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## A Cost Benefit Analysis from Instructor, Community Partner, and Student Perspectives: Cabrini College CBR Courses Merge Service, Education, and Research

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# A Cost Benefit Analysis from Instructor, Community Partner, and Student Perspectives: Cabrini College CBR Courses Merge Service, Education, and Research

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## Abstract

Two community-based research (CBR) courses—Watershed Citizenship and Watershed Ecology—were piloted at Cabrini College in southeastern Pennsylvania. The courses connected service, education, and research using a local Pennsylvania stream, Crabby Creek, as the focal point, while working with several community partners. Course feedback using a qualitative student focus group regarding attitudes about environmental awareness, interdisciplinary thinking, and community-based, undergraduate research experiences showed that students gained a better understanding of how different disciplines can collaborate to address a problem in an integrative manner. Students also valued the faculty interdisciplinary team-teaching approach of the courses. We offer a model for designing and conducting an interdisciplinary team-taught CBR course employing instructors with different disciplinary backgrounds and areas of expertise. In this paper we present a case study in which we discuss the benefits and costs of these types of courses offered through the eyes of course instructors, community partners, and students and emphasize lessons learned that should prove helpful for others considering developing similar courses.

## Literature Review

In order to share our experience and insights with prospective participants in interdisciplinary CBR projects, we present a case study of two interdisciplinary CBR courses. CBR offers a compelling opportunity for faculty to integrate the research, teaching, and service activities both expected and valued in college and university settings. They also offer faculty a chance to use and transmit professional research skills and scholarly knowledge into projects that directly benefit community partners and whose impact is immediate and relevant (Reardon, 1998; Chapdelaine & Chapman, 1999; Strand, Marullo, Cutforth, Stoeker, & Donohue, 2003; Council on Undergraduate Research, 2004; Hofman & Rosing, 2007). CBR may help instill an attitude or disposition toward engaged citizenship in the next generation of students. Furthermore, because it emphasizes the elements of rigorous research sometimes missing from the direct service model of traditional service-learning, this practice has a level of credibility important for faculty promotion and tenure in many disciplines (see Faculty for the Engaged Campus at <http://www.ccpb.info/>; Ward, 2002). Finally, CBR, undertaken with care and attention, can complement more traditional research agendas by using a partnership approach of mutuality and reciprocity to foreground social change initiatives addressing community-based problems (Reardon, 1998; Stocking & Cutforth, 2006). It does so, moreover, through the application

of skills and extension of knowledge while helping to build capacity among diverse stakeholders (Chapdelaine & Chapman, 1999; Sunderland, Catalano, Kendall, McAuliffe, & Chenoweth, 2011).

By its very nature, CBR is interdisciplinary, since it can necessitate research methods in several disciplinary fields based on issues raised by community partners (Strand et al., 2003). One of the primary benefits of interdisciplinary, problem-based pedagogy is its ability to help students make profound connections within and across multiple fields and modes of inquiry, while requiring them to develop their knowledge in active, engaged, and contributory ways (Sternberg, 2008; Watterson et al., 2011). Scholars have noted that such approaches accentuate meaningful community-based learning experiences for students (Furco, 2002). Berkes (2004), for example, describes the potential power of interdisciplinary CBR for understanding environmental issues. He highlights the importance of joint undertakings for civic engagement—in this case conjoining natural sciences and social sciences. His findings reveal the interplay of science and local knowledge in enhancing the understanding of multiple parties, offering a particularly useful backdrop for examining students' experiences of integrating research approaches from both the social and natural sciences in addressing environmental problems.

Such benefits notwithstanding, Strand et al. (2003) describe four major pedagogical challenges

inherent in teaching CBR courses. These include finding a disciplinary connection, building CBR into the curriculum, ensuring student readiness for the complex tasks required of CBR, and structuring the experience for students. As indicated by Willis, Peresie, Waldref, & Stockmann (2003), even an enthusiastic student may have difficulty with a CBR project if the student is not skilled in the research method being employed to carry out the project. Stocking and Cutforth (2006) use as a case study two CBR courses to provide a framework for how to overcome some of the pedagogical challenges inherent in teaching these types of courses. They further point out additional factors important for the success of CBR courses. One of these factors includes institutional support, whether in the form of grants and instructor course release and/or a dedicated office of service learning that can ably assist with CBR projects. Another factor for success includes the dissemination of research findings to the community partner and, if acceptable, the broader public. Done well, both the community partners and students benefit in many ways, including students' gaining valuable skills useful not only for future employers but in their role as citizens as well.

