of an additional major in Public Communication. This, plus a reenergized marketing effort, contributed to a significantly increased undergraduate enrollment in department majors. A revised, and in some cases, new curriculum was developed. Reflecting the energy and positive dynamic created by these changes, a logo was created and a t-shirt was developed and widely distributed bearing the department's logo and its challenging motto of "How will you change the world?" The department began to receive positive reviews, both from within the university and externally. For example, a recent external evaluation report on department performance done by the USDA Cooperative State Research, Education, and Extension Service cited the following positive attributes:

Faculty who consistently strive to further revise and refine their courses;

Receptivity and an impressive level of adoption of information technology strategies in support of teaching and service learning activities; high quality advising on the part of faculty and staff; a strong commitment

Figure 2.

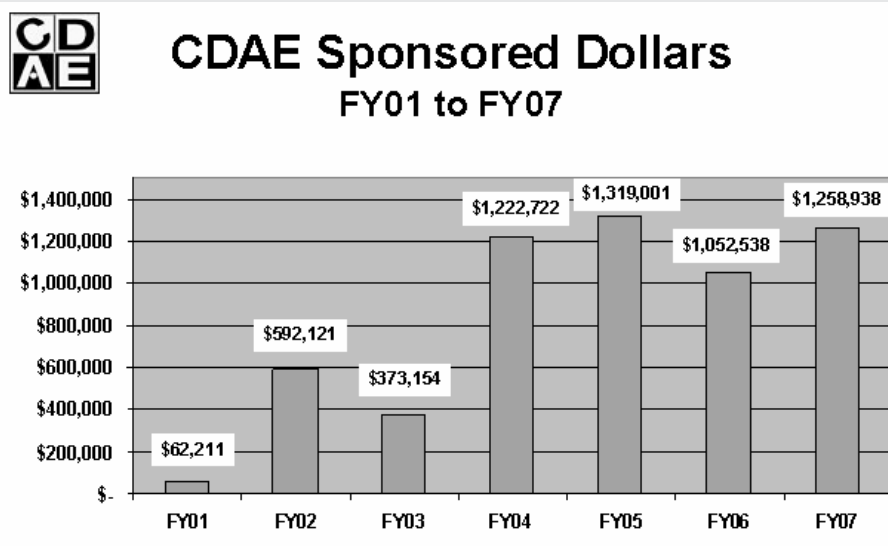


Figure 3.

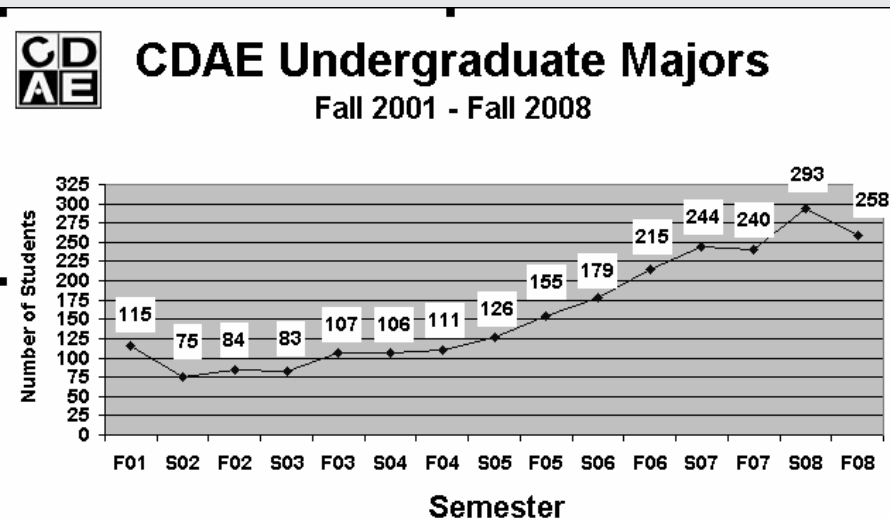
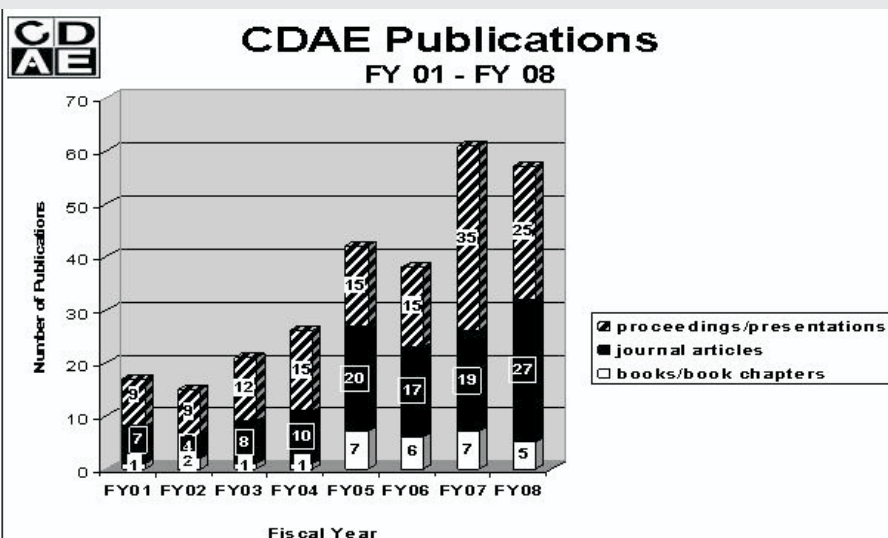


