Legal Liability of Faculty on Applied Research Projects

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ABSTRACT

University faculty on virtually all campuses must engage in teaching, scholarly activity, and service. The distribution of effort between these three pillars of academe varies from institution to institution, with larger universities generally emphasizing research (one type of scholarly activity), and smaller colleges often focusing on undergraduate education. No matter what the size or nature of the institution, all faculty must do some sort of work to remain current and contribute to the body of knowledge in their field. Basic research, funded by government grants, is likely the most common form of scholarly work among engineering faculty. Applied research, funded by external sources (either government or private) is somewhat less common but growing rapidly and contributes a great deal to scholarly activity on college campuses.

The benefits of applied research are three-fold: a technical solution is developed for a "client" (the external funding source), faculty members and student researchers apply their expertise to real-world problems, and the university provides a service to the broader community. Unlike basic research, where fundamental concepts are investigated and technical journal articles produced, applied research focuses on specific problems, and results in study reports, recommendations, and (sometimes) engineering designs.

With a decrease in government funding for fundamental research, faculty members are increasingly turning to applied research projects to fill the funding gaps. The issue of legal liability resulting from applied research projects is not often addressed on college campuses. Who is responsible if an engineering disaster results from recommendations made in an applied research report prepared by a faculty member – or even a student? Is it the student? The faculty member? The university? This paper explores the ways legal liability for applied research is handled at two different types of institutions: a large research-oriented state university, and a smaller undergraduate education-focused state college.

INTRODUCTION

The Three Pillars of Academe

Throughout time, the roles and responsibilities of university faculty have evolved to fill the needs of society. Instruction of the next generation of scholars, statesmen, and merchants was the initial focus, with origins dating back to Plato and Socrates. By the turn of the 20^{th} century, research had become part of the role of faculty, at least in the physical sciences. Publication of research results in scholarly journals and presentations at formal gatherings of professional societies were the means by which new knowledge was disseminated. In this sense, education and research were seen as a service to humanity.

As higher education matured, research and scholarly activity gained increasing prominence in the role of all faculty members. Societal needs often became the driving force behind much research, which led to increases in the size of faculty (and resulting cumulative research output) in the middle 20^{th} century, especially in the areas of science and technology. The Cold War and Space Race spurred much of this research, with the goal of maintaining national security and military superiority.

In the United States, the land grant colleges and universities had an explicit additional mission of service to the growing country. Thus, the foundations of the modern university roles of teaching, research, and service have deep roots in history.

Institutional Expectations of Scholarly Activity

Today, university faculty continue the tradition of teaching, scholarly activity, and research. These core responsibilities are stated (either explicitly or implicitly) in the mission statement of virtually every college or university. Faculty are expected to engage in all three areas, and to (ideally) excel in all of them, as well. Tenure and promotion decisions are based upon how well new professors have achieved in each of the areas.

The typical career path for university faculty starts at the *Assistant Professor* level, with a "probationary" period of five to seven years of renewable, but non-permanent contracts. This is the time when new faculty are establishing new courses, starting a research program of their own (usually distinct from their graduate school research topics), and "learning the ropes" of being a faculty member. During this time, faculty have periodic performance reviews at most institutions, to assess whether year-to-year contracts should be renewed.

Teaching effectiveness is assessed by means such as peer observations, self assessment, and student evaluations. Success in scholarly endeavors can be assessed by objective criteria (*e.g.* number of publications, number of proposals written, dollar value of grants awarded) as well as subjective criteria such as the quality and prestige of publications or conferences or the nature of the funding source. For example, a research paper published in the prestigious peer-reviewed periodical such as the *Journal of Fluid Mechanics* may carry more weight than one published in a new online electronic journal. Likewise, more weight may be given to a faculty member who receives a prestigious NSF Career grant than one who has obtained all of their funding from industry or local government agencies. Finally, service is evaluated based upon the types and number of activities that the assistant professor undertakes. Serving on departmental and college committees, local and national professional societies, and civic and governmental organizations are examples of the types of service activities expected of many faculty members.