Co-teaching interdisciplinary CBR courses has a number of advantages from a faculty perspective. The fact that course instructors co-teach interdisciplinary courses requires constant communication as to course logistics of student work, lesson plans, and research methods. As well, since interdisciplinary teams of faculty must construct course design and craft syllabi together, team-taught courses allow for a more deliberate and robust integration of different disciplines and research methods (Davis, 1995; Wenger & Hornyak, 1999; Sandholtz, 2000). Team teaching interdisciplinary courses can also provide a means of focusing more on the process of learning instead of only on accumulating content knowledge (Shibley, 2006). However, team teaching is resource intensive from an administration level and takes more time and effort than teaching alone (George & Davis, 2000; Sorensen & Wittmer, 1996). On top of this, co-instructors must negotiate with one another which disciplinary-specific research methods should be included and integrated in such ways to make the course truly interdisciplinary (Klein, 2010). Thus, team-taught interdisciplinary CBR courses require a high and consistent level of commitment from all those involved in its implementation.

Our current study builds upon this emerging

body of work and sheds light on the rewards and challenges of team-taught intentional interdisciplinary CBR courses from three perspectives: the instructor, community partner, and student. Our case study of two team-taught interdisciplinary CBR courses consists of three sections. The first describes the intentional design and implementation of two team-taught interdisciplinary CBR courses, Watershed Citizenship and Watershed Ecology. The second section outlines the benefits and costs of these types of courses as viewed through the eyes of faculty, community partners, and students. The third section details lessons learned by team teaching interdisciplinary CBR courses that should provide guidance for others attempting to teach these types of CBR courses.

## **Background**

### *Designing and Implementation of Interdisciplinary CBR Courses*

Six years ago, two faculty at Cabrini College, a biologist and a psychologist, began conducting CBR projects with the Valley Creek Restoration Partnership (VCRP). The VCRP is a coalition of several key stakeholder organizations united around the purpose of protecting and enhancing the Valley Creek watershed located in Southeastern Pennsylvania (Terlecki, Dunbar, Nielsen, Ratmansky, Watterson, McGauley, Hannum, Seidler, Bongiorno, Owens, Goodman, Marshall, Gill, Travers, & Jackson, 2010). The biologist, Dr. David Dunbar, worked with the VCRP and a few dedicated students performing preliminary stream studies on Crabby Creek, an important tributary to Valley Creek. The stream studies were important in establishing baseline stream quality measurements prior to major stream restoration work. Dunbar has formal training as a molecular biologist but has a personal interest in watershed stewardship that evolved from his passion for fly-fishing. Around the same time, the psychologist, Dr. Melissa Terlecki, became involved in developing a community attitude survey in consultation with the VCRP to gauge the community's awareness of the restoration work being done on Crabby Creek. Terlecki and a few of her dedicated students analyzed the survey results and reported them to members of the VCRP. This work quickly developed into an honors course, Environmental Psychology, co-taught by Dunbar and Terlecki. The course engaged students in research methods in both the social and natural sciences and included a large service-learning component that involved assisting the VCRP in

organizing and hosting a Crabby Creek Earth Day event. This event showcased the work of VCRP and served as a vehicle for establishing backyard ecology programs for several area homeowners by presenting best practices in management of storm water runoff. The course offered a minor CBR component by developing storm water management brochures distributed in key locations throughout Crabby Creek Park and students training local residents in water quality testing. Based on student feedback from the initial course, students valued the interdisciplinary nature of the course and stated that they gained value in learning different research methods. However, students also indicated that the course would be even more powerful if they were able to employ research methods learned in the course in more robust CBR projects in conjunction with the community partner.

Because of the success of our initial course offering and its incorporation of some CBR, we desired to offer more robust CBR classroom experiences for our students. This strategy fits well with our current curriculum emphasis at our institution in having more of our service-learning courses with a CBR component. Additionally, CBR has been demonstrated to be an important extension of more traditional service-learning models historically valued at our institution (Watterson et al., 2011; Stoecker, 1997). In addition to students valuing a CBR course taught by two instructors with different areas of expertise, both of the instructors felt that working together in a classroom setting allowed them to align CBR projects more closely with VCRP's desires; after all, the very nature of co-teaching required more dialogue both between instructors and with members of VCRP. Since both faculty felt somewhat out of their element conducting classroom-based CBR, especially since both were recent practitioners in the field of CBR, we began a dialogue with educators at Stroud Water Research Center (SWRC) about how best to develop interdisciplinary CBR courses incorporating watershed issues with VCRP. The staff at SWRC work in interdisciplinary research teams, blending their individual talents in watershed ecology and ecosystem modeling to study the physical, chemical, and biological processes of streams and rivers, the life histories of individual organisms, and the ecology of watersheds. Their expertise and input into this dialogue quickly led to the development of a NSF-funded grant to implement two related, interdisciplinary CBR courses. The two CBR courses that emerged, Watershed Citizenship

and Watershed Ecology, were designed to bring both social and natural science perspectives to environmental issues. Moreover, both courses were intentionally designed to employ a team-taught interdisciplinary approach using instructors with different disciplinary foci. For instance, the Watershed Citizenship course was co-taught with Dunbar, a molecular biologist by training, and Terlecki, a cognitive psychologist by training, and Dr. Susan Gill, director of education at the SWRC with expertise in environmental planning. The Watershed Ecology course was co-taught by Dunbar, who had previously mastered basic stream study methods, Dr. Caroline Nielsen, whose training primarily lies in terrestrial ecosystems, and Christina Medved, education programs manager at SWRC with expertise in aquatic biology, watershed education, and experience in working with citizen volunteers in stream monitoring groups.

