

Reformatting an EET Program For TAC of ABET TC2K

**James A. Lookadoo,
Steve M. Hefley,
Randy Winzer**

**Pittsburg State University
Pittsburg, Kansas**

Abstract

This paper outlines the changes of an Electronics Engineering Technology (EET) program as it prepared to participate in TAC of ABET's pilot study for outcomes-based assessment (TC2K). These changes include philosophic, policy, and management adjustments. This paper also notes the difficulties and unsuccessful strategies encountered by the program.

I. Introduction

This paper is a narrative describing a small EET program's efforts to convert its operations to an outcomes-based philosophy. The paper's goal is to offer colleagues across the country some measure of the challenges in meeting TAC of ABET accrediting standards. We also discuss adjustments made following our last accreditation visit experience. This account should be of use to the Engineering Technology community because our program was one of two electronics programs that participated in the 2001 pilot studies conducted by TAC of ABET in its conversion to TC2K.

II. Prolog to the TC2K Conversion

Pittsburg State University is a small institution in the state of Kansas' Regents system. With an enrollment of about 6000 students, the university has colleges of liberal arts, education, business, and technology. The EET program has an approximate enrollment of sixty-five and is one of five programs comprising the Department of Engineering Technology. The rural environment and absence of local high-tech industries present significant funding and educational challenges for our EET program. Additionally, institutional support is somewhat sparse. However, the three-person faculty is relatively autonomous, and functions as a well-knit team. Significant concerns for standards and quality are hallmarks of our program.

Prior to TC2K conversion, individual faculty members owned their courses. As a result, management of the program and curriculum tended to be reactive in nature. As program problems surfaced, faculty effort was applied in ad-hoc fashion. Significant curriculum changes involving university faculty senate review were relatively rare and these change actions were usually unchallenged beyond the departmental review level. Most other problems or opportunities for change were handled by informal discussion among the program's faculty. These adjustments usually took the form of independent actions by course owners but it was not uncommon to see cooperative actions, as well. Course owners monitored the effects of changes within their own courses but no formal tracking usually occurred as resources for such activities were scarce. In summary, this program is probably typical of what would be found across the country in programs of our size range. Our program could be viewed as a confederation of interested parties within a wider university confederation.

The program's effectiveness and quality tended to be high. This is due to the dedication of its staff and students rather than any systemic institutional effort at academic quality. We do not imply that there have been no problems for the program. Three years ago, the program was severely rocked with the sudden departure of a disgruntled faculty member. The loss of a third of the staff was a serious impact, but the departure also offered a chance to implement changes.

III. The TC2K Challenge

Prior to this upheaval, the EET faculty had been examining an idea to strengthen the overall program. We viewed our sequence of senior design courses as quite beneficial in preparing our students for their future jobs. We wanted to harvest some of these experiences and incorporate them into our first EET course so that we could have more competitive students throughout their stay in our program. This objective suggested that we recast the introductory course. Another vexing problem was the lack of flexibility in upper division courses. The chain of prerequisites built into our curriculum at that time was too restrictive. Also, we were fighting a tendency in our students to forget lower-level course concepts. Our discussions in faculty meeting led us to believe that we could solve both problems with one additional course. We were looking at a model where we would use a gateway course at the end of the sophomore year. Passing this gateway course would open all upper division courses to successful students. The gateway course would consist of a battery of exams based upon key concepts in the core curriculum of courses taken in the first two years. Our two remaining faculty members undertook the task of legislating all of these changes two years ago.

It was a daunting challenge implementing these curriculum changes, finding temporary instructors for existing courses, and conducting a search for a new permanent faculty member. In addition to all of this, we knew that we were scheduled for an accreditation visit in 2001. At this time, our group was vaguely aware that TAC of ABET was planning a major shift in accreditation style. We were also aware that EAC of ABET had already undergone such change. As all our energies were focused on our immediate challenges, we were not very attentive to TC2K. However, that was about to change.

In the summer following this tumultuous year, one of us was accepted as a TAC of ABET program evaluator and underwent the requisite training session. As part of that training, the preliminary TC2K accreditation criteria^[1] and their implementation plans were presented. This was our first real exposure to TC2K. It did not appear at that time to be a near-term challenge as we expected to be reviewed using the existing TAC of ABET format.