Figure 4.



## Moving toward

to incorporating service learning and field experiences; a conscientious effort to build on the multidisciplinary nature of the department; openness to innovation in the recruitment of new majors; and a “can do” attitude on the part of the faculty and staff in terms of their willingness to tackle the challenges faced by a department of this nature. Figures 2-4 demonstrate graphical illustrations of these trends.

Finally, due in part to the new chair's positive relationship with the College administration, new tenure-track positions were opened within the department. Its transdisciplinary focus was put in writing in every job description and all candidates were reviewed with this as a major consideration. As a result, the recently hired department faculty have been prime examples and supporters of the transdisciplinary nature of the department.

The department now offers three undergraduate majors – community and international development, community entrepreneurship and public communication – and two graduate programs – a master of public administration (MPA) and a master of science in community development and applied economics. All of these are grounded in a transdisciplinary approach and most include service-learning in their curricula.

The community entrepreneurship program combines transdisciplinary theories, methods, and tools in preparation for starting and managing sustainable and ethical, community-based enterprises with service learning opportunities related to owning and operating a community-based enterprise. It evolved from an Agricultural Economics major available at many Land Grant institutions.

The community and international development program focuses on the transdisciplinary theories, methods, and tools that support sustainable and ethical community development and integrates applied economic, ecological, and policy principles in advancing sustainable community development. It evolved from both majors in International Agricultural Development, Consumer Studies and applied Rural Sociology.

The public communication program is the newest major and grew out of the increasing demand for an existing advertising minor that focused on consumer well-being and the tradition at many Land Grant institutions to house majors based on Extension education and communication. This program emphasizes the importance of communication for the public interest.

The department is still evolving and, given the dynamic nature of current global problems, will continue to do so. Clearly, considerable challenges remain. These include developing an appropriate incentive and rewards structure, in a broader organizational context which remains largely structured along disciplinary lines. Relatedly, careful attention must be paid to ensuring rigorous and appropriate peer review, especially in the RPT

process, given the range of perspectives, backgrounds and disciplines of origin of different department faculty members. This is a challenge because the process remains largely entrenched in disciplinary silos, as does the government research funding structure. It is, however, possible to assess performance without fully deferring to the criteria of traditional disciplines and without watering down the quality of the process. For example, a wider net for referees can be cast. Fortunately, an increasing number of refereed publications are welcoming transdisciplinary submissions and other, newer venues for submitting output like web-based publications are coming on line. Also, it is extremely important that the Chair select reviewers who understand transdisciplinarity.

Creating a solid constituency of support among university administrators and other stakeholders on campus continues to be a work in progress. Other, more traditional departments, which perhaps do not fully understand CDAE's mandate, do not always appreciate substantive areas of overlapping focus, and may view the department as a “competitor,” especially in a period of limited resources. These tasks, however, have become more manageable as the department's track record has become more established.

## Lessons Learned

This journey to the present provides some lessons learned that may be helpful to other departments that are evolving in a transdisciplinary direction. Perhaps the biggest lesson learned is that collaborating across disciplinary lines is not easy. However, we are firm believers in the notion that, “collaboration provides a type of ‘reality check’ for research processes and outcomes” (Wickson, et al., 2006, p. 1051). Our effort to fuse disciplinary, multi, inter and transdisciplinary knowledge and process is unfolding amidst a broader landscape. As higher education institutions become more cognizant of their roles within wider and increasingly complex systems, the question of how to structure the academy to support the multiple kinds of scholarship mentioned here becomes increasingly crucial.