The Watershed Citizenship course emphasizes community-based research as approached from a social science perspective in order to bring that perspective on specific environmental issues of importance to communities. This course thus provides valuable exposure and experience in undergraduate CBR by linking local water quality to land use, and, just as importantly, to the choices people make about managing their local environment. A major CBR component of this course entailed students constructing a community watershed survey in consultation with VCRP. With its focal point on the Valley Creek watershed, Watershed Citizenship complemented its companion Watershed Ecology course by foregrounding the human component: helping students and our community partner gain an appreciation of residents' perspectives on local watershed issues in order to develop strategic planning for implementation of watershed management practices in the local community.

In the Watershed Ecology course, students not only studied the natural systems that comprise the environment of streams, but also conducted water quality testing and research on Crabby Creek. To assess water quality, students collected water samples, identified the physical and chemical characteristics of the stream, as well as the aquatic macroinvertebrates. Additionally, in conjunction with SWRC, students participated in a larger effort to compile a genetic library of local aquatic fauna by DNA bar-coding. This project provided an exciting opportunity for non-science-major students to participate in groundbreaking national research.

Interdisciplinary both by design and in implementation, the two CBR courses drew on the strengths of the course co-instructors as well as the needs of VCRP. Course planning and implementation involved course instructors, educators from SWRC, and members of VCRP attending joint meetings describing course goals. VCRP members were likewise invited to attend the Cabrini courses throughout the semester, an arrangement that proved valuable in giving course instructors key feedback during the process of conducting the courses. In the Watershed Citizenship course, for example, the chair of VCRP and SWRC partners thought it would be a good idea for us to invite members of other watershed organizations to our class so that students could gain a better appreciation of other dedicated watershed groups and how their members' views might differ from their own. Gill's contacts with many regional watershed professionals allowed us to have a broad range of speakers address the class. This exposure, moreover, provided real-world examples of watershed management that added greatly to the students' understanding of what being a citizen of a watershed entails. Another example occurred during the Watershed Ecology course. Members from VCRP recommended additional stream sampling sites for Crabby Creek as a way to determine the health of the stream in areas outside of the restoration area. Indeed, the recommendation of additional stream sampling sites was later implemented in a future Watershed Ecology course.

## **Methods**

To further probe student course evaluations on administered surveys, we conducted focus group interviews with students co-enrolled in both Watershed Ecology and Watershed Citizenship courses. During the subsequent academic semester, a facilitator from Cabrini College's Center for Teaching & Learning conducted a small student focus group. The focus group lasted approximately one hour. Students' anonymous responses were audio-taped and transcribed by professional transcription services (students were referred to as "student #1", etc. during focus group audio-taping). The student focus group was semi-structured (Anfara, Brown, & Mangione, 2002) with the facilitator asking questions developed by the course instructors.

To analyze students' focus group responses, we used a directed content analysis of these qualitative data to identify recurring themes

(Hsieh & Shannon, 2005). Three of the authors coded themes that arose during the focus groups individually after which they compared results and then came to a coding consensus. Thus, we were able to organize focus group results according to specific themes based on the type of questions asked during focus group sessions. Five students participated in one focus group discussion three months after completing both the Watershed Ecology and Watershed Citizenship courses.

## **Findings**

### *Benefits and Costs of Team-Taught Interdisciplinary CBR Courses: A Course Instructor Perspective*

From a course instructor perspective, there are several benefits of team teaching interdisciplinary CBR courses. Course instructors are prompted and encouraged to move into new areas of research that sustain the community partnership by meeting their needs. In many instances, this type of innovation may not readily emerge without the catalyst of team teaching CBR courses. For example, Dunbar felt that the interdisciplinary, community planning perspective that Gill brought to the Watershed Citizenship course broadened his own understanding of the multidimensional aspects of community engagement. Another example of this serendipity emerged in the Watershed Ecology course when the community partners expressed a desire to understand the types of bacteria found in a local stream to see whether there was a sewer line break releasing raw sewage into the stream. Developing the Watershed Ecology course, we used one instructor's ecology expertise (Nielsen) and another's genetics expertise (Dunbar) to DNA barcode selected bacterial strains that students isolated in the stream. Another example arose in the Watershed Citizenship course. The first two renditions of Watershed Citizenship were co-taught by Terlecki, Dunbar, and Gill. One key aspect of that class was our desire to model collaborative, interdisciplinary problem solving. For the final exam in that course, Gill developed an individual scenario for each student that required her or him to forge a solution to a complex community issue. Students were given one week to complete their answers and were encouraged to brainstorm with their classmates. For the students, this model proved a new and challenging experience. The exciting result of this examination was that even students who had been passive during the class discussion were able to develop nuanced answers to complex questions. During the latest rendition of Watershed Citizenship, the course was co-

