What, No Lectures?
The Francis Tuttle Vocational School

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Oklahoma's Francis Tuttle Vocational School has one of the best training systems in the United States. This system is based on an innovative approach in which traditional live lectures are replaced by videotaped lectures, competency-based printed and online materials and computers that allow students to study at their own pace. The School delivers vocational training education to more than 30,000 students. Its sophisticated technological equipment and strong ties with high schools, colleges and enterprises have allowed it to successfully attract a wide variety of technology-intensive industries in need of human resources trained in the latest demand-driven skills. Tour groups from 47 countries, including Brazil, Pakistan and China, have visited the school.

Blueprint for a First-Rate Votech Training System

The late Dr. Francis Tuttle, former Director of the Department of Vocational and Technical Education, and his staff were entrusted by then Governor Bartlett to develop a first-rate vocational training system. That system has evolved through the years to become so remarkable that it has been considered by educators and industrialists outside Oklahoma to be one of the first training systems in the United States.

Clear Goals

One of the factors that contributed to the state's success is that the goals were clear from the beginning. They focused on the creation of a labor force that could compete in skills with that of leading industrial states and of a critical mass of highly skilled workers who understood the value of quality work habits and procedures. In addition, Oklahoma wanted to be able to offer to incoming industries an attractive package to train all their workers in whatever trades or specialties they demanded. All of these goals were pursued while keeping in mind Dr. Tuttle's philosophy: industry and education are economically related; the success of both requires that this relationship be positive and productive. As a result:

- The system was built by a handful of conscientious, energetic and persistent educators, rather than by laws, decrees or plans alone.
- It has a large army of school managers that have a clear sense of purpose and the right attitudes to forge in the right direction.
- There is a large degree of decentralization and diversity in the system. Individual schools follow general guidelines from the State VoTech Department, but are free to be creative and follow the paths that best suit their needs (i.e., catering their local markets and/or targeting the specific needs of individual enterprises).

Links with High Schools and Colleges

Furthermore, unlike most school systems, Oklahomans have managed to establish functional and mutually advantageous links both with high schools and higher education. Oklahoma operates a secondary-level vocational program, and a multitude of in-service training and upgrading programs for adults, including the well known 2+2 formula. Parallel to their efforts to sell training to the various industries, for instance, schools aggressively recruit students from the general high schools by allowing their students to visit the nearest VoTech school as early as sixth grade. Middle school students have the chance to spend one week in the summer, sampling different programs offered by the vocational schools, in order to ex-

plore different career possibilities that are available. In addition, VoTech administers to all 8th graders a test battery to ascertain their interests, motor coordination and academic ability levels. The same test is given again to the same students when they reach the 10th grade, in order to verify consistency of results on all dimensions. Furthermore, Francis Tuttle courses are eligible for college credit through Oklahoma City Community College and Oklahoma State University. The close working relationship with regular schools, the entire higher education system, and state businesses and industry greatly enhances the value and achievements of the training system.

Outsourcing Training

Contrary to traditional belief, forward-looking enterprises are increasingly concentrating their in-house activities on what they do best and outsourcing everything else. This includes their employees' training activities, since a school is conceived to teach and is expected to do it better and cheaper than a factory that has other objectives. This is not a barely perceptible tendency, but already a clear cut and forceful movement. The key factor, though, is the competency of the local training institutions. This is precisely what Oklahoma offers, thus enabling the enterprises to unload their training to VoTech and concentrate on what they can do better.

Student Remediation

There is no doubt that the workplace is increasingly demanding workers with strong critical thinking skills. Even classic occupations such as truck driving are changing their skill profiles, since truck drivers have to operate on-board computers and need to operate the GPS (Global Positioning System) to communicate with headquarters. Car mechanics have to deal with the fact that a new model automobile today goes out of the assembly line with 600,000 pages of technical literature. Contrary to his counterparts in some European or Asian countries which have a strong cognitive skills background, the average American student is unable to reach the threshold of basic skills required by the new industrial occupations. In the Stillwater vocational school, for instance, 95 percent of the students who enroll in avionics have never taken a trigonometry course. As a result, it is necessary to offer the students remediation in these areas and this is often done by using the concrete context of the same technical occupations that are being taught as a launching pad for the development of cognitive skills.

