THE DISAPPEARING ASSOCIATE DEGREE PROGRAM IN ELECTRONICS TECHNOLOGY

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Each year, fewer and fewer students enroll in Associate degree programs in Electronics Technology. Most schools offering such programs know that the decline in interest and enrollments has been continuing for over a decade. The question every department asks is: why? On the other hand, the electronics industry and its employment have grown over the same period. The use of all types of electronic equipment continues to expand and the increasing equipment complexity would seem to indicate an increasing need for more technicians to install, maintain, service and repair this equipment. Why has the need for technician level personnel continued to decline?

According to the National Science Board, the number of associate degrees earned in engineering technology dropped from more than 52,000 in 1981 to 33,000 in 1997, a 36% decline. Across the United States, many schools have quietly dropped their electronic technology programs for lack of student interest or local industry need. While there are no formal statistics maintained on the number of electronic programs, it is estimated that there are approximately 1000 AAS electronic technology programs in the US and that over 20 programs have been discontinued in the past ten years.

In a recent survey of electronic technology faculty and administration, 77% of those responding said that their enrollments had declined by 20 to 90% during the past decade. Another 11% of those responding indicated flat enrollment while 12% reported a small increase. Most of those responding to the survey were seriously concerned about enrollments and the potential cancellation of their programs.

This paper summarizes the reasons for the widespread decline in enrollments and offers suggestions for correcting this problem. The information presented here reflects the opinions of the survey respondents as well as numerous informal discussions with faculty and administration at community colleges nationwide, as well as interviews and conversations with employing companies.
Reasons For the Decline

There is no single overwhelming reason for the continuing decrease in electronic enrollments. Instead, there are multiple valid and interrelated reasons forming a complex answer that does not readily reveal an improvement strategy. Listed below, in general order of estimated impact, are the reasons most cited for declining enrollments.

1. Loss of local technician jobs caused by manufacturing moving offshore. A high percentage of technician jobs were associated with manufacturing. Technicians were used in assembly, test, troubleshooting, and quality control. Many US companies have moved their manufacturing operations to other countries or outsourced manufacturing to foreign concerns to lower costs and maintain price competitiveness in the marketplace. This has been a gradual process that continues to this day.

2. Loss of local jobs due to economic conditions. Some loss of jobs and the need for technicians is related to the economy. During economic downturns, companies lay off many workers. Most are never rehired. During the past decade there has been two such economic downturns. The American Electronics Association reported that high technology jobs were down by 2% or 113,000 positions during the first half of 2002. Most of these positions were manufacturing related although all sectors including services were affected. The only increase was job growth in the biomedical sector.

3. Fewer technician jobs caused by improved technology. The primary job of most technicians is equipment repair, service and maintenance. Thanks to modern semiconductor technology, most electronic products are made with just a handful of integrated circuits. Such equipment is far more reliable than older discrete component designs and therefore requires less service and repair. Furthermore, when repair is necessary it is no longer economical. The cost of technician time and test equipment to make repairs far exceeds the cost of simply replacing the product completely, often with a lower cost, improved version. While service technicians do still exist, they rarely troubleshoot to the component level. Most repairs are made by replacing complete printed circuit boards, modules, or major assemblies. This has been a gradual but increasing phenomenon that has greatly reduced the need for service technicians in virtually all sectors of electronics.

The U.S. Department of Labor’s, Occupational Outlook Handbook, 2002-03, indicates that the need for many types of electronics technicians is in a decline or in a period of slower than average growth. The only areas showing growth were computer/networking, biomedical electronics, and line/cabling installation.

In general, the nature of technician work has changed. Technicians work at a
higher or systems level where their main work is installation, configuration, testing, and conformance to standards. They are more concerned with the equipment at the block diagram level, the signal flow, and performance specifications. They are concerned with wiring, cabling and other system interconnections. They make critical measurements and troubleshoot but at a module or equipment level. Technicians do not design nor do they perform mathematical analysis of circuits or systems. While some math capability is essential for any technician, it is less than that currently taught in most programs.

4. Loss of students to computer and/or networking programs. During the 1980s, most colleges instituted a variety of computer science, computer information system, and PC repair programs. Then during the 1990s, colleges followed the industry growth into networking and telecommunications. During this time, there was enormous job growth in the computer and networking fields. While some of these programs were developed under electronic departments, others were not. If they were initially created under an electronics department, they were eventually spun off into separate departments that enjoyed significant growth in the 1980-2000 period. Since most computer and networking jobs are perceived to be more interesting and contemporary and pay more than electronic technician jobs, students opted for these less rigorous programs.

