Technology Education as College Prep

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Should technology education become an integral component of the college preparation track in high schools? If your answer to this question is “no,” you need not read any further. If your answer to this question is “yes,” read on, as the authors strongly believe that technology education should be part of the college prep track. To support the thesis that technology education should be college prep, this article describes an internationally recognized college prep program that currently includes a two-year course in technology education. The authors also suggest another strategy to move technology education into the college prep arena in the U.S.

Historically, the profession has tried to make the argument that technology education (and its predecessor, industrial arts) is a component of “general education” that benefits all students. This position infers that technology education is “beneficial” for those students who are preparing to go to college as well as for those who do not plan to attend college after high school. However, kind of like Rodney Dangerfield, technology education does not seem to get any respect—especially with regard to its potential as college prep education. Far too often, technology education has been perceived as pre-vocational courses for those not planning to go to college or as “shop” courses for low ability students. As long as these perceptions persist, college-bound students will be less likely to enroll in technology education classes.

The proposition that technology education should be part of the college prep track was put forward in a short essay in 1991 (Bell and Erekson, 1991). The essay noted that “technology” was an emerging area of study in higher education (e.g., the New Liberal Arts; Science/Technology/Society; Industrial and Engineering Technology). Thus, it seemed logical that the “technology” should also be studied in high schools in order to prepare students with the educational base requisite for success in college.

While the Bell and Erekson (1991) essay tried to “make the case” that technology education should be college prep, they noted that the perceptions of technology education held by the academic community would need to be changed. There are many indications that the perceptions of technology education are improving in the education community. The release of Standards for Technological Literacy: Content for the Study of Technology
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(ITEA, 2000) in the spring of 2000 placed technology education in a strategic position, especially since the standards document was developed under a grant from the National Science Foundation. It is important to note that the National Research Council (NRC) and the National Academy of Engineering (NAE) supported the development of these standards, and both groups participated heavily in their development (Wulf, 2000). Involvement by these prestigious groups, combined with funding from the National Science Foundation, should help improve the perceptions of technology education as the standards are adopted and implemented.

However, it will take more than these standards, even with the support of prestigious national research organizations, to move technology education clearly into the college prep track at the high school level. It is common knowledge that requirements for university admission exert a great influence on the array of course offerings in high schools. Since technology education has not been a course required for university admission, how can the profession position technology education so that university admissions officers will consider it as preparation for university admission?

Before this question can be answered, one needs to look at the courses currently required for college admission. It should be realized that colleges and universities have disparate requirements for admission. However, in most instances, courses in the traditional academic subjects (English, math, science, and social studies) are required, often complemented with courses in a foreign language and the fine arts. In addition, these "core" courses prepare students for college entrance exams, such as the ACT, that are designed to test knowledge in these subjects. No college entrance tests in the U.S. currently include sections about technology education.

High school GPA, course taking pattern, and entrance exam scores comprise a major part of the college admission algorithm, especially at highly selective universities. There is, however, another series of courses and exams that are highly regarded by university admissions officers, often with additional weighting in the admissions algorithm. These are:

- International Baccalaureate (IB) courses and exams, and
- Advanced Placement (AP®) courses and exams

The AP® program is probably more familiar to technology teachers in the U.S. than the IB program, and it will be discussed in more detail later in this article. It behooves technology educators, however, to learn more about the IB program, as it already includes a course in "Design Technology" as part of a very rigorous, prestigious liberal arts college prep education.

**IB Program**

The IB curriculum is similar to the more familiar AP® program. However, the IB program is worldwide in scope and provides an international approach to learning. AP® students may choose one or two classes that suit their interests, but IB students must take advanced classes in all subject areas.

The International Baccalaureate Organization (IBO) was founded in Geneva, Switzerland in 1968 as a nonprofit educational foundation. Its initial purpose was to establish a university preparation education common across international settings for highly motivated, geographically mobile students. The IBO program concentrated on the last two years of secondary school to develop a rigorous college prep curriculum, grounded in critical thinking, which would be recognized by universities in every country. In effect, the two-year curriculum takes the "best" from the educational programs of many countries—with a balance of breadth and specialization of study. The result is a comprehensive, two-year program for students between the ages of 16-19 years old. There are more than 1,100 IB approved schools that are found in 101 countries worldwide (International Baccalaureate Organization, 2001a).

Students who successfully complete the comprehensive program and score well on the international examinations can earn the IB Diploma, a prestigious recognition of academic preparation and excellence. While the Diploma Programme grew out of international efforts to establish a common curriculum and university entry credential, the designers were motivated by a vision that emphasizes critical thinking and exposure to a variety of viewpoints to foster intercultural understanding among young people (International Baccalaureate Organization, 2001b).