taught by the same biology professor along with a communications professor, Dr. Janice Xu. Having a communications professor co-teaching the course proved advantageous, for at this time VCRP desired to get a weekly pulse on the students' perspective of their involvement with the partnership. Xu decided to integrate weekly open access, online blogs where students commented on their interaction and work with VCRP. Based largely on these blogs, the community partner realized a need for video documentaries showcasing their efforts in the community to address storm water management practices. With the assistance of Xu, members of VCRP skilled in video production and a communications student previously enrolled in the course created video documentaries and are currently in the planning stage for airing on local television broadcasts.

It turned out to be advantageous to have the biology professor co-teach the Watershed Citizenship course since later departmental obligations with the psychology professor no longer allowed her to co-teach the course. The biology professor, from the onset, has served as the point person for the collaboration between Cabrini College and VCRP. Yet a third example of benefits is illustrated when the biology professor learned social science research methods from the psychology professor during the initial implementation of the Watershed Citizenship course. These same research methods were later used by the biology instructor in the Watershed Citizenship course when he co-taught with a communications professor; they collaborated in developing, implementing, and analyzing a community survey, a process that again evolved out of a need defined by VCRP as it had expanded its restoration work in a second nearby community and thus found it beneficial to conduct a similar survey.

From an instructor's viewpoint several powerful outcomes result from co-teaching interdisciplinary CBR courses including that these types of courses attract students from different majors and disciplines. This response was particularly true on our campus since Watershed Ecology satisfied a science requirement for non-science majors and Watershed Citizenship satisfied a core curriculum requirement in the form of a writing intensive course called Engagements in the Common Good (ECG). All students must take ECG courses at Cabrini College, a series of courses that, in the sophomore and junior level, typically embed some service-learning or CBR component. These combined factors made the Watershed Citizenship

course particularly well-suited for a team-taught CBR approach. As noted above, interdisciplinary CBR courses introduce many students, faculty, and community members to research methods outside of their primary discipline. Indeed, through feedback from student focus groups, we found that such exposure allowed students to make connections more easily to the importance of interdisciplinary research. One student, for example, was quoted as stating, "I feel like everyone in the classes, students and the faculty, was getting something out of the courses by each faculty member bringing their own unique perspective to it." Another student co-enrolled in both CBR courses indicated that, "Due to the interdisciplinary nature of the linked courses I learned a lot about CBR, DNA barcoding, macroinvertebrates, water regulations, stream conservation, and surveys, just to name a few of the topics covered in the two courses."

Most faculty come to our institution with little or no experience in CBR, so team teaching interdisciplinary CBR with another more experienced faculty member offers many advantages. For example, junior faculty inexperienced with CBR felt they were less risk averse when team teaching with a senior faculty experienced in CBR courses. Dunbar, as a tenured associate professor, had several years of experience working with VCRP before Nielsen came to Cabrini as an untenured assistant professor. With Dunbar's guidance during her second year as a faculty member in the science department, Nielsen co-taught Watershed Ecology.

Although there are notable benefits of co-teaching an interdisciplinary CBR course, there are costs associated with these types of courses from a faculty perspective. Several course instructors who co-taught the CBR courses share concern that they have not mastered all of the current research methods and techniques currently used in the courses, since many of these procedures are outside their area of immediate expertise. If a situation arises such that one of the courses can no longer be co-taught, it could be difficult for faculty to teach these courses on their own, without additional guidance. For example, in Watershed Ecology, many of the techniques used were developed by SWRC, and the two Cabrini faculty involved in the course still feel that they need some guidance for several of the techniques such as stream macroinvertebrate studies. Another related example comes from the Watershed Citizenship course. Although we successfully constructed and distributed a community attitude survey, we strongly leaned on the assistance of one student, a psychology major

who served as a teaching assistant and was skilled in SPSS software.

Another concern for faculty involves negotiating interpersonal matters. There may be the potential for hard feelings to arise among colleagues not involved in co-teaching CBR courses, a situation that could lead to promotion and tenure challenges, particularly for junior faculty. One large concern for faculty, of course, is how team teaching these types of courses will be weighed in tenure and promotion decisions, especially since interdisciplinary, team-taught courses are novel to our institution. Several faculty who are part of teaching these courses are apprehensive that fellow faculty may perceive them as doing less work or investing less time in team teaching the CBR courses, additional time spent in community-based endeavors notwithstanding. Several colleagues not involved with the CBR courses also expressed concern that it is not fair for faculty co-teaching courses to both receive full course credit in terms of course load. The accepted model for faculty co-teaching courses at our institution is for each instructor to receive ½ course credit. Finally, we found that dissonance takes a great deal of effort to manage, particularly if faculty have different teaching styles and expectations for the types of community-based projects connected to courses. In one of the two courses, two instructors had highly divergent teaching styles; hence, the constant tension between them was palpable to others involved in designing and teaching these collaborative courses.

