Permanent Tenure and Academic Freedom in Engineering

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The tenure system exists in most public and private universities and 4-year public colleges in the United States. The American Association of University Professors has argued that tenure provides the most reliable means of assuring academic freedom, faculty quality, and educational excellence. However, budgetary constraints and the end of mandatory retirement in the '90s have resulted in questioning the merits of the tenure system. It is argued that tenure entrenches a lazy professoriate, encourages the creation of temporary faculty positions, and supports research over teaching. This article examines the tenure system as practiced in engineering institutions in the United States because engineering faculty serve as an interesting case study of 21st-century technology and 19th-century values. It illuminates issues underlying the tenure system beyond the traditional justification of academic freedom.

Key words: *AAUP, academic freedom, economic security, engineering faculty, higher education, tenure*

In the United States, the civil right of freedom of speech guarantees the right of citizens to express their views without punishment from the government. Academic freedom is an intra-academic privilege exclusively to protect the independence of the faculty from state legislators, governors, trustees, administrators, colleagues, students, alumni, media, and public. The best way to guarantee that faculty will pursue truth freely and objectively is if they have no fear of being penalized in case they break with tradition, try new approaches, or turn up unpopular results (De George, 1997; Finkin, 1996). Tenure provides such a guarantee to faculty who have served the academy for a period of time. The 1940 Statement of Principles on Academic Freedom and Tenure states that tenure ensures "(1) freedom of teaching and research and of extramural activities, and (2) a sufficient degree of economic security to make the profession attractive to men and women of ability" (American Association of University Professors [AAUP], 1995, p. 3).[1] Tenure functions as a guarantee of continuous employment until the faculty member dies, voluntarily retires, or is relieved of his or her duties because of adequate cause or financial exigency.[2,3] Dismissal of tenured faculty is rare and difficult, but not impossible, provided procedural standards are followed.[4]

Before tenure, many academics had been fired because of their views on such contentious issues as slavery, secession, evolution, racism, colonialism, Marxism, war policies, and opposition to university authorities (De George, 1997; Finkin, 1996; Metzger, 1973). During the McCarthy era of the '50s, even tenure did not protect professors suspected of harboring communist sympathies in their background (Schrecker, 1986). Still, tenure provides the faculty a right to hold any intellectual conviction and engage in political or any other controversial activities. The faculty of natural sciences and engineering cannot be dismissed even if their views on religious, political, or sexual matters displease the administrators (unless done in the classroom instead of teaching the subject). The faculty of social sciences and humanities can express dissident views on controversial matters in the course of teaching and research, provided they are not doing propaganda for legally prohibited groups. Academics, however, are not entitled to the right of academic freedom if they teach classes without adequate preparation, repeatedly fail to meet scheduled classes, distort teaching, falsify research results, have improper relations with students, and practice favoritism in students' evaluations. Tenure ensures academic competence as validated by peers and administrators in the areas of scholarship, research, teaching, and service.

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Tenure is also justified on the ground of job security to compensate low salaries of the faculty given long duration to complete education. In fact, the model of tenure and freedom was implemented in most public and private universities and 4-year public colleges in the '60s when these institutions faced an acute shortage of faculty members and found tenure a way to attract candidates. With the expansion of institutions of higher education after World War II, tenure became an inducement in recruiting and retaining faculty members. Earlier, only a very small amount of outstanding scholars and teachers filled permanent positions. For instance, at Harvard in the late '30s, annual appointees were marching forward with a strength of about 30 per year, 3-year appointees with a strength of about 12 per year, and permanent appointees with a strength of fewer than 5 per year (Conant, 1970, p. 160). However, tenure would be justified even if faculty were well paid because it is viewed as the best means to secure and preserve academic freedom (De George, 1997; Finkin, 1996).