To earn the IB Diploma, students must study subjects in six areas—two languages, mathematics, experimental sciences, creative arts, and humanities. In addition, they take an interdisciplinary course called "Theory of Knowledge" which challenges students to question the bases of knowledge. They must complete a programme called CAS, short for Creativity, Action, Service, which involves participation in community service, and, for example, theatre production and sports. Students are required to write an extended essay of 4,000 words to acquaint them with the kind of independent research and writing skills expected of them at university (International Baccalaureate Organization, 2001a).

The committees that govern the IBO are served by representatives from governments and authorized
schools as well as others in the field of education. The chief executive officer (director general) and his staff are based in Geneva, Switzerland. Research activities are based in Bath, England, UK. Curriculum and assessment, and the business and financial operations are based in Cardiff, Wales, UK.

**IB Design Technology**

In 1996, a new IB course, Design Technology, was added to the category of Experimental Sciences (International Baccalaureate Organization, 1996). In the IB Diploma Programme, Design Technology is perceived as equal among the more traditional sciences of biology, chemistry, physics, and environmental systems. The course is, however, a true technology education course, grounded in design and pre-engineering. Design Technology is available both at the standard level (one-year) and the higher level (two-year).

The Design Technology curriculum guide (International Baccalaureate Organization, 1996) notes that "science tells us how things are, technology looks at how things might be" (p. 5). It also notes that the "design cycle," the method of disciplined inquiry used by designers and technologists and taught in the course, is "equivalent to the scientific method" (p. 6). This is consistent with the findings in *A Conceptual Framework for Technology Education* (Savage and Sterry, 1991) that identified a "technological method" as the mode of inquiry in our field, analogous to the scientific method.

The IB Design Technology course is perceived as good preparation for students who are considering studying "science, applied science, technology, and engineering" in college (International Baccalaureate Organization, 1996, p. 6). This is especially true when taken with any of the other courses in the Experimental Sciences group. Design Technology "provides such a student with the opportunity to deal with realistic problems and to synthesize appropriate solutions using the processes practiced during the course," especially given the teaching tool of the project method (p. 6).

The IB Design Technology course is not perceived as being only related to the experimental sciences. It is viewed as providing a strong complement to the arts. Design Technology "interfaces well between the sciences and the arts, owing its knowledge base to the former and its emphasis on creative flair to the latter" (International Baccalaureate Organization, 1996, p. 6).

The major topics covered in the "subject specific core" (SSC) for the IB Design Technology course are:
- Designers and the design cycle
- The responsibility of the designer
- Materials, manufacturing processes, and techniques
- Production systems
- Processing and control systems
- Designing in action—a project
- Investigations/practicals
  Additional higher level (AHL) material in Design Technology includes:
- Appropriate technologies
- Product analysis and evaluation
- Microstructures
- Macrostructures
- Mechanisms
- Electronic control systems
- Raw material and final product
- Designing in action—further work on a project
- Investigations/practicals

The Design Technology curriculum guide includes the following options:
- Raw material to final product
- Products in context
- Mechatronics
- Food technology
- Computer-aided design and manufacturing
- Invention, innovation, and design
- Health by design

The philosophical base and topics in the IB Design Technology course are congruent with high quality technology education programs. And, it is included in an elite, prestigious, liberal arts college prep program.

This sounds great, so there must be a catch. The major downside at the present time is the number of IB schools in the U.S. that offer Design Technology. There are currently only two such schools—a public high school in the state of Washington (Mt. Rainier High School) and a private prep school in New York City (The Dwight School). Why only two schools? First, a shortage of technology teachers, especially those who can teach at the IB level, and second, a lack of recognition by universities—most just do not seem to be able to view "design technology" as a lab science. So, the profession still has its work cut out for it.

**The AP® Program**

The Advanced Placement (AP®) program began in the 1950s and is a function of the College Board, Princeton, New Jersey. AP® courses are intended to be equivalent to those taken by college freshmen, sophomores, or juniors. AP® courses are rigorous courses that are taught by high school teachers who are well versed in their subjects. AP® exams are administered by ETS (Educational Testing Services) and provide the culminating activity for the AP® course.

A student who receives a score of 3 or better on an AP® exam is often given college credit for a course, or courses, in the subject area. According to the College Board, more than 2,900 colleges and universities give college credit for high scores on the AP® exams. Receiving AP® credit at a
college or university can provide cost savings for the student in addition to accelerating the time toward completion of the degree. The College Board estimates that 52% of the secondary schools in the U.S. participate in the AP® program.

