Expanding the Content Base of Technology Education: Technology Transfer as a Topic of Study

Scott D. Johnson, Elizabeth Faye Gatz and Don Hicks

The first automobile safety "air bag" was successfully demonstrated in 1955 by its inventor, who boasted in a news reel film that the next year's automobiles would have the air bag as a standard equipment feature. Looking back, one must wonder why such an important safety device took nearly 40 years to become a standard feature in the automobile industry. During the same time frame, Dr. Jonas Salk discovered a cure for the dreaded polio virus. In contrast to the air bag innovation, it was only a few months before every school child in the nation began receiving a polio shot. Why did these two life saving innovations differ so radically in their rate of transfer from the developer to the user? This question addresses two interdisciplinary fields of study; (1) *technology transfer* and (2) *diffusion of innovations* (Cottrill, Rogers, & Mills, 1989). These fields provide the link between technology development and utilization, and moves the work of technology developers into the hands of end users. Without the successful movement of technology out of a development lab and into a user's environment, the potential of new technologies cannot be fully realized.

While technology transfer typically "refers to the development of a technology in one setting which is then transferred for use in another setting" (Markert, 1993, p. 231), diffusion is used to describe the "spreading" or use of a technology within a society, organization, or group of individuals (Rogers, 1995). Technology transfer tends to focus on the producer of the technology while much of the focus of diffusion relates to the end user of the technology. Viewed from the holistic perspective of technology development and utilization, these two areas are closely interrelated and must be considered together. In this article, the term technology transfer will be defined broadly to include both the movement of technology from the site of origin to the site of use and issues concerning the ultimate acceptance and use of the technology by the end user. Adopting this broad definition of technology transfer implies that a technology has not been successfully transferred until it has been accepted and used by the end user.

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Technology transfer is not a new field of study. Although the term "technology transfer" appears to have been coined in the United States in the 1940s, examples of technology transfer can be traced back to the advent of technology itself. Formal studies of technology transfer began with the technology diffusion research conducted by European social scientists and quickly gained acceptance in a number of disciplines as an important area of inquiry (Rogers, 1995). This line of research began to grow in the United States in the 1920s and continued to expand until the late 1970s (Backer, 1991; Rogers, 1995). After a lull of nearly a decade, the study of technology transfer has once again become a focus of researchers in sociology, economics, technology, and education. It has been estimated that the technology transfer literature base now exceeds 10,000 documents (Backer, David, & Soucy, 1995).

With the recent renewed emphasis on technology transfer by business, government, and academia, educators who teach about technology should consider technology transfer as a worthy and necessary area of study. While the curriculum in technology oriented programs has traditionally emphasized technological development and the applications of technology, little attention has been given to issues of transfer and end user acceptance. In the mid 1980s, technology educators began to address the importance of technology transfer (e.g., Todd, 1985), yet little progress was made in expanding the curriculum to emphasize the links between technology development, transfer, and utilization. More recently, a cursory review of issues of *The Technology Teacher*, the *Journal of Technology Education*, the *Journal of Industrial Teacher Education*, and the *Journal of Technology Studies* for the past five years revealed only one article that addressed technology transfer directly, and the topic as covered in only one paragraph (Rogers, 1993). One would expect to find a similar void in existing curriculum documents. If it is acknowledged that technology transfer is a major factor in the field of technology, this topic should be reflected in the technology curriculum. The purpose of this article is to provide an overview of the concepts contained in relevant technology transfer literature in order to encourage future curriculum development effort.

Conceptualizing Technology Transfer

Various views of technology transfer have been developed over the years to address different aspects of the issue. Many of the early views were restricted to mean the transfer of technology between developed and developing countries. These types of studies emphasized the economic, political, and cultural differences between the developer and the receiver of the technology.

Federal agencies define technology transfer differently. When Congress passed the Stevenson-Wydler Innovation Act of 1980 followed by the Federal Technology Transfer Act of 1986, all Federal laboratories were required to develop active programs for transferring technology to State and local governments and the private sector. Through this mandate, Federal laboratories are required to develop a "process by which existing knowledge, facilities or capabilities developed under Federal R&D funding can be utilized to fulfill public and private needs" (The Federal Laboratory Consortium for Technology

Transfer, 1996). The above legislation was further amended by Public Law 104-113 that created incentives and encouraged the commercialization of technologies created in federal laboratories (National Technology Transfer and Advancement Act, 1996).