This article addresses the issue of permanent tenure as a means to academic freedom in engineering.[5] It concentrates on engineering faculty because they are not perceived to be engaged in controversial research or teaching for which academic freedom has been justified. In fact, despite many studies showing the impact of social factors in the production of engineering knowledge, engineering faculty members themselves claim to be neutral in teaching and research. At the same time, engineering faculty members handle the most compelling technologies of the 21st century—genetic engineering, robotics, information technology, and nanotechnology—which have resulted in debate among academics and policy makers, as well as the public. Furthermore, engineering faculty members collaborate with industries, which tends to compromise the ideal notion of academic freedom in research and dissemination of results. As a result, tenure and academic freedom in engineering makes an interesting case study combining 21st-century technology with 19th-century values.

Controversies Surrounding the Tenure

The tenure system in the United States has been a source of controversy since its very inception; however, it has intensified in recent years due to budgetary constraints, the end of mandatory retirement, and an increase in the cost of higher education. For instance, the state of California had cut $341 million from the budget of the University of California system between 1990 and 1994. New York had slashed $200 million from the annual operating budget of the State University of New York between 1988 and 1994 (Holden, 1997, p. 24). In 1992, San Diego State University sent dismissal notices to more than 100 tenured faculty members (Mooney, 1993). In 1994, bills were introduced into the Florida legislature that provided for the abolition of tenure (Yasuda, 1994). The same year, Bennington College in Vermont fired 27 tenured faculty members ("Academic freedom and tenure," 1995). From 1995 to 1997, the University of Minnesota considered the changes in the tenure code (Magner, 1997). In 1997, the chairman of the Massachusetts Board of Higher Education declared that tenure was simply a scam that must end (Healy, 1997). Even though budgets have gone up in some states and many bills against tenure have not been passed, many institutions of higher education in Colorado, Florida, Georgia, Hawaii, Kentucky, Maryland, New York, South Carolina, Texas, Washington, and Wisconsin have focused on some form of posttenure review to ensure greater accountability.

Critics argue that academics are not the only ones to speak out on controversial subjects and challenge authority. Writers, journalists, filmmakers, and whistleblowers also espouse unpopular views and challenge orthodoxy without the protection provided by tenure (Huer, 1991). With the end of the cold war and decline of communism, many people have come to believe that academic freedom is widely accepted, institutionally implemented, and judicially protected, and that tenure is no longer necessary to its preservation. They see the courts assimilating academic freedom under freedom of speech and tenure under property rights. In 1991, Congress passed legislation that allows plaintiffs to try their federal discrimination cases against colleges and universities before juries. Since then, the number of tenure-denial suits has ballooned, making an expensive, burdensome affair for both the institution and the faculty member (Franke, 2000).

Critics further point out that a major threat to outspoken professors can be found within the academy itself. If offended, the members of the tenure committee may not recommend tenure to untenured professors. Many people view the first 7 years as a conformity training period in which untenured faculty learn to be safe rather than bold. Unless untenured professors can show that ideological, racial, or gender bias

led to tenure denial, they have little recourse.[6] It is argued that to get tenure, one has to be political and learn the rules of the game. John Livingston (1973), then professor of government and political science and acting dean at Sacramento State College, found that tenure is given to the wrong people for the wrong reasons. According to him, those who have it do not need it, and those who need it do not have it. The 7-year rule to grant tenure is further criticized as not being adequate for faculty to prove their performance in the areas of scholarship, research, teaching, and service by peers and administrators.

The most frequent attack against tenure is that it leads to a lazy professoriate. Conservatives have characterized professors as radicals who would rather produce esoteric research to be presented in faraway conferences than in teaching (Anderson, 1992; Bloom, 1987; Kimball, 1990; Sykes, 1988). The media have characterized many professors as incompetent and tenure as the academic equivalent of welfare (Editorial, 1995; Tully, 1995). It is argued that untenured faculty work harder before than after getting tenure. Once tenured, they have little incentive to publish or keep up in their fields. They spend as little time as possible in their offices or working with students and do not take the same interest in teaching. Less extreme argument suggests that tenure is based on the assumption that a professor who has demonstrated his or her ability at the age of 30 to 35 will continue to maintain it for the next 35 years or so (McGee & Block, 1997).