Kezar, in her work in the area of higher education reform, asks “How can colleges and universities move from bureaucratic structures and siloed disciplinary units to an organizational context that supports collaboration?” (Kezar, 2005, p. 52). She suggests that higher education institutions need to consider how best they can build capacity to support greater collaboration between disciplines and among academics, students and external partners. She also suggests that attention should be given to institutional mission, the role of the institution within wider networks, the importance of “integrating structure” (such as support centers and computer systems), the role of rewards and incentive structures, organizational learning, and how to deal with the sense of

priority from people in senior position (Kezar, 2005).

The following three simple lessons distill what we have learned from this experience:

Adopt a participatory management style. This type of fundamental paradigm shift from traditional disciplinary silos to an integrated transdisciplinary department cannot be accomplished in a closed, authoritarian, top-down fashion. To move towards collaboration, it is vital to have open, collaborative leadership. Faculty must “buy into” the process or it will be doomed to failure. Their participation should be solicited at each stage of the process, and they should have the freedom to pursue their personal and professional interests, even if they are not always transdisciplinary in nature. Transparency of decision making helps a department move forward. People collaborate best when they aren't forced to do so. Over time, most, if not all, will make a contribution in a collaborative fashion.

Recognize that there may well be opposition and that some individuals and other departments will feel threatened by this change. Faculty will be concerned about their status in a department changing its approach, and likely worry that their research focus will not be appreciated. It is important to acknowledge and manage these concerns, for example, by emphasizing that the goal of this process is not for individuals to lose their disciplinary identities but to work together across disciplines to create positive-sum results.

Similarly, other outside departments may feel threatened. In going transdisciplinary, one will inevitably meet resistance from traditional silos. For example, CDAE encountered sustained resistance from the Business school, which “blacklisted” i.e. did not recognize certain CDAE courses they perceived as competing with existing Business School courses.

This type of push-back should be expected in the early going. It takes time for initial suspicions to be overcome. Our experience, however, suggests that it is possible to co-exist and that over time, other, recalcitrant departments will be willing to see the value-added benefits resulting from the existence of a transdisciplinary department, especially in terms of providing alternative perspectives on issues of their own disciplinary interest.

The attitude of the central administration must also be considered. Its perspective may run the gamut from total opposition to enthusiastic support. In the current highly competitive environment for undergraduate enrollment, however, the existence of what should prove to be a cutting-edge and trend-setting department can be of considerable value to the university as a whole.

Be patient. This paradigm change is not easy and does not happen quickly. It has taken 15 years to arrive at a place where CDAE is now able to assert that seeds have been firmly planted, and it is ready to grow further into the transdisciplinary future. Curriculum and majors have changed three times.

Faculty and staff went through phases of trying to please everyone, pleasing no one, sitting on the fence, and finally, standing tall and appreciating all that has been achieved.

In summary, the transaction costs that leaders of transdisciplinary departments face are high and require considerable effort and resources be invested in the building up of social capital that bridges different disciplinary actors. The successful leader must take time and care to balance engagement with other campus actors against the goal of maintaining and strengthening the department's unique identity. Within the department, the leader cannot assume that faculty and staff understand each other's perspective. While fluency is not required, s/he must have at least a working knowledge of the language of different disciplines. In reorienting toward transdisciplinary concerns, it is likely that incentive structures for doing so will be limited and it will probably be difficult to generate a consensus across campus that transdisciplinarity is a worthy initiative. Continuing support and trust are a prerequisite for success.

## Conclusion

It is not by accident that the College of Agriculture and Life Sciences is the locale for this transdisciplinary endeavor. The capstone feature of this approach is the type of interdependent activity that is closely linked to the applied character of a land-grant institution. In its broadest sense, we are all “extension” workers, connecting people with information.

Reading this article, one may get the impression that the authors believe that basic research or the knowledge creation undertaken in much of the activities of traditional departments is not useful or needed in today's world. Nothing could be further from the truth, as obviously much of it still is. Its fruits can be fed into the multi-, inter- and trans-disciplinary work that is increasingly becoming a key future direction of the academy's evolution. The experience of CDAE at UVM is one example of this trend, which can help ensure that higher education in the United States retains its and path-breaking role in the world.

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