AC 2008-628: NATIONALLY NORMED EXAMS FOR OUTCOMES ASSESSMENT OF ENGINEERING TECHNOLOGY PROGRAMS AND CERTIFICATION OF ENGINEERING TECHNOLOGY GRADUATES

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Nationally Normed Exams for Outcomes Assessment of Engineering Technology Programs and Certification of Engineering Technology Graduates

Abstract:

Four-year engineering programs often use the FE exam as a direct measure of outcomes for EAC of ABET accreditation, but such use of the FE exam is not universally appropriate for engineering technology programs. Many engineering technology programs are at the two-yr community college level, and graduates of those programs are not typically eligible to sit for the FE exam. There are fifteen states or other jurisdictions in the U.S. that do not allow graduates of 4-yr engineering technology programs to take the F.E. Use of the FE exam for outcomes assessment of engineering programs and its appropriateness for outcomes assessment of engineering technology programs are examined in detail. The implications of using the FE, which is designed as a test of minimum competency, for outcomes assessment are discussed.

A need is identified– particularly at the community college level and in states where graduates of four-year ET programs are not eligible to take the FE – for nationally normed exams that can be used for direct assessment of outcomes for TAC of ABET accreditation and for state and regional accreditation purposes. Since graduates of 2-yr ET programs are not eligible for engineering licensure in most states, some type of certification such as that offered by NICET, a division of NSPE that has been certifying engineering technicians since 1961 and engineering technologists (by education and experience) since 1980, may be important for career advancement. This paper examines the considerations in developing exams that can meet such needs. Other topics addressed include: the need for different exams at the 2- and 4-yr levels, an exam format that includes separate breadth and depth components, the types of exam-result data that are most helpful for outcomes assessment, development of the question items, and student motivation.

Introduction:

Four-year engineering programs in the U.S.A. often use the Fundamentals of Engineering (FE) exam as a direct measure of outcomes for EAC of ABET accreditation, but such use of the FE exam is not universally appropriate for engineering technology programs. Many engineering technology programs are at the two-yr community college level, and graduates holding only associate's degrees are not typically eligible to sit for the FE exam. There are fifteen states or other jurisdictions in the U.S. that do not allow graduates of 4-yr engineering technology programs to take the FE [1].

There is at least one existing possible alternative to the FE exam that is worth examining. Professional Publications, Inc. [2] offers preparatory materials and practice exams for a variety of professional licensure and certification exams such as engineering, architecture, surveying, LEEDS, interior design, landscape architecture, and geology. The Professional Publications web service [2], Exam Café©, allows the user, potentially an engineering or engineering technology department, to create custom-designed exams for a range of engineering subjects and develop statistics for evaluation of student performance. It appears the statistics are limited to comparisons made within the single cohort of students taking the exam at that particular institution and exam administration. Such data might be useful for a longitudinal study that examined student performance over time at a single institution and for a single program, but assessment of student performance in any nationally normed context is mostly precluded by the custom nature of the exams and limited statistical data.

Nationally normed exams that can be used for direct assessment of outcomes for TAC-ABET accreditation would be particularly useful at the community college level and in states where graduates of four-year ET programs are not eligible to take the FE exam. In an informal online survey conducted by the authors in the fall of 2007 on the ASEE Engineering Technology List Serve, several engineering technology faculty and administrators for community college programs around the country described how nationally normed ET exams would be beneficial in helping them satisfy regional accreditation requirements and state demands for value-added accountability – often in the form of some type of exit exam. They were concerned that exams designed for community college graduates were not available. Many survey responses also indicated that a single exam subject area would not be sufficient. To meet the needs of the diverse specialized disciplines of ET, there should be exams that go beyond just a general engineering technology breadth component to focused optional exam depth modules in different practice areas.