Most universities now have technology transfer centers or offices that adopt a rather narrow view of technology transfer. A recent informal survey of university World Wide Web sites revealed few educational programs in technology transfer, with most Web sites dealing with technology transfer issues related to the securing of rights to intellectual property as university-developed technologies are transferred to the commercial sector. The industry funding of university research often results in the transfer of technologies between the two entities, while at the same time provides students with experience tackling the barriers between technological development and its broader utilization. For example, some universities consider the goal of technology transfer to facilitate the efficient transfer of technology from government agencies, industries, and institutions of higher education to appropriate firms. Others tend to view technology transfer from a broader perspective, that of disseminating or diffusing technological knowledge throughout society.

In its most basic form, technology transfer includes the transfer item itself, the developer of the technology, various channels to accomplish the transfer, and the technology recipient (Markert, 1993). From a conceptual perspective, it does not matter if the developer is a private or federal R & D laboratory, a university, or a farmer in South America. Along the same line, the end user of the technology may be a commercial venture, the government of a developing country, or a neighboring farmer in South America. The important point is that a technology that exists in one setting is transferred in some way to a user in another setting who accepts and uses the technology.

Technology transfer can best be described through the use of a conceptual model (see Figure 1). The macro model in Figure 1 is based on a synthesis of published case studies of technology transfer and is intentionally very simplistic and general in nature. This model includes the (1) technological activity that leads to the development of an innovation, (2) the many barriers that may impede the transfer and diffusion process, and (3) the process through which the technology is transferred.

Technological Activity

Technology transfer begins with the development of a new technology or the modification of an existing technology. This development process occurs in reaction to a perceived want or need for a product and results in *technological activity*. This activity results in the expansion of human capabilities through the creation of technical processes, artifacts, and knowledge. All technological

activity occurs within a social, economic, and psychological context (see Figure 2). The activity itself is the "result of combining ingenuity and resources to meet human needs and wants" (International Technology Education Association, 1996, p. 11). The resultant technology emerges through the combination of knowledge, thinking processes, and physical means (Johnson, Foster, & Satchwell, 1989). The outputs of technological activity are innovations or modifications of existing technologies that fall within the categories of physical, biological, informational, and organizational technologies.

