Session 2000 -0912

ACCREDITAION CRITERIA FOR DETERMINING THE QUALIFICATIONS OF A DEGREELESS PERSON TO TEACH OR PRACTICE ENGINEERING

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Abstract

The paper proposes criteria for determining the qualifications of a person to be an engineer or an engineering professor in a given discipline when he/she does not have a degree in the discipline, and encourages AAUP, ABET, ASEE and NSPE membership to address this problem. The US Department of Immigration and Naturalization Services [INS] considers an experience of 12 years equivalent to an engineering degree under certain conditions and, based on that, grants an appropriate visa to a person with such experience to work in the United States. Sometimes instructors and professors move into new disciplines and participate in teaching and making academic decisions along with those who have the real expertise in these disciplines. It is very important that a person be qualified to work as an engineer before he/she starts working as an engineer. A professor should have had training for teaching in a college and be fully qualified to teach and participate in decision-making committees that decide curricular and faculty evaluation matters in the discipline of which he/she claims to be a professor.

Introduction

Normally, when a person receives a degree in a discipline and embarks on a career in the discipline, he/she becomes an engineer after some years. Similarly when a person receives the Ph.D. degree in a discipline and gets a faculty appointment in the department of the discipline in a university, he/she becomes an [assistant] professor of the discipline even though he/she might have had no training for teaching in a college. In both these cases, the question of their being qualified in their respective disciplines does not arise since both the engineer and the professor, under these normal circumstances, are considered to be qualified to perform their respective duties. The paper does not address such engineers and professors.

Degree Earned Through Experience

The United States Department of Immigration and Naturalization Services has some criteria, given in '8 code C.F.R. 214.2 (h) (4) (iii) (D)' [given in Appendix I], to determine if the

professional experience of a person without a bachelor's degree can be considered to be equivalent to an engineering degree from an accredited engineering department[1]. The INS criteria consider professional experience for three years equivalent to successful completion of one year of full-time study in an accredited engineering degree program so that a person who has no formal education beyond high school and has 'professional' experience for twelve years may be determined to have earned the equivalent of a bachelor's degree. There is a lot of subjectivity involved in this type of evaluation. We are not aware if ASEE and/or ABET have addressed this issue; NSPE position is given in Appendix III. Recognizing work experience equivalent to an engineering degree when a person has had no formal education at the college or university level is of paramount importance to the engineering profession since 'engineers' without a degree and considered to have satisfied these criteria by two 'authorities' are allowed to work in the United States as full-fledged engineers. Some states in the US, the state of Hawaii for example, allow them to be considered for licensure exams to earn the registration as a professional engineer.

Professor Wearing a Hat of a New Discipline

When a new engineering discipline emerges or some discipline receives more recognition due to its recent emergence or economic or some other reasons, some professors move to the new discipline. An excellent example is that of a professor of electrical engineering in the department of electrical and computer engineering [or a professor of mathematics in the department of mathematics and computer science]. Such professors in some schools claim to be professors of computer engineering [or computer science] and teach courses in programming and even other courses in the computing discipline. There is a widely prevalent misconcept that a person who is a good programmer is as qualified to be a professor of computer science and engineering [CSE] as a professor in the CSE discipline. This is equivalent to considering that a qualified pilot is as well qualified in the discipline of aeronautical engineering as a professor of aeronautical engineering, which, of course, is totally untrue! Such professors get involved in decisions pertaining to curricular matters, violating the integrity and soundness of the academic process. They evaluate, for promotion and tenure, their colleagues in the discipline in which they are not really qualified. They have input in deciding the departmental needs for faculty in different fields in the CSE discipline. They are involved in the process of recruitment of faculty in a discipline that they really do not belong to. The students fail to get the due coverage of material that they are entitled to when such professors teach courses in the CSE discipline.

Need for Criteria to Determine Competency

There is no data that this author has seen pertaining to US citizens and immigrants without a formal degree in engineering who may be working in the capacity of an engineer in an American industry. Before an alien without a formal degree in engineering is hired to work as an engineer in US, he/she has to satisfy US Immigration and Naturalization Services [INS] criteria. The INS criteria state: "It must be clearly demonstrated that the alien's training and/or work experience included the theoretical application of specialized knowledge required by the specialty occupation… ."[1] It is the responsibility of the evaluating authorities to determine that the alien who was actively involved in analysis and design for a period of twelve years has indeed acquired an understanding of all the basic concepts in an engineering discipline taught in an accredited engineering program. We have not seen any detailed criteria laid out for this purpose.