Outcomes assessment and the FE exam:

EAC of ABET and TAC of ABET accreditation regimes require outcomes assessment. TAC of ABET documentation [3] under Criterion 3, Program Outcomes, stipulates that each program must demonstrate its graduates have:

a. an appropriate mastery of the knowledge, techniques, skills, and modern tools of their disciplines
b. an ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering, and technology
c. an ability to conduct, analyze and interpret experiments, and apply experimental results to improve processes

d. an ability to apply creativity in the design of systems, components, or processes appropriate to program educational objectives
e. an ability to function effectively on teams
f. an ability to identify, analyze and solve technical problems
g. an ability to communicate effectively
h. a recognition of the need for, and an ability to engage in lifelong learning
i. an ability to understand professional, ethical and social responsibilities
j. a respect for diversity and a knowledge of contemporary professional, societal and global issues
k. a commitment to quality, timeliness, and continuous improvement

These are the well known "a through k" criteria for engineering technology programs. EAC of ABET documentation [3] delineates a very similar set of criteria for engineering programs. The general criteria apply to all ET programs at both associate and baccalaureate degree levels. For programs in specific disciplines, different additional outcomes are listed for associate and baccalaureate degree programs. For example, the program criteria for "Civil Engineering Technology and Similarly Named Programs" are listed as follows [3]:

Outcomes

Associate degree programs must demonstrate that graduates are capable of:
a. utilizing graphic techniques to produce engineering documents;
b. conducting standardized field and laboratory testing on civil engineering materials;
c. utilizing modern surveying methods for land measurement and/or construction layout;
d. determining forces and stresses in elementary structural systems;
e. estimating material quantities for technical projects; and
f. employing productivity software to solve technical problems.

Baccalaureate degree programs must demonstrate that graduates, in addition to the competencies above, are capable of:
a. planning and preparing design and construction documents, such as specifications, contracts, change orders, engineering drawings, and construction schedules;
b. performing economic analyses and cost estimates related to design, construction, operations and maintenance of systems in the civil technical specialties;
c. selecting appropriate engineering materials and practices;
d. applying basic technical concepts to the solution of civil problems involving hydraulics, hydrology, geotechnics, structures, material behavior, transportation systems, and water and wastewater systems; and

e. performing standard analysis and design in at least three of the recognized technical specialties within civil engineering technology that are appropriate to the goals of the program.

Evaluation of these outcomes should be accomplished by using a variety of assessment tools that can be a mix of direct and indirect methods, but ABET clearly gives preference to direct measures. Subjective surveys of current students, graduates and employers are common examples of indirect assessment tools. Other assessment instruments typically recognized as direct measures by ABET include student portfolios, instructor-collected samples of student work, supervisor evaluations of co-ops and interns, and standardized exams, the FE in particular.

The Joint Task Force on Engineering Education Assessment [4] correlated possible program assessment measurement devices with ABET "Engineering criteria 2000" attributes. The FE exam was given their highest rating (out of three possible levels) as a "reasonable" assessment measure for only one of the 11 a through k engineering criteria: knowledge of math, science, and engineering. The rating for the FE was "moderate" as an assessment measure for two of the other attributes: problem solving and contemporary practice and issues [4.] The Joint Task Force suggested that with careful attention to detail, it may be possible to measure other outcomes with some success.

NCEES has promoted use of the FE exam for outcomes assessment and has published guides [5 6] to assist with interpretation of the data. LeFevre et al. [6] list the EAC of ABET outcomes that, in their estimation, the FE exam is well equipped to assess. The corresponding TAC of ABET general criteria outcomes are: *a*, *b*, *c*, *d*, *f*, and *i*. The authors caution against focusing on the percent of students who pass the exam [6]. Instead, departments should make use of the NCEES subject matter reports that can be obtained from NCEES or from state licensing boards to analyze their students' performance in specific topic areas over several years of record. Topic areas are divided into morning and afternoon sessions and were revised somewhat for exams administered after October 2005.

All examinees take the same general engineering morning module that covers a total of 12 topics: chemistry, computers, electrical circuits, engineering economics, ethics & business practice, and statics & dynamics [6]. The general afternoon exam [6] covers engineering economics, material science/structure of matter, advanced engineering mathematics, engineering probability & statistics, biology, engineering mechanics, engineering of materials, electricity & magnetism, and thermodynamics & heat transfer. In lieu of the general engineering afternoon module, a discipline-specific afternoon depth module may be selected from chemical, environmental, industrial, civil, electrical, or mechanical options. The topics covered, for example, in the environmental engineering afternoon module are: water resources, water & wastewater engineering, air-quality engineering, solid- & hazardous-waste engineering, and environmental science &

management[6]. LeFevre et al.[6] recommend several methods of analyzing the data, but all focus on assessing student performance in the different topic areas over several administrations of the exam.