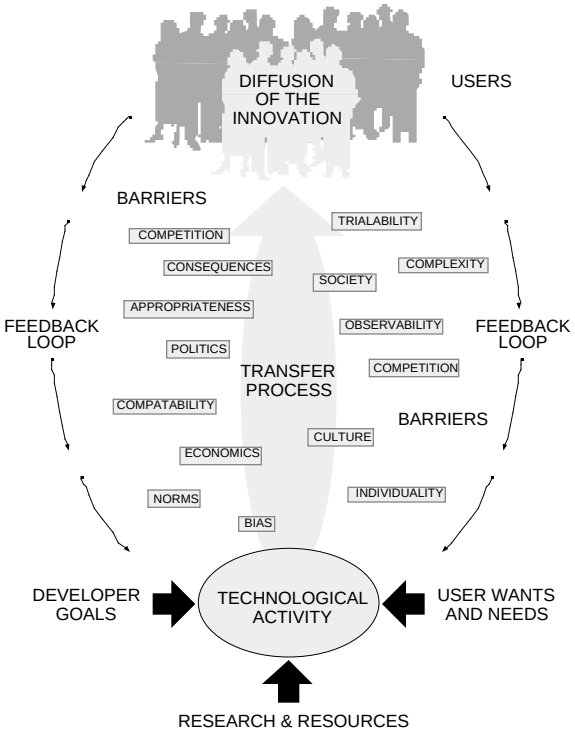

Figure1. Conceptual View of Technology Transfer

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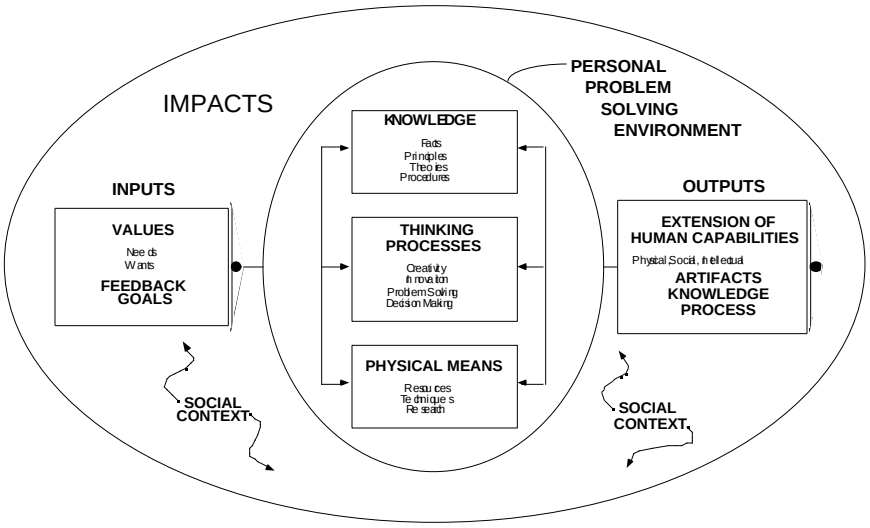

Figure 2. Model of Technology Activity

The end user should be, but is not always, the principal consideration in the design of technologies. Through early and regular contact with the end users, technologies can be developed that suit their needs. This interactive development becomes even more important when differing cultural and social values are involved. For example, in some cultures individuality and craftsmanship are valued far more than a price-break for a more efficiently produced product. Developers who realize this may ultimately be more successful in the transfer of technologies to the marketplace. Without a sensitivity for the needs of the end user and a recognition of the environment in which the technology will ultimately be used, the transfer of technology will be a difficult process. In other cases it is the technology developer's desire for prestige, money, and fame that determines the direction of technological activity. This approach to technology activity tends to ignore the end user, which may hinder the success of the transfer process.

A feedback loop is needed to complete the process. With the development of new technology comes the development of new wants and needs, leading to further technological activity. As technological developments occur, the end user becomes aware of new possibilities for using technology in their lives and may make demands, which creates a "market pull" that influences the direction of future technological activity (see Figure 1).

Barriers to the Transfer Process

Technology does not stand alone, but encompasses political, social, economic, and cultural values that can serve as barriers that impede the diffusion

or transfer of technology (see Figure 1). The barriers to technology transfer exist for all innovations, but some transfers are more affected by the barriers than others.

Social barriers. It is important to recognize that transfer occurs within a social system. The social system defines the boundary or limits within which the innovation will be transferred and diffused. Most transfers assume some sort of societal judgment. An individual will not recommend a technology to neighbors if it is detrimental to them or not of substantial benefit. Similarly, news of a new technology will not be printed in a scientific journal unless its benefit has been adequately proven.

Political barriers. The influence of political barriers on transfer was evident in a problem that occurred in India, where a near-famine situation prompted the development of an agricultural research system and the reform of the bureaucracy that had driven the peasants to poverty (Parayil, 1992). Before the development of the new technology, the colonial government was interested solely in increasing the production of exportable cash crops. In this case, the political agenda largely ignored the needs of the citizens between 1947 and 1965. The political barriers to transfer were not broken until an influential change agent gained a high level position in the government. This change agent pushed the technology through the political barriers by creating partnerships between the government and research institutions that ultimately helped to avert the famine and created an infrastructure in which the technology could thrive.

Economic barriers. The role of economic barriers in technology transfer is apparent in studies of the transfer and diffusion of technology to the American cotton-textile industry (Feller, 1974). The adoption rate of a new loom was slow in the North because the industry had a heavy investment in non-automatic looms. In contrast, the new looms quickly spread throughout the South due to a relatively new textile industry that had not yet committed financial resources to a particular technology.

