

Using On-Campus Centers to Enhance Course Content

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UNC Asheville is an undergraduate, liberal arts institution with a strong research program. As is common in most colleges and universities, UNC Asheville houses centers that provide opportunities for student employment, faculty participation and staff career opportunities. They also provide rich and varied opportunities for student research. Often overlooked is the impact that both faculty participation in centers/programs and center management/staff can have on enhancing the academic classroom experience with timely, real-world issues, practices and problems. This contributes directly to the university mission of preparing students for productive careers. This paper provides examples of recent faculty-Center collaborations at UNC Asheville. These collaborations resulted in (a) creating course content through Center-defined projects, (b) enhanced student learning opportunities, and (c) progress made on Center projects. This paper can be used as a guide for recognizing Center projects that can lead to successful course enhancements.

UNC Asheville centers and programs highlighted in this report are: National Environmental Modeling and Analysis Center (NEMAC) [1], the North Carolina Center for Creative Retirement (NCCCR) [2], the Health and Wellness Program (HWP) [3] and the Environmental Quality Institute's Lead Poison Prevention Program (LPPP) [4]. NEMAC is an applied research oriented center focused on approaches to solving fundamental environmental challenges using multidisciplinary strategies; (it seeks to form diverse collaborations from the academic community, from government, and from private enterprise). As such, it is a prime source of interesting research ideas, student projects, guest speakers, and funding opportunities. The collaborations with this center are the major impetus for this paper. The other centers/programs, (i.e., with NCCCR, HWP and LPPP), are primarily service oriented (not research oriented). They too provide opportunities for student projects, examples of which are discussed in this paper.

The primary author teaches several courses in database, analysis and design, and programming languages. Thus it should come as no surprise to the reader that most projects highlighted in this paper involve planning, analysis, design and implementation of database projects.

Background

The premise of this paper is that the key to learning is the interaction of knowledge with experience and application (applied research). Projects help shift the emphasis from teaching to learn-

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ing and from individual learning to collaborative learning. Projects can offer concept reinforcement to open-ended, critical thinking academic learning, thus raising the quality and level of students' engagement and achievement as well as the ability to apply the course subject matter in contexts beyond the classroom. [5,6,7]

Projects in Computer Science courses can be used to enhance course content so that it remains current, relevant, fresh, and interesting. Every educator teaching these courses today faces these content challenges. And since the computer industry innovates rapidly, course content can become stale when not referencing and including real-world issues, practices and problems. I have found that using on-campus Centers is an effective way to identify, prepare, and include projects in Computer Science courses.

A project is an organized attack on an unorganized problem. A project "...consists of a temporary endeavor undertaken to create a product or service. ...Business and science projects involve a collaborative enterprise, frequently involving research or design that is carefully planned to achieve a particular aim".” (www.Wikipedia.org)

Benefits for students: Deepening comprehension of course content, strengthening the sense of social responsibility, integrating theory with practice, sharpening abilities to solve problems creatively.

Benefits for faculty: New opportunities to orient research, current awareness of problems faced by small to medium sized organizations, enriched course content.

Benefits to the Center: Deeper insight and awareness of the problem, documentation, prototype solution, collaboration with faculty who have an interest in the problem domain. Projects also have the potential to make unique contributions to addressing unmet needs.

Part 1 – Planning and Implementing a Project

Part 1 is a reflection on projects we have undertaken. Our focus here is on the factors that lead toward or away from success. We also address the roles of the center, the instructor, and the students in the project.

Lessons learned: Factors Favoring a Successful Project

Overall:

- The project should be integrated into the central concept/topic of the class.
- The project should support the Center to meet its needs.
- The project should be designed to be completed within a semester with achievable goals.
- The project experience itself does not ensure that significant learning or effective center support will occur.

The Center:

- Identifies a meaningful project suitable for inclusion in an undergraduate class.
- Provides a contact person/manager for the project.

- Provides funding.
- Controls the project definition and scope.
- Provides necessary documentation for understanding the project
- Obtains necessary permissions for use of Center resources (documentation, data, equipment, people, etc.).
- Coordinates with the instructor on expected outcomes.
- Participates in the conduct of the project as coordinated by the Instructor.
- Provides ongoing feedback to the Instructor during the project.
- Receives and evaluates the results of the project.
- Provides feedback to the Instructor at the end of the project.

Initial meetings between the Center and the Instructor are crucial for setting expectations of the result of the project. Student projects will typically not result in a production-ready system.

Worthwhile projects can also be initiated that involve other universities and non-profit organizations. (Projects involving for-profit organizations would entail a consulting agreement). Projects with outside organizations require more coordination and, although beneficial to the community, would not directly benefit your university.

