TECHNOLOGY AND TECHNIQUE: AN EDUCATIONAL PERSPECTIVE

Prof. Dr. Aytekin İŞMAN
Sakarya University – Turkey
aytekinisman@gmail.com, ismanay@hotmail.com, isman@sakarya.edu.tr

ABSTRACT
Today, technology is developing very fast around the world. This technological development (hardware and software) affects our life. There is a relationship among technology, society, culture, organization, machines, technical operation, and technical phenomenon. Educators should know this relationship because technology begins to affect teaching and learning facilities. For this reason educators are increasingly using technology in all aspects of their profession (e.g., creating curricula, classroom instruction, work assignments) This trend can be enhanced by educating the educator about cultural and cognitive aspects of technology and technikos, as well as the associated advantages and disadvantages related to educational and human development goals.

1. DEFINITIONS AND CONCEPTUAL MODELS OF TECHNOLOGY

When people think of "technology," they tend to think of human artifacts such as machines, electronic devices, scientific hardware, or industrial manufacturing systems. However, a formal definition (College Dictionary) of technology indicates that it has a more general meaning which includes any "practical application of knowledge" or "manner of accomplishing a task".

DEFINITION OF "TECHNOLOGY":
1 : ***the practical application of knowledge*** especially in a particular area…
2 : ***a manner of accomplishing a task*** especially using technical processes, methods, or knowledge…
3 : the specialized aspects of a particular field of endeavor <educational technology>

Human's use of technology involves not only machines (e.g., computer hardware) and instruments, but also includes structured relations with other humans, machines, and the environment. In short, technology is more than a collection of machines and devices. To go beyond simplistic intuitions about technology requires investigation of the human mind and socio-cultural environment as well as interactions with technological artifacts.

Note that the word "technical" came into use around 1617 A.D., four hundred years before the term *technology* was coined. A dictionary definition[1] of the term *technical* includes the following:

DEFINITION OF "TECHNICAL":
1 a: **having special and usually practical knowledge** especially of a mechanical or scientific subject…
2 a: of or relating to a particular subject b: of or relating to a practical subject organized on scientific principles…

This indicates that the most general sense of the word technical is having *any* special knowledge on a particular subject. In other words, *technical* knowledge is "especially" but not necessarily associated with mechanical or scientific subjects.
Philosophies of science have developed definitions of technology that go beyond formal dictionary definitions or people's "everyday" intuitions. For example, Teich (1977) asserts that technology includes linguistic and intellectual tools as well as scientific and mathematical techniques. In general, he defines technology as the *organization of knowledge for practical purposes*. This expanded view of technology helps in understanding the extent and variety of its effects on both our institutions and values.

Another scientist, Ihde ("Philosophy of Technology," 1993), constructed a broad definition of technology that consists of three concepts. First, technology must have some material elements. Secondly, technology must enter into some set of *praxes*—uses which humans may make of these components. Last, people must be included in the definition: We must focus on the *relationships* between the technologies and the humans who use, design, make, or modify them (İhde, p.47, 1993).

Another model of technology in human culture, described by Ellul in his book on *Technological Society* (1964), describes *technique* as a group of movements and actions that are for the most part manual, organized, and traditional, all of which unite to reach a known end (i.e., an end reached through a technique associated with a physical, chemical or organic process). Sociologists who are interested in anthropology often prefer this

definition because it offers a conceptual structure for thinking about technology that avoids *philosophical or subjective questions* in religion or art.

Feenberg (1991) proposes yet another way of modeling technology. He asserts that technology is "neutral," without any content value of its own. Feenberg's analysis consists of four points.

1. Technology, as pure instrumentality, is indifferent to the variety of ends it can be employed to achieve. Thus, the neutrality of technology is merely a special case of the neutrality of instrumental means, which are only contingently related to the substantive values they serve.
2. Technology also appears to be indifferent with respect to politics at least in the modern world, and especially with respect to capitalist and socialist societies.
3. The sociopolitical neutrality of technology is usually attributed to its rational character and the universality of the truth it embodies. Technology, in other words, is based on verifiable causal propositions.
4. The universality of technology also means that the same standards of measurement can be applied in different settings.

