Articles

Technology Education from the Academic Rationalist Theoretical Perspective

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The purpose for this article is to explore technology education from the perspective of the academic rationalist. Such an exploration is intended to provide information for technology educators who are grappling with education reform since it appears that the reforms of the 1980s are based on academic rationalism curriculum theory. This exploration includes consideration of the theoretical perspective, rationale, source of content, organizational structure, perceived advantages, and unresolved issues.

Academic rationalism conceptualizes curriculum as distinct subjects or disciplines. This perspective is the most widely used curriculum design pattern and it originates from the seven liberal arts of the classical curriculum (Herschbach, 1989). Academic rationalism is described by Hirst and Peters (1974) as follows:

> Academic rationalism, among the several curriculum orientations, is the one with the longest history. This orientation emphasizes the schools' responsibility to enable the young to share the intellectual fruits of those who have gone on before, including not only the concepts, generalizations, and methods of the academic disciplines but also those works of art that have withstood the test of time. For those who embrace this curriculum orientation, becoming educated means becoming initiated into the modes of thought these disciplines represent or becoming informed about the content of those disciplines (pp. 198-199).

Thus, the major purpose undergirding academic rationalism is to transmit the knowledge and aesthetics of one generation to the next. This is accomplished through education which is organized within recognized academic disciplines.

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Theoretical Perspective - Technology as a Discipline

Bruner (1960) proposed that curriculum organization and design be based on the structure of the academic disciplines. McNeil (1981) described Bruner's perspective as follows:

> He [Bruner] proposed that the curriculum of a subject should be determined by the most fundamental understanding that can be achieved of the underlying principles that give structure to a discipline. The basis for his argument was economy. Such learning permits generalizations, makes knowledge usable in contexts other than that in which it is learned, and facilitates memory by allowing the learner to relate what would otherwise be easily forgotten, unconnected facts. (pp. 56-57)

Academic disciplines organize subjects around conceptions of knowledge. McNeil (1981) suggests that "the irreducible element of curriculum is knowledge" and that the "nucleus of knowledge and the chief content or subject matter of instruction are found in academic subjects that are primarily intellectual" (p. 53). Schwab (1974) contends that the "knowledge of any given time rests not on the facts but on selected facts — and the selection of the conceptual principles of inquiry" (p. 165). McNeil (1981) also indicates that recognized scholars in a field or discipline are the ones who select the goals and the content of the curriculum.

Given the theoretical perspective of organizing subjects around conceptions of knowledge, the academic rationalist perspective of technology education will emanate from a characterization of technology as knowledge, which provides the boundaries or framework for a discipline. This perspective is supported by the technology education study group, a group of twenty-five leaders who developed the document entitled, *A Conceptual Framework for Technology Education*. In the conceptual framework document (Savage and Sterry, 1990), the following definition of technology is provided: "Technology is a body of knowledge and the application of resources to produce outcomes in response to human needs and wants (p.7)." In effect, this definition embraces academic rationalism by characterizing technology as "a body of knowledge." Historically, this body of knowledge has been viewed in the profession as the knowledge of practice, or praxiology if you will. Praxiology was used as a part of the philosophical foundation in the rationale for the Industrial Arts Curriculum Project. Lux and Ray (1968) provided the following description: "This body of knowledge is termed 'theory of practice,' 'knowledge of practice,' or 'praxiology.' It encompasses man's (sic) ways of doing which bring about what is valued, or ought to be, through action." (p. 7)

Skolimowski (1972), citing work by the Polish philosopher Kotarbinski, described praxiology as the theory of efficient action. He contends that "it is through constructing praxiological models that we accomplish progress in technology" (p. 46). Of course, praxiology analyzes action from the perspective of efficiency and Skolimowski refers to praxiology as a "normative discipline."

Several technology educators have endorsed the academic rationalist perspective of technology and view technology as a discipline. While this perspective has created some controversy, the most notable justification for this perspective was made in DeVore's 1964 monograph "Technology: An Intellectual Discipline." DeVore makes the case for viewing technology as a discipline based on the five criteria put forth by Shermis (1962) in an article published in the *Phi Delta Kappan*. These five points were presented by DeVore as follows:

An intellectual discipline:

1. has a recognizable and significant tradition, an identifiable history.
2. has an organized body of knowledge which has structure with unity among the parts. The knowledge has:
   a. been objectively determined by verifiable and agreed upon methods,
   b. stood the test of time thereby evidencing durability,
   c. been found to be cumulative in nature, and
   d. deals in concepts and ideas from a theoretical base.
3. is related to man's (sic) activities and aspirations and becomes essential to man by addressing itself to the solution of problems of paramount significance to man and his (sic) society,
4. identifies as a part of its tradition and history a considerable achievement in both eminent men (sic) and their ideas, and
5. relates to the future man (sic) by providing the stimulation and inspiration for man (sic) to further his (sic) ideas and to reach his (sic) goals. (p. 10)

In the monograph, DeVore describes how technology meets these criteria and, therefore, is an intellectual discipline.