Lawson[7] examines the reliability and validity of using the F.E. exam for assessment of individual competence and of engineering program outcomes. Lawson[7] notes the difference between criterion referenced exams such as the F.E. and norm referenced exams such as the SAT or GRE[8]. An individual's performance on a norm referenced exam is by implication evaluated through comparison to the performance of other examinees or groups of examinees[7]. The F.E. exam is criterion referenced because performance on the exam[7] "is evaluated based on a designated standard, learning objective, or goal." NCEES devotes considerable effort to developing exam questions or items for the FE and the Principles & Practice of Engineering (P&PE) exams that focus on the technical content that is currently taught in engineering programs and the technical skills required for professional practice. Professional Activity and Knowledge (PAK) studies are conducted by surveying extensive numbers of engineering faculty and practitioners to determine the distribution of topics that should be covered on the tests.

Minimum passing or "cut" scores are set by subject-matter experts with the intent of insuring that those who pass the exam are at least minimally competent in the subject matter[7.] There is a possible mismatch between the designed purpose of the FE exam for measuring minimal competency and its use for assessment of engineering or engineering technology programs as part of a continual improvement process that presumably strives for excellence. In designing items for minimum competency tests, care must be taken to make items the appropriate level of difficulty. If items are too difficult, fairness requires that cut scores be reduced[9]. For multiple choice tests such as the FE, low cut scores increase the likelihood of an examinee passing by chance. Less difficult or simpler questions are, in fact, preferred because they result in higher cut scores and thus improve an exam's ability to discriminate between incompetent and minimally competent examinees. The simpler questions may not serve as good indicators of program outcomes, however.

There are a number of other potential pitfalls in the use of the FE exam for outcomes assessment, particularly for engineering technology programs. Lawson[7] warns about the danger of using statistics from a biased sample of examinees or a population of examinees that is extremely small. The problem of small sample populations has been exacerbated by the change in FE format from general engineering morning and afternoon sessions to a format retaining the general engineering morning session but allowing for discipline-specific afternoon modules. The afternoon depth module can now be selected from: Chemical, Civil, Electrical, Environmental, Industrial, Mechanical, and Other/General engineering[10]. In addition to the problem of small or biased samples, academic programs in disciplines that are not explicitly represented in the list of six discipline-specific afternoon modules are faced with interpreting FE exam results from a test that is probably not totally consistent with the unique goals and objectives of those programs and the associated subject matter focus.

For EAC of ABET engineering examinees who major in one of the discipline-specific areas represented in the afternoon, there is less danger of small sample sizes or inconsistency between the test and the program. For examinees from programs not in the list of specific engineering disciplines offered as afternoon depth modules, however, there are seven choices of afternoon module for them to take. Unless such examinees are directed to take specific modules by their departments, examinee results will very likely be spread over several subject areas. Some afternoon modules may be selected by very few examinees from that institution, and the smaller numbers spread over several different exams will weaken the statistical comparisons that can be made.

Not only is there the risk of few examinees from any one institution taking a particular module, but there may be few examinees nationwide in the comparison category who took a particular afternoon module. Changes to the reports issued by NCEES have also made comparisons more difficult. Prior to 2005, in report 5A, it was possible to obtain data for the institution's examinees and all examinees nationally grouped by major and by all majors combined. The latest version of the report has omitted the option of obtaining data for groupings with all majors combined. Consider, for example, the data obtained from NCEES and presented in Table 1 for an administration of the FE exam in April 2007. The reported data are broken down by (1) program type, (2) student indicated major, and (3) PM exam. Students were encouraged but not required to take the exam at this institution.

For the combination of general engineering major (as specified by the examinee) and general engineering PM exam, the one individual from this institution was the only person in the whole ***nation*** who was from an engineering technology program who specified a general engineering major and who took the general engineering exam. At this institution, the civil PM exam was the only module taken other than the general/other engineering module. The only statistic that is relatively easy to glean from these data is that for this exam administration and this institution, nine students enrolled in the engineering technology program sat for the FE exam, and seven passed.