Thus, technology is said to routinely increase the productivity of labor in different countries, different eras, and different civilizations. Feenberg's model defines technology as "neutral" on the assumption that technologies are essentially under the very same norm of efficiency in any and every context.

2. BRIEF SURVEY—HISTORICAL CONCEPTS OF TECHNOLOGY

The modern philosophies of technology discussed above draw from a framework of Western philosophic ideas. This does not imply that ancient forms of technology and technique appeared earlier in other cultures. Ellul (1964) asserted that was principally in the Near East that nontrivial techniques for manipulating the environment first developed. However, Ellul suggests that the oriental technology/techniques had very little in the way of scientific foundation, and considers the Greeks to be first to engage in coherent scientific activity and construct scientific conceptual systems.

İhde (1993) remarks that although the classical Greeks were not strong in technological advances, they produced numerous inventions, often in the field of warfare (e.g., solar mirrors that focused sunlight for starting fires on enemy ships, and machines for elevating or lowering gods on a theater stage). Note that the etymological root of the word *technology*, (i.e., *technologia*—the systematic treatment of an art), is in accord with the ancient Greek's use of technologies primarily for their aesthetics.

Subsequently, a phenomenon occurred which still astonishes historians—a philosophical approach that sought to separate human mental skills/attributes (i.e., *technique*) from the physical objects involved in the ancient technologies. Plato and Aristotle's interest in the nature of knowledge is reflected by the etymological roots of the word technology: *technologia* (*techne*–"art, craft or skill" + *ology*–"study of"). First, Plato posited that knowledge of reality comes through the unaided, inner reason of rationalism. Second, Aristotle posited that knowledge also comes through information about the outside world (Nichols, 1987). Historical trends developing around Aristotle's philosophy facilitated thinking in terms of cause and effect. This cause-effect approach to life promoted human cognitive orientations and thinking which viewed the physical environment, everything outside the mind, to be manipulable.

Cultural acquisition of this cause-effect orientation led to manipulation of the environment and development of technologies that had desirable material benefits and facilitated overall quality of people's lives. Given these obvious benefits, the Renaissance culture freely accepted and used new technologies, although their scientific grounding remained somewhat implicit (Ihde, 1993). The leading precursors of modern science focused on the external world—fascinated by technology's power over nature. (e.g., Leonardo da Vinci's ingenious designs of machines for warfare, for flying, and for travel underwater).

A contemporary manifestation of people's fascination with the power of technology is what Teich (1977) refers to as "pure technology," which is related to the building of machines for their own sake and for the pride or pleasure of accomplishment. Teich describes people's pursuit of "pure technology" to be a creative art somewhere between art and science:

"…the record-breaking vehicle, built purely to see if it will behave as intended; the chess-playing computer program, devised for the sheer entertainment of seeing how well it plays; and that masterpiece in miniature, scientific American's Great International Paper Airplane Competition."
Teich (1977)

Recall that the technology is defined in the dictionary as the *practical application of knowledge especially in a particular area*, and it is debatable whether people who are engaged in such "pure technology" activities are engaged in the practical application of knowledge. Certainly they are involved in *acquiring* knowledge and technical skills that could in other circumstances be considered practical.

Similarly, professors who acquire and apply skills used in writing articles "for their own sake and for the pride or pleasure of accomplishment" may also be pursuing a type of "pure technology." On the other hand, writing an academic article often fits the basic definition of technology since in most instances there is a *practical application* of the systematic knowledge: career advancement. In any case, why do we tend to view the professor's work as something different from technology? Probably, because we associate technology with hardware. We have no difficulty in thinking of the professor is *using* technology, but it is not as easily perceived that such work is intrinsically technological.

In summary, people tend not to think of technology in terms of its historical meaning (i.e., technologia—the systematic treatment of an art) or its general dictionary definition (i.e., "the practical application of knowledge" or "a manner of accomplishing a task"). This is in part due to the historical separation of *technology* and skills associated with systematic knowledge—what in the next section we well describe as *technique*.

