Assessing Outcomes Using Program Assessment Portfolio Approach

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Abstract: The Accreditation Board for Engineering and Technology has developed and implemented new criteria for accrediting engineering technology programs in the United States. The new criteria, Technology Criteria 2000 (TC2K), have changed the way that engineering technology programs conduct their business. In order to survive in the future, each program has to develop a strategy to meet the new requirements specified in the TC2K. The Department of Engineering Technology at Texas Tech University has developed a program assessment portfolio (PAP) to assess the department performance toward the attainment of TC2K Criterion 1. This paper presents 12 assessment methods within the PAP. Particularly, it demonstrates how to develop and implement one of the assessment methods, pre- and postcourse assessment, to a senior-level course. Data collected from the implementation has been analyzed and results indicate that pre- and postcourse assessment provide valuable information regarding student learning. Furthermore, the information can be used to continue improving effectiveness of teaching.

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Introduction

In 1996, the Accreditation Board for Engineering and Technology (ABET) in Baltimore embarked on a revolutionary accreditation reform effort designed to foster an environment in which each graduate of engineering , technology, computing, and applied science possesses the skills necessary for both lifelong learning and productive contribution to the profession, employers, economy, and society. The centerpiece of this reform was a set of criteria for all ABET disciplines that would allow institutions to be flexible to constituent needs, to allow them to innovate while still maintaining a strong emphasis on educational quality. This reform reoriented ABET's accreditation philosophy from institution inputs to student outcomes and encouraged constructive interaction with institution constituents to maintain educational quality and relevance. Based on the new criteria for accrediting engineering technology programs, Technology Criteria 2000 (TC2K), published by the Technology Accreditation Commission (TAC) of ABET, there are seven major criteria that an institution shall meet in order to receive accrediting including: (1) students and graduates; (2) program characteristics; (3) faculty; (4) facilities; (5) institutional and external support; (6) assessment; and (7) program criteria. Under Criterion 1, Students and Graduates, TC2K specifies 11 attributes that an engineering technology program must demonstrate that graduates have (TC2K 2001) including

1. An appropriate mastery of the knowledge, techniques, skills, and modern tools of their disciplines,
2. An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering, and technology,
3. An ability to conduct, analyze, and interpret experiments and apply experimental results to improve processes,
4. An ability to apply creativity in the design of systems, components, or processes appropriate to program objectives,
5. An ability to function effectively on teams,
6. An ability to identify, analyze, and solve technical problems,
7. An ability to communicate effectively,
8. A recognition of the need for, and an ability to engage in lifelong learning,
9. An ability to understand professional, ethical, and social responsibilities,
10. A respect for diversity and a knowledge of contemporary professional, societal, and global issues, and
11. A commitment to quality, timeliness, and continuous improvement.

When the old TAC/ABET criteria were in place, an institution could almost wait until the year before the accreditation visit to start working on preparation for the visit. This is not to say that institutions could ignore the criteria for 6 years at a time. However, the bulk of the work required for preparation for a visit would be in the year preceding the visit. With the TC2K to be implemented for accreditation visit, this is no longer the case. Institutions must demonstrate achievement toward goals through various methods such as outcomes assessments, graduate career performance, and employer feedback. Institutions are also required to demonstrate continuous improvement. To aid in this ongoing effort, each institution who seeks ABET accreditation shall establish specific educational goals, determine the appropriate outcomes, and develop and implement assessment methods to measure the outcomes. This paper presents a program assessment

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TC2K Criterion 1	Assessment Methods												
	Alumni Surveys	Capstone Project Report	Employer Surveys	Fundamentals Review Exam	Graduate Questionnaire	Internship Report	Competitions Performance	Focus Group Exit Interviews	Organization Participation	Seminar Attendance	Computer Skills Self-Evaluation	Pre/Post Course Assessment	**Assessment Method Totals**
a. an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines.	▨	▨	▨	▨	▨	▨		▨			▨	▨	9
b. an ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology.		▨	▨	▨		▨	▨			▨	▨	▨	8
c. an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes.		▨		▨			▨					▨	4
d. an ability to apply creativity in the design of systems, components or processes appropriate to program objectives.		▨		▨			▨						3
e. an ability to function effectively on teams.		▨	▨			▨	▨		▨				5
f. an ability to identify, analyze and solve technical problems.		▨	▨			▨	▨		▨			▨	6
g. an ability to communication effectively.		▨	▨			▨	▨	▨	▨	▨	▨		8
h. a recognition of the need for, and an ability to engage in lifelong learning.	▨		▨		▨			▨					4
i. an ability to understand professional, ethical and social responsibilities.	▨		▨	▨	▨	▨	▨	▨	▨	▨			9
j. a respect for diversity and a knowledge of contemporary professional, societal, and global issues.			▨		▨			▨	▨	▨			5
k. a commitment to quality, timeliness, and continuous improvement.	▨		▨		▨	▨	▨	▨	▨	▨			8
Criterion Totals	4	7	9	5	5	7	8	6	6	5	3	4	