Personal barriers. An individual's particular concerns about a given technology seems to be an influencing factor in the degree of acceptance (Hall & Loucks, 1978). Hall and Loucks stress that individuals have different concerns about innovations and proceed through various stages before they fully accept the change. Rogers (1995) also asserts that transfer depends on certain characteristics of the end user. He contends that a very small percentage of the population, called *innovators*, constantly seek out new innovations. This group is followed by a larger group called *early adopters* who are generally eager to test new technologies. This group influences those around them and is often sought out for advice. This is a key group for change agents working to transfer a technology to identify because they can have a strong impact on their peers. Following this group is the *early majority* who tend to wait until they receive positive feedback from the early adopters about the technology before they become interested in adopting. Nearly half of the population trails behind these groups and has been classified as *late majority* and *laggards*.

Cultural barriers. Cultural barriers also play a key role in technology transfer. In many cases, the culture in which a technology is designed is different from that where it is ultimately used. Thus, it is important for designers to

communicate with and understand the receiving culture (Pacey, 1986). This communication will help assure a solution that is appropriate for the culture and acceptable to social norms and values. Baranson (1963) stressed that designers should consider the characteristics of the labor force and the resources available in the receiving country. In developing countries, equipment should be small-scale, rugged, and require minimal training for successful operation. These features should not be limiting, however, as the technology should have the potential to expand as a country's needs and resources expand. He explains that "little attention has been paid to accommodating technological design to cultural traits; instead emphasis has been placed upon adjusting societies to machines" (p. 26). As systems become more automated, those in charge of technology tend to believe that more computer power will make their processes more efficient. In pulling manufacturing and design toward automation, the tendency is to give as much power as possible to the machine and leave the remaining job tasks to the worker. This automation philosophy discounts the knowledge and intuitive capabilities of workers and pushes them to resent the technology. A better approach is to design systems around the workers, which offers the workers a change from mechanistic job tasks to higher-level tasks.

The Process of Technology Transfer

Successful technology transfer is not achieved through the simple movement of technology to a new environment; it requires the development of a process and infrastructure that will help the technology "break through" the barriers described above. In some cases the technology is needed so desperately that the end user will help the technology break through the barriers. Other innovations have to be pushed through the maze of barriers to the end user by the current "owner" of the technology. The degree to which the end user wants and/or needs the new technology will determine whether the technological potential or the social constraints will prevail, and the speed with which the innovation may travel from the original source to the end user.

Communication is a key element in the transfer process. If a new product is available but the public is not made aware of it, the technology will never reach its intended market. Transfer requires human intervention for a technological innovation to become part of a larger system. The communication channels that support the transfer process include the printed word (e.g., journals, books, newspapers), personal correspondence (e.g., letters, conversations), scientific societies, formal instruction (e.g., universities, research institutions), travel and exploration, mass media (e.g., public information promotions, demonstration programs such as the model farm), bureaucratic and institutional reform, and research (e.g., adaptive research, agricultural research stations). Other, more specific, examples of transfer vehicles include personalized training (Hall, Loucks, Rutherford, & Newlove, 1975); open dialogue (Pacey, 1986); inter-industry communication (Rosenberg, 1970); education and training (Stern, 1992); management techniques and timing (Tyre & Orlikowski, 1993); student

exchange programs and cooperative scientific ventures (Markert, 1993). Obviously, societies that control and limit open communication hamper the process of diffusion and ultimately the successful use of innovations.

Broad Issues that Influence the Transfer of Technology

Building on the above conceptual view of technology transfer, the remaining discussion focuses on factors that influence the transfer of technology. The ease with which an innovation is transferred from the technology development stage to the end user is contingent upon several factors. First, the process that is used to transfer a technology influences the success of the transfer. This process is described below in terms of "models of transfer." Second, the "power" or appropriateness of an innovation seems to have a significant impact on its ability to overcome the transfer barriers. Power can be defined as the strength of the human wants and/or needs related to the particular innovation that propels it through, around, under, and over the barriers; that is, if there is a strong perceived need for a technology then it will more easily overcome the barriers. This could explain why the polio vaccine got to the school children so quickly and why other innovations such as the air bag take so long or even fail to overcome the barriers. Third, the timing of the transfer is critical and fourth, characteristics of the change agent greatly influence the transfer of technology. Each of these influencing factors are described below.