We can also see that all three who attempted the general engineering PM module passed, while four out of six who attempted the civil PM module passed. Because different PM exam modules cover different subject matter, the only curriculum-wide comparisons that can be made are for subjects on the AM portion of the exam. Valuable analyses of subject matter performance for the PM exam are weakened because results for an already small examinee population are split between two different afternoon exam modules. The validity of the data is tremendously compromised for the general/other engineering afternoon module because the sample size is very small, and the students from this one institution constitute three of the nine engineering technology examinees in the whole country who took the general exam in majors corresponding to those listed by the students at this institution. The students from this one institution were three of the seven who passed. If the FE comparator groups are composed of engineering technology majors only and are compared only by major, small populations of examinees are expected to be typical.

Table 1. Example FE exam statistics for currently enrolled students in engineering technology programs taking the exam, by major and by PM exam, (institution/national).

Student-Indicated Major	PM Exam Module			
	Taking		Passing	
	General/ Other	Civil	General/ Other	Civil
Agricultural	1/2		1/2	
Civil		1/134		1/1
Construction		1/22		0/8
General	1/1	3/5	1/1	2/2
Other	1/6	1/1	1/4	1/1

A final issue that must be considered is the motivation of the students taking the FE exam. The dilemma faced by engineering programs and, as we have seen, engineering technology programs in particular, is that unless all seniors in the program are required to sit for the FE exam, the population of students taking the exam in an engineering or engineering technology program at a particular institution may be very small. To address this issue, many engineering programs have opted to require that their seniors take the FE exam, but have not mandated any requirements to pass it.

In confirmation of historical observations regarding low-stakes testing, it has been well documented that students who are uninterested in licensure but who are nonetheless required to take the FE exam often simply sign in, randomly mark responses on the answer sheet, and then leave the examination room if they are not also required to pass [7]. Institutions that require students to take, but not pass, the F.E. exam often provide financial inducements for the students to make a good effort by reimbursing them for exam expenses if they pass. There is strong evidence that not even these financial stakes provide enough incentive for all students to do their best [11]. Other institutions try to motivate students by including exam results on student transcripts [10].

Good arguments can be made against requiring engineering students to pass the F.E. exam as a condition for graduation; those arguments are even more pertinent in the case of engineering technology students since the FE is designed to measure competence at a presumably higher level or at least more theoretically advanced level than engineering technology students are typically expected to perform. The student motivation factor, in the absence of an onerous requirement to pass the exam, is probably sufficient argument against requiring all students, whether engineering or engineering technology, to sit for the FE.

The best method of motivating students, whether engineering or engineering technology, would seem to be to encourage students to voluntarily take the exam through a combination of incentives (some, perhaps, financial) and establishment of an academic program culture in which licensure is strongly promoted as a career goal. Such an approach must be carefully implemented so as not to bias the population of students taking the exam. Still, use of the FE exam for assessment is not an option for ET programs located in jurisdictions that do not allow ET graduates to be licensed; nor is use of the FE possible for two-year ET programs because few states allow applicants with only associate degrees to take the FE.

Certification and Testing of Engineering Technicians and Technologists:

Career paths for engineering technicians and technologists most often do not and in some jurisdictions cannot include professional engineering licensure. The National Institute for Certification in Engineering Technologies [12] (NICET) is a not-for-profit division of the National Society of Professional Engineers created in 1961 (originally as ICET) to recognize the roles of engineering technicians and technologists as "important parts of the engineering team" and to serve the certification needs of the engineering technology community by providing credentialing services to skilled professionals in engineering-related fields that fall outside the purview of professional engineering licensure.

NICET's services benefit both workers and employers. "NICET's nationally recognized certification programs lay out a path for career advancement from entry to senior level responsibilities. Designed by industry experts to provide engineering technology fields with a qualified workforce, programs are increasingly used by employers and specifiers to measure job skills and knowledge." [13]

NICET defines engineering technologists as members of the engineering team who work closely with engineers, scientists, and technicians. Technologists have a thorough knowledge of the equipment, applications, and established state-of-the-art design and implementation methods in a particular engineering area.

Currently, Technologist certification requires a Bachelors Degree in an engineering technology program accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC of ABET). The Associate Engineering Technologist (AT) grade is available upon graduation, while the Certified

Engineering Technologist (CT) grade requires at least five years of related work experience after graduation. CT applicants must also submit two endorsements. There is currently no exam requirement for Technologist certification.

Engineering technicians are the "hands-on" members of the engineering team who work under the direction of engineers, scientists, and technologists. They have knowledge of the components, operating characteristics, and limitations of engineering systems and processes particular to their area of specialization. Technician certification is based on passing an examination, meeting work history requirements, job performance, and third-party evaluations.