3. TECHNIQUE: ACTIVITY THAT IMPLEMENTS SYSTEMATIC KNOWLEDGE

The etymological root of the words *technique* and *technical* is the same, from the Greek *technikos*: "skillful in an art." A typical dictionary definition[1] of technique includes the following:

DEFINITION: "TECHNIQUE":
1. The manner in which technical details are treated… or basic physical movements are used…
2. Also the ability to treat such details or use such movements: a) A body of technical methods <as in a craft or scientific research> b) a method of accomplishing a desired aim.

Thus, in contrast to the word technology which implies systematic treatment (i.e., from Greek *technologia*: "systematic treatment of an art"), technique signifies manners, ways, and capabilities involved in *implementing* systematic technical knowledge. Thus in a general sense, technique can be any manner in which basic physical movements are used, and is sometimes associated with non-scientific activities (e.g., dance technique, flower arranging technique).

In general then, we can think of technique as a method or style of implementing systematic technological knowledge. This general definition of technique includes cultural behaviors as well as human interactions with tools and products associated with human arts, crafts, and skills.

Awareness of fast-changing techniques associated with technological change is important in maintaining effective, successful, and competitive educational systems. People with limited vision only focus on technological hardware is isolation from cognitive/behavioral techniques and associated cultural patterns. This simplistic view of technology as hardware may stem from the fact that as the functions and devices of technology increase in complexity, their internal operation becomes a marvel in itself, separate from their use and socio-cultural context. Historically, most technology and related techniques were experienced in direct connection with the goal or product of the technological process (e.g., a traditional artist learning how to construct and use different types of paint brushes understands, appreciates, and sees the connection of the paint brush technology to the finished product). However, as technology became more complex and indirect in its contribution to the goal or product, people had less direct knowledge and ability to with unexpected technical problems. For example, a university staff is given a computer database system scheduling courses and meetings, yet they are resistant and revert to word-of-mouth arrangements because they are not fully trained or aware of how to interact with the database—it's weaknesses and potentials.

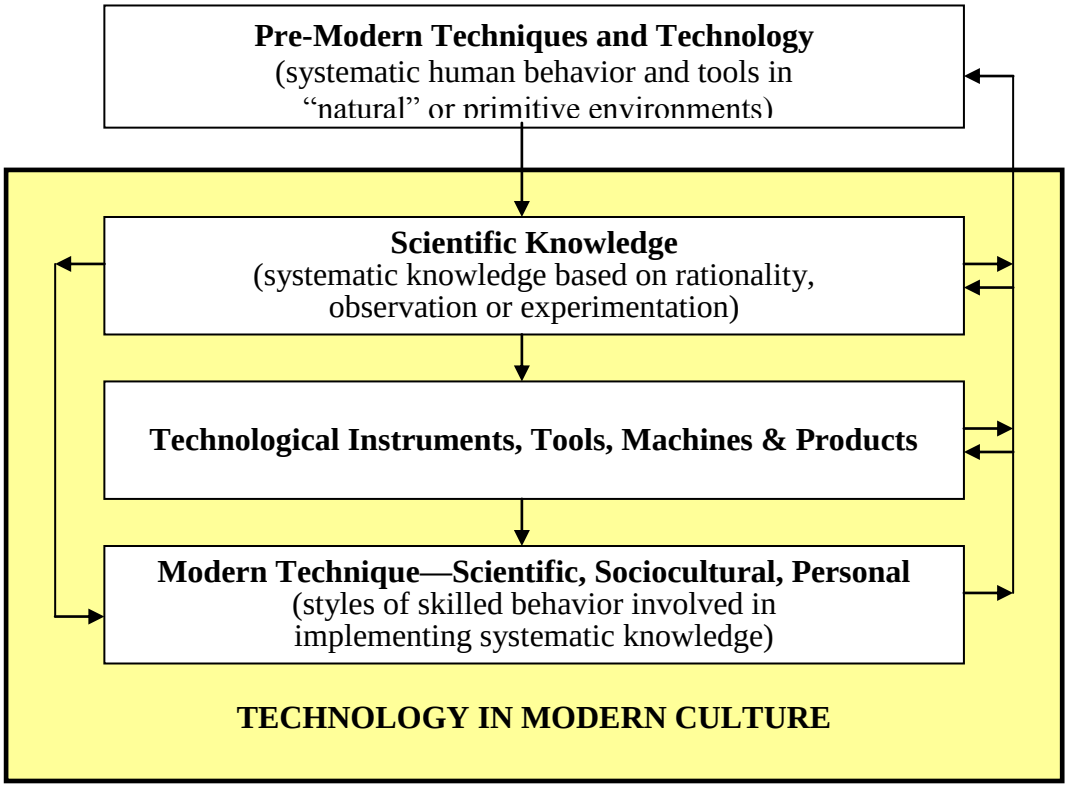
Thus, instead of techniques related to understanding technical systems and their direct relationship with the environment or goal, a whole new level of human technique evolves which consists of interacting and dealing with constraints of technology (symbolic manipulations like the keyboard interactions that a graphic artist learns to use a computer art application). These kind of technical skills (i.e., techniques) have often been negative and less meaningful to people because human-machine interactions are often structured by inherent technological limitations or nonhuman aspects of the technology. Additionally, technology and related techniques involve new sociocultural structures which can be problematic in themselves.