If a faculty member can demonstrate adequate performance in the three pillars of academe during this probationary period, they are granted tenure and (at most institutions) promoted to the rank of *Associate Professor*. If an assistant professor does not perform to the expectations of the institution, then tenure is denied, and the individual is soon looking for another job.

As an associate professor, faculty expectations for teaching, research, and service are continued, with the goal of progressing to the rank of *Full Professor*. To achieve this, the faculty member must maintain (and even enhance) their records in each of the areas. For example, teaching evaluations should ideally improve over time, as a faculty member becomes a better instructor. The number and quality of publications and research grants should increase. The associate professor should assume a leadership role in collegiate and professional committees, to enhance the reputation and visibility of their department and institution.

The distribution of effort between these three pillars of academe varies from institution to institution, with larger universities generally emphasizing research (one type of scholarly activity), and smaller colleges often focusing on undergraduate education.

Types of Scholarly Work

No matter what the size or nature of the institution, all faculty must do some sort of work to remain current and contribute to the body of knowledge in their field. The most common form of scholarly work is ***basic research***, with dissemination of results in professional journals and conferences. Less common among engineering and science faculty today is ***applied research***, where dissemination of results is generally more limited.

Basic research is generally funded by government grants from agencies such as the National Science Foundation, Environmental Protection Agency, or Department of Defense. In this type of work, fundamental concepts are investigated; hypotheses are made and tested. While there may be some application of the results at a future date, the primary goal is the generation of new knowledge. This type of research generally results in technical journal articles, presentations, and books.

Applied research is usually more focused, with the goal of solving a particular problem or creating a design of something that can be constructed. Typically funded by external sources such (both from industry and government), applied research results in study reports, recommendations, or engineering designs.

The benefits of applied research are three-fold: a technical solution is developed for a "client" (the external funding source), faculty members and student researchers apply their expertise to real-world problems, and the university provides a service to the broader community.

EXAMPLES OF APPLIED RESEARCH AT DIFFERENT INSTITUTIONS

Just as there are differences in the distribution of emphasis between teaching, research, and service between smaller education-oriented colleges and larger research-focused institutions, there are differing types of applied research that are conducted at both.

Comprehensive Regional University

Rowan University is a comprehensive regional institution with an enrollment of approximately 10,000 students. Part of the New Jersey State College system, Rowan (formerly Glassboro State College) is the only comprehensive institution in the southern part of the state. Founded as a state teacher's college in 1922, it has grown to include six academic colleges (Education, Liberal Arts and Sciences, Fine and Performing Arts, Business, Communication, and Engineering) and a graduate school.

Primarily an undergraduate-degree granting institution, Rowan does offer professional graduate degrees (primarily in education and business), with a small Master's-level program in the College of Engineering.

The College of Engineering was founded in 1992, with the express goal of creating a vibrant program with an innovative project-based curriculum. The engineering curriculum at Rowan University contains a core of *Engineering Clinic* classes (Clinics), which cross over disciplinary boundaries and span the entire four-year undergraduate education. The origins of the Clinic program at Rowan have been described previously [*e.g.* Schmalzel, *et al.*, 1998]. The content and nature of the Clinics vary over the four-year curriculum, as shown in Table 1.

Table 1: Overview of Engineering Clinic Content

Year	Engineering Clinic Theme (Fall)	Engineering Clinic Theme (Spring)
Freshman	Engineering Measurements	Competitive Assessment
Sophomore	Interdisciplinary Design	Discipline Specific Design
Junior	Open-ended problem solving in small teams	
Senior	Open-ended problem solving in small teams	

Clinics for first-year students focus on basic, introductory skills. In the second year, engineering students are introduced to multidisciplinary action through a number of projects. In the third and fourth years, students participate in team projects that feature open-ended problem solving and design.

Most faculty in the College of Engineering at Rowan University engage in scholarly practice through upper-level Clinic projects. Clinic projects range from design-build-test of mechanical systems to investigation of bioremediation techniques to analysis of high-strength polymers and pharmaceutical delivery systems. These clinic projects serve as a learning laboratory for students, whether they are working on basic research, applied engineering, or something in between.