The Instructor:

- Articulates clear project goals for the Center and the student participation.
- Expects active, sustained Center commitment.
- Insures that the project is necessary and important to the Center.
- Assures that the time commitment is appropriate to the learning goals.
- Coordinates project information flow between the Center and the students.
- Provides direction to the students in implementing the project.
- Provides for meaningful student reflection on the experience.
- Evaluates the impact of the project on the students' learning and on the Center

The instructor without sufficient project experience should undertake projects in a sequential, non-overlapping, fashion until a skill base is established and success factors are well understood. Projects tend to accumulate – they are easy to start and hard to terminate.

The Students:

In addition to the normal requirements expected of students (attendance, participation, problem solving ability, etc.), the following factors are emphasized during a project:

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- Works well in collaboration with other students.
- Asks questions to clarify unclear goals and concepts.
- Is able to work with “messy” assignments (i.e., ones not as neatly laid out as textbook exercises).

Upper level undergraduate students tend to be more project-ready than freshmen and sophomores.

Lessons learned: Factors Contributing to an Unsuccessful Project.

The following factors are identified:

- The project is too complicated for the student competency level.
- The project involves proprietary systems and data
- The project evolves rapidly from the initial understanding.

An early experience was with a Center that defined a project that was too complex for the time allowed and student level of sophistication. The student experience was not satisfactory since they felt that they did not complete the project while the Center had hoped for more. With more experience, we have learned to be more cautious about what can be delivered. The mistake in this case was in not recognizing that projects tend to get more complicated once they are underway.

Another experience was with a project that did not get past the planning stage. The reason it was abandoned was the several proprietary computer systems and customer data that the students would need to understand. The Center was not able/willing to invest in creating a non-confidential environment for the students to study.

Part 2. Examples of Recent Projects

Section 2 is the “ideas” part of the paper. Curriculum-enhancing projects can come from unexpected sources. You can use this section to stimulate your thinking on where your next project could come from.

Over the past year, we have partnered primarily with UNC Asheville Centers in an effort to infuse curriculum with real-world problems. Many of the Centers mentioned above operate as mini-business with more or less well defined business processes and multiple collections of data (manually maintained data collections, spreadsheets, and databases). The following sections outline several content-enhancing projects.

Examples of UNC Asheville Database Projects for Students.

Centers that maintain data in spreadsheets can be prime candidates for upgrading to a database. We found the following centers willing to work with students directly and with faculty to define class-based database projects.

Health and Wellness Program: This organization used spreadsheet to record companies, internships the companies offered. In addition, spreadsheet data tracked students who enrolled in courses representing an internship. This unwieldy situation was resolved by designing a small database system. Students designed and implemented the solution as part of a database course.

Lead Poison Prevention Program (LPPP): This program also used a spreadsheet to record lead levels at multiple sites within residences. The recorded data also included people (contacts, occupants, physicians, etc.). They now use a database designed by students in a projects course.

North Carolina Center for Creative Retirement (NCCCR): Although this center already had an Access database for volunteers, it was not being used since it was part of a complex larger system and did not handle all the requirements. A simple two-form design – one for volunteers and their skills, and one for the requests that needed specific skills – satisfied their needs.

These activities happened due to active faculty involvement in the UNC Asheville community, and the willingness of faculty to get involved, take risks, and create. The benefits from these projects were student involvement in design and implementation-beyond-textbook learning, faculty solidification of practical knowledge for future classes, and, for the Center, a useful database system. Without these centers and participation of their staff, these curriculum benefits would not have occurred.

Examples of Other Database Projects for Students.

Worthwhile projects can also involve other universities and non-profit organizations. These projects enhanced the course offering by providing the students (and instructor) a wider view of the community needs and engaging them in active involvement in the local community.

Student Registration Database: A-B Tech Basic Skills Department [8]. This project started as a two-week course project in a database class for juniors and seniors and evolved into a production system that is in-use today and completely replaces a paper-driven system. The result is higher quality (fewer errors and omissions) and less effort required.

Artists' Resource Database: Arts 2 People [9]: This project started as a course project in a database class for juniors and seniors. It involved developing a database for a local non-profit agency from a collection of resource information of use to artists seeking professional development opportunities. The database information will be delivered to the local artist community via the Web (but that's another project).

Book Review Process Database: This project supports book reviewers for the Theatre Design and Technology Journal (published by the non-profit United States Institute for Theatre Technology). The database tracks book review status for a multi-step review process for published books. This project was initiated as a project in a Database Projects course.

Example of New Courses Created

The National Environmental Modeling and Analysis Center (NEMAC), in working with its partner, the US Forest Service, identified a system integration project suitable for a semester long Computer Science course.