Two months later at the beginning of the academic year, our department chair informed us that we had been invited to volunteer in the 2001 pilot visit project. Our other Engineering Technology programs were in good shape and could shoulder the responsibility. While the EET program circumstances were not ideal, we had sufficient positive factors and so we also agreed to accept the challenge. Our three-member faculty group at that time consisted of a recently trained TAC of ABET evaluator, a former program coordinator who was the initial creator of the program's high-quality standards, and our newest member who had detailed experience in outcomes-based public education. The chance to make substantive improvements with outcomes-based management was appealing.

IV. Conversion Activities Prior to TAC of ABET Visit

Our acceptance of the invitation to participate in the pilot program started a one-year count down until the time of the visit. Our first examination of the TC2K resulted in a misleading estimate of the amount of work required. In examining the criteria, we believed that we were already in substantial compliance. We were focussed on the immediate task of forming our new three-person program. The knowledge that we would be meeting with members of the TAC commission at the Engineering Technology Leadership Institute conference in October allowed us to justify delaying an in-depth a study of our conversion task. The loss of two months of preparation time would prove not to be helpful. Classically, hubris precedes nemesis. At the ETLI conference, we began to see a truer picture of the task ahead. TAC commissioners afforded us the opportunity to meet with them for approximately an hour. During this meeting, representatives of the TAC commission outlined the structure of the new accreditation standards. We were also informed that self-study guidelines would not be available until closer to the end of the year, and were advised to await their release before proceeding too quickly with our preparations.

Not all conversion work was delayed. During that time, we began reviewing our program's basic goals. What would seem to be an almost trivial task actually required quite a bit of time. Several faculty meetings were consumed with considering the program's role, scope, and reconsidering how the various courses support this basic structure. Nothing revolutionary arose from this review process as our limited resource base dictated little beyond a basic educational role. However, it was time worth spending as it gave our new faculty group a chance to develop a coherent EET program view. Another useful outcome was reaffirming the curriculum contents with regional industry needs.

By the end of the year, guidelines for TC2K self-study^[2] were available from TAC of ABET. It was now becoming clear how much work remained to be accomplished. In addition to the self-study guidelines, representatives from each of our five Engineering Technology programs were

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invited to attend TAC of ABET's pilot visit evaluator training session in January of 2001. We were afforded the opportunity to shadow our program's visitors as they made their preparations to train for TC2K style evaluation visits. During this event, we became acutely aware of the parallels between TC2K and ISO 9000. Our faculty group began a more intensive set of reviews to determine how we were going to satisfy the dictates of TC2K criteria one through six. As the professional societies that constitute ABET had not finalized criterion seven language, we were not to be held to this last criterion in the pilot visit. In one sense, we had started a six-front battle. Much time and effort went into defining the procedures we needed and into preparing blueprints our new processes supporting the six criteria. While all of this had to be addressed, it would end up being an inefficient use of our limited time. It would have been better had we concentrated our efforts on criteria one and six. However, this would not become apparent to us until the time of the visit in October.

In reviewing ISO 9000 style operations ^[3-10], it was immediately obvious that we could not emulate all of the tenets of this set of standards. There was no way we could match the corporate resources available to pursue formal ISO 9000 type operations in an academic setting. Our task would be one of modifying this model to fit our particular circumstances and still satisfying the ISO 9000 flavor of TC2K. We needed a structure that was not cumbersome yet would allow us to adequately document our processes and our continuous improvement plans. We were discovering that TC2K hinged primarily on criteria one and six. In fact, criterion one would prove to be central to the whole process with criterion six as its main support. While we did not know it at the time of the evaluator training session, TAC of ABET would begin to view criteria two through five as leading indicators for future program health. In fact, criteria two through seven would take on the label of "enablers" for criterion one. As such, a better use of our time during that spring semester would have been to concentrate all of our efforts on criteria one and six. Of all of our six battlefronts, these two would prove to be the most crucial in TC2K accreditation efforts.

From this narrative, it would appear that our program was having few successes. This would be a misrepresentation. Several important gains were made in outcomes-based management. In a previous section we discussed the creation of a new course at the beginning of our curriculum. Our original concept for this course, Prolog to Electronics, was to introduce certain skills and attitudes we believed would be very beneficial for success throughout the four years of our curriculum. With the advent of TC2K, we further modified this course to include additional challenges to our students. These challenges are based upon the A-K attribute list found in TC2K criterion one. In essence, our beginning students are now apprised of this list of attributes that their future employers are demanding. Our students are now asked to plan their next four years so that they can demonstrate mastery of these attributes upon graduation.

