Preparing Innovation of Emerging Technology through Technology Education

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***Abstract*—**The core of technological method is peoples' mind. This core activates recognition of problem solving and promotes the use of resource and technology process to create innovation. Technology expanding people's ability to gain control of their work.. With technology, people could do new thing for tracing better results. It is the root of innovation. There is a need to find a focal point in our general education to lead this innovating eager society. The purpose of this study was to identify the structural connection between technology education and innovation based upon technological method model.

***Keywords*—**Innovation, Technology Education, Technological Method Model

I. Introduction

TECHNOLOGY education is a subject area of common education and provides learner the opportunity of understanding technology. New technology grows everyday and the information and knowledge of technology expands, too. Systems of technology in some areas are even exploded, such as energy & power technology and information & communication technology[1-4].

In science education, how to integrating emerging technology into formal education becomes a concern. Education reform acts in Taiwan pointed out this trend and raised a "High Scope Curriculum Development" project to foster teachers to design teaching material and learning activities of emerging technology[5, 6].

Technology education is a important course to host learners with the opportunity of adopting technology to gain innovation. Based upon the recognition of problem solving, technology resource and technology process, learning experience could provide a profound foundation of preparing behavior in using technology.

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II. 2 Problem Formulation

The purpose of this study was to identify the structural connection between technology education and innovation. The problem of this was whether there is a significant relation between technology recognition and technology innovation. In this session, literature review of technology are presented as the foundation for this study.

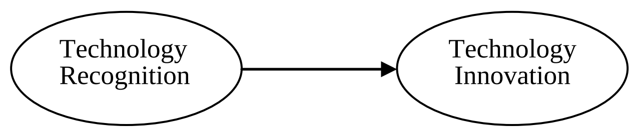

Fig. 1 Relationship between Technology recognition and Innovation

A. Technology Education

Technology is a body of knowledge and the systematic application of resources to produce outcomes in response to human needs and wants. Technology education is a subject of studying technology in which learners could learn about the context, process, and knowledge related to technology[7].

Technology is an integral part of our social structure. This structure can be defined in part by its use of technology which transforms the environment, ideologies, and its sociological elements. It is this interaction, that is, the dependence of humans on technical means for survival, that warrants the study of technology by all people.

Survival of the human species has continuously relied on means to adapt to the natural environment. Humans, constrained by their biological inheritance, have been forced to utilize support mechanisms for their sheer survival. By creating technical means for this survival, hun1ans were able to adapt both physically and socially. The acquisition of these technical means has been cumulative over the years with each new element adding to the existing inventory of knowledge. Archaeological evidence reveals the use of technical means in the past and it is obvious that our reliance on our technology has not diminished today. As a result, the nature of humans is expressed in cultural contrivances, both tangible (e.g., tools, machines) and intangible (e.g., ways of thinking).

One of the major contributors to the W1iqueness of our culture over the last quarter century is the scope and pace of technological change. Since we do not inherit culture through genetic transformation, we must rely on our exposure to information.

In this way, culture is learned. Understanding and coping with technology was relatively easy decades ago. However, today, making sense of culture on a global basis is a difficult task due to the avalanche of inventions and innovations.

A society is a group of people working as a cohesive unit bound together by its culture. Within society is the human endeavor called technology. Therefore, it is the human who conceives what should be developed, and it is the hun1an who should control its destiny. One significant challenge is to ensure that technical means are used appropriately for the welfare of all people without dan1aging the natural environment. It is imperative, therefore, that information be available for all people information that is accurate and usable. The primary vehicle for this dissemination is the educational enterprise. Just as society advances technologically, so must its educational system, thus enabling individuals to make a commitment to generating a society and environment that are human and controlled for the betterment of humankind.

The massive growth of technology and technology transfer has introduced us to the realities of an interdependent world. Global culture has moved within the past decade from self-sufficient economies to an integrated system of global production.

The use of technology is a global phenomenon with no country immune to the need for extending the potential of the human being. Willie not all countries have developed equally in a technological sense, it is clear that today new technologies will develop ·where human resources and commitment exist. No longer is the greatest asset capital or natural resources, but rather the ability to use information. Information is one of the most useful resources in developing and managing technological systems.

Countries who have access to and can manage technical information have a definite competitive edge in the worldwide marketplace. As a result, the demand for more innovations and inventions related to technology will continue to increase on a global scale.

Technological advancement, however, increases the demand for finite natural resources, compounding the problems of our planet. New transformations, prompted by technological growth, will come in shorter periods of time and will be more potent than ever before, while providing both social dissonance and opportunity.

The human race cannot look only to history to guide it through future unprecedented problems and opportunities. We must look to technology for more answers. Technology is a

product of human effort; therefore, it must be carefully designed and utilized so that all cultures may benefit. This must be done with a global view, in order to maintain a balance of the systems which sustain the human race. Hence, technological literacy should be a mandate in all cultures.

In the early 1980's, the Jackson's Mill Industrial Arts Curriculum Theory (Snyder & Hales, 1981) identified a base for curriculum derivation. Many of those concepts have been incorporated into the foundation of this document, especially the perspective on the relationship between the domains of knowledge and the hun1an adaptive systems.

Scholars[7] have identified knowledge which enables humans to adapt to their environment. This prospective knowledge gives people an understanding of what was, what is, and what can be. It is provided with a syntactical and conceptual structure into bodies of knowledge known as domains. Four major cultural universals or domains for providing a cognitive base for human adaptation in the natural environment are the (1) sciences, (2) humanities, (3) technologies, and (4) formal knowledge. These four domains are intrinsically linked, with the fourth, formal knowledge, being represented by language, linguistics, mathematics, and logic. Formal knowledge is separate, yet provides form and structure for the other three domains.

Each domain has its unique purpose, knowledge base, and structure (Snyder & Hales, 1981). The technologies domain of knowledge contains all recorded knowledge relating to the types of technology. Similarly, the sciences and humanities domains of knowledge contain all recorded knowledge of the sciences and humanities, respectively.

Technology as a human endeavor can be understood by analyzing the three human adaptive systems[7]: (1) technological, (2) sociological, and (3) ideological. Technological human adaptive systems pertain to technical means of manipulating the physical world to meet human needs and wants. Sociological systems are patterns of societal endeavor, characterized by social organization and regulation. Ideological systems are concerned with the values and beliefs of society. The three human adaptive systems, as presented in the]Jackson's Mill Industrial Arts Curriculum Theory, are interrelated and exist within the human-made and natural environments [8].

The human adaptive systems mutually interact with the domains of knowledge and contribute to each other. As people develop better and approved ways to adapt, the results contribute to the domains of knowledge. The adaptive systems utilize knowledge processes to create new knowledge (Snyder & Hales, 1981) by calling upon appropriate quantities of technological knowledge usually through a systematic process.

Any new knowledge produced as a result of this interaction becomes part of the body of knowledge of technology. As previously noted, technology exists as a domain of knowledge which gives people an understanding of what it was, is, and can be. The application of technology in a human adaptive system involves people applying technological knowledge and other resources in a social/ cultural context through technical processes and systems to produce outcomes in response to human wants and needs. Technology, as a human adaptive system, interacts with the other two human adaptive systems:

ideology and sociology. As a result, technological outcomes