Models of Technology Transfer

Many models of technology transfer exist in the literature. Tenkasi discusses four predominate models of technology transfer: the appropriability model, the dissemination model, the knowledge utilization model, and the contextual collaboration model (Tenkasi & Mohrman, 1995). The *appropriability model* follows the belief that good technologies sell themselves. Based on this model, purposive attempts to transfer technologies are believed to be unnecessary. When the developer of the technology makes it available through common communication channels (e.g., television, newspapers, technical reports, journals, conference presentations), interested potential users will adopt the technology without further effort on the part of the developer. The *dissemination model* takes the view that transfer is best accomplished when experts transfer specialized knowledge to a willing receptor (Rogers, 1995). This model suggests that the technology flows from the initial source to the end user much like water flows through a pipe as long as restrictions are kept to a minimum. The *knowledge utilization model* focuses on strategies that put knowledge to effective use in the recipient's setting. While this model has gained acceptance in recent years, it still suffers from a linear bias (as do the first two models) that the process of transfer moves in one direction from the developer to the end user (Tenkasi & Mohrman, 1995). The *contextual collaboration model* is more of a diffusion model, building on the constructivist notion that knowledge cannot be simply transmitted, but must be subjectively constructed by the receiver through contextual adaptation (Tenkasi & Mohrman, 1995). If innovations are to be transferred successfully, both the knowledge and the technology being transferred must be contextually adapted. This model goes

beyond the other models that view transfer as information transmission or communication by implying that successful transfer requires learning on the part of both parties and the need to recognize the perspective of others.

Another set of technology transfer models has been proposed by Ruttan and Hayami (1973). Their model distinguishes three phases of international technology transfer: material transfer, design transfer, and capacity transfer. *Material transfer* is characterized by the simple transfer of new materials or equipment such as machinery, seeds, tools, and the techniques associated with the use of the materials. In this case, adaptation of the technology to the local conditions is not a direct concern. *Design transfer* is accomplished through the transfer of designs such as blueprints and tooling specifications so the receiver can use the new technology on site. *Capacity transfer* is the most comprehensive of the three, and involves the transfer of knowledge, which provides the end user with the capability to design and manufacture a new technology on their own. This type of transfer serves to expand and build upon a technology base while at the same time providing for learning and development of the receiver. Licensing agreements and franchises are two practical examples of this form of transfer.

A good example of these three phases of transfer is evident in Russia's attempts to develop their heavy equipment industry in the early twentieth century (Dalrymple, 1964). Russia could have decided to simply import sufficient numbers of tractors to meet their needs. However, due to the depressed economic climate, the Russians imported a small number of tractors, disassembled them to study their design, and then produced exact copies of the tractors in plants that resembled those used in the United States. This attempt at reverse engineering (Markert, 1993) proved moderately successful but the Russians' desire for capacity transfer failed because of institutional constraints (Dalrymple, 1964). Three problems hampered the Russians: (1) they were unable to copy the exact material specifications of the tractor parts, (2) they failed to educate the end users about the proper use of the tractor, and (3) their maintenance facilities proved to be inadequate. In this case, partial transfer was successful, but the creation of the capacity to design, use, and maintain the new technology was aborted because the Russians failed to recognize the entire scope of the technology transfer process. While cost constraints may require that only materials be transferred, the benefits of technology are sustainable only if the user population can adapt the technology to meet their cultural and environmental needs (Parayil, 1992).

Appropriateness of Technologies

Pursell (1993) suggests that the appropriateness of a technology influences the transfer of an innovation. Appropriate technologies are inexpensive, easily maintained, suitable for small scale application, compatible with one's need for creativity, and are relatively easy to learn to use. Appropriate technologies are those that match the needs and wants of the individual or group receiving the technology. A good example of an appropriate technology occurred during the "Green Revolution" in India in the 1960s and 1970s. The introduction of new varieties of wheat into Indian agriculture was successful partly because the