Tenure is also blamed for the devaluation of teaching or developing practical insights. There is a growing tendency to attach greater importance to research than to teaching in granting tenure, especially since the end of World War II. Critics observe that receiving an award for good teaching does not result in tenure.[7] Conservatives even suggest that academics are hostile to teaching, making sure that faculty members with an outstanding teaching record do not get tenure (Anderson, 1992; Bloom, 1987; Kimball, 1990; Sykes, 1988). It is argued that the general culture in academia is that faculty members who are good in teaching are necessarily deficient in research.

The quality of higher education is further affected by the recruitment of temporary faculty to circumvent tenure. It is estimated that 45% of academic jobs are part-time (Finkin, 1996) because tenure imposes an inflexible financial burden on institutions (Anderson, 1992; Bloom, 1987; Kimball, 1990; Sykes, 1988). Critics argue that the university has few new openings and tenurable positions because, with the abolition of mandatory retirement in 1994, tenured faculty do not need to retire and they cannot be fired. According to them, without downsizing, universities have become inefficient. Given rapid changes in economy due to globalization and information technology, tenure ends up locking faculty into a long-term employment pattern, which is incompatible with adaptation to new circumstances and opportunities.

Critics also argue that the tenure system makes it difficult to expand the representation of women and minority groups. For instance, women hold more than 50% of the part-time jobs in academia. Very few universities hire their own part-time faculty for permanent positions when they open up (Thompson, 1996). Then there are cultural barriers to the women and minorities in academia.

A Case Study of Engineering

Academic freedom, the principal rationale for tenure, is utilized differently in technical fields such as basic sciences, mathematics, and engineering than in nontechnical fields such as the humanities and social sciences. Almost 100 years ago, John Dewey (1902) suggested scholars in humanities and social sciences needed freedom of investigation because they addressed "the problems of life," and thus faced "deep-rooted prejudice and intense emotional reaction." According to him, advancing knowledge about humans, culture, and relationships to society would question existing modes of life and thus generate hostility to the institution. Most academic fields in humanities and social sciences address issues related to social, ethical, economic, and political aspects of life and thus end up critiquing accepted norms and values. Historically, advancement of knowledge in these fields has depended on academic freedom (Finkin, 1996; Fuchs, 1963; Metzger, 1973).

Engineering, however, is concerned with what John Dewey (1902) would call "problems of technical theory." Instead of people, subject matters of engineering are mechanics, thermodynamics, electrical circuits, electronics, aerospace, polymer, metallurgy, calculus, construction, minerals, radiation, and computers. Yet, engineering is somewhat different from basic sciences and mathematics. Although engineering sciences have their roots in basic sciences and mathematics, they put knowledge to creative applications. Engineering design is a decision-making process in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to

meet a stated objective (Accreditation Board for Engineering and Technology, 2000). This aspect also highlights the nontechnical content of engineering. Technical designs often imply some understanding of the structure of society, social organizations of work, people's safety, and protection of the environment. John Law (1994) notes that engineers design infrastructure, social institutions as well as societies within which the designed technology would work. Engineering has both technical and nontechnical contents and thus makes an interesting case study for tenure and freedom.

There are two aspects of academic freedom: the freedom to perform academic actions, namely teaching, research, and publications, and the freedom to participate in those activities that are legal but challenge orthodoxy (Shils, 1993). The freedom to teach means that faculty have a right to select the subject matter for the courses, determine how they will be taught, make the class assignments and exams, and evaluate students' performance. Teaching decisions are not to be controlled by chairs, deans, and other university administrators. Faculty members enjoy academic freedom if they teach subjects as they are laid out in the best literature to the level of their own abilities and to the level of the students' capacities to learn.

Unlike humanities and social sciences, topics in engineering are technical, and there is little link with political or religious statements outside the classroom. Furthermore, engineering is concerned with precision and measurement; humanities and social sciences are concerned with a greater room for ambiguity and disagreement. Most topics in engineering, no matter how complex or detailed, can generally be taught as right and there is little room for a particular point of view. University administrators do not need to act like headmasters who have to police the content in the classroom in engineering. Tenure appears to play a limited role in providing freedom of conscience or judgment in teaching engineering topics.