In summary, whereas in ancient Greece technology was considered to be the study of knowledge and skills involved in specialized arts (i.e. technologia), technology and associated techniques have now permeated human culture, experience, and cognition. Strangely enough, the nature of such profound changes in human experience is difficult to be aware of and define. Nonetheless, understanding the impacts of technology and its relationship to human learning is an important factor in pursuing liberal ideals associated with a fully functioning educational system. The next section discusses how technology and technique have been ignored or misunderstood as having a compartmentalized relationship with science and machines. This superficial view of technology and technique inhibits understanding major determinants of human thinking, learning, and culture.

4. TECHNOLOGY: TECHNIQUE, SCIENCE, AND MACHINES

Techniques—Mothers of Invention

As noted above, relationships between technique (skillful thought and behavior), science (systematic knowledge), and machines were studied at least as far back as the classic Greek philosophies. A diagram showing how these concepts and relationships are viewed for the purposes of this paper is shown in Figure 1.



Sciences—Mothers of Technology

In contrast with its Greek origins, early modern science was experimental. In the context of early modern science, an experiment: 1) used technological tools, and 2) was performed in a situation in which the natural phenomenon was controlled or put under certain constraints (Ihde, 1993). This scientific curiosity and manipulation of the environment produced technologies which can be conceived of as products of science (Fellows 1995). Thus technologies, technique, and associated products are often viewed as essentially scientific—in the sense that they are divorced from any human-oriented or socio-cultural values. This leads to the intuition that modern technology threatens humanistic ideals: "high" culture, liberal education, community, and spiritual values.

However, this view of technology as a neutral scientific force is inadequate if people want to understand and control effects on the contemporary conditions of humanity. Recall Feenberg's (1991) model which characterizes technology as a politically and culturally neutral but progressive-positive force; a "universality of truth" that is innate to instrumentality. This view is optimistic, but does not account for negative aspects of technology. For example, consider the technology of transportation. In the past transportation has utilized technology such as animal drawn vehicles, and now we have the much improved fuel consuming automobiles. We cannot, however, characterize the automobile as being "indifferent with respect to politics" or "indifferent to the variety of ends it can be employed to achieve." People who drive their car seventy-five meters to buy

something from a nearby store may be choosing an inefficient and irrational means of achieving their end (e.g., walking might take less time and be better for one's health). Similarly, use of individual automobiles instead of constructing much more efficient mass transportation systems may be relatively destructive in a sociocultural sense. The technology of war, drugs, invasion of privacy, etc. provide plenty of examples that contradict the view that technology evolves in association with inherently rational goals and means. In sum, technology and technique are often not representative of a "sociopolitical neutrality of technology" having some inherent "rational character and the universality of the truth that it [technology] embodies."