It is conceivable that a person could do the same 'simple' design for years that does not require a comprehensive knowledge of the basic concepts in the discipline he/she is working in and may be considered by some evaluators, from an engineering qualification point of view, to be equivalent to a person who has worked hard for four years to get a degree from an accredited institute. It must be clarified here that the author is not complaining against aliens who satisfy INS criteria and get to immigrate and work and the US. It is the INS criteria that are questionable.

Developing improved criteria at the moment appears to be an open problem and would require some debate among ABET, ASEE and NSPE membership. One possible criterion would be to require that the 'engineer' should have worked on a certain number of totally distinct projects that collectively require an understanding of virtually all of the basic concepts taught in an accredited engineering program of the discipline he/she is working in. It would be helpful if these three organizations could develop a list of minimum basic concepts expected of an engineer in a given discipline. The evaluating authorities, then, would have refined criteria to judge an alien's experience against. Perhaps an ideal solution would be to give such degreeless persons a comprehensive test covering the basic concepts in the discipline. Two tests currently used for engineering graduates are the EIT (Engineer in Training) and the PE (Professional Engineer) examinations, administered by NCEES at Clemson University. The degreeless persons should be required to pass these tests.

Accredited programs require 18 credits of humanities and social sciences for a bachelor's degree in engineering. As shown in Appendix III, the Code of Ethics adopted by NSPE[2] requires a pledge from an engineer 'to dedicate my professional knowledge and skill to the advancement and betterment of human welfare.' ABET, ASEE and NSPE should decide whether the maturity in ethical, professional and other human aspects in the personality of a degreeless should also be considered while granting him/her the equivalence of a degree in an engineering discipline and all the privileges that go with it.

Criteria to Be Able to Teach

Nowadays a doctoral degree in a discipline is almost always needed to teach in an accredited degree program in the discipline. We should also require that an applicant for a teaching position in a college must have some training for teaching in a college. This implies that, in order to be able to teach in a discipline, a person must have training to teach in a college and an excellent grasp of the basic concepts covered in the core courses in the discipline in addition to an excellent mastery over several advanced topics in the mainstream areas of the discipline. No university or college that I know of requires any training for teaching in a college prior to his/her appointment on the faculty of the college.

As long as qualified people are available to teach in a discipline, instructors and professors of other disciplines should not be allowed to teach courses in the former discipline and should not be given the privileges and responsibilities of a professor of the discipline. If they have to be assigned teaching of a course in this discipline due to extraordinary circumstances, they should not be considered professors of this discipline.

A person graduating with a bachelor's degree in a discipline acquires an understanding of the basic concepts in the core courses in the discipline and an exposure to advanced topics in the mainstream areas of the discipline. A person who claims to be a professor of a discipline should have an understanding of the concepts and topics in the discipline no less than the understanding that the students graduating in the discipline have.

A comprehensive, coherent and consistent design of a relevant curriculum is a very serious matter. Voting, in curricular and faculty evaluation matters in a discipline, by a professor who does not have the adequate background of the discipline may be guided by political and other nonacademic considerations. Only professors who have a thorough grasp of all the basic concepts and advanced topics in mainstream areas should be allowed to participate in curricular design, additions, deletions, modifications and upgrading. Only such professors should be allowed to vote on hiring, promotions, tenure and other decisions relating to faculty evaluations. Only then the soundness and integrity of academic processes will be preserved.

Conclusion

It should be the primary concern of ABET, ASEE and NSPE that some legitimate criteria, recognized by them, are applied before a person, alien or citizen, without a degree in an engineering discipline earned through formal education is 'granted' the equivalence of a degree in the discipline by the US INS criteria. The criteria used by the US INS need to be supplemented and complemented. Perhaps the best solution would be to give such applicants for an equivalent degree a comprehensive test covering all the basic concepts in the discipline he/she has been working in as well a test on ethical and professional topics. One possible way to evaluate such applicants would be to give them EIT exam administered by NCEES. [This exam is called FE exam (Fundamentals of Engineering) now]. Their attitude to service to mankind and positive interest in human welfare too must be determined.

It would be highly desirable to require some training to be able teach in a college prior to appointing a person to teach in a college or at least have him/her acquire it in the first semester of his/her teaching.

It is very essential that the professors who have moved over to a new discipline acquire at least as much understanding of all of the basic concepts of the core courses and advanced topics in the mainstream areas of the discipline as a student graduating in the discipline does. This is absolutely essential to protect and preserve the soundness and integrity of the vital academic processes, engineering profession and education, and our commitment to impart the best possible engineering services to mankind and the best possible education to engineering students.