Apprenticeship

In addition, VoTech is carrying out its share of experiments in apprenticeship. In fact, some of them have served as models for the nation in the federal program "Craftsmanship 2000." It should be noted that these programs are a far cry from the true apprenticeship program. Nevertheless, to a greater or a lesser extent, all of them display some of its features. For instance, there is the Oklahoma version of PrepTech, a national program sponsored by the Center for Occupational Research and Development (CORD). This is the so-called 2+2+2 scheme. The first "2s" stand for the regular Oklahoma system of training, with mornings in school and afternoons at VoTech (or vice-versa). The last "2" takes place at an enterprise. This program has been called "Co-op Training" in Oklahoma and its attractive feature is the strong link between training received and a concrete job waiting ahead.

Training on Demand

A distinct characteristic of the Oklahoman training system is that all the training responds to a clear demand coming from real profit-motivated enterprises and not to needs imagined by educators. Thus, industry personnel develop curricula and courses are created and discontinued depending on the jobs that are in demand. However, the system succeeds in remaining demand-driven without becoming a demand-victim by keeping on top of market trends and business cycles. Usually, reasonable informed guesses have to be made concerning the fluctuations of the business cycle when taking decisions regarding course offerings.

Largest Producers of Industrial materials

The VoTech Curriculum Center has become one of the world's largest producers of industrial materials for vocational education, which include more than 400 different courses and 400 videotapes for 42 different topic areas. These materials cover the technological descriptions, workshop practice, written exercises, final tests, transparencies for overhead projectors, lists of workshop equipment, and supplies. Included, as well, are materials that are meant to develop basic skills, such as reading, applications of math, creative thinking and so on, allowing schools to have all they need to proceed.

The Francis Tuttle Vocational School

The Francis Tuttle School was born 21 years ago, in 1979 and given the name of the founder of the VoTech system of Oklahoma. In August of 1982, it had 752 daytime students enrolled. Currently, more than 30,000 students are taking at least one short-term course, and they have a wide variety of courses to choose from, since the school offers more than 30 daytime education programs and over 300 short-term courses[1].

Multidimensional Nature of Skills

The speed of change of technology has increased so much in the last few years that experience is becoming an almost irrelevant asset when it comes to hiring employees. Firms can no longer require many years of experience because in most cases the equipment and the processes did not exist to allow anybody to acquire it. What matters then is the ability of a worker to think through the overall manufacturing system involved in the fabrication process. Workers who can only work with their hands are becoming a relic of the past in an increasing number of occupations. Francis Tuttle prepares its students for critical thinking while teaching them lifelong skills. As a matter of fact, one of the hallmarks of its main program in technology is the multidimensional nature of the skills taught. The orientation of the courses is justified by two main findings. First, not only do some firms offer higher wages to workers with multiple skills, but also in periods of crisis firms do not lay off these types of workers. Second, there is an immense market for the maintenance of complex equipment.

About one third of the School's students are youth who split the last two years of high school with a vocational training (the 2+2 formula). The remaining students attend either to participate in cooperative programs with local colleges, or to get an associate degree in one of the technical fields offered, since many firms tend to hire youth with associate degrees because they see them as potential candidates for supervisory positions. This is one of several schools that, in addition to its regular programs, contracts with enterprises to train their workers in short or long term courses. When this is the case, an assessment of the needs is conducted and on the basis of that assessment, the school can design a custom made program to fit exactly the need of the specific enterprise. While the needs assessment may require a significant effort, the customization of the program may only take a few minutes to do, since the school already has training modules for almost everything an enterprise might request.

The school programs are developed in very close collaboration with industry in order to offer students courses that will enable them to participate in high demand jobs. There are more than 300 business representatives looking at the school's curricula and course content as participants in the various program advisory committees.

[1] Francis Tuttle web page (http://www.francistuttle.com/).

Technology for Training

Each instructional program at Francis Tuttle is fully equipped with industry standard equipment valued at over $10.9 million. The school's services and programs include a teaching factory, advanced technology programs and VAN SAT, which is an engineering and electronic commerce center provider. In addition, the main campus has an 11-meter satellite teleport for distance learning, that is the largest in the state. This allows students to surf on the Internet during real-time 12 LIVE interactive classes as part of their daily activities or take specialized classes taught at other locations. 12 LIVE is the first cooperative network that is able to connect a mixture of city and rural schools to a vocational center, a community college and a university. Furthermore, each classroom has remote-controlled cameras, television monitors, microphones and speakers. The teachers' workstation includes an image document camera, a VHS player, a computer loaded with software and tied to a laser printer, Internet access, and a fax machine.