In the past two decades, the internal activities related to teaching have been changing with a decline in revenues from traditional sources. For instance, between 1980 and 1996, state appropriations for all public institutions of higher education declined from 44.8% of all institutional support to 32.5%, representing a constant dollar loss of approximately $17.5 billion (Slaughter & Leslie, 1997, p. 82). A consequence of such decline has been the expansion of virtual education in most disciplines, including 300 engineering programs in the nation. Many institutes now require faculty to utilize computer telecommunications technology to deliver higher education. Although private companies find institutions of higher education as the market of their products, university administrators view computer-based instruction as a means of reducing their direct labor and plant maintenance costs, such as fewer teachers and classrooms.

David Noble (1998) finds that the high-tech transformation of higher education to be initiated and implemented from the top down, either without any student and faculty involvement in the decision making or despite it. Gary Rhoades (1998) argues that such use of technology is making faculty command powerless discretion in teaching. For instance, courses are being redesigned to eliminate the personalized forms of teaching, class sizes are increasing, faculty are shrinking, and Big Brother is watching. In such situations, tenure can enhance faculty members' control over teaching. Still, Big Brother can exercise limited supervision in engineering compared with humanities and social sciences because of the technical contents of engineering. Furthermore, engineering faculty love to experiment with technology in the classroom. Their challenge is how to link the content of courses with the practice and experiments, which requires smaller classes and more faculty to be effective. Tenure does not appear necessary to protect engineering faculty from the virtual teaching.

Most engineering faculty pursue teaching with research. With the rise of importance of research over teaching since World War II, faculty designating research as their primary work responsibility quadrupled in engineering and roughly doubled in sciences (National Science Foundation [NSF], 2000, p. 6/27). Yet, it is difficult to say that the quality of teaching is declining in engineering only due to increased emphasis in research in tenure decisions. Faculty in engineering hold the highest degree offered in the United States, specialize in specific fields, and seldom teach classes outside those fields. They are the experts on the subjects and knowledgeable about the standards. Furthermore, graduate students tend to teach more basic courses in humanities and social sciences than in engineering; graduate students mostly teach discussion sections in engineering that are to supplement main lectures, and to do lab problems and homework. The issues engineering faculty face in teaching are as follows: to introduce remedial work in mathematics and science for the freshmen; to increase enrollment of students, namely women and minorities, especially at graduate level; and to broaden participation of all

groups in engineering. If there is any decline in teaching, it is mostly due to universities' quest for reaping big rewards from selling technology developed on campus. For instance, research universities earned $725 million on the royalties and other income derived from patents, up 19% from 1997 (Cohen, 2000, p. 19).

The freedom to research means that the faculty should be able to decide their research agenda, the techniques to investigate the subject, where to publish the results, and to whom to transmit the inquiry. Peers police the research of fellow faculty members with respect to their expertise and the knowledge produced (Chubin & Hackett, 1990). This self-regulation preserves academic freedom by excluding outside authorities from controlling or evaluating the work.

However, with the challenges of the U.S. industry to compete successfully in increasingly global markets in the '80s (Varma, 1995), industry and government agencies together and separately are supporting academic research that is geared to help industry (Slaughter & Rhoades, 1996). For instance, the NSF, through its new Engineering Research Centers program, has increased funding for university-industry research collaboration. Industry's share of academic research has more than doubled since the mid-1970s. In 1990, there were more than 1,000 university-research centers at more than 200 universities and colleges, nearly 60% of which were established during the 1980s. Patent awards at the top 100 research universities increased from 177 in 1974 to almost 1,500 in 1994. Approximately 200 offices were created to oversee the transfer of technology and licensing activities developed on campus to industry in 1990, compared with 25 in 1980 (NSF, 1998, p. 5/12). Growing industry support of academic research has been changing patterns of work on the part of faculty involved with industry (Varma, 2000a). For instance, restrictions are being placed on open disclosure of research results. A study of university-industry research centers found publication delays (53%) and deletion of information prior to submission for publication (35%). The same study found restrictions on faculty communications with faculty and staff at the home university (21%), with those at other universities (29%), and with the general public (42%) (NSF, 1998, p. 5/12). These numbers were higher for centers strongly oriented toward industry needs. Most institutions of higher education are increasingly and explicitly integrated into what Sheila Slaughter and Larry Leslie (1997) call "academic capitalism." Instead of tenure, universities' quest for dollars and their partnerships with the private sector appear to be harming the basic principle of academic research.