5. Growth of certification programs. The development of certification programs by vendors of computer and networking hardware and software caused a major shift in hiring emphasis. Instead of looking for employees with specific educational credentials, companies sought workers with knowledge and skills validated by certifications. Individuals seeking a career found that they could skip college and go directly to a certification by way of local continuing education courses, seminars and in some cases by self study. The resulting jobs paid better and could be obtained in a fraction of the time it takes to get an AAS degree in electronics.

6. The math/science problem. Each year, the math skills of high school students seem to decline. Students selecting electronics as a field of study quickly discover that algebra, trigonometry, and sometimes calculus are required for AAS degrees. Many cannot or are unwilling to do the math-oriented course work and thus leave the program. Most high school students know that engineering or technology degree programs have high math and science requirements and therefore deliberately avoid such programs by selecting less rigorous career paths and degrees.

7. Lack of understanding of what electronics is and what electronic technicians do. When selecting a potential career path, high school students seem to select what they know and understand. Computers and networking jobs are generally more well known and understood. Not electronics. While most computer and networking jobs are based upon electronics, most high school students do not
know that. Neither do they know about the many other electronic technician jobs that do still exist. There also appears to be the belief that electronic technician jobs pay less and are considered more “blue collar” or “lower class” than computer and networking jobs. If an electronic technician has an image with the public at all, it is a poor one that generally lacks respect.

8. Lack of relevancy of programs to local job needs.
Most students go to school for one reason: to get a good job. If there are no jobs locally, most students will discover this and opt for some other career path. If local degree programs do not address current industry interests and needs and target specific know job opportunities, they are at risk. If electronic jobs no longer exist, why offer a degree programs? Schools in cities with few jobs that export their graduates to other localities may be the exception, but degrees should match job opportunities nationally or at least statewide.

In some instances, colleges do not connect with the local industries. As a result, their programs bear little resemblance to what is needed in industry. Industry has generally come to accept the fact that the colleges often do not provide the desired background. They accept the graduates “as is” and simply plan to provide the necessary additional training either on the job or in company classes. AAS programs that do not serve industry are not supported by industry and therefore are bound to decline or ultimately fail.

9. Dated curriculum and courses.
Most electronic departments were started decades ago and still maintain a curriculum with the same courses that addressed technology at the time of their establishment. In general, most AAS electronic programs are based on a model that is at least 30 years old. These programs have generally failed to take into consideration the significant changes that have occurred economically, technologically, and socially. Not only is there less need for technicians today but also the knowledge and skills required for today’s jobs bare little resemblance to those being taught. There are fewer jobs for engineering technicians, those assisting engineers in design, development and research. And what little technician work is available does not require technicians to solve loop and node equations, bias discrete bipolar transistor circuits, or minimize Boolean equations with Karnaugh maps. Since technicians do not design anything, the need for the advanced circuit analysis and mathematics is simply not needed. Yet the more system level and practical skills are rarely taught. Most AAS degree programs are skewed from reality. One industry representative said that community college AAS programs do an excellent job of teaching the history of electronics.

10. Lack of interest in and/or resistance to changing and updating programs.
Change is difficult in any academic environment. The sheer difficulty of implementing any course or program changes at the college or state level is usually discouraging. Accrediting requirements (e.g. ABET) further impact the ability to
make needed changes. Couple this with the lack of motivation in the faculty and administration, and the result is the status quo. Most electronic departments are living in denial and fail to act.

11. Loss of electronic programs in high schools.
   In the past, many high schools offered vocational/technical courses in electronics that helped interest students in electronics and direct them to local college programs. Such programs have been slowly disappearing in most high schools.

Potential Solutions

Because the problem is complex and multidimensional, there is no simple solution. Yet there are many things that can be done to slow or even stop the decline. In some cases, schools have actually increased their electronic enrollments despite the negative trend. Listed here are solutions that have been adopted in some departments.

1. Increase recruitment efforts.
   When enrollments decline, most departments think first of going to the high schools and seeking out interested high school students. This is worthwhile effort but requires considerable faculty time. The important thing to remember is that you must promote not only your program but also educate potential students about the industry and the jobs. Recruiting efforts can also include evening or weekend orientations for students and parents, open houses and tours, summer camps, and college career fairs. Many school districts now say that it is important to recruit at the junior high/middle school level as this is where student interests are formed and developed.