#### *Benefits and Costs of Team-Taught Interdisciplinary CBR Courses: A Community Partner Perspective—the SWRC*

SWRC educators teach over 2,000 students, from grades 4 and up, annually. With a multidisciplinary approach in their watershed education programs, their hope is that participants will be motivated to become responsible stewards of freshwater resources. The inclusion of SWRC into the CBR courses complemented very well the work Cabrini College was trying to do and what SWRC has done for many years. SWRC has known for years that because watersheds have natural boundaries and are universal in nature, they are ideal models or themes around which science, education, conservation, and public policy can be discussed as all of those topics require an interdisciplinary approach. SWRC saw a benefit to working with Cabrini College in that it expanded their typical audience into the collegiate level, for

an entire semester at a time. While engaging the next generation of community members and homeowners, the SWRC educators felt it was important to teach them—as well as the students—about the importance of water bodies in their neighborhoods and how everyday decisions can impact a local stream and why those impacts matter. The partners also recognized that all instructors learned from each other, not only technical information, but also teaching strategies and classroom management techniques. While teaching the courses, instructors were likewise receiving professional development. It was creative and rewarding to utilize instructors' personal as well as professional interests in the development of the final student projects. For example, the SWRC educator co-teaching the Watershed Ecology class has a master's degree in communication and was able to provide feedback to students on their public speaking as well as poster presentation and layout to help the students prepare for their presentations to members of the VCRP partnership.

While working at a non-profit is extremely rewarding on many levels—indeed one of the perks is allowance for working on diverse projects—a challenge to all non-profits is being paid for time spent on projects: whether it is time spent teaching, traveling, or grading papers, and in addition, travel/mileage costs. Packing up gear every week rather than having it at hand in our own laboratory was time consuming, as was the travel to and from Cabrini College, on average a one-hour commute each way. With the type of programming provided at SWRC, the educators are usually not creating or grading homework. This was a great opportunity for them to practice such tasks as well as to receive feedback from co-teachers about rubrics in grading and appropriateness of questions and evaluation given the student audience.

#### *Benefits and Costs of Team-Taught Interdisciplinary CBR Courses: A Community Partner Perspective—the VCRP*

From the VCRP perspective, several benefits of team teaching CBR courses stand out. According to the chair of VCRP, Dr. Owen Owens, our interdisciplinary, co-taught CBR courses by definition expanded the intellectual capacity and technical wherewithal of the project. That is, the collaborative composition actually ensured that a range of diverse research methods could more easily be tailored to meet the community partnership's needs. Bear in mind that most community partners, in every community, are volunteers. Owens



indicates that without interdisciplinary teams of course instructors discussing an array of possible watershed projects, it would have been difficult if not impossible for many of their research goals to be carried out. One example Owens pointed out includes the collection and analysis of aquatic macroinvertebrates in a stretch of creek that was stabilized through a grant by VCRP. In his view, VCRP would like to use macroinvertebrate data for long-term assessment on whether the restoration on Crabby Creek contributes to stream health over time. The macroinvertebrate studies carried out with students in the Watershed Ecology course drew upon the knowledge of an educator from the SWRC partnership. Another highlight of such interdisciplinary problem solving includes the environmental and attitudinal surveys that were conducted by residents in the Crabby Creek and Wilson Run watersheds as part of the Watershed Citizenship course. The survey results indicate what level of support VCRP members are likely to have when undertaking a conservation project in the community in which the surveys were conducted. Without the Watershed Citizenship course initially being co-taught by a psychology professor, these surveys would not have been part of the course.

From the VCRP perspective another powerful element of co-teaching CBR courses centers on the constant dialogue between community partners and course instructors. According to one member of VCRP, the dialogue usually sharpens the issue or objectives of the projects undertaken by VCRP. For example, what VCRP learned is that when one instructor (Dunbar) became involved with the partnership, he became a lead or primary partner. VCRP's thought of partnering with Dunbar had initially trended along biological lines and how to address the issues surrounding water quality; this alliance emerged both because of this one faculty member having received a grant to research this topic and because of his academic status, subject knowledge, and experience. When Dunbar then started to involve other junior faculty in CBR, he then became a bridge between the VCRP and Cabrini College, taking the project beyond the preliminary issues of biology and water quality. In other words, Dunbar became both a partner and a facilitator. His work helped generate additional activity and outcomes for both Cabrini and VCRP beyond what he, acting alone, could have accomplished. This type of personnel investment at Cabrini College required a similar response within the partnership. Because the projects that came out of the classes were multi-disciplinary and multi-

faceted, they required experienced individuals (partnership members and course instructors alike) to become more involved in order to handle the volume and the scope of activities.