Machines—Mothers of Modern Culture

The strong connection between machines and technology reflects the fact that without machines, normal/everyday connotations of the word "technical" would not exist. For example, people are likely to include knowledge and skills connected with the use of *machines* that control fire in their concept of technology. However they are less likely to view general knowledge about controlling fire as technology (Cotrell, 1972). Nonetheless, Ellul (1964) asserts that techniques (i.e., methods for applying technical knowledge) have now become almost completely independent of machines, which lag far behind humanity's ability to implement and utilize systematic bodies of knowledge. Obviously, many techniques involving our use of systematic knowledge are implemented outside the scientific and industrial use of machines (e.g., advertising techniques, self-help techniques, negotiation techniques, and so on). Moreover, machines as well as science-oriented tools and processes are often conceived from and *depend* upon these systematic bodies of knowledge and techniques. In short, machines are now the result of technical knowledge rather than determining it. Not only are machines representative of a particular type of technical methodology, but the social and economic applications of machines are made possible by the advantages of various other types of technical methodology. Technology can be viewed as comprising heterogeneous bodies of knowledge and techniques by which, in addition to devices, man progressively masters his natural environment (Fellows, 1995). For better or worse, technical knowledge and techniques seem to have taken over most of man's activities, not just his productive activity.

This pervasive use of technical knowledge may be deeply symptomatic—a socio-cultural imperative resulting from a principle inherent in machines—due to the fact that replication of machines across culture requires human activity involving a particular set behaviors and techniques. Ellul (1964) suggested that the relationship between machine and technique penetrates to the very core of the problem of our civilization. His philosophical analysis suggests that the pervasive use techniques, born from but not necessarily directly connected to machines, results in transferring characteristics of the machine into society. In other words, the machine has influenced human culture to become more "mechanical" in some sense, because almost all things in culture (e.g., transportation, entertainment, health, sport, education, and so on) would cease to exist as we know them without the machine. Mechanization of culture is viewed negatively in part because machines are antisocial objects—they do not explicitly engage in social activities.

5. TECHNOLOGY, CULTURE, AND SOCIETY

Technology and Social Organization

Next we discuss the connection between organization and technikos (i.e., technique, technical methodology). Organization has been defined in several ways. First, Ellul (1064) describes organization as *technique applied to social, economic, or administrative life* Organization in this sense is used by almost all people to successfully accomplish their organizational or personnel goals in life.

Second, the primary *goal* of organization is to manage and accomplish objectives in an efficient and economic way. In other words, people implement organization in order to save time, money, and work.

Ideally, organization establishes standardization and the rationalization of economic and administrative life. Standardization means resolving in advance all the problems that might possibly impede the functioning of an organization (Ellul, 1964). It aids people to develop specific rules which must be applied to efficiently and effectively solve their problems in their life by people. In addition, standardization is interested in more methods and instructions than individuals. It means that people can not create their personal standardization. To be organized means to be used in a general way by a group of people. Of course, as we all know, individuals learn to use organized systems to implement their personal goals and emotional needs. Further, a culture may insert its own practices which co-opt or overlay what are nominally the system's organizational standards. In short, technikos and human nature may clash, which is a source of cultural differences: Which types of organization and technique will individuals and groups within a culture accept and participate in?

Organization is something other than technique, organized people have in a way discovered a new field of action and new methods, and that people must study organization as a new phenomenon, when it is nothing of the sort

(Ellul, 1964). On the other hand, he refuses to change his ideas about the continuity of the technical process. He believes that it is this process which is taking on a new aspect and is developing on a world-wide scale.

There are two kinds of consequences. First, mechanical technique produced the problems at the end of the application of technique. This organization which is succeeding technique is in some way a counterbalance to it, and a remedy (Ellul, 1964). It is mentioned that exactly the opposite is true. This development adds to the technical problems by offering a partial solution to old problems, itself based on the very methods that created the problems in the first place.