In the Civil and Environmental Engineering program, student teams have worked on several successful water resources clinic projects recently. In one project, students have participated in planning, design, and monitoring of streambank restoration along the stream that bisects the university campus. In a second project, students have conducted hydrologic and hydraulic analyses of several small, privately owned dams near the university campus. A third group of projects has focused on field work to support development of Regional Stormwater Management Plans.

Streambank Stabilization

The streambank stabilization project focused on the Chestnut Branch of Mantua Creek, which bisects the university campus. Decades of development of the campus and surrounding community have resulted in higher peak runoff rates, leading to stream bank erosion and reductions in water quality downstream. A bank stabilization effort was undertaken in 1993, to reduce the sediment load to a lake downstream from the campus. Eleven years later, the results of this initial bank stabilization effort have been mixed. To address the shortcomings of the initial stabilization project and address erosion problems at other locations on the campus, students have participated in all phases of planning, design, and monitoring of additional streambank restoration measures.

Dam Safety Analysis

The dam safety project focused on analyses of three privately owned dams in southern New Jersey. Wadsworth, Sterling, and Kandle Lake Dams in the upper Mantua Creek watershed were analyzed by undergraduate students to assess the impact of dam failure on lands downstream of the structures. Physical parameters such as watershed areas, land use, and precipitation intensity were used to estimate stream flow for a number of storm events. Each storm event was run with and with out dam failure conditions, in order to determine downstream inundation effects. From the results of these analyses, students developed conceptual alternatives for dam rehabilitation, as well is flood inundation maps. The technical reports produced were submitted to the New Jersey Department of Environmental Protection Bureau of Dam Safety and Flood Control on behalf of the dam owners. The state of New Jersey requires that engineering reports submitted to state agencies be signed and sealed by a licensed Professional Engineer. The faculty member who worked with and supervised the students is a licensed PE in New Jersey, and performed the necessary certifications.

Regional Stormwater Planning

Regional stormwater management plans are comprehensive tools for addressing hydrologic issues in developing and developed watersheds. One aspect of regional planning includes watershed characterization and assessment. Undergraduate students in several engineering disciplines have conducted assessments of coastal plain watersheds in southern New Jersey, and modeled watershed hydrologic processes. The work undertaken by the students has aided in development of regional stormwater management plans, and has also been part of larger efforts aimed at providing a variety of environmental information to a broad range of stakeholders. Student teams have conducted visual assessments of stream corridors, made quantitative measurements of water quality and stream flow, and mapped sediment deposits in a suburban lake. Students have interacted with stakeholders, K-12 students and educators, consultants, and government officials.

The use of these integrative, "hands-on, minds-on" applied projects has enabled students to gain a much deeper understanding of water resources engineering issues (both technical and social) in a way that is not possible in a regular classroom setting. Involving students in all aspects of these projects introduces many concepts not included in traditional classroom instruction, such as the ecological benefits (and detriments) of engineering solutions. In addition, students are exposed to the socio-economic and political realities that engineers must contend with in professional practice.

Large Research University

Clemson University was founded as a land grant University in 1889. Originally an all male military institution until the 1960s, Clemson has since expanded it's role as a land grant institution to include undergraduate and graduate programs in more than 70 fields of study serving over 16,000 students. The University consists of five colleges, Agriculture, Forestry and Life Sciences; Architecture, Arts and Humanities; Business and Behavioral Science; Engineering and Science; and Health, Education and Human Development.

Today, Clemson University is classified by the Carnegie Foundation as a Doctoral/Research University-Extensive, a category comprising less than 4 percent of all universities in America. As the state's land grant university, Clemson reaches out to serve the citizens of the state through public service activities, cooperative extensions and five off campus research and education centers. The university serves as an economic engine for the state by creating new technologies and a highly skilled workforce. Part of this is obtained by conducting applied research projects for "clients" around the state which serves not only the community but provides critical hands on training experiences for the students.