   Another important factor is that in many community colleges, most students are not recent high school graduates. In most technology programs, less than 10% of new enrollments are recent high school graduates. The greater percentages of community college students today are older (22-50+). These students are usually employed and are seeking a career for the first time or retraining for a new career. Recruitment efforts must be tailored to this group with promotional efforts.

2. Increase promotional activities.
   Most successful programs are heavily promoted. In fact, it can be said that up to a point, enrollments are almost proportional to the amount of promotion you do. If careers and jobs do indeed exist locally, promoting that fact along with your program will produce results. This means creating new and better promotional catalogs, brochures and mailers. Use direct mail, newspaper ads, billboards, local TV channels, and radio spots to produce leads that can be followed up with a mail response or a telemarketing effort. And don’t forget to promote the industry and jobs as well as the program.

   A very effective approach is to use public relations (PR) techniques. These include
getting relevant articles and interviews published in local newspapers, creating and promoting interesting news events as well as soliciting TV interviews and speaking engagements by faculty and administration.

3. Seek increased input and cooperation with local industry. Most departments already have some association with local industry by way of advisory committees. Curiously, many do not. Take the time to research local industries and contact them for input. Form an internal committee to investigate current job opportunities. Monitor the local newspaper job ads and the state employment or workforce offices. Consider “local” to be anything within a 100-mile radius. Most local companies are happy to provide information on employment needs and will willingly work with colleges to help with employee education needs and program content.

4. Revise curriculum and courses to better fit current technology and local needs. Identify new areas of concentration and revise programs to better fit present needs. Develop new programs as new areas of specialization are discovered. Local needs vary considerably so it is imperative that you clearly pinpoint companies, industries and markets in your own area. Then survey current technology to see what technical areas are booming. The most promising areas for electronic technicians, ignoring computer and networking which continue to be good, are process control, biomedical, cable TV, fiber optics, and some manufacturing areas particularly those including advanced automation and robotics. Many of the “hot” areas of electronic technology are related to some segment of communications. Telecommunications and wireless (cell phone and LANs) are good fields although currently the industry is down but expected to resume growth in the near future. When computers and networking became popular in the 1980s and 1990s, many schools discontinued or stopped offering courses in communications. You should consider revising, updating and offering new versions of these courses as a high percentage of the jobs in any community are communications related.

5. Revise curriculum and courses to reduce math, analysis, and design and focus more on testing and measuring, systems analysis and troubleshooting. It will be difficult to convince any faculty that this is necessary or desirable. Any discussion or consideration of this will be emotional. Yet given evidence from industry, it seems necessary for survival and future growth. Since most faculties will no doubt loathe this, it is essential that each department research and validate the job availability and duties for themselves.

A likely outcome will no doubt be the same courses but with less math and analysis and more practical knowledge and skills related to the newer technologies. The emphasis should shift to more block diagram/signal flow analysis, tests and measurements, and systems level experiments.
6. What some other colleges are doing.
Based upon the survey referred to before, here is a list of some the effective strategies and tactics being deployed.

a. Change the name(s) of the department or programs. Include the term “computer” as many departments have already done. Use focused or specialized names that explain the jobs and program (e.g. wireless, automation and robotics, etc.) This does help attract more students.

b. Add more computer-related or computer-assisted courses. Students and graduates can never be too computer/software literate. Include computer simulation with Multisim/Electronic Workbench or similar software. Expand the embedded microprocessors course with more programming and interfacing. Add materials or courses tied to PCs such as data acquisition or industrial control. Expand software and programming instruction. Virtually every electronic product today either contains one or more embedded microprocessors or is interfaced to a PC. Teach that.

c. Focus and specialize rather than generalize. Electronics is so broad that when you talk about a job in electronics no one has a clue what it may be. If you say PC service or networking administration, it is much clearer. Focus on local needs and interests. In the late 1990s, many colleges had unusual success and growth with semiconductor manufacturing. The jobs were clear cut and available, industry provided wide support and the programs were focused. They were easy to sell. One college reporting an increase in enrollments has had exceptional success with an audio engineering technology program. The Occupational Outlook Handbook confirms that sound technician jobs in broadcast, video and elsewhere are growing. Programs should be focused on wireless, fiber optics, biomedical, process control or some other clearly defined field.

d. Develop articulation agreements with nearby universities offering bachelor of technology degrees. Promote these institutions and programs along with your own program. Many students still do not understand technology versus engineering education. And parents will be more likely to support a community college education if they know that a bachelor’s degree is available in the future without starting over.