wheat was *appropriate* for the setting to which it was transferred. In this case, both the agricultural production conditions and the personal taste of the consumers matched the characteristics of the wheat (Parayil, 1992). Another example of the importance of appropriate technologies for successful transfer occurred during the same time period in Mexico (DeWalt, 1978). Efforts were made by the government to provide tractors to the peasant farmers to enhance the productivity of their farms. The transfer of this technology to the peasant farmers failed because the tractors were too expensive, they were too large for planting seeds on their small plots of land, maintenance facilities were unavailable, and fuel was costly and scarce. Clearly the tractor was not an appropriate technology for these farmers. In an attempt to increase their yields by reducing the labor costs for planting and to better control the planting process by improving the consistency of the seed depth, a creative framer designed a mechanical seed drill that was pulled by animals, deposited seeds at the correct depth, and could be manufactured by a local blacksmith. Because this technology could be developed by the indigenous farmers, was simple to fabricate, and easy to use, it was appropriate for this setting, quickly gained acceptance by the farmers, and was diffused throughout the region. This is also an example of an *intermediate technology*; a technology that is at a level between the current technologies of the area and the "high tech" technologies that are available elsewhere.

Another way to consider the appropriateness of a technology is to examine its characteristics. Rogers (1995) argues that the characteristics of a technology, as perceived by individuals, influence the rate at which an innovation is transferred and diffused into the society or organization. He describes the five characteristics of relative advantage, compatibility, complexity, trialability, and observability.

- *Relative advantage*. The degree to which an innovation is perceived as better than the idea it supersedes as measured in economic terms, social prestige, convenience, and satisfaction. It does not really matter if the new technology is an advantage as long as it is perceived as one. The greater the perceived advantage, the more rapid the adoption.
- *Compatibility*. The degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An idea that is incompatible with values and norms of a social system will not be adopted as rapidly as an idea that is compatible.
- *Complexity*. The degree to which an innovation is perceived as difficult to understand and use. New ideas that are simpler to understand are adopted more rapidly than ideas that require new skills and understandings.
- *Trialability*. The degree to which an innovation may be experimented with on a limited basis. An innovation that is trialable represents less uncertainty to the individual who is considering adopting the technology and therefore is more likely to be accepted.

- *Observability*. The degree to which the results of an innovation are visible to others. The easier it is for individuals to see others using the innovation with positive results, the more likely they are to adopt it.

Timing

Timing is an important factor in the success or failure of an innovation's ability to progress from the technological activity output phase to beneficial use. There are numerous examples of technologies that appeared either ahead or behind their time, that is, they were made available either too early or too late to benefit the user. Successful transfer requires that technologies be delivered at the optimum time it is needed or wanted by the user. Timing also influences an innovation's ability to overcome the barriers. When the timing is right the barriers will be more easily overcome during technology transfer.

Change Agents

Technology transfer is accomplished by "agents, not agencies" (Burns, 1969, p. 12). Within the social environment are key players, opinion leaders, or change agents who have the influence or power to change peoples' attitudes about an innovation. For example, when Joseph Stalin of the USSR decided that a low head hydroelectric power plant would be constructed, his influence and power led to the successful transfer of new technologies from the United States (Dorn, 1979). Although Stalin was a powerful change agent, he did not have enough knowledge of the technology to lead the transfer effort. Instead, the Russian searched the world for an expert who could guide the transfer process. In this case, Hugh Lincoln Cooper was employed from the U.S. because he had both the technical expertise to guide such a project and the influence needed to see that the project succeeded. Change agents have a professional responsibility to be sensitive toward the receiving culture. They need to "consider issues and take part in decisions regarding transportation, land use, pollution control, defense, and restricting or encouraging technological activities. Sound decisions demand an understanding of the impacts, relationships, and costs of such technological activities." (International Technology Education Association, 1996, p. 8). It is important that discussions between change agents and the members of a receiving population be two-sided (Pacey, 1986). After all, the potential users of technology are experts in another sense, that of understanding their culture and society. Through this cooperation, technological solutions can be developed that adequately address social, cultural, economic, and political concerns.

Specific Technology Transfer Strategies

While the discussion of the nature of technological activity, the characteristics of technology, and the societal barriers that support or hamper transfer provides a conceptual understanding of technology transfer, concrete strategies are needed to facilitate successful technology transfers. Facilitating a smooth transition from the owners of the current technology to the end users of the new technology requires a strategic plan. It is too often assumed that

innovations can be transferred simply, as if by magic, to the user. In practice the transfer process is much more difficult. When successful, the transfer process could take anywhere from a few days or weeks to several centuries. Still, some transfer efforts are never successful and languish in a sort of technology transfer purgatory.