Such developments have other unintended but advantageous consequences, too. One such attribute is the exposure of students to outside professionals and volunteers from different disciplines who have experience in dealing with various watershed issues. As community members, the VCRP partners believe it important to help develop the knowledge and skills of students in the area of watershed management; even if those students do not take future residence in, or study, the local watershed, they will ultimately end up connected in some way to a watershed. The VCRP likewise gained exposure to a much wider audience for their goals and aspirations; at the most obvious level this exposure included relationships with the students enrolled specifically in the CBR courses; but the VCRP also gained added exposure from being on the campus of an institution of higher education with a voice in shaping engaged pedagogies.

Initially, the VCRP hesitated to describe any downsides or costs associated with our CBR courses, but when pressed, several members indicated that it did take some investment in time to get several of the faculty co-teaching the courses "up to speed" in understanding the VCRP's goals and aspirations. Another cost was the time and transportation required for meetings with Cabrini College faculty. However, VCRP members stressed the advantage of the experiential education format that the course instructors provided in the CBR courses, with the help of SWRC, which went far beyond the type of learning provided in a more standard college classroom. The VCRP also emphasized that student learning may be even more all-encompassing than the course instructors think, involving relationships, real life situations (actions and reactions), as well as the usual basic learning component such as what is a watershed or why macroinvertebrate studies are important in monitoring stream health. One example of a "real life situation" involves a student whose current activity level in social issues revolving around water issues came directly from her passion from working with VCRP in the Watershed Citizenship course. This student is currently an activist against natural gas drilling taking place in Pennsylvania.

*Benefits and Costs of Team-Taught Interdisciplinary CBR Courses: A Student Perspective*

From a student perspective, several benefits of team-taught interdisciplinary CBR courses deserve a closer look. For example, student focus group data indicate that these types of courses offer far more intensive faculty/student interactions than traditional courses offer. Additionally, there are sustained CBR learning opportunities outside the students' major fields, discussed later in this paper. Furthermore, seeing faculty willing to explore outside of their disciplinary comfort zones helped students themselves feel more comfortable engaging in research outside their own major. Although different teaching styles were a significant cost for two faculty who were co-teaching one of the two courses, the students consider this diversity a great benefit of the course. Student focus group work suggested that the course succeeded largely because of the faculty's distinctive styles of teaching. For instance, in the Watershed Citizenship course, one student indicated that "it was a cool concept to have instructors team teaching and then really approaching the same subject from two different standpoints." The same student went on to explain that "there was constant collaboration between the professors throughout the entire semester" and that "looking at topics from different standpoints enriched the class." Another student indicated for the same course that the experiential aspect of the course highlighted a different way of thinking, adding, "We just learned about how we can protect our environment by thinking about it differently." A third student indicated,

When you brought in the psychological aspect, it actually showed the cognitive dissonance you can have yourself. The knowledge and learning experience that I gained from having three different professors, each with their own unique style, really improved my understanding of the material.

Several students articulated the merits of a team-teaching approach in the Watershed Ecology course as well: "I feel like everyone in the class, students and the faculty, was getting something out of the courses, with each faculty member bringing their own unique perspective to it."

Another student stated,

I think it was really beneficial to have faculty together team teaching, especially

when we were doing the DNA bar coding experiments. If we didn't have Dr. Dunbar at that point, we would have actually been lost because even the other biology professor, Dr. Nielsen, had never done the DNA bar coding before, and she was learning with us.

Perhaps the most promising benefit of our CBR courses was that of student-acquired academic skills, particularly in the area of research methods, either within or outside of their major or disciplinary focus of their undergraduate studies. As defined by Lichtenstein, Thorne, Cutforth and Tombari (2011), "academic skills pertain to cognitive skills related to academic learning" (p. 12). In their study, the researchers indicate that many students involved in CBR projects increased their applied research method skills within the student's major area of undergraduate study. Our work using the team-taught CBR courses as a case study shows how several of our students continued their CBR projects working mostly independently and using research methods they had only recently mastered precisely because of their involvement in an interdisciplinary CBR course. For instance, one student, majoring in English, continued to work with Dunbar on DNA barcoding a native crayfish species that was recently discovered in the Valley Creek watershed. The student received science undergraduate research credits for his DNA barcoding project. The student was inspired to take on a crayfish DNA barcoding project as a result of listening to a presentation by the Valley Forge National Historical Park, a partner of VCRP, who discussed the need to acquire as much information on the native crayfish species as possible, for it is an endangered species thought to be important to the Valley Creek watershed ecosystem. This student felt confident he could take on this sophisticated project as an English major, since he had learned and mastered molecular genetics techniques in the Watershed Ecology course. Two additional students, both of whom are business majors, approached the science faculty about conducting additional water chemistry studies on Crabby Creek during a semester in which the Watershed Ecology course was not being taught. They have done so as part of one of their business course community-based service-learning projects with little guidance from science faculty other than lending them necessary equipment and materials they were accustomed to using as part of their CBR project in the Watershed Ecology course. Such yearly stream chemistry