Fig. 1. TC2K Criterion 1/assessment method matrix

portfolio (PAP), which was developed by the Department of Engineering Technology at Texas Tech University in hopes of providing acceptable levels of assessment to verify department performance toward the attainment of TC2K Criterion 1. Specifically, the paper demonstrates how to use the pre- and post-course assessment, which is one of the assessment methods within PAP, to measure the outcomes from a senior-level course CTEC 4321 Construction Contracts and Specifications.

Program Assessment Portfolio Background

Outcome assessment has been a major topic of discussion in almost all fields of higher education. The methodologies of assessment have been debated for many years and become more pressing in recent years (Bakos 1999; Lee and Schechter 2000; and Nirmalakhandan and White 2000). A large part of the motivation for the department to develop PAP is the accreditation requirement. The department has performed well in past accreditation reviews, but considered addressing the assessment of the program in light of the new criteria to be a priority. After studying the TC2K Criterion 1, the department quickly realized that it would be impossible to use only one method to assess the outcomes toward attaining acceptable performance of TC2K Criterion 1. It was at this point in the history of the process that the department decided to look at using multiple assessment methods to verify the attainment of TC2K Criterion 1. What the department now views as a PAP was developed with 12 assessment methods including

1. Alumni survey,
2. Capstone project report,
3. Employer survey,
4. Fundamentals review exam,
5. Graduate questionnaire,
6. Internship report,
7. Competition performance report,
8. Focus group exit interview,
9. Organization participation report,
10. Seminar attendance report,
11. Computer skills self-evaluation, and
12. Pre and post course assessment.

Fig. 1 shows a matrix which indicates the relationships between the attributes of TC2K Criterion 1 and the assessment methods of the PAP. The rows of the matrix list the attributes of TC2K Criterion 1. The columns list the assessment methods constructed by the department to be included in the PAP. The shaded, intersect areas of the matrix indicate that the attributes on that row are being addressed by the assessment methods listed in the intersecting column. The highest assessment number achieved was for attributes “a.” and “i.” with nine assessment methods, and the lowest assessment number achieved was for attribute “d.” with three assessment methods. Although each attribute did not receive an equal application of assessment methods, the department believes that the distribution of methods and the nature of the methods used results in an adequate assessment of the outcomes under the demands of TC2K Criterion 1. As is common in portfolio assessment strategy, each assessment method is not equally represented among all factors nor does each assessment method carry equal weight in the final evaluation.

Assessment Methods within Program Assessment Portfolio

As the department set about to develop the assessment methods for the PAP, it turned first to those assessment methods that were currently in place and integrated these methods into the PAP. Examination revealed that the existing methods of evaluating the

department's performance could be divided into formal and informal methods. In order to fully understand the scope of the PAP, it is necessary to examine each assessment method briefly.

Existing Formal Methods

The formal methods had clear objectives, document sources, and were used for some time to generate reports for department decision making (Pigott and Karr 2001). The assessment methods that belonged in the formal category were alumni surveys, capstone project report, employer survey, fundamentals review exam, graduate questionnaire, and internship report. The Research Services Office at Texas Tech University conducts alumni surveys at 1, 3, and 7 years after graduation. The survey collection consists of a general institutional survey, a College of Engineering survey, and an Engineering Technology Department survey. Currently, the responses to the department survey have been slow, but over time, the department expects this method to generate some very usable data. Because the department has been receiving data from the general survey on a regular basis, it did not consider this method to be new. However, out of necessity, the department was required to construct a survey form that reflected the demands of TC2K.

The capstone project report was originally recorded as part of a student grade, but within PAP, the individual student score can be recorded as a tool for assessing the overall effect of the department on student performance. Students are evaluated on a rubric developed by the department that is designed to evaluate the objectives associated with the capstone project. The data collection is very straightforward with each student's performance being recorded in the PAP database.

The most formal of the existing methods used by the department was the employer survey. This survey was distributed to graduates of the department at their workplace and consisted of a series of questions to be answered by the employer. Having the graduates give the survey to his/her employers produced a better response than when the survey was mailed directly to the employer. Even so, the response was not overwhelming, but it did produce enough information to develop an influence on the curriculum and the practices of the department. The survey has been updated to reflect the demands of TC2K, and it will continue to be distributed on a regular basis.