The chances of successful transfer are enhanced by understanding the technology transfer process and by developing strategies that can enhance the prospects of successful transfer. The following lists identify many of the important strategies for successful transfer that emerge from the concepts discussed in the literature. While incomplete, these strategies highlight the complexity of issues that need to be addressed when supporting a technology transfer process. These strategies are categorized according to technological readiness questions, design considerations, and end user needs.

Technological Readiness Questions

These questions provide the basis for an initial overview or 'scan' of a user environment. Answers to these questions help assess whether a user environment is prepared to embrace and develop the knowledge needed to successfully adopt a new technology.

- Who will be using the technology?
- What is their current level of technology?
- Who are the stakeholders? the decision-makers? the influential people?
- Do the end users have the education needed to adopt the technology?
- Will training be needed?
- What are the available financial resources? Will they be sufficient to sustain the technology?
- Will the current infrastructure support the technology and its expected growth?
- What other aspects might affect by this transfer?
- Is the full benefit of the technology limited by other bottlenecks in the system?

Design Considerations

These design considerations build on the concepts of the appropriateness of technology and emphasize factors important in achieving more than a material transfer of technology.

- Design the technology and infrastructure so that it can grow with the user.
- Develop and adapt technology so that it is appropriate for the culture, and intermediate if the society's needs dictate.
- Present demonstration programs to assure small-scale success.
- Keep the end user in the loop during the design process to assure that needs are being met.
- Document technology procedures (in terms the user can understand) so that the user has as much information as needed to operate the technology independently.

- Provide research and/or training support to facilitate the transfer of knowledge.
- Maintain a systems view. Recognize that the technology is not independent, but affects other parts of the system.

End User Considerations

Central to the models of technology transfer is the role of user needs and wants in the technological development process. The issues described below build on the importance of the user in the design process and extend this consideration of users to the technology transfer process.

- Evaluate end user's needs and available resources.
- Consider how large a system the user will be able to staff and maintain.
- Identify influential people, stakeholders, and decision-makers. The power of the change agent may dictate a technology's success or failure. Facilitate communication among those involved, and foster a cooperative relationship.
- Treat the end user's values and culture with respect. Develop technology solutions that are fitting for that environment.
- Do not impose status and education on the receiving culture. Maintain two-sided innovative dialogue and establish communication channels.

Relating These Concepts to Technology Education

The concept of technology transfer has relevance for all technology education programs, including programs in elementary and secondary schools, technology teacher preparation, and industrial technology at the university level. Given the assortment of technology transfer concepts introduced in this article, that relevance may not be immediately apparent. While technology development has been a central aspect of technology education programs through the years, issues dealing with the transfer of technology and its diffusion through society have been neglected. If a goal of technology education programs is to help students understand their technological future, the curriculum must provide a comprehensive study of technology that covers the entire range from technology development to utilization. Technology transfer seems to be the missing element in a comprehensive technology education program.

What should students of technology know about technology transfer? The answer to this question certainly depends of the education level and the goals of the specific programs. As teachers of technology we need to be sure our students are aware of the issues and have the potential to facilitate successful technology transfer efforts in the future. At the very least, students should be aware that technology transfer is a much more complex concept than simply moving a technology from one environment to another. Technology itself encompasses social and cultural values and, in most cases, has a profound impact on the receiving culture. As members of a literate and knowledgeable society, students also need to know more about the technology transfer process and how it can be improved. They need to realize that there is not just one prescription for successful technology transfer. Understanding the technology transfer process

and the individual, social, political, economic, and cultural influences on that process would be a likely starting place in the curriculum.

Because technology transfer, as a field of study, is relatively new and undeveloped, there are many areas in need of more investigation. Educational researchers in technology education need to identify where we fit in the process and how we can contribute to this body of knowledge. For too many years we have ignored this topic altogether.

The concepts and strategies presented in this article provide a starting point for the design of curricula that addresses the processes of technology development, transfer, and diffusion. Through a scholarly examination of this topic, we may better prepare ourselves, and ultimately our students, to recognize the importance of technology transfer.

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