Curriculum Rationale

From a theoretical perspective, academic rationalists believe that the curriculum should develop the mind with objective knowledge that can be tested through empirical evidence and reasoning (McNeil, 1981). Hirst (1974) purports that the development of the mind, from a rational perspective, is achieved by mastering the fundamental structure of knowledge, logical relations, meaning, and criteria for assessing and evaluating truth.

However, academic rationalists do not limit their perspective only to the transmission of existing knowledge to future generations. Academic rationalism includes the perspective that knowledge can be created and the systems for disciplined inquiry are an integral part of the theoretical rationale. This is described by McNeil (1981) as follows:

> . . . most curriculum theorists today reject this fixed view of knowledge and instead hold that knowledge can be constructed. The creation of knowledge -- valid statements, conclusions, or truths -- occurs by following the inquiry systems of particular disciplines or cognitive forms. The acquiring of disciplinary forms for creating knowledge constitutes the most valid aspect of the modern academic curriculum; the recitation of given conclusions apart from the methods

> and theories by which they are established is less defensible in a period characterized by both expansion and revision of knowledge -- new truths departing from older principles. (p. 55)

Thus, the curriculum rationale from the academic rationalist perspective is to develop a structured organizing pattern which transmits knowledge and involves students in the creation of new knowledge. This rationale is embraced by technology educators who organize curriculum such that students are immersed in *doing* technology, or in learning through performing like technologists. This perspective is supported by Bruner who suggested active involvement as though a specialist in the discipline as a vehicle for learning the discipline. According to Bruner (1960) "the school boy (sic) learning physics is a physicist, and it is easier for him (sic) to learn physics behaving like a physicist than doing something else" (p. 31). Likewise, those who would advocate that technology is a discipline would suggest that the student learn the discipline by behaving like a technologist. This approach is intended to facilitate the acquisition of technological knowledge and knowledge of practice, or "to gain knowledge in 'doing' technology not just 'knowing' about technology" (Todd, 1990). After all, technological knowledge is being created and changing at an ever accelerating pace.

This curriculum rationale, based on a perspective of technology as a discipline, is further supported by the identification of a method of inquiry, the "technological method," in the Conceptual Framework document (Savage & Sterry, 1990). The identification of the method of disciplined inquiry whereby technology is created is critical to the academic rationalist perspective of technology education. The technological method, analogous to the scientific method, is an approach to problem-solving and is described by Todd (1990) as follows:

> By attending to human needs and wants 1) problems and opportunities 2) can be addressed by applying resources 3) and technological knowledge 4) through technological processes 5). The result of this effort can be evaluated 6) to assess the solutions and impacts 7) resulting from these general technological activities (p. 3).
>
> Todd's description of the technological method is consistent with the description provided in *A Conceptual Framework for Technology Education* (Savage & Sterry, 1990).

Source of Content

From the academic rationalist perspective the content reservoir for technology education should be based on a taxonomy of technology. While there is no uniform agreement on a taxonomy, the most widely agreed upon taxonomy emanates from the Jackson's Mill project (Hales & Snyder, 1982). This approach identifies the domains of knowledge and the interaction with the human adaptive systems. The curriculum taxonomy that has evolved from Jackson's Mill focuses content on four adaptive systems; manufacturing, com-

munication, construction, and transportation. Each of these adaptive systems has been categorized in their unique curriculum taxonomies in various state and local curriculum guides.

The discipline of technology should not be limited to only these industrial-related technologies as the source of content. There are several other areas of technological knowledge that are equally important for study. For example, the bio-related technologies provide an array of possibilities for inclusion and study in Technology. To this end, the Conceptual Framework document identified four sources of content for Technology Education; communication, transportation, production, and bio-related technology (Savage & Sterry, 1990). These sources of content were not identified to become the end all, rather they were identified to be representative of technologies that could be included in the curriculum. It was further realized that new technological areas would likely emerge in future years and decades which would be appropriate for study.

An academic rationalist could also derive a curriculum taxonomy based on an analysis of the technological method. In effect, this approach would be to structure curriculum content to develop knowledge of the technological method and its components. Under this arrangement students would learn how specialists in technology discover knowledge (McNeil, 1981). Thus, the content becomes the taxonomy of the technological method.

Organizational Structure

According to Schwab (1974) the structures of modern disciplines are very diverse and complex. This complexity suggests that there is no one best organizational structure for all disciplines. Rather, there are diverse structures depending on the discipline as described by Schwab (1974):

> The diversity of modern structures means that we must look, not for a simple theory of learning leading to a one best learning-teaching structure for our schools, but for a complex theory leading to a number of different structures, each appropriate or "best" for a given discipline or group of disciplines (p. 163).

There is no doubt that technology is a complex, diverse discipline, and there has been no "one best" structure identified. Examples of diverse organizational structures are provided in state curriculum guides for technology education. State guides include structures such as Bio-related Technology, Physical Technology, and Communication Technology (State of Ohio; Savage, 1990); Production Technology, Communication Technology, Transportation Technology, and Energy Utilization Technology (State of Illinois; Illinois State Board of Education, 1989); Invention and Innovation, Enterprise, Control Technology, Information Processing, Energy, Materials and Processes, Technical Design and Presentation, and so forth (State of New Jersey; Commission, 1987); Technological Systems, Communication Technology, Power/Transportation Technology, Manufacturing/Construction Technology (State of Pennsylvania; Pennsylvania, 1988).