For many years, the department has been teaching a fundamentals review course and has encouraged its students to take the fundamentals of engineering (FE) exam. Using FE exam results to assess student outcomes has been discussed in the engineering education society for many years (Mazurek 1995; Wicker et al. 1999). However, the department is reluctant to require every student to pass the FE in order to graduate. Therefore, the department has developed its own version of fundamentals review exam, and requires all students to take the exam after the fundamentals review course is over. Passing this exam is a requirement for graduation. Once the exam is completed the first time, pass rate is recorded in the PAP database.

The department distributes a questionnaire to all graduating students in the semester in which they are scheduled to graduate. The department chair maintains the information recorded on the questionnaire form and is responsible for the interpretation and use of the data. The PAP requires that the questionnaire be updated on a regular basis so that it reflects the true attitude of the students as they graduate. No major changes were required to integrate the graduate questionnaire into the PAP.

The internship report, which is to be filled out by the intern's supervisor, is very similar to the employer survey and was also amended to reflect the demands of TC2K. The department believes that its students greatly benefit from participation in an internship program. One of the major benefits is improved full-time employment opportunities after graduation. Accordingly, all students are required to complete the equivalent of at least 3 months of full-time work of an appropriate nature in order to graduate. Data collection methods are the same as for the employer survey with the results recorded in the PAP database.

Existing Informal Methods

The informal methods included competitions performance information, focus group exit interviews, organization participation information, and seminar attendance information. Previously, these methods were not part of the information collecting strategy for the department and existed more as common knowledge throughout the department. Faculty members were aware of the performance of the program as it related to these methods. None of these methods generated documents that could be used to support accreditation reports, but the department chair utilized it in formulating department decisions and in supporting and defending the performance of the department. The four methods mentioned previously have several common features (Pigott and Karr 2001). First, all of these activities involve students in noncredit activities. Second, the activities do not require regularly scheduled participation by students. Third, the faculty responsible for tracking performance indicators is not formally assigned. The department has attempted to formalize these activities but not structure them to the point that they become intrusive for the faculty responsible.

Competition activities, organization participation, and seminar attendance are very closely related in structure and will be handled as one category of activity. These activities are part of the overall education of our students, but maintaining performance records on these activities can very easily become part of the department lore. In order to make the results of student participation in these activities part of the PAP database, it was necessary to formalize the record keeping and move the results to a more permanent form. In the past, the faculties have kept track of the involvement of students in these activities, and the recording of results has been left up to the individual faculty. Under the PAP approach, the faculties are required to either report students' results to the department secretary for inclusion in the database or to perform the input themselves. Changes required to formalize the reporting of these three activities were minimal. No additional forms were necessary and the only true change was that information that had once been in someone's head now resides in the PAP database.

The department chair conducts the focus group exit interview with the graduating students at the end of the regular semesters to determine the general attitude of the students toward the department. The department chair also obtains the students' evaluation of the education and preparation received in the students' course of study. Several of the questions asked relate directly to the demands of TC2K. Graduating students are poised between student and alumni worlds and can offer a unique view of the department's performance. The interview is conducted in a fairly casual manner. The results of the interviews are maintained by the department chair. To integrate this method into PAP structure did not require making any changes in the interview methodology. The only changes required were the quantification scale and the inclusion in the database.

New Assessment Methods

As the department began to examine the existing assessment methods and the requirements of TC2K, it realized that two areas of department performance under increasing scrutiny were the performance of courses students were required to take and the level of student computer skills. As a result of this observation, the department decided to develop and implement two new assessment methods, which were the computer skill self-evaluation and pre- and postcourse assessment. Both methods add additional layers of assessment to areas that were covered in some form by existing approaches, but the department decided that the new methods would strengthen its ability to show satisfactory performance in both areas.

The computer skill self-evaluation covers areas of computer skills determined by the department to be essential to satisfactory performance in the field of engineering technology. The department was surveyed to determine which skills were essential to satisfactory performance. When the results of the survey were examined the department determined that skills in the areas of using the Windows operating system, a word processing program, presentation tools, a spreadsheet program, e-mail, Internet, and an equation solver such as TK Solver were departmental requirements. The instruments used to determine student performance in computer skill acquisition is a student self-assessment survey administered to both entering and graduating students in any given semester. Although self-assessment scales are open to a variety of interpretations, the department determined that the individual student's comfort level would be a good indicator of competency. There is no performance requirement on the survey, so all data is self-reported and not based on a performance grade. Another new assessment method being developed and implemented is the pre- and postcourse assessment which will be discussed in detail in the rest of this paper.