The overall direction of all the training is the operation and maintenance of the new generation of machines and technology equipment. The school builds on the belief that the ability of enterprises to generate new technologies has far outstripped the ability of servicepersons to maintain them. As a result, these maintenance requirements will create more jobs in the next several years than the country is able to train individuals to fill. There is clearly a scarcity of maintenance technicians who can understand the mechanics, electronics, and pneumatics of such machines. One interesting example mentioned at Francis Tuttle is the new generation of pagers transmitting through satellites. The technology and satellites are available, but there are very few technicians who have the breadth of skills and the specific knowledge required to repair them.

No Lectures

All of the courses offered are competency based. This factor alone indicates the commitment of this institution to offer serious training that is clearly geared to the needs of industry, since competency-based training clearly shows the links between training and expected performance. This approach leads to teaching methods that avoid conventional lectures as is the case at Francis Tuttle, were all live lectures have been eliminated. Videotaped lectures, written materials and computers are used instead. Yet, teachers are not replaced so the valuable interaction between teachers and students is fully preserved. The experience of this school suggests that not all students operate well with this system and there are attempts to help those who have initial difficulties with computers and VCRs. However, only a few consider this method to be inadequate and curiously they are not necessarily the weakest students academically. The school uses one-to-one tutoring in the difficult cases and this is the price to pay for an otherwise interesting innovation.

By eliminating lectures and using competency-based training materials, this system allows each student to move at his own pace. Students can join the course at any moment and leave when they finish their modules. They use Learning Activity Packets (LAPs) to advance and they are required to take performance tests in order to demonstrate mastery of one LAP before moving on to the next. Others do not slow fast moving students down and slow students can fully master the contents by taking as long as they need. LAPs are used because they are an excellent tool for delivering competency-based instruction. Some estimates based on similar programs elsewhere indicate that efficiency increases can be quite substantial, depending on how they are defined.[2] On the downside, the fixed investment to operate with this method are consistently higher, the logistical problems much more pressing and the administrative and technical

[2] On average, students took only two thirds of the time to finish the courses. Another 15 percent gains from repeating subjects they already know. Filling places left open by dropouts may account for savings of about 25 percent. A large number of school days increase productivity by 18 percent. Joao Oliveira and Claudio M. Castro, "Individualized Training Systems for Vocational Technical Training: A case study of the Euvaldo Lodi School" in *Innovations in Educational and Training Technologies*, edited by Claudio M. Castro, D. Wilson and Joao Oliveira (Turin: ILO/WB, 1991).

overheads are somewhat higher. But all these are minor problems. Overall, the method seems to be a step ahead that, unfortunately, is not taken up by many schools.

A Modular Program

Perhaps the most interesting aspect of the series of courses offered by Tuttle is the modular nature of the curriculum and the vast common core of subjects. There are no more than five basic processes: Mechanics, Electricity, Thermal, Fluid and Optics. In all of them, there are 13 major concepts (such as force, energy and so on) and all the manufacturing processes are based on a combination of these. To become a technician, one needs an integrated view of all of them.

Students devote about 30 percent of their time to classroom theory work and the remaining time is spent on applications and on hands-on activities. In addition, given the weakness of high schools in math and science and the importance of this type of knowledge in the various high demand occupations, remedial courses are offered to those who need them. All students spend about 60 percent of their time taking common core modules and the remaining time in specialization. Since these basic processes change very little over time, 60 percent of most courses is common for all specializations and needs no frequent updating. In electronics programs, for instance, 80 percent of the materials are the same in all the courses offered. Therefore, the fixed investment of developing a systems approach based on five processes can be justified.

Can It Be Replicated?

The Francis Tuttle School remains committed to continuous quality improvement and the word on its intriguing achievements has spread worldwide. Tour groups from 47 countries, including Australia, Brazil, China, Great Britain, Pakistan, Russia and Saudi Arabia have visited the school.