The medical profession requires not only a formal degree in medicine from a foreign medical graduate but also his/her passing two parts of United States Medical Licensing Examination before he/she can be a resident in a hospital. In fact even a graduate from a USA medical school is required to take the same examination. Engineering professional societies need to closely examine the procedures and standards set by American Medical Association and learn from it.
We hope that this paper will encourage AAUP, ABET, ASEE and NSPE membership to address these issues and solutions suggested here attempt to find better solutions .

Acknowledgement

The author is pleased to acknowledge gratefully the kind help provided by Mr. Laurence D. Bory (Larry), Director, Government Relations, NSPE, by emailing NSPE Code of Ethics and other information, including factual issues related to licensing and NSPE support of licensing and registration of engineers.

References

(1) Aliens and Nationality 8: Code Federal Regulations, Office of Federal Register, National Archives and Records Administration, Revised January 1998, page 261.

(2) CODE OF ETHICS, Adopted by National Society of Professional Engineers, June 1954. NSPE Polices and Procedures 1998-99, NSPE, 1998.

APPENDIX I

INS Regulation 214.2(b) (4) (iii) (D):

"EQUIVALENCE TO COMPLETION OF A COLLEGE DEGREE: For purposes of paragraph (h) (4) (iii) (D) of this section, equivalence to completion of a United States baccalaureate or higher degree shall mean achievement of a level of knowledge, competence, and practice in the specialty occupation that has been determined to be equal to that of an individual who has a baccalaureate or higher degree in the specialty and shall be determined by one or more of the following:
"An evaluation from an official who has authority to grant college-level credit for training and/or experience in the specialty at an accredited college or university which has a program for granting such credit based on an individual's training and/or work experience;

"The results of recognized college-level equivalency examinations or special credit programs, such as the College Level Examination Program (CLEP), or Program on Noncollegiate Sponsored Instruction (PONSI);

"An evaluation of education by a reliable credentials evaluation service which specializes in evaluating foreign educational credentials;

"Evidence of certification or registration from a nationally-recognized professional association or society for the specialty that is known to grant certification or registration to persons in the occupational specialty who achieved a certain level of competence in the specialty;

"A determination by the Service that the equivalent of the degree required by the specialty occupation has been acquired through a combination of education, specialized training, and/or work experience in areas related to the specialty and that the alien has achieved recognition of expertise in the specialty occupation as a result of such training and experience. For purpose of determining equivalency to a baccalaureate degree in the specialty, three years of specialized training and/or work experience must be demonstrated for each year of college-level training the

alien lacks. For equivalence to an advanced (or Masters) degree, the alien must have a baccalaureate degree followed by at least five years of experience in the specialty. If required by a specialty, the alien must hold a Doctorate degree or its foreign equivalent. It must be clearly demonstrated that the alien's training and/or work experience included the theoretical application of specialized knowledge required by the specialty occupation; that the alien's experience was gained while working with peers, supervisors, or subordinates who have a degree or its equivalent in the specialty occupation; and that the alien has recognition of expertise in the specialty evidenced by at least one type of documentation such as:
"Recognition of expertise in the specialty occupation by at least two recognized authorities in the same specialty occupation;

"Membership in a recognized foreign or United States association or society in the specialty occupation;
"Published material by or about the alien in professional publications, trade journals, books, or major newspapers;
"Licensure or registration to practice the specialty occupation in a foreign country; or

"Achievements which a recognized authority has determined to be significant contributions to the specialty occupation.[1]"

Appendix II

Comment of Art Schwartz, General Counsel NSPE:
"NSPE's current policy really makes no exception and requires an ABET/EAC degree or its equivalent for purposes of engineering licensure (or in some cases a Ph.D. or doctorate from a university that has an ABET/EAC program). NSPE's policies do not define the term "engineer" in any other substantive manner except within the general concept of licensure.

"Some states [in the U.S.] licensure laws permit individuals to become licensed without an engineering degree based upon experience. The Engineering Licensure Manual Matrix on this point would be helpful in determining the states and their requirements."

Appendix III

Engineer's Creed:
"As a Professional Engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare.
I pledge:
To give the utmost of performance;
To participate in none but honest enterprise;
To live and work according to the laws of man and the highest standards of professional conduct;
To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations.
In humility and with need for Divine Guidance, I make this pledge." Adopted by National Society of Professional Engineers, June 1954 CODE OF ETHICS[1].

Bibliographic information

Dr. Moiez A. Tapia was born in Surat, India. He received his Ph. D. from U. of Notre Dame. He taught at Georgia Institute of Technology for 5 years and went to work for the NASA Langley Research Center as ASEE-Ford Foundation Resident Fellow. He has been at the U. of Miami since August 1974. His current areas of interest are real-time systems and object-oriented languages.