Second, organization as a phenomenon whose effects can not yet be seen. However, the final results is that technique will assimilate everything to the machine; the ideal for which technique strives is the mechanization of everything it encounters (Ellul, 1964). It can be said that the technical age continues to help people successfully organize their lives. For this reason, people should think of technique and organization together in an appropriate way in order to solve their problems. Thus, people must receive the advantages of organization and technique to successfully accomplish their goals in their life.

Technology and Culture

Technikos is a mental process that is associated with real world activities involving techniques or technical methodologies. Technikos as a mental trait is an aspect of culture, and the associated techniques/technical methodologies affect people's lives, behavior, communication style, and so on. Technologies can be embedded so deeply in culture that people have not acquired knowledge of the technikos and technological methodology that produced them. However, in with a deeply embedded technology, new technikos are created along with new human-technology interactions at a higher a simpler level. These new human-technology processes entail "ways of seeing"—whether or not the actual technology equals the metaphysical way of seeing—that comprise essential characteristics of a culture.

Like science, technology—which is the application of knowledge or discovery for practical use—is also a feature or product of culture (Fellows, 1995). Technology contributes to, and is determined by, its cultural environment.

Technology and Society

According to Teich (1977), the close relationship between technological and social change itself helps to explain why any given technological development is likely to have both positive and negative effects. These effects are as follows:

1. Technological advance creates a new opportunity to achieve some desired goal.
2. This requires alterations in social organization if advantage is to be taken of the new opportunity.
3. Which means that the functions of existing social structures will be interfered with.
4. With the result that other goals which were served by the older structures are now only inadequately achieved (Teich, 1977).

Consider three views on the role of technology in society. First, technology is an unalloyed blessing for man and society. Technology is seen as the mother of all progress, as holding the solution to most our social problems, as helping to liberate the individual from the clutches of a complex and highly organized society, and as the source of permanent prosperity; in short, as the promise of utopia in our time (Teich, 1977). Second, technology is an unmitigated curse. Technology is said to rob people of their jobs, their privacy, their participation in democratic government, and even, in the end, their dignity as human beings. Teich also notes that technology is seen autonomous and uncontrollable, as fostering materialistic values and as destructive of religion, as bringing about a technocratic society and bureaucratic state in which the individual is increasingly submerged, and as treating, ultimately, to position nature and blow up the world (Teich, 1977).

A third view of technology differs from the previous characterizations as ultimately good or bad. It argues that technology as such is not worthy of special notice, because it has been well organized as a factor in social change at least since the Industrial Revolution. It is unlikely that the social effects of computers will be nearly so traumatic as the introduction of the factory system in 18th-century England, because 1) research has shown that there has been no significant change in recent decades in the time period between invention and widespread adoption of new technology, and 2) improved communications and higher levels of education make people much more adaptable to new ideas and to new social reforms required by technology (Teich, 1977).

A society should respond to the opportunities produced by technology for productive and positive development. Unfortunately, societies sometimes hinder people from developing or utilizing a particular technology. For example, high level decision makers may think that the cost of a technological development is too high, or companies may conclude that some technologies will not be favorable for maximum profits.

Therefore, there is an interaction between technology or technique and society. We can see this effect anywhere in our society. For example, computer development aids society to organize work, association, company, and others to save time and money. It means that technology provides society with new opportunities to design all things well.

6. CONCLUSION

Definition and analysis of technology, it's history as well as its role in human life… to us that there is a relationship among technology, society, culture, organization, machines, technical operation, and technical phenomenon.

Educators are increasingly using technology in all aspects of their profession (e.g., creating curricula, classroom instruction, work assignments) This trend can be enhanced by educating the educator about cultural and cognitive aspects of technology and technikos, as well as the associated advantages and disadvantages related to educational and human development goals.

Since the Renaissance, modern everyday attitudes tend to freely accept and use new technologies. Technology is usually comprehended in terms of hardware and the end experiences it produces (good or bad) or its material benefits (profitable or unprofitable), rather than understanding deeper relationships between technology, human nature, and culture. What produces technology—cultural organization, human values, research and development, and so on—is less obvious and less interesting than experiencing it's products and benefits.

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