At Clemson, research is generally funded through external grants, with work done by graduate students under the guidance of faculty advisors. These projects are often applied in nature and are conducted to determine a specific outcome for a particular project. Upon completion of the project, students often continue on with less focused objectives to gain additional information which could be used to develop more general design guidelines in the future. Examples of recent applied research projects in Civil Engineering at Clemson include river water intake models, cooling water pump stations, and water supply influent tunnel modeling.

River/Canal Water Intake Modeling

Large flood control pumping projects often involve complex hydraulic intakes along the sides of rivers or canals. The Velasco Drainage District in Texas recently upgraded a number of their floodwater pumping stations to increase the discharge capacity. These large pumps (often several hundred thousand gallons per minute) require relatively uniform approach flow conditions. Evaluating these markedly three-dimensional structures often requires a physical hydraulic model study. The district commissioned a physical model study to evaluate the impact of the installing additional pumps upstream of an existing pump intake. Clemson University faculty and graduate students conducted the physical model study to determine not only the impact on the existing structures, but to develop modifications which could improve pump performance or alleviate potential adverse hydraulic conditions.

Cooling Water Intake Studies

The recent de-regulation of the power industry has led to an increase in new power plant construction. Combined cycle natural gas or coal burning facilities require large amounts of cooling water for optimum steam turbine performance. This cooling water in increasingly obtained with re-circulating cooling towers rather than “once-through” systems. To reduce costs, the cooling towers are typically much shallower than the submergence required by the pumps. To accommodate this, deeper pump sumps are installed on the end or sides of the basins. The performance of the sump is often evaluated with a physical hydraulic model study. Faculty and graduate students have conducted numerous pump sump model studies with the aim of improving the approach flow hydraulics. The outcomes from these studies are incorporated into the design of the structure and the pump manufacturers base decisions regarding pump warranties on the results of the study. Technical reports are issued which are used by the design engineers to modify the proposed or existing structures.

Water Supply Influent Modeling

A large horse-shoe shaped water distribution tunnel was planned for the Shoal Creek Water Treatment facility outside of Atlanta, GA. The tunnel was used to supply water from the middle of Lake Lanier to a large circular caisson type pump sump. The unique geometric configuration of the structure resulted in limited design guidance and available data to predict performance. A model of the influent tunnel was constructed and tested to determine the overall headloss characteristics of the system as well as any tendencies for sediment accumulation. The information obtained during the model study was used to determine minimum operating levels for the sump and to evaluate Net Positive Suction Head available (NPSHa) for ensuring proper pump performance.

LEGAL LIABILITY ISSUES

No matter what the size of the institution, faculty engaged in applied research (either for external or internal "clients") should be aware of the legal issues involved. Unfortunately, there appears to be little discussion on this subject in the literature at the present time. This leads to the basic question: *Who is responsible if an engineering disaster occurs as a result from recommendations made in an applied research project?* Is it the faculty member? Is it the University? Perhaps the student(s) involved in the work? Is the client liable in any way?

This paper can not provide a detailed analysis of these basic questions, but we can explore the approaches towards liability issues taken at two differing institutions of higher education with the hope of generating discussion and thought on the issue.

Large Research University

Clemson University is research-oriented doctoral granting institution. Faculty members are expected to contribute significantly to research, whether basic or applied. Because of the strong emphasis on obtaining funded research, there are well-stated policies that have been established regarding risk management. In fact, Clemson has an office specifically focused on minimizing and managing the variety of risks and liabilities encountered by the institution.

As stated in the Clemson University *Risk Management Policy,*

> The goal of Risk Management is to coordinate efforts with all departments on and off campus to ensure the protection and preservation of Clemson University human, physical and financial assets.
>
> This goal is accomplished by identifying potential human, physical, financial and natural losses and evaluating the best method for handling the risk whether it is risk avoidance, prevention, assumption or transfer.

The University's Office of Risk Management acts as an internal insurance broker, dealing with property, liability, and surety coverage and claims. Fees for their services and the associated coverages are assessed to individual departments based on factors such as the nature of the risk, number of departmental employees, and value of insured university property.

In addition to building and personal property insurance, the Office of Risk Management handles insurance policies for business interruption, livestock mortality, automobile fleet coverage, commercial crime insurance, and liability insurance for all university employees, among others.