data are critical for VCRP. The VCRP needs to determine the results of the restoration to deal with storm water runoff in a section of the creek. The two business students, on their own initiative, also recruited several other business students to assist Valley Forge National Historical Park to help remove an invasive crayfish population from the Valley Creek watershed one year after they had taken Watershed Ecology. Another student, a psychology major, decided to conduct research with Terlecki, examining in further detail the community attitude surveys that were developed, distributed to community members, and analyzed by the students in the Watershed Citizenship course. This student received research credits for her work in the psychology department and presented her findings not only to the VCRP but also at the Cabrini College annual Undergraduate Arts, Research and Scholarship Symposium. Recently, two students, a psychology/English double major and a business major, worked with each other to further analyze the results of a recent survey of a community in a section of Valley Creek located just outside the border of Valley Forge National Historical Park. The two students presented their work to the VCRP with little guidance from any of the course instructors. These students indicate that their CBR course experience, both learning research methods and interacting with the community partner in the Watershed Citizenship course, gave them the added comfort level to sustain their involvement in CBR with little instructor guidance.

In the three short years we offered these CBR courses, seven students continued CBR projects after their course experience and did their work with little guidance from faculty mentors, a true testament to their enhanced academic skills as a direct result of their interdisciplinary, co-taught CBR experience. This is the first reported example at Cabrini of several students willing to sustain CBR projects with faculty outside their disciplinary major. A recent study by Puma, Bennett, Cutforth, Tombari, and Stein (2009) has shown the same transitioning with graduate student CBR from classroom-based to projects that require a much greater degree of independence. Here we demonstrate a similar transition of undergraduate students from course-based CBR to projects that build upon their research skills to more independent CBR initiatives. We feel that students become more comfortable in conducting CBR outside of the majors by removing the mystique of CBR, in part by observing diverse faculty in the team-taught course challenging each other to work

outside their areas of expertise. As reported by the students and noted above, students thought it is a rewarding experience seeing faculty learn from other faculty in the courses.

After having a candid conversation with the faculty co-teaching the courses, a cost emerged; namely, the perceived inconsistencies in course expectations between the faculty. According to several students, the main inconsistency regarded assignment grades. Students indicated that faculty from different disciplines have different grading criteria that may be a reflection of a faculty's disciplinary training. Although faculty co-teaching the course made earnest attempts to "stay on the same page" by discussing grading criteria and sharing their grades on student assignments, the increased chances for miscommunication appears to be a real issue that can arise around these types of interdisciplinary, team-taught classes. Granted, such misperception could be symptomatic of "too many cooks in the kitchen." Yet, given the inherent uncertainty and surprises that regularly arise in many community-based projects that involve multiple partners, it is little surprise that there is heightened need for explicit and regular communication. One idea suggested by the student author of this paper, Jenna Cardone, is for course instructors to devise common grading rubrics for course assignments to ensure instructors are using the same grading criteria and meet more regularly in discussing rubric scoring differences as a way to alleviate this problem.

## Discussion

### *Lessons Learned of Team-Taught Interdisciplinary CBR Courses*

One of the most powerful outcomes of team-taught interdisciplinary CBR courses from a student perspective arises from seeing faculty learn research methods both from one another and alongside community members. Students indicate that working alongside faculty, themselves working outside their comfort zone, and learning with them took away much of their uncertainty about doing CBR and ultimately, for several of them, giving them the confidence to conduct research with faculty outside of the students' disciplinary focus. Team-taught interdisciplinary CBR courses are thus enriching to students in allowing them to see how different disciplines can work together, in this case on an environmental issue. Faculty participants found learning research methods and problem-solving epistemologies from colleagues in different disciplines to be enriching and providing insights

they likely would not have acquired without the intense team-teaching approach. Team teaching interdisciplinary CBR courses allows faculty to be creative in co-designing community-based projects in a mutually informative, reciprocal manner, often in conjunction with multiple community partners; such integrative projects may not have emerged in precisely that fashion without the input of so many constituents. Working closely, faculty are encouraged to think of CBR practices and protocols in ways they would not have had the courses not required constant communication about approaches to teaching and research. This powerful experience of interdisciplinary, team-taught, CBR courses demonstrates the potential for other institutions to have a similar impact on faculty and student participants, on the institution itself, and on community partners. This model of teaching replicates for students what happens in the real-world with everyday decisions whether it is at the community, state, or federal level or in a corporate boardroom.