McNeil (1981) discusses the concept of "structure in the disciplines" which has been utilized as a basis for an organizing pattern and identifying curriculum content. He identified three kinds of structure:

1. Organizational structure -- definitions of how one discipline differs in a fundamental way from another. A discipline's organizational structure also indicates the borders of inquiry for that discipline.
2. Substantive structure -- the kinds of questions to ask in inquiry, the data needed, and ideas (concepts, principles, theories) to use in interpreting data.
3. Syntactical structure -- the manner in which those in the respective disciplines gather data, test assertions, and generalize findings. The particular method used in performing such tasks makes up the syntax of a discipline. (McNeil, 1981, p. 57).

The structure of technology education, given McNeil's perspectives of structure, would follow the proposals in the Conceptual Framework document (Savage & Sterry, 1990; Todd, 1990). The conceptual framework provides the following:

1. Organizational structure -- content organizers of production, communication, transportation, and bio-related technologies with an emphasis on "doing" technology.
2. Substantive structure -- problems and opportunities that come in response to human needs and wants, and the social and environmental impacts often provide the basis for inquiry.
3. Syntactical structure -- the identification of the technological method, and its use, provide a syntax for the discipline of technology.

Perceived Advantages

In making the case for identifying technology as a discipline, DeVore (1964) states the major advantage as follows:

> There is only one suitable reason [for identifying technology as an intellectual discipline]. A subject area so identified meets certain stringent criteria established by others and takes its place as an area of study essential to an understanding of man (sic) and his (sic) world. By becoming an intellectual discipline an area becomes accepted as a necessary and contributing study in the education of all youth (p. 5).

By embracing academic rationalism, technology educators have the opportunity to become an equal area in the curriculum with the associated respect. In addition, much of the educational reform movement is founded in academic rationalism. For example, the Holmes Group recommendations for the reform of teacher preparation is discipline- based (Erekson, 1988). Those technology teacher education programs that have perceived technology as a discipline have, in effect, endorsed academic rationalism, and have found it much easier to develop redesign proposals in concert with the tenets of the Holmes Group.

Where technology education is perceived as a discipline it has gained respect and an equal place in the academic curriculum. This is exemplified in the proposed revised requirements for high school graduation in the State of Maryland (Maryland State Department of Education, 1991). The previous standards required a one semester course in the "practical arts" which could be met through a course in technology education or a course in areas such as home economics, vocational education, or computer education. The proposed new standards eliminate the practical arts requirement, however, the Maryland State Department of Education has added a new requirement in technology education. In effect, students may be required to take a one year course in technology education to graduate from high school. Thus, technology education has moved from one of the practical arts to a subject equivalent to science, social studies, math, and language arts. By advocating, academic rationalism, that technology education is a new discipline, perception and policy have changed.

Unresolved Issues

There are two major issues that need to be resolved in order for technology education to be congruent with the tenets of academic rationalism. First, the academic rationalist conceptualization of technology education requires that the curriculum be organized into distinct, separate subjects. Technology is dynamic, diverse, and inherently interdisciplinary. As such, it is difficult to identify the unique boundaries of the discipline.

The second issue to resolve concerns the identification of the scholars of technology. Academic rationalism is founded on the premise of recognized disciplines which organize curriculum around conceptions of knowledge. These disciplines and conceptions of knowledge are identified and developed over time by a body of scholars. Who are the scholars for the discipline of technology? Are they engineering faculty? anthropologists? historians? technology teacher educators? Furthermore, if the profession can identify a group of technology scholars, do these scholars identify themselves with the discipline of technology?

Conclusion

According to McNeil (1981) the separate subject, academic rationalist, perspective will remain the prevailing conception of curriculum in the future. If technology education desires equal status in the curriculum with the classical subjects, technology educators will need to embrace academic rationalism and advocate the perspective of technology as a new intellectual discipline. Some might suggest that it will be almost an impossible task to establish technology as a new intellectual discipline. However, there are newer disciplines which are gaining acceptance in the academic arena. Examples are described by McNeil (1981) as follows:

> Newer disciplines claim to be more relevant than the older ones. Psychology, for instance, is challenging literature for the honor of interpreting human nature. Anthropology begs admission on the grounds that it can do a better job of helping pupils gain a valid world view than can history, a field known for reflecting parochial interests. (p. 69)

It is possible to establish a new intellectual discipline. Technology has the potential to become an intellectual discipline and, like psychology and anthropology as cited above, technology can claim to be more relevant than many of the older disciplines. However, to establish technology as an intellectual discipline, it will require the identification of a body of scholars of technology -- individuals who view themselves as scholars of technology. It will also require time, perhaps decades, for technology to gain acceptance as an intellectual discipline among the academicians. However, as is the case in Maryland, technology education can gain equal status with the academic subjects.

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