Pre- and Postcourse Assessment Background

Assessment's most powerful point of impact is the individual classroom (Banta et al. 1996). Traditionally, the department has used the Student Evaluation of Course and Instructor form to evaluate the individual class and instructor. Although the evaluation method has value, it is clear that this method does not provide information regarding how much knowledge students have gained by taking the course. The department realized that there is a need to transform the department from a teaching environment to a learning environment, and gradually abandon the focus on inputs in favor of measurable outputs or performance-oriented criteria, which are required by TC2K. In order to achieve this goal, the department decided to develop and implement the pre- and postcourse assessment.

The concept of pre- and postcourse assessment is quite simple. Students will be given a precourse assessment at the beginning of the semester and a postcourse assessment at the end of semester. Each assessment includes a set of questions which covers the basic topics of the course. Questions in the precourse assessment and postcourse assessment are the same. The instructor of the course is responsible for developing the pre- and postcourse assessment with help from other faculty members and department chair. By comparing the results of precourse assessment and postcourse assessment, the department will know some of or all of the following: (1) if students moving through the courses have the necessary background to be successful without remediation; (2) are students making the knowledge gains the course is intended to create; and (3) what improvements in content and approach could make the course perform better. The results can also be used as indicators to demonstrate whether the students meet some of or all of the requirements of Attributes 1, 2, 3, and 6 specified in the TC2K Criterion 1.

Developing and implementing pre- and postcourse assessment began as a very small effort. Initially only one course was assessed to determine the best procedure for structuring the process in 2000. During that time, one question, which was frequently asked, was the difference between the pre- and postassessment and the regular semester student examinations. The difference between the pre- and postassessment and the student examination is that the latter is an evaluation of the students whereas the former is an evaluation of the course. An examination requires the students to apply what he/she has learned in the course to solve a problem he/she has not seen before. The pre- and postassessment asks rather simple questions, usually multiple choice or true/false, to evaluate whether or not the basic material was conveyed to and understood by the students. Currently, there are 11 courses using pre- and postassessment approach in the department with five courses in the fall semester and six in the spring semester. Gradually, this approach will be implemented in all courses in the department.

Design of Pre- and Postcourse Assessment

One of the courses implementing the pre- and postcourse assessment is CTEC 4321, Construction Contracts and Specifications. CTEC 4321 is senior-level course for students in the construction engineering technology major. After taking this course, students are expected to have mastered the following:

1. Legal aspects of contract documents, drawings and specifications,
2. Owner, general contractor, and subcontractor relationships and responsibilities, and
3. Bidding methods and contract performance.

When designing the pre- and postcourse assessment for CTEC 4321, several aspects of assessment had to be considered including

1. The assessment should measure whether or not the basic information covered by the course had been adequately presented,
2. The format of the assessment should be simple so that it would not require great effort from students to perform the assessment, and
3. The results of the assessment should measure the basic knowledge gain of the students.

Based on these criteria, the instructor developed 25 true-or-false questions to assess the outcome of the course (see the Appendix). These 25 questions cover the major topics of the course. The true-or-false format makes it easy for students to conduct the assessment. In order to make sure that the assessment measures the basic knowledge gain of the students, it discourages students from guessing the answers by introducing the following test rules: (1) each correct answer receives +1 point; (2) no answer receives 0 points; and (3) each incorrect answer receives −1 point. The highest possible score for each student is 25 points.

Implementation and Data Analysis

The pre- and postcourse assessment was implemented in the CTEC 4321 during the Spring 2002 semester. Fifteen students

Table 1. Pre- and Postcourse Assessment Data Summary

	Question number																								
Items	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Sum
Preassessment																										
Correct	12	5	6	2	1	1	0	3	9	1	0	6	3	8	1	9	1	6	4	0	1	0	2	1	5	87
Incorrect	0	4	0	1	2	1	5	0	0	1	9	2	4	0	2	0	2	0	1	2	0	2	1	0	0	39
No attempt	1	4	7	10	10	11	8	10	4	11	4	5	6	5	10	4	10	7	8	11	12	11	10	12	8	199
Class score	12	1	6	1	−1	0	−5	3	9	0	−9	4	−1	8	−1	9	−1	6	3	−2	1	−2	1	1	5	48
Postassessment																										
Correct	12	12	13	13	7	10	6	11	12	12	11	13	9	12	11	13	8	10	13	12	12	7	8	10	13	270
Incorrect	1	1	0	0	6	3	7	2	1	1	2	0	4	1	1	0	4	2	0	1	1	6	5	3	0	52
No attempt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	3
Class score	11	11	13	13	1	7	−1	9	11	11	9	13	5	11	10	13	4	8	13	11	11	1	3	7	13	218