Yet, many fields in humanities and social sciences remain independent from market forces and enjoy relatively more autonomy within their respective disciplines than engineering. After life sciences, engineering has the highest levels of research participation; the lowest level is in mathematics and social sciences (NSF, 2000, p. 6/11). The ideal notion of professional autonomy is compromised for engineering faculty who have to raise funds from industrial sources to support their research. Furthermore, they face restrictions in the disposition of the research results, which are the basis for future scientific inquiry and their professional reputation. In such situations, tenure is likely to encourage engineering faculty to engage in disinterested research and openly present results to peers and a general audience.

One of the serious charges against tenure is of deadwood—after receiving tenure, faculty become out-of-date, lazy, incompetent, or senile. Empirical studies, however, have found little decline in research productivity after tenure (Blackburn & Lawrence, 1995; Rees & Smith, 1991). It is argued that the overall reputation of a faculty member that tends to be built over a lifetime is likely to be more important to the institution's standing than is the yearly output of an individual faculty member. With the low supply and high demand of faculty in engineering (Finn & Baker, 1993), engineers accept a faculty position not because it was the only position they were offered. Engineering faculty look for a particular characteristic in the institution or in the faculty. They do not choose an institution based on shared intellectual and political interests. Instead, their decision about where to join is often influenced by the research programs they observed while in graduate school. They have a research agenda, are grant active, and publish their results. The Institute of Scientific Information, which maintains an extensive database on scientific and engineering articles published in journals, did not find any decline in the production of articles in engineering (NSF, 2000, p. 6/43). The deadwood argument against tenure does not hold in engineering. Tenure is not an excuse for failure to perform at an acceptable level. Tenured faculty are continually evaluated with promotions and salaries.

The freedom to engage in controversial social and political activities means that the faculty should be free to express their opinions without fear of reprisal. Engi-

neering faculty cherish the ideology of objectivity and supposedly practice what Robert Merton (1957) called "analytical detachment." Despite numerous studies showing the impact of social factors in the production of knowledge, engineering faculty tend to remain neutral on nontechnical issues in the best tradition of science and intellectual impartiality. The detached engineering faculty are most readily rewarded with the higher status. Indeed, more questions on the responsibility of engineers to the society tend to be raised by social scientists than by engineers. One of the reasons for science and technology studies programs to emerge in technical institutes is to educate future scientists and engineers about social and political consequences of science and technology. It is generally social scientists, not scientists or engineers, who run these programs. In fact, the comments or opinions of engineers in popular technical publications (e.g., *Technology Review* and *Prism*) tend to justify engineers' point of view; that is, an optimistic way of looking at technology to solve practical problems. Engineering faculty are not as involved in controversial issues pertaining to social, political, and ethical aspects of scientific and technical issues as are scholars in humanities, social sciences, and to some extent biology (e.g., evolution and IQ). Because engineering faculty teach and research the subjects with neutrality and seldom utilize academic freedom for controversial political activities, tenure does not appear imperative.

Engineering faculty, however, have been dealing with technologies that are profoundly transforming the society (Varma, 2000b). The consequences of technology-based progress have been so pervasive since World War II that they are unavoidable. The basic means of life—food, clothing, shelter, transportation, entertainment, and healing—involve some forms of technology. However, all technological developments have not resulted in favorable consequences. The impact of new information technology on individual privacy, the increased cost of industrial development with the deterioration of the environment, the limits to economic growth with the depletion of resources, and the proliferation of nuclear weapons, are matters of general concern. Many technologies such as nuclear power plants and petrochemical industries are so interactively complex and tightly coupled that they can seriously harm people and the environment (Perrow, 1984). Whenever such technological systems have failed, as with the nuclear power plant accident in Chernobyl, Russia, or the gas leak at the Union Carbide chemical plant in Bhopal, India, they have caused catastrophe. In addition to those fallible systems, the technologies of the 21st century promise—or threaten—even more decision making by machines, as robotics develops intelligent machines that can do all things better than human beings (Joy, 2000). Because of the nature of technologies, scale, magnitude, environmental impact, and social changes, academic freedom as an ethical responsible practice appears a way to protect an individual engineering faculty member as well as society.