As stated in the *Risk Management Policy* regarding liability:

C.3.a. Employees Liability

1) Employee liability insurance has been secured by the University for the benefit and protection of the Board of Trustees, Faculty, Staff, and Student Employees who may be legally liable to third parties who are injured or killed as a result of actual or alleged negligence of the insured in the performance of his or her regularly assigned duties. Coverage provided by this insurance include, but are not limited to, such things as protection against false arrest, detention or imprisonment, libel, slander, violation of right of privacy, discrimination, violation of civil or constitutional rights, and use of non-highway licensed mobile equipment. Liability for University watercraft under 26' feet and non-licensed motor vehicles are also covered under this policy.

Thus it appears that faculty engaged are covered against certain liability claims (*i.e.* personal injury or death) *"as a result of … negligence … in the performance of his or her regularly assigned duties."* The question remains as to whether or not faculty are covered against liability claims regarding property damage or acts that result in something other than personal injury or death. In addition, there is no discussion of liability coverage for students who may be engaged in research with a faculty member. General research agreements indicate work will be carried on with a "best faith effort" but little is offered in the way of professional liability issues.

Comprehensive Regional University

The situation at Rowan University is quite different from that at Clemson. The institution has only recently developed a strong extramurally-funded research base. This has sometimes led to creation of policies and procedures in a less-than-ideal fashion. In many cases, there are no published policies, and decisions must be made on a case-by case basis by the University's attorney, a Deputy Attorney General (DAG) for the State of New Jersey.

In the context of the Engineering Clinics, which are focused on student education, the question arose regarding faculty, student, and institutional liability in the context of the dam safety analysis projects. The engineering reports prepared required the signature and seal of a licensed Professional Engineer (in this case, the faculty member). The clinic projects focused solely on analysis and modeling of existing hydrologic conditions of a series of privately owned dams.

For this project, a request for interpretation was submitted to the dean of the College of Engineering and the DAG's office. Several months later, an opinion letter from the DAG stated that the faculty member will be provided defense and indemnification under the New Jersey Tort Claims Act (N.J.S.A. 59:1-1) against claims resulting from professional work associated with the Engineering Clinic program (Malloy, 2002). The letter of interpretation states that the Tort Claims Act will cover the faculty member's certification of the analysis reports. As with Clemson, there is no specific mention of liability of students who may be working on applied research projects with faculty.

As stated in the letter of interpretation:

> This office makes this determination after analyzing: (1) the activities of the clinic, including [the] certification of the students' analysis of the dams; (2) the fact that the primary scope of [the faculty member's] public employment is teaching engineering at Rowan University, which includes the supervision of student work in a clinic setting; and (3) [the faculty member's] control and supervision over the activities of the clinic students and their analyses. This office determines that the connection between these three factors is sufficiently close to justify coverage under the Tort Claims Act, not only because of the factors themselves, but also because of the degree of nexus among them.

The letter of interpretation also cautioned that "this analysis is specific to the activities … described with regard to this particular clinic [project]. Activities from other clinics, or possibly even different activities within this clinic, are subject to a case-by case determination … as to whether coverage under the Tort Claims Act is appropriate."

Thus, there is no blanket policy regarding faculty liability at Rowan University for applied research projects.

CONCLUSIONS

From these two disparate case studies, it is apparent that there is a wide divergence in institutional perspectives regarding faculty liability. It is likely that a broad spectrum of institutional policy regarding liability exists at colleges and universities.

One way to minimize potential liability is to ensure the use of contracts for all applied research, to delineate obligations (and thus liability). Another technique is to shift liability back on the client in advance, by requiring the client to sign a hold-harmless agreement. Some institutions of higher education (such as the University of Iowa) provide standard agreements for applied research grants, and provide easy access to model agreements (University of Iowa, 2005).

Questions still remain regarding the circumstances under which students are (or not) covered for their work on applied research projects. In addition, the prudence of faculty members obtaining their own professional liability coverage has yet to be explored. The authors solicit feedback and input from a range of institutions, practicing professionals, and legal experts regarding these issues.

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