took the precourse assessment at the beginning of the semester. During the semester there were two students who withdrew from the class. The remaining 13 students took the postcourse assessment at the end of the semester. The results of the 13 valid sets of data are presented in Table 1. The correct, incorrect, and no attempt rows for pre- and postcourse assessment recorded the numbers of students who answered the questions right, wrong, or skipped the questions, respectively. Since each correct answer received +1 point, no answer received 0 points, and each incorrect answer received −1 point, the class score was equal to the number of correct answers minus the number of incorrect answers. Comparing the results of pre- with postcourse assessment (Fig. 2) both sum of correct and sum of incorrect were up from 87 to 270 and from 39 to 52, respectively. Sum of no attempt was down from 199 to 3. The sharp decrease of no attempt indicated that students felt more confident to answer the questions at the end of semester. Most of them answered the questions correctly. Few of them answered the questions incorrectly. As a result, the sum of correct increased almost 210%, while the sum of incorrect increased only about 33%. The class score was 48 for the precourse assessment or 4 out of 25 points on average for each student. This score improved to 218 at the end of the semester or 17 out of 25 points on average for each student. The large increase of the sum of correct and class score, and sharp decrease of the sum of no attempt all demonstrate the effectiveness of student learning and appropriate mastery of the basic knowledge of students' disciplines after taking the course.

Figs. 3 and 4 show the pre- and postcourse assessment results, respectively. Percentage of sum of correct increased from 27 to 83% and percentage of sum of incorrect was up from 12 to 16%. Although both the sum of correct and the sum of incorrect were up, the increase in sum of correct was much larger than the increase in sum of incorrect. Percentage of sum of no attempt was down from 61 to 1%. Figs. 5–7 present more detail comparison between the results of pre and postcourse assessment. These provide more detailed information regarding student learning. For example, for question Number 20, none of the students knew the correct answer at the beginning of the semester, but at the end of the semester, 12 out of 13 students gave the correct answer (Fig. 5). This indicates that the instructor taught the subject very well during the semester. For some questions, such as Numbers 5, 22, and 23, the number of incorrect answers increased by four (Fig. 6). This was a warning sign to the instructor that he might not have covered the material very well during the semester. In the

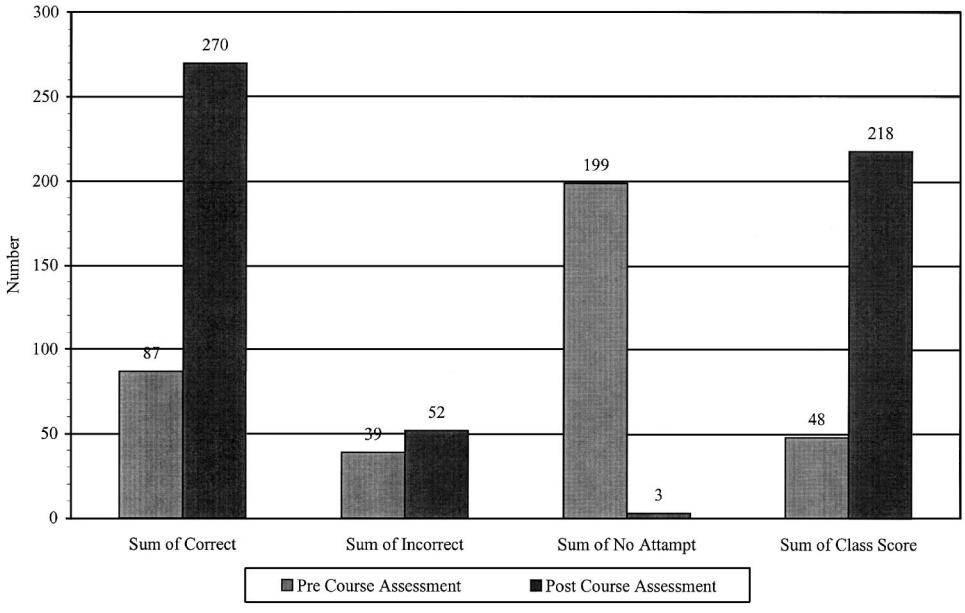

Fig. 2. Precourse assessment results versus postcourse assessment results

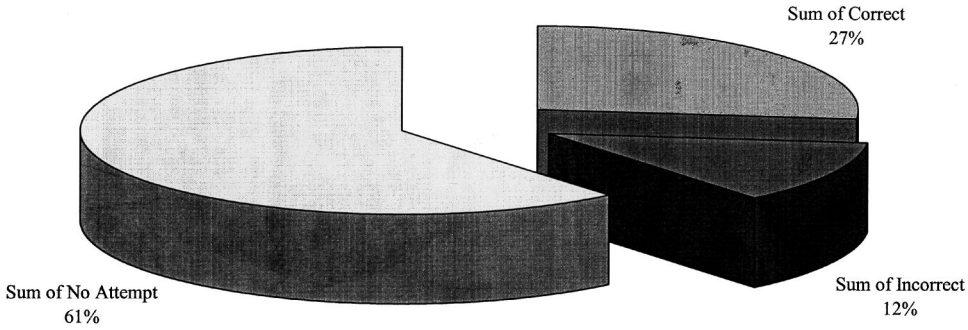

Fig. 3. Precourse assessment results (percentage base)