From a curriculum standpoint, our faculty was now challenged with a new way of thinking about the first two years of our program. We have adopted a group ownership philosophy for all of the EET courses in this portion of our program. These courses comprise the EET program core curriculum and include DC and AC analysis, logic circuits, and a devices and circuits course. The last course taken in the core is comprised of a battery of exams. Originally, this course was to be a set of tests of the basic concepts presented in the other core courses. Now, the course is

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expanded to include opportunities to measure A-K attribute acquisition. As this course develops, we should have a valuable tool for assessing our compliance with TC2K's criterion one as well as a method to measure continuous improvement efforts for the first half of the curriculum. Similar sorts of assessments of senior level courses can be made using our already existing senior design sequence.

Implementing a comprehensive plan for continuous improvement was also a task we had to address. There are volumes of materials on implementing ISO 9000 style continuous improvement schemes. Again, we discovered that these formalized processes would require resources that our program simply does not have. Somehow, we were going to have to forge a structure to address program measurement evaluation and documentation requirements with insufficient staff time. It was while addressing these problems that we chanced upon a promising solution. What was consistently productive in yielding workable approaches to our outcomes-based reformatting was the time that our faculty could devote exclusively to the problems. While productive, these sessions were carved out of very busy schedules and came with a cost to our routine activities. The mechanism that we adopted was adding a new ritual to our yearly schedule, a focussed retreat to measure progress, review curriculum issues, analyze the data gathered and set future plans. Performing these functions in a venue away from offices and classes seemed to be the only mechanism that would allow us a chance to adequately address our TC2K challenge.

One additional outcome in our program's way of doing business involved planning a significant upgrade in our senior laboratory. TC2K's Criterion 4 addresses facility issues. With the addition of a new member to the EET program, we had an excellent opportunity to upgrade one of our labs. Our college dean was presented with a general proposal for the upgrade and this was accepted. This proposal differed from usual practices in that details of an exact equipment manifest were absent. The proposal outlined the goals for the lab. However, several constituencies were to be consulted before specific plans for equipment were submitted. Local chapters of professional organizations, our industrial advisory committee, regional companies, and students were all brought into the process of finalizing plans for the upgrade.

In the conversion process, we had worked through most of the challenges raised by TC2K. We had reviewed and affirmed the central purposes for our program. Our staff had reviewed the curriculum and tied all of our courses to this mission. We had a start to the documentation process for all of the criteria in TC2K. Our advisory committee was on board for the conversion process. We have adopted a continuous improvement blueprint. In spite of all of these efforts, the program had not finished its conversion by the time of the visit.

V. The TC2K Pilot Visit Experience

In this section of our narrative, we address two aspects of the visit. The mechanics of the visit will be briefly outlined with emphasis on what is different from a traditional visit. Then we will examine the outcomes of our particular visit as they relate to our post visit activities.

Programs experiencing visits in the last two years have already experienced some of the new accreditation visit style. TAC of ABET has been including elements of its TC2K philosophy for this time period. An example of this is the requirements for written program goals. Also, in the last year, visits started on the Sunday afternoon proceeding the traditional Monday start time. Evaluators use this additional time to review the program's display materials.

From the program coordinator's standpoint, the biggest difference in the TC2K visit mechanics is the Sunday afternoon portion of the visit. In traditional style visits, the evaluators spend their time alone with display materials. In the new style visits, a spokesperson for the program serves as host for the visit. Hosting duties consist of both guide functions as well as expositor functions. From our program's perspective, this is a welcome change. It allows evaluators to quickly focus on any concerns they may have, and it allows a better representation of program content. Of course, this format does require an interaction that does not interfere with the evaluator's review task.

From the program's faculty standpoint, the biggest difference in a TC2K visit is found in the personal interviews. Many of the traditional type questions were asked, but also questions concerning outcomes and processes are now addressed. This even impacts student interviews. It is clear that a model where only one individual handles all of the TAC of ABET TC2K accreditation issues will not work well. It is an area where our EET team environment was a very positive feature for our particular visit. We extended our faculty group preparation efforts by giving briefings to all of our students. We also kept them well informed and active in our changes.