Within engineering, women and underrepresented minorities confront different threats to their academic freedom. They experience more institutionalized sexism and ethnocentrism in engineering than in other fields. The maleness and Whiteness of the engineering faculty are conspicuous. Women are best represented in social sciences, where they account for one half of all workers; they are least represented in engineering (9%) (NSF, 2000, p. 6/23). This is mostly because of a shortage of women and underrepresented minorities pursuing doctoral degrees in engineering. For instance, in 1997, women earned 12% of all engineering doctorates as opposed to almost half in the social sciences and 38% in the biological sciences. Similarly, underrepresented minorities received 8% of doctoral degrees in social sciences, 4% in the natural sciences, 3% in engineering, and 2% mathematics and the computer sciences (NSF, 2000, p. 3/14). Currently, most engineering programs are facing faculty shortage, caused by a decline in the number of U.S. citizens pursuing engineering doctoral degrees (Finn & Baker, 1993), which has resulted in difficulties recruiting faculty and thus hiring of foreign-born engineers (Freeman & Aspray, 1999).

The content of engineering education and practice conveys and reinforces masculine values, which is rarely mentioned in other disciplines (Hacker, 1990). What distinguishes engineering from other masculine professions is the machismo: It is for strong men who wish to have a close encounter with heavy, oily machinery (Mcllwee & Robinson, 1992). Unlike in other fields, women face many cultural barriers to acceptance in an engineering milieu (Boice, 1992). They end up taking longer than men take to achieve tenure and promotions (Bentley & Blackburn, 1992). Other minorities such as Blacks, Hispanics, and Native Americans face similar issues more in engineering than in social sciences. These underrepresented minorities sense a lack of respect or inter-

est from their colleagues and feel marginalized. They take on extracurricular responsibilities to encourage other women and minorities to influence department as well as national policies. As minority social activists, they tend to fare better with academic freedom yet face hardship in tenure decisions.

Critics of tenure have also argued that junior faculty spend 7 years conforming to the desires of tenured colleagues who make the tenure decision, and such a time period is too short to evaluate the faculty for tenure. Engineering faculty do not entertain ideas for the sake of ideas; instead, they address what makes something useful in society. Because the measure of usefulness is embodied in the idea's marketability, engineering faculty seldom take a very long time in research. Academic fields that are independent from market forces and from practical considerations tend to take a longer time for research. Also, when the market dictates research, external considerations instead of departmental politics play a major role in faculty's autonomy. Therefore, the 7-year rule does not appear short to grant tenure in engineering. Similarly, departmental politics are unlikely to play as big a role in tenure decisions in engineering as in some other disciplines. Instead of managing their probationary years with great care and competing with their colleagues for the favoritism of the senior members, junior faculty tend to concentrate on publications and getting grants that have become a major source for gaining tenure in engineering.

Conclusion

The question of importance is whether tenure has become obsolete in guaranteeing academic freedom in engineering. The answer is yes and no.

Historically, tenure has provided protection for those faculty members whose views on intellectual, religious, or political matters have been offensive to their chairs, deans, university administrators, trustees, media, or public. However, violation of academic freedom of faculty for their religious or political activities by administrators has become rare. Edward Shils (1995) notes that it is not because of tenure but rather because universities and technical knowledge have come to enjoy high esteem and because intellectual originality is highly valued. In engineering, faculty do not encounter the necessity of expressing their views on religious, political, or sexual matters in routine teaching and research. Instead of locating traditional justification of permanent tenure in academic freedom, there is a need to realize new circumstances and rethink tenure accordingly. In engineering, infringements on academic freedom are imposed due to declining funds for higher education and increasing funds from industrial and government sources for research that is relevant to industry.