AP® exams currently cover 22 subject areas with 33 different exams. The subject areas include: Art, Biology, Calculus, Chemistry, Computer Science, Economics, English, Environmental Science, European History, French, German, Government and Politics, Human Geography, International English Language, Latin, Music Theory, Physics, Psychology, Spanish, Statistics, U.S. History, and World History. In most cases, the AP® exam is a combination of multiple choice and free response items. However, in Art, for the subset of Studio Art, the students produce a portfolio that is developed according to specifications detailed by the College Board. The Studio Art portfolios are assessed by a national panel of experts established by the College Board.

While the AP® exams are the culminating activity for the students, they are not the only part of the AP® program. The College Board provides curriculum resources and course outlines for AP® courses. Teaching AP® courses often requires more time and materials than would normally be found in the high school course. As a result, an AP® teacher needs additional time to prepare for and effectively teach an AP® course. In addition, AP® students will likely need access to specialized and supplementary materials for some courses, including sophisticated laboratory facilities.

The College Board provides a variety of workshops for AP® teachers to assist them in preparing to teach AP® courses. An array of summer institutes, subject-specific courses, and other workshops is available to AP® teachers. In addition, the National Science Foundation has funded programs that have included training for AP® teachers.

AP® Technology Courses

If we truly believe that technology education should be considered college prep, the establishment of technology AP® courses and exams could be a powerful catalyst in achieving the goal. To establish technology education as a new area for AP® courses and exams, university leaders in technology will need to convince the College Board that an additional subject area should be included in the AP® program. Given the current status of Design Technology in the IB program, it may be easier to approach the College Board than previously thought. It is possible to add new subject areas and exams to the AP® program. Initially, in the 1950s, there were 11 subjects that had AP® exams. Since its founding, the AP® program's courses and exams have grown from 11 to 33.

Is it possible for technology to become an additional subject area in the College Board's AP® program? If it is possible, how can technology educators make it happen? The answers to these questions are complex. It should be realized, however, that establishing technology as an AP® subject area, perhaps with two or three courses and exams, would go a long way to solidifying technology education's position as part of the college prep track at high schools throughout the nation.

For technology to become a new subject area in the College Board's program, university technology faculty will need to initiate a conversation with key staff at the College Board. The purpose for this conversation would be to make the case for technology becoming an AP® subject area. Once it has been determined that technology should be investigated as a potential subject area for the AP® program, a committee of key university faculty will be convened to determine the course(s) and format for the exam(s).

The exam format is developed by a committee in collaboration with AP® content experts and statisticians at ETS. Developing the specifications and items for a new AP® exam takes several years to assure reliability and validity. For example, work began in January of 1999 on the new AP® exam for World History; however, the first exam in World History will not be administered until May 2002 (College Board, 1998). Again, because it is vital that each course and exam reflect what is being taught in schools and colleges, the development process is complex and involves close collaboration among a large number of stakeholders.

What types of courses/exams might be included as part of an AP® Technology area? Because AP® courses and exams tend to focus on general education courses at the university level, one of the AP® Technology exams could be for a course entitled "Technology and Society." Many universities offer a course in Technology and Society as part of their general education program. Such a course generally receives social science credit as part of the general education program at the university. Likewise, Standards for Technological Literacy includes several content standards relating to technology and society. It is likely that the standard format of multiple choice items and free responses would provide an appropriate AP® exam for a Technology and Society course.

Another potential AP® technology course could be in the area of Design and Technology. Design is viewed by many in the profession as the mode of inquiry in technology. Again, Standards for Technological Literacy includes several content standards
about design, including the design process and the engineering approach to technological problem solving. An AP® course and exam could be developed in the area of design; however, it is more likely that a framework for portfolio development may be the most appropriate way to assess AP® Design skills. Like AP® Studio Art, an AP® Technology Design course could culminate with the submission and review of student portfolios.

There are other technology areas for courses that could receive AP® credit under the category of technology. It is not the purpose of this essay to identify all potential courses; rather, it is to promote the proposition that technology education should be included in the college prep track at the high school level and that AP® Technology courses and exams should be developed. AP® courses are acknowledged by more than 2,900 colleges and universities in the U.S. By establishing technology as a subject area for AP® courses and exams, the profession can gain acceptance for technology education as part of the college prep track at the high school level. The development of AP® technology courses would also benefit the profession by establishing “uniform” courses to be taught at the high school level that are grounded on Standards for Technological Literacy and consistent throughout the nation.

The Challenges
The challenge for leaders in the profession is to work to significantly increase the number of schools offering the IB Design Technology course. Springboarding from the successful IB Design Technology course, university leaders should initiate a dialog with the College Board regarding the establishment of AP® technology courses. Additionally, teachers and curriculum specialists should develop rigorous technology courses that are consistent with college courses.

References

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