The Monday protocol of the visit still focuses on the traditional tasks of interviewing faculty, reviewing support mechanisms, and additional fact-finding. Tuesday's tasks still involve attempts and final resolution of uncovered problems and preparing for the accent review. Programs recently visited have seen the new style exit interview where written copies (form T11) of the preliminary findings are left at the conclusion of the visit.

Concerning the immediate outcomes of our EET program's visit, we feel we were somewhat successful. Overall, our approach was found acceptable. There was, however, the problem of not being finished with our conversion and all of the requisite documentation. The findings for our program represented as reasonable an assessment picture as was possible at the time the visit occurred. Accreditation evaluators must report conditions as they find them. The experience did allow post visit efforts to focus on the key elements of conversion. This effort is described below.

VI. Conversion Activities Post Visit

Following the visit experience, our faculty considered the TAC of ABET team's draft findings. We did not contest any of the initial findings for our program. As we had not finished our conversion, we knew we were lacking in comprehensive documentation. We switched from working with the various parts of the TC2K requirements and began to develop overarching

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procedures knitting these parts into a comprehensive structure. A bottom up approach was replaced with a top down approach. This has been a beneficial switch as it is allowing us to better see how to craft the links between the newly developed program elements.

Here is one example of how these links are working now. One difficulty we had at the time of the visit was an incomplete documentation of the outcomes expected for our graduates. The information in this list of capabilities comes primarily from course description sheets for all of our courses. Since the visit, these have been gathered together and then reviewed by our industrial advisory committee. The advisory committee adopted this review as a permanent agenda item. This triggered a revision of advisory committee charter and bylaws to incorporate the review function. Also, discussions arose about goals for the program mission. Capturing the key elements of these discussions provides a basis for effecting change and identifying appropriate metrics. These, in turn, serve as a basis for future evaluation of continuous improvement.

Currently, we still need to document how these items relate to the A-K attribute list of criterion one. We also need to annotate each item with the metrics used to substantiate them. To facilitate the additional documentation, one of our students wishing additional experience in technical writing has agreed to assist in coordinating the final document package. This document will be a key document in future visit displays. It will also contain annual revisions documenting the evolution of the program from the time of this first visit. We anticipate its completion before the summer of 2002.

Complete formalization of our metrics tracking had not been completed at the time of the visit. Specifically for our program, many elements noted in the second finding are contained in our two new courses, Prolog to Electronics and Electronics Core Exam. We do not imply that these two courses are the only mechanisms needed for TC2K compliance but they are certainly key elements in our plans. The prolog course was in its premiere offering at the time of the visit. The exam battery will be offered in the spring of 2003.

Aging laboratory equipment is a continual challenge for our program. As we are in the second year of collecting a new equipment fee from students, we may be able to partially address this problem. Our program plans to finalize a comprehensive laboratory plan. This plan will play a support role in the documentation described above and will also serve as the basis for meeting criterion four in TC2K. We should note that our student constituents are deeply involved in this process. Our student professional organizations represent the mechanism used to gather their collective input in the planning and monitoring process.

Finally, as this paper is being finalized, we are preparing a procedures manual to address the dictates of outcomes-based management. After the requisite TC2K mandated pieces are finished, we plan to fold many of our other program features into the same document. Our expectation is that we are now far enough along the learning curve that we can begin the first cycle of operations in the next academic year. We need a complete shakedown to our processes to test practicality.

VII. Notes on What Did Not Work

In this section, we list some of the counterproductive elements our program faced in attempting to reformat as an outcomes-based operation.

- Isolation - Our program is located in rural Kansas. Our lack of opportunity for many contacts with other EET programs prohibits our exposure to much of the discussion ongoing with TC2K efforts. This undoubtedly lowered our efficiency in conversion.
- Insufficient Resources - The amount of time and the number of people directly involved in our conversion were marginally adequate. Reconstruction of this magnitude should be spaced over two years and involve some release time to be highly effective. We used no release time and tried all of our conversions in less than nine months, including a summer.
- Past History – In some ways, our past experiences with TAC of ABET accreditation proved a hindrance. We tended to adhere to custom and we did not capture fully the magnitude of the changes occurring. We should stress that this is a second order effect compared with the first two items listed.
- Display – Our display format was an item we did not have time to properly modify. Our materials collection had started prior to our full knowledge of the changes we were to experience. The old-style collection practice was based on courses. Our next display will be crafted to document the A-K attribute list of criterion 1. Based on our experience, we do not recommend a course-based approach to displays.