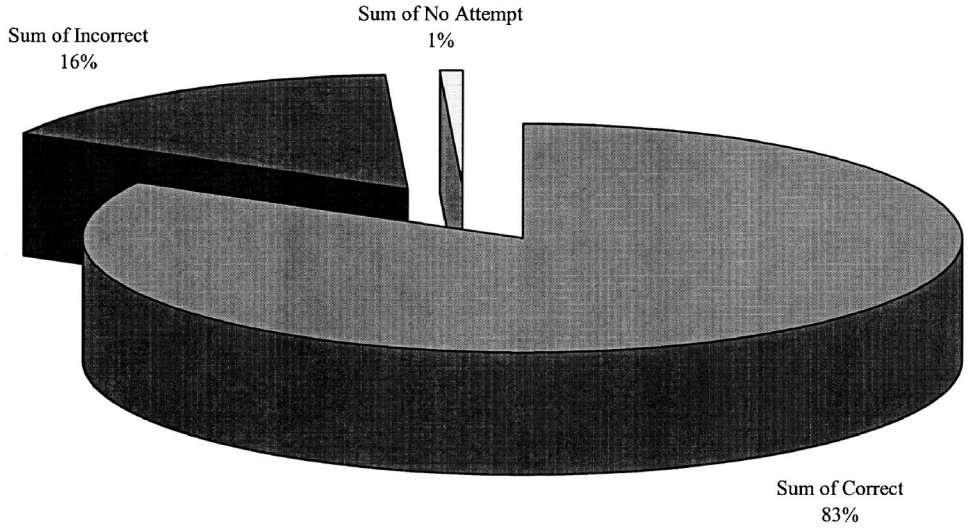

Fig. 4. Postcourse assessment results (percentage base)