Another powerful outcome is that course instructors are capable of moving into new areas of research that sustain the community partnership by meeting community partner needs. This responsiveness allows for greater flexibility for faculty to conduct research with a community partner based on that partner's wants and needs. All key stakeholders—faculty, students and community partners—were able to draw on each other's strengths and expertise. Such mutually beneficial interactions from collaboration serve as a stellar example of a synergistic effect in which the results are greater than the sum of the parts. Our institution thus saves time engaging with a partnership as an entity, while the partnership reaps the same benefits working with a college.

Ultimately, our work supports the model articulated by both Mulroy (2004) and Rosing and Hofman (2010) on using multiple CBR courses to institutionalize a CBR project. Our interdisciplinary CBR project has taken on a coordinated model, to use the typology articulated and defined by Mulroy (2004), a coordinated model brings together faculty members and students from different disciplines to work together toward serving the research interests of a community partner. The project initially started with two professors, a biology professor and a psychology professor, working with their students on separate CBR projects but with the same community partner. Both professors worked with one another and with key members of SWRC to integrate their CBR with one another

and developed the Watershed Citizenship course. As it evolved, another course emerged, Watershed Ecology, co-developed with the biology professor, a new ecology professor, and with assistance from educators at SWRC.

Interdisciplinary CBR courses such as the ones described here can be viewed instructively as consonant with a wider discussion on interdisciplinarity and integrative learning. In a public report issued by the Integrative Learning Project, a three-year collaboration of the Carnegie Foundation and the American Association of Colleges and Universities, those involved asserted that “fostering students’ abilities to integrate learning—over time, across courses, and between academic, personal, and community life—is one of the most important goals and challenges of higher education” (<http://www.units.muohio.edu/aisorg/>). Among the pedagogies that engage students more deeply and thus lead to integrative learning, the most prevalent and prominent are service-learning, problem-based learning, collaborative learning, and experiential learning such as interdisciplinary service-learning/CBR courses. All of these pedagogies of integration, and many more, share certain qualities and elements regardless of the level at which they are used. The Carnegie Foundation's findings are particularly pertinent, for they acknowledge the realities of a changing world in which disciplinary and curricular isolation are neither feasible nor desirable. In short, interdisciplinary, team-taught CBR courses help to blur the boundaries between areas of expertise, placing teachers, students, and community partners in new cognitive and affective arenas.

## **Conclusion**

Based on our experience, we have several suggestions addressing the challenges of team teaching CBR courses for those considering this powerful but intensive form of pedagogy at other institutions. We recognize institutional barriers to maintaining this high-intensity collaboration so we recommend a model that builds on the relationships that were previously cultivated with faculty and community partners, even if this involves taking baby steps in the initial process of course planning and implementation. Initially, we had two faculty working independently with a few of their students and the community partner. It took over a year of planning for these two faculty to develop and implement an interdisciplinary CBR course called Environmental Psychology. Additionally, we found that the main institutional barrier for faculty co-teaching CBR

courses is each of them receiving full course credit. Also, some faculty might enjoy co-teaching a CBR course but find it problematic because of time constraints and/or other course commitments.

One strategy that has worked well for us is to have a valued colleague(s) guest lecture or teach a research method to the class. Building a relationship with a valued colleague might lead to a co-teaching CBR course in the future as it has for us in one of our courses. For instance, since we are no longer funded by an NSF grant for our ongoing courses, key members of SWRC can no longer be as involved in our courses as they were during initial course implementation phase. However, SWRC educators are still actively involved in assisting and training faculty teaching the Watershed courses in research methods. SWRC educators also continue to be guest lecturers in our Watershed courses and we find this ongoing collaboration highly valuable to continue to train faculty in research methods outside their areas of expertise. We find it important that at least one faculty team member serve as the primary liaison between the faculty and community partner. This strategy releases some of the burden on additional faculty in attending community partner meetings, setting up meeting times, etc. However, even if one member serves as a primary liaison, we continue to find that it is critically important to maintain collaboration through regular communication among course instructors and the community partner, including occasional face-to-face meetings, even if one member serves as the primary liaison. This not only serves to ensure that all instructor ideas and input are valued but also to ensure that the community partner hears the voices of other instructors.

There were a few instances in which the ideas generated by the community partner and faculty liaison did not reflect the ideas of course co-instructors and created a degree of consternation since the ideas were already being implemented without others having adequate time for valued input.

However, community partner and faculty authors of this paper feel strongly that time invested in interdisciplinary CBR projects is time well spent and that the project took on added meaning with increased investment time with all project stakeholders. We have currently taken what we have learned (both cost and benefits), made adjustment to address the concerns and continue to offer these courses in a way that is sustainable at our campus. Additionally, we are in the process of replicating these courses at other schools of higher education in southeastern Pennsylvania.

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