VIII. Notes on What Did Work

After reviewing some of the difficulties we've faced, it is important to share some of the items that we found very productive.

- Teamwork – First and foremost was the presence of a well-knit faculty team dedicated to conversion. When we first began to examine the TC2K criteria, we saw advantages for our students and decided to undertake this task. Without this commitment, our efforts would have resulted in some paper effort without the underlying structure necessary for real outcomes-based program management.
- Teamwork – This is so important, it deserves a double listing. We would not recommend using anything less than the entire program faculty in a conversion effort.
- Planning Sessions – The most productive single element in conversions occurred when our entire group was fully engaged. Being a small program, we were very effective in developing a comprehensive plan attempting to incorporate the spirit of outcomes-based management.

- Curriculum Review – Parallel with the planning sessions was a review of the current curriculum. This allowed us to remind ourselves of the interconnections we had previously established. Periodic review and continuous improvement elements will allow us to keep a coherent curriculum.

IX. Epilog to the TC2K Conversion

Actually, this section is not an epilog, as the conversion being described is not finished. With the process of continuous improvement, we will be continually reinventing and refining our processes. In this brief section, we will express some concerns with the TAC of ABET conversion as it may impact other programs faced with these changes.

Philosophically, it is important to address concerns about the driving forces in outcomes and quality based management. We have no qualms including industry constituents as major influences in the process. Through our advisory committee, these interests have always been a part of our small program. However, there may be underrepresented constituents in the TC2K format. If we claim that our educational endeavors are for the good of our society, how are the interests of non-technical constituents to be included in meaningful ways? Such a constituency would seem to be an important counterbalance to the important industry constituent viewpoint. While noting this apparent omission, we see no reasonable solution.

On a practical note, there is another element that should be considered by TAC of ABET. The majority of TAC of ABET accredited programs are two-year programs with many smaller than our baccalaureate program. Our efforts to meet these standards strained our group to its limits. What will happen with the more numerous two-year programs and their even more limited resources? Our hope is that effective models for small programs could be prepared to allow more programs to meet outcomes-based management. If this is not addressed, we fear the accreditation process could be more detrimental than beneficial to many programs. If these programs drop accreditation, the resulting cost of the process may become exorbitant to the remaining group.

X. Conclusion

The central question raised by all of the above is “Did we develop a successful model?” At the time this was written, the answer is that we do not know. The final results of the visit will not occur until a month after the ASEE 2002 National Conference and Exposition when the TAC of ABET commission will meet and issue its decision. Clearly, we did not accomplish everything in our conversion process by the time of the visit. We continue to be very active in this conversion. If our visit had occurred in January of 2002, we believe we would have had fewer findings. In a real sense, success can only be measured at the time of our next visit. If the outlined changes are standard operating procedures at that future visit and we have demonstrable benefits derived from all this, we will proclaim success. It is also possible that experience may suggest even better procedures. For now, our hope is that this material and our first efforts will be of value to the Engineering Technology community as others prepare for this new style of accreditation. We close by acknowledging support for some of these conversion activities which came from the NASA/Kansas Space Grant Consortium and the National Space Grant program^[11,12].

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XII. Biographic Information

JAMES A. LOOKADOO, Ph.D., PE

James Lookadoo received his BS in Physics and Mathematics from Henderson State University and his MS in Physics from Texas A & M University. He holds a Ph.D. from the University of Arkansas in Electrical Engineering. He began his faculty service at Pittsburg State University in 1985 and is a full professor in the Electronics Engineering Technology program where he currently serves as program coordinator

STEVE M. HEFLEY

Steve Hefley received his BS in Technology in 1969 and an MS degree in Technology in 1974 from Pittsburg State University. He began his tenure at Pittsburg in 1974 and holds a rank of full professor. In his twenty- seven years of service, he coordinated the Electronics Engineering Technology program for nine years and was a principle architect of the current curriculum.

RANDY WINZER

Randy Winzer holds a BS in Electronics Engineering Technology from Pittsburg State University and will complete his MS in Engineering Technology at the end of this year. He has been an assistant professor with the Electronics Engineering Technology program since 2000. He has several years of experience supporting network and computer systems for outcomes based education in public schools.