The purpose of NICET exams is to provide a fair, valid, and reliable means to assess an individual's knowledge and skills. NICET's certification programs are created according to the accepted standards of the certification industry. A procedure much like that employed by NCEES in performing its PAK studies is used. This means that the examinations are based on a job/task analysis of the industry being certified and must be corroborated by actual practitioners. Thus, NICET has committees of subject matter experts (SMEs) who practice in the field, and NICET administers surveys in the field so that a wide section of practitioners at all levels may provide input. Results of the job/task analysis survey are compiled and an examination blueprint or examination specification is developed and published.

From the examination blueprint, the number of questions for each area is determined. Questions are written to detailed question writing standards by committees of SMEs and are reviewed prior to insertion into a test. Once there is a sufficient number of questions generated, a Beta test is created. This is a test of the test; here the candidates may take a test and their results are examined to see if the question is performing in the way it is intended; that is, to distinguish between those with the knowledge to practice and those who do not have that knowledge.

The passing score is set at the end of the Beta testing period by a committee of technical SMEs (not those who created the original items). The panel meets for at least a day to consider an examination. They take the examination just as if they were candidates; review the examination questions and the candidate performance. Candidate names do not appear in this review; so any individual's performance will not be known to the SMEs. The panel, through an iterative process, comes to a consensus as to the minimum number of items a knowledgeable candidate would have to get right in order to be considered competent. Given the statistics created from examination performance, the number of people who took the exam and the number of questions they got right or wrong, a passing score will be set. The passing or cut score is the score at which all earning less than that number will have failed, while all earning the cut score and above will have passed. The Modified Angoff method [14], Bookmarking [15], and Borderline

Groups [16] are the more popular methods used to set cut scores. NICET uses one of these methods to determine a passing score for a particular exam administration. NICET exams provide criterion referenced evaluations of performance as does the FE exam.

NICET's management system addresses and documents all these procedures and any exceptions. This process closely emulates the procedures used by NCEES in developing, administering, and grading its exams. NICET examinations are designed and monitored to ensure that those with the knowledge expected of a practitioner at a particular level can successfully complete the exam. Since development, administration, and scoring of the NICET exams so closely emulates those of the NCEES exams, the same observations about validity and reliability made by Lawson [7] with respect to the FE exam apply. The examinations delivered by NICET are based on industry practice and are created, administered, and scored according to test industry standards for fairness, validity, and reliability. Earning NICET certification is a valued achievement and is a mark of competence that is endorsed industry-wide.

A key difference between the current NICET exams and the FE exam is the emphasis the NICET exams place on practice. In this respect they are more similar to the NCEES P&PE exams than to the FE exam. Because much of the knowledge needed to successfully pass the NICET exams can reasonably be expected to be gained only through practice, they are not entirely suitable for assessment of knowledge obtained through purely academic efforts. Since the current NICET exams are intended for testing engineering technicians, who would typically have no degree or just a two-year degree, they do not cover the range of higher level technical subject matter that would be appropriate for testing engineering technologists, who would have bachelor's degrees.

Demand for Nationally Normed Fundamentals of Engineering Technology Exams and Exam Characteristics:

Thus far, we have examined the characteristics of existing exams that could potentially be used for outcomes assessment of engineering technology programs. The FE exam is designed for testing minimum competency of seniors in or graduates of EAC of ABET engineering programs. A combination of factors ranging from ET students being excluded from taking the exam in some jurisdictions, to mismatches between available discipline-specific PM exam modules and ET program focus, to career objectives of ET students that may not include licensure will often yield low and possibly biased populations of ET examinees in national comparator groups. Statistically valid inferences about ET program outcomes will often be difficult to obtain. Additionally, the FE exam is typically unavailable to recent graduates or graduating students of two-yr ET programs. The NICET exams are nationally normed criterion-referenced exams of minimum competency in ET subject matter, but are focused on skills obtained mostly through practice. They are not currently satisfactory for outcomes assessment of either two-year or four-year ET programs. Tests developed for assessment of two- and four-year ET programs could possibly be designed to play a role in the certification process, but that potential use will need to be further examined.