There are reasonable arguments for permanent tenure in engineering, though they have little to do with the traditional justification of academic freedom. Tenure is a means by which engineering programs compete with the salaries offered to talented engineers by industry as well as other private institutions of higher learning. For instance, median salaries for recent Ph.D. recipients in engineering were $65,000 working for a private company and $50,000 on tenure-track at a 4-year institution (NSF, 2000, p. 3/19). Furthermore, unlike academia, engineers working for industry are able to organize interdisciplinary projects and have access to more resources and time to conduct research (Varma, 1999). Engineering faculty accept financial and other sacrifices in exchange for the relative independence of academic work. Without tenure, the attractiveness to join academic institutions will surely decline. It is especially true for women and minorities who are marginalized in engineering and thus vulnerable to intimidation. Furthermore, tenure is likely to provide a ground for risk-taking research, which is being shifted due to increasing industrial support for engineering research. It will also provide a basis for engineering faculty to disseminate knowledge to their peers and the general public. With tenure, women and minorities can engage in challenging research and scholarship rather than being safe. Without tenure, the increasing reliance on the temporary faculty will damage the long-term relationship between faculty and students, which is critical to the quality of students and education in engineering. Students must see a real professor for quality education in the era of cutting-edge engineering work.

Rather than the outright abolition of tenure as happened in the United Kingdom in the late '80s, some institutions such as the College of the Ozarks, Evergreen State College, Florida Gulf Coast University, Franklin Pierce College, Goddard College, Governors State University, Hampshire College, and Philadelphia College of Textiles and Science have been moving toward term contracts. Generally, faculty are hired on a long-term contract, 3 to 5 years, which is subject to renewal. However, it is not clear what would happen

if 300 engineering programs in the United States adopted a rolling contract system as an alternative to permanent tenure. This requires, at minimum, an empirical study in which engineering faculty determine the worth of tenure and how an alternative system should be structured. Such study should incorporate the views of students, whether they would prefer to get engineering degrees from institutions without a tenure system, as well as administrators, whether they would prefer to manage universities without tenure. This article shows that underlying roles for tenure in engineering go beyond traditional justification of academic freedom. The AAUP and other supporters of the tenure system need to realize the new realities of the 21st century and mold the justification for tenure accordingly, before increasing reduction of tenure-track lines eliminates the tenure system.

Notes

1. It is the fundamental policy statement on substantive and procedural standard for tenure, formulated by the American Association of University Professors (AAUP) and the Association of American Colleges (AAC), and endorsed by more than 160 professional and educational organizations in the United States.

2. Adequate cause refers to demonstrated incompetence or dishonesty in teaching or research, to substantial neglect of duty, and to personal conduct that substantially impairs the individual's fulfillment of his or her institutional responsibilities. A termination should occur only after full academic due process.

3. Financial exigency is an imminent financial crisis that threatens the institution as a whole and that cannot be alleviated by less drastic means.

4. In 1971, the AAUP with the AAC created the Commission on Academic Tenure, which carries out its own program of investigation and reports directly to the academic community and to the general public in its bimonthly publication, *Academe*. The AAUP has censured 50 institutions that did not adhere to the generally recognized principles of academic freedom and tenure (AAUP, 2000).

5. The Carnegie Foundation for the Advancement of Teaching had classified institutions of higher education in the United States into disjoined categories based on the size of their degree programs, the amount of research funding, and selectivity on students. In 1996, 126 research universities provided more than 60% of engineering degrees at both the graduate and undergraduate levels. The doctorate-granting universities awarded more than 17% of degrees, followed by master universities granting more than 13%. The research universities received the most federal funding (NSF, 2000, p. 4/8). Under the new Carnegie classification of 2000, research universities are known as doctoral extensive.

6. One of the best-known tenure-denial cases was of the Harvard sociologist, Theda Skocpol (1980). She charged gender bias, noting there were no female tenured professors in a department of 11 and a tiny percentage of tenured women faculty in Harvard general (3.4% compared with about 10% nationwide).

7. For example, three out of four recipients of Harvard's teaching award were denied tenure. Stephen Ferruolo at Stanford, and Bruce Tifney and Faye Crosby at Yale were denied tenure after winning teaching awards (McGee & Block, 1997).

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