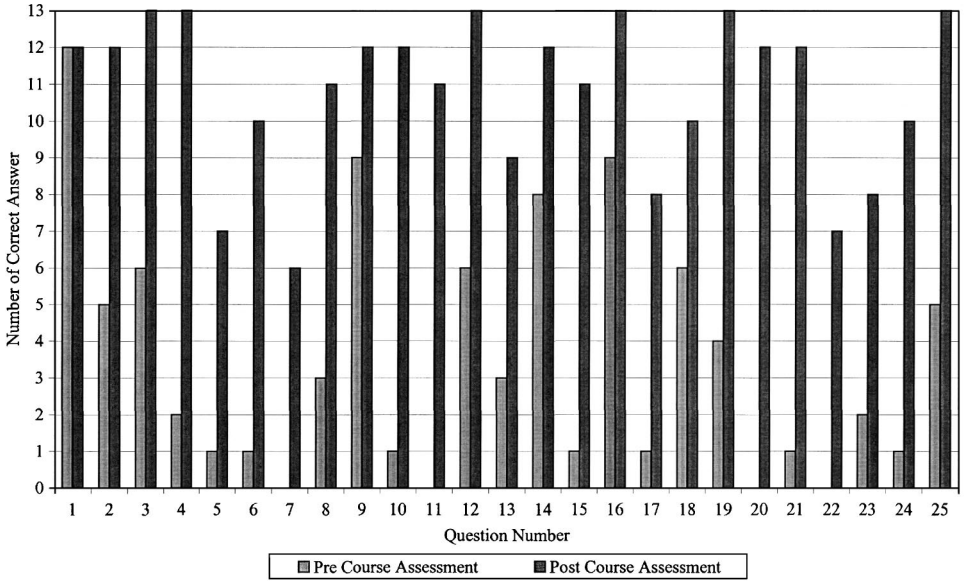

Fig. 5. Preassessment correct answers versus postassessment correct answers

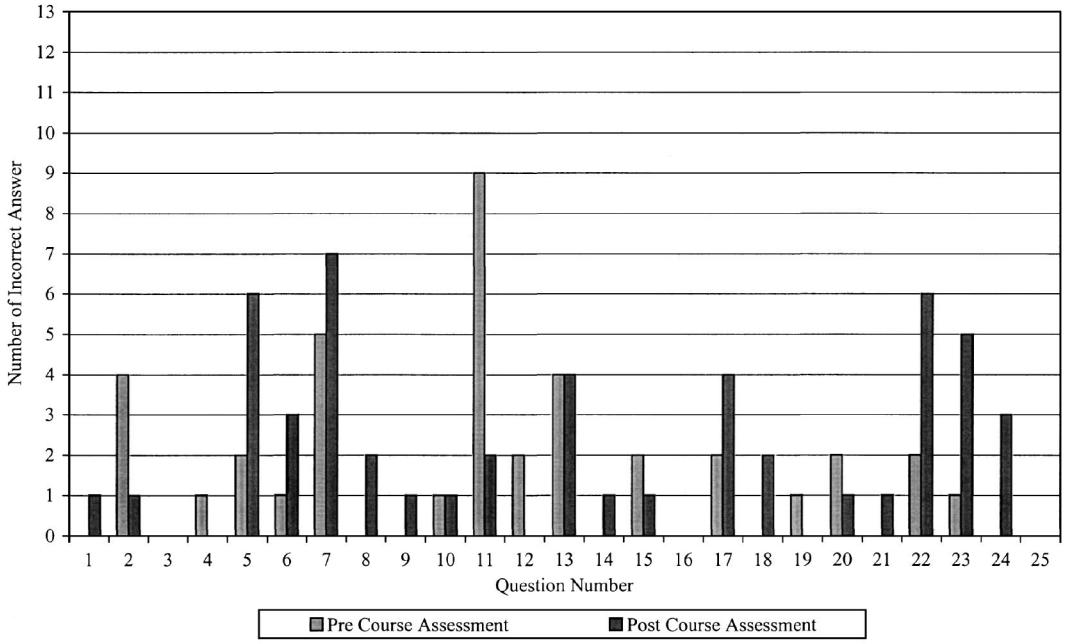

Fig. 6. Preassessment incorrect answers versus postassessment incorrect answers

future classes, the instructor should pay closer attention to the latter topics to ensure the students understand what is being presented. Thus, the comparison results actually provide valuable information to the instructor in terms of where he can improve his teaching in the future. Some students made no attempt to answer Questions 15, 17, and 18 at the postcourse assessment (Fig. 7). This indicated that some students did not know the subject covered in these questions. Again, these were the indicators that some students might have difficulty learning the material covered in these topics and the instructor should pay closer attention to these subjects in the future.

Conclusions

TC2K has changed the way that engineering technology programs conduct their business. In order to survive in the future, each program has to develop a strategy to meet the new challenges. The Department of Engineering Technology at Texas Tech University has developed the PAP to assess the department performance toward the attainment of TC2K Criterion 1. The portfolio includes 12 assessment methods. Ten of them have been used either formally or informally in the department. Two of them, computer skills self-evaluation and pre- and postcourse assess-

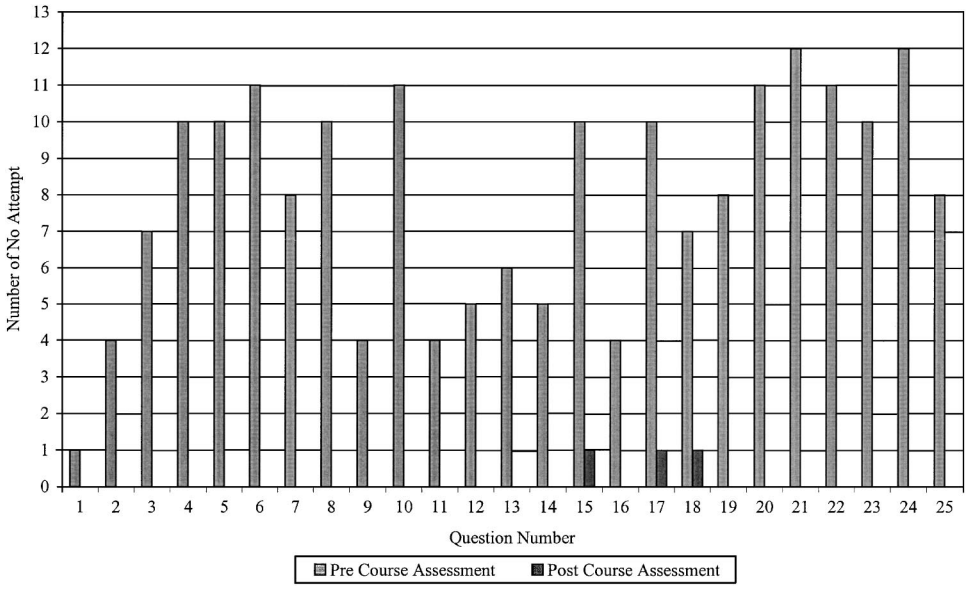

Fig. 7. Preassessment no attempt versus postassessment no attempt

ment, are newly developed methods. Pre- and postcourse assessment has been implemented in one of the senior-level courses, CTEC 4321 Construction Contracts and Specifications in the Spring 2002 semester. The results of the data analysis provide valuable inside information regarding the student learning and effectiveness of teaching. The results also demonstrate whether the department has achieved the requirements specified in TC2K Criterion 1. Furthermore, the department can use the results to continue improving its teaching efforts since the results show which topics students may have difficulty learning and where the instructor should pay closer attention in the classroom. Based on these facts, the derived conclusion is that the pre- and postcourse assessment is an effective method to assess the course effectiveness and continue improving the instructor's teaching ability. Because of these features of the pre- and postcourse assessment, institutions can use it to demonstrate their performance toward the attainment of TC2K Criterion 1.