CSCI 446 System Analysis and Design Project (Middleware) (3 contact hours) Spring.. Required for Information Systems Concentration. Instructor: Dr. Joe Brownsmith. This projects course was developed in collaboration with NEMAC and its partner, the US Forest Service (USFS) [10]. The USFS Eastern Forest Environmental Threat Assessment Center identified a need for a rules-based business system to automate the updating of expired data in its databases. Student teams designed and implemented seven cooperating software components (including databases, email, Web components and a rules engine) to accomplish this comprehensive objective.

CSCI 373 Database Projects (3 contact hours) Spring and Fall. This innovative course provides an opportunity for studying and applying database techniques to a variety of problems in a real-world setting. In this course students participate in the analysis, design, and implementation of small to medium-sized real-world database projects. In a past offering of this course, several database projects were undertaken in collaboration with UNCA Centers and departments.

Reflection: The Middleware course was created due to active faculty involvement in NEMAC and the recognition of the need for a vision for automated business processes. The project motivated clarity of concepts through design, and focused the implementation efforts. This probably would not have been achieved as rapidly without the course offering and the students work. A further result is that the customer benefited from the rigor imposed by the classroom experience. The students achieved a sense of accomplishment due to their team's component working to achieve an integrated result.

The database projects course was created in response to recognizing the student need for a course whose focus is project-centric.

Example of Center Management Participation

The National Environmental Modeling and Analysis Center (NEMAC) management have participated in the following course as case study.

CSCI 342 Systems Analysis and Design Methods (3 contact hours). Spring. Required for Information Systems concentration. This course included real-time tracking of a project-in-progress. The project involved making bibliographic reference data available for reference and update on the Web. The current (problem) system was studied to determine its capabilities and several alternatives were analyzed. The project was real (and completed) during the semester by NEMAC staff. The students compared the models (documentation, diagrams, etc.) of the project with the textbook recommendations.

CSCI 446 System Analysis and Design Project (Middleware). This course, described above, required NEMAC project management participation in the problem requirements and scope. The final exam included a demonstration of the working system to this management.

Reflection: This activity was defined by proactive faculty who envision student learning on encountering and reflection upon the textbook materials and contrasting it with modern business practice.

Example of Use of Center Intellectual Property (IP)

Research oriented centers such as NEMAC develop intellectual property (IP) that can be used in the classroom. The advantages of using Center developed IP software are: The IP was developed locally and the Center employs someone who understands it, its' purpose and coding details; and who can explain it. The IP may also contain unique or advanced features that can be studied in context.

CSCI 373 Special Topics in Computer Science: Software performance

Evaluation (3 contact hours) one section, 7 students, Fall. Instructor Dr. Joe Brownsmith. This course uses NEMAC intellectual property, i.e., CEDAR system software, to illustrate performance principles and techniques. This software exhibits many advanced and professional techniques that students would not otherwise experience.

Reflection: This useful result occurred since the author sought to explain and focus textbook learning by using a known system.

The examples in the previous section highlight the importance of proactive faculty who are engaged in the University community, and who seek collaboration within to enhance the educational experience for students.

Examples of Center Management and Staff Involvement in Curriculum

Research centers can provide a rich source of guest speakers on a variety of topics. Here are some recent examples of guest lectures given by NEMAC staff;

ENVR 230 Energy and Society: "Fossil Fuel Exploration," Guest Lecturer: Jim Fox.

MLA 560 Seminars on Science and Human Values: Climate and Culture,

"Uncertainty and Decision Making," Guest Lecturer: Jim Fox

ENVR 384 Introduction to GIS:

"Visualization Techniques," Instructor Brandie Farris, Guest Lecturer: Greg Dobson. "GIS Application for Informal Education," Instructor Brandie Farris. Guest Lecturer: Jim Fox. "Use of GIS, Databases and Modeling in Forest Management," Instructor Brandie Farris, Guest Lecturer Dr. Todd Pierce.

CSCI 431 Organizations of Programming Languages: "Yahoo! Pipes, and Linden Scripting Language". Guest Lecturer: Dr. Todd Pierce.

CSCI 373 – Science Visualization. Team Teaching: Jim Fox (NEMAC) team taught with Susan Reiser an extended lab/lecture. Jim helped teach the lab for the first four weeks when we constructed the modules for the Haze Forecast Kiosk. The kiosk is on display at the Colburn Earth Science Museum in Asheville.

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Reflection: Research centers are engaged in recent and evolving technology in collaborations with the community. Bringing this to the classroom engages the students in current activities and projects for informs and shapes their learning, and in doing so helps prepare them for.

Summary

This paper has presented examples of curriculum enhancement that are driven by a combination of factors; namely, university centers that engage in research and real-world problems, and proactive faculty who desire to focus textbook material through examples and projects for the generation of in-depth learning. Centers, such as NEMAC, that actively seek wide collaborations among academe, government and private enterprises are especially useful in creating multiple curriculum enhancement opportunities.

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