e. Offer an Introduction to Industry and Technology course. Some colleges are beginning to offer a one semester hour course that explains the electronic industry, the jobs and the essential technology. Guest speakers from local industry are featured and tours of interesting local companies and facilities are included. Furthermore, such a course can explain technology versus engineering education and describe in detail the kinds of work graduates do in industry. The idea is to “sell” incoming
students on the industry, jobs and general prospects and get them excited about it. Such courses appear to work.

f. Offer one or more shorter duration certificate programs. The idea of these programs is to quickly prepare students for specific technician jobs that do not necessarily require the full AAS degree. Students go to school to find a job. The sooner the better. Include courses that lead to the degree so those students can come back to school part time to pursue the full degree after getting a job.

g. Support certification programs. Electronic certification programs have been available for much longer than the currently popular computer and networking certifications. Yet, industry has not widely accepted or required them. There is no opposition to certification as such and in some fields it is desirable and necessary to have a specific certification for success. Some of the more widespread certifications are International Society for Certified Electronic Technicians, Electronic Technician Association, Consumer Electronics Association, National Cable Television Engineers, ISAs Certified Control Systems Technician, and SME’s Certified Manufacturing Technologist. Many of these have been around since the 1970s. There are many other specialized certifications. Even the once ubiquitous commercial FCC radiotelephone license has made a come back as a valid hiring credential by some cell phone and wireless companies, and it is still required for avionics and marine electronics jobs.

The idea is to support such certifications and encourage, even require, certification as a graduation requirement. There is no better time than while in school for a student to prepare for the exams with department instruction and support. This gives the student an additional credential that should be helpful in seeking employment. The more certified individuals applying for jobs the greater the likelihood that companies will become aware of, accept and recognize certification.

h. Establish a department website. Some departments already have such a site but few are well known or effective. The site should include full details about your programs and courses, but what is even more important is job, career, industry and economic information. Includes useful links to hiring companies, industry, associations, and job sites of relevance. But most of all, be sure to promote the website in your catalog, brochures, and other promotional activities. It is a useful recruiting tool if the site educates and informs.
i. Initiate distance learning.
Distance learning courses are increasing about 10 to 20% per year in community colleges. In many states now it is possible to complete an entire Associate degree on-line. Colleges are finding that they can greatly expand their reach to nearby rural communities and to better serve the so-called non-traditional student with distance learning. Distance learning is clearly a growth opportunity in many colleges; yet, little has been done in electronics. In the survey, several colleges reporting a growth in enrollments attributed it at least partially to distance learning.

A Call to Action

If the loss of a department and a teaching or administrative job is not sufficient motivation for action, what is? Some departments are only now just feeling the gradual nature of the decline. Since it takes time for major changes to produce a turnaround, immediate action is required. The need is somewhat akin to starting a new business from scratch. This includes identifying a market and a need, building products (new programs), and promoting them aggressively. If you are seeking excitement in your educational career and you are still turned on by electronic technology, making the necessary changes should appeal to you.

While most departments are actually willing to change, few know how to change. Many departments are unwilling to face reality and therefore dismiss what they do not know or understand as incorrect. Even if there is a willingness to revise and update, the “what” and “how” are internally debated without consensus as enrollments continue to fall. What programs should be developed, what courses are to be offered, and what is the required math/science level?

One viable approach is to begin immediately by making changes to the existing courses, either decreasing math work, adding new technology, or implementing more computer related activities. This can be done quickly. Institute new programs, change program names, and increase promotion. Be proactive. Don’t worry and wait for the ax to fall. Make something happen. But do it quickly. Think of this as equivalent to a turnaround in a nearly bankrupt company. Quick action is required to avoid the inevitable business closing. Many viable companies have disappeared for lack of timely action. Don’t let your program disappear.

Finally, wouldn’t it be great if the colleges experiencing this problem could come together in a national effort to revitalize and update electronic curricula. Clearly there is an opportunity to completely restructure AAS degree programs in electronics to better match the jobs and technology in the 21st century.
Bibliography


Biography

Louis E. Frenzel Jr. has 25+ years of electronic industry experience as well as 9+ years of teaching experience in community college electronic programs. He helped start the semiconductor manufacturing technology (SMT) program at Austin Community College and served as the first Department Head. He now teaches as an Adjunct Professor at ACC. Mr. Frenzel is currently employed as a Technology Editor for *Electronics Design* magazine. He is author of 16 books on electronic and computer subjects. His education includes an AAS degree from Capitol College (formerly CREI), a Bachelor’s degree in Electronics Technology from the University of Houston and a Master’s degree in Education from the University of Maryland.