A need does exist, particularly at the two-yr ET program level for an outcomes assessment tool that can be used for valid statistical analyses of program outcomes. Since 15 states and jurisdictions do not provide access to the FE exam for ET students, there would seem to be sufficient demand for an alternative assessment tool for four-year ET programs in those locations. To be useful to the widest spectrum of ET programs, a fundamentals of engineering technology (FET) exam would need to have both breadth and discipline-specific depth components, perhaps modeled after the FE format.

At a minimum, the same seven disciplines covered by the FE should be considered: Chemical, Civil, Electrical, Environmental, General/Other, Industrial, and Mechanical. An argument could be made for also including Construction, Electronics, and Manufacturing. Since these exams would be directed at measuring competence of *engineering technologists* and would focus on *engineering technology* disciplines, even four-year ET programs located in states that allow ET graduates to be licensed might be enticed to use the FET exam in lieu of or in addition to the FE if it is perceived as a better fit for their students and program objectives. The exams could be available in 2-yr or 4-yr versions; one approach might be to employ a computer adaptive testing [17] (CAT) protocol that would assess performance at different levels, i.e., two-year and four-year.

Another possible market that should be considered is international. The United States is a provisional signatory of the Sydney and Dublin Accords [18]. The Sydney Accord is an agreement between the bodies responsible for accreditation of engineering technology baccalaureate programs in the signatory countries that recognizes the substantial equivalence of the engineering technology programs accredited in those countries. The Dublin Accord is an agreement establishing international recognition of Engineering Technician qualifications in the signatory countries.

Other than in a handful of exceptional locations, the FE exam is typically not administered outside the United States. Since most of the signatories to the Sydney Accord have accreditation agencies that employ some type of outcomes assessment, there is potentially a large international market for an internationally normed exam, perhaps administered through computer-based testing, that could be used as a direct measure of outcomes for engineering technology programs. Internationally normed exams that play a role in certification of Engineering Technicians might also find an international market.

For maximum program assessment utility, the criterion-referenced results of testing should provide ample statistics that can be used for easy comparison by topic area of student performance in different disciplines across institutions and majors and in longitudinal studies at a single institution. It might be possible to provide directly some of the statistics recommended by LeFevre et al [6] for analysis of FE exam data.

For any test, whether it be the FE or some FET exam, the question of student motivation must be addressed. Student motivation for taking an FET exam is, perhaps, even more problematic than for the FE exam, already discussed. Since engineering licensure is not at stake with an FET exam, students may have less motivation to put in an honest effort.

If, however, the exam played a role in some type of professional certification that is perceived by the student as being valuable, those stakes might provide the incentive for most examinees to make a serious effort. NICET certification for engineering technicians might play that role for students from two-yr ET programs. There is currently no role that examination plays in NICET certification of engineering technologists, so institutions may need to experiment with different approaches to motivate students from four-yr ET programs. Detailed topic scores should be provided for each examinee for the institution to use in any way that might help to motivate its students. Finally, a program culture in which professional licensure and/or certification are promoted will encourage students to put forth an honest effort.

Summary and Conclusions:

The FE exam has been used successfully as one instrument of outcomes assessment for EAC-ABET accredited engineering programs, although it does have shortcomings. Among those shortcomings are mismatches between the discipline-specific afternoon modules of the exam and the range of engineering program types and program objectives at various institutions. The problem of student motivation in low stakes testing situations is particularly important. It is possible to use the FE for outcomes assessment of ET programs, but it is not universally appropriate because ET seniors and graduates are not permitted to sit for the FE exam in at least 15 jurisdictions in the United States. The FE exam may not adequately test program outcomes for some ET programs.

A market definitely exists for an FET examination that can be used for outcomes assessment by two-year ET programs and by four-year programs in the 15 states or jurisdictions that do not license ET graduates. It is possible that an FET exam could be used internationally as well.

NICET is capable and enthusiastic about working with the education community and industries to explore the possibilities. NICET is experienced in developing and administering engineering technology exams. Plus, a corresponding certification could increase student motivation to take an exam.

In jurisdictions where ET seniors and graduates can sit for the FE exam, they should certainly be encouraged to do so if that is where their career aspirations lie; but for many ET students, including but not limited to those whose jurisdictions don't allow their licensure, a career path that involves engineering technician or technologist certification may often be the best choice. Four-year ET programs in states that allow ETs to be licensed may prefer to use an FET exam for outcomes assessment if it is a better fit for their students and program objectives.

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