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Appendix. Pre- and Postcourse Assessment

CTEC 4321 Pre/Post Course Assessment
Department of Engineering Technology
Texas Tech University

Instructions for completing this assessment

1. Write your name, date and student ID in the spaces provided below.
2. Answer as many questions as you can in the time allowed.
3. Guessing on individual questions can negatively impact the assessment of student learning. Each correct answer receives + 1 point, no answer receives 0 point, and each incorrect answer receives – 1 point.

Correct answers improve your score Wrong answers lower your score No answer has no effect on your score

Thank you for your assistance in improving the quality of higher education.

Name: _____ _____ Date _____
Last **First**

Student ID# ☐☐☐ - ☐☐ - ☐☐☐☐

1. Law includes court decisions as well as legislative acts.
   T—True F—False
2. Laws is a set of rules rather than a process.
   T—True F—False
3. Oftentimes the dispute has no right or wrong but rather is a contest between competing interests, both of which are legitimate.
   T—True F—False
4. One of the construction contracting methods is design-build or turnkey construction. One of the advantages of design-build is that it is possible for construction to begin before completion of the design for the project
   T—True F—False
5. A contract can be bilateral or unilateral. Most construction contracts are unilateral in that the contractor promises to perform the construction work as specified and the owner promises to pay a stated amounted for this work.
   T—True F—False
6. Estoppel is a principle by which a contract becomes binding in spite of the fact that no formal agreement was made between the parties concerned.
   T—True F—False
7. The contractors are required to purchase bonds such as the bid bond and performance bond in order to transfer risk, same as buying the insurance.
   T—True F—False
8. Listing alternates in the lump sum contract has a significant advantage to the owners.
   T—True F—False
9. Extra Work consists of work that is outside and entirely independent of the contract. Additional Work consists of work that must be undertaken to meet the contract requirements and without which the work requested in the original contract could not be completed.
   T—True F—False
10. The term Differing Site Conditions is typically applied to sub-surface conditions
    T—True F—False
11. Construction cannot start until owner and contractor sign the formal contract.
    T—True F—False
12. Since architects and engineers design the project, they always have the right to issue change orders to contractors.
    T—True F—False
13. A working day is universally defined as any day except Saturdays, Sundays, and any holidays.
    T—True F—False
14. The subcontractor receives payment from the general con-

tractor when the general contractor is paid by the owner. If the owner does not pay the general contractor, then the general contractor does not need to pay the subcontractor even the work is properly completed.
T—True F—False

15. If the construction contract contains no express warranty provision of compliance with the drawings and specifications, such a warranty is automatically inferred or implied.
T—True F—False
16. Under worker's compensation insurance, compensation is granted for disability and medical treatment for injuries resulting from accidents occurring as a result of employment, regardless of fault
T—True F—False
17. In the subcontract, the general contractor will establish a relationship with the subcontractor so that the subcontractor has a direct responsibility to the general contractor but not to the owner. Because of this relationship, the work of the subcontractor must be approved by the general contractor, not the owner.
T—True F—False
18. The subcontractor is bound to the terms of the general contract in addition to those of the subcontract.
T—True F—False
19. The amount of liquidated damages can be defined by the court.
T—True F—False
20. Awarding of subcontract is not dictated by law or public policy even on public projects.
T—True F—False
21. A contract can be executed or executory. A construction contract is fully executed only after the contractor has completed the construction work is accordance with the contract documents and the owner has paid the contractor for his/her work.
T—True F—False
22. The right of the federal government or a state or other public agency to take possession of private property and appropriate it for public use can be best described as Lien.
T—True F—False
23. If the contract time is stated as being 180 days, the contract may state that the contractor must pay $1,000 per day for each day the project delivery extends beyond 180 days. This amount is called Fine.
T—True F—False
24. As a general rule, construction delay caused by force majeure can not be used to claim damages.
T—True F—False
25. Arbitration is the most popular alternative to litigation. The advantages of arbitration compared with litigation are less time consuming and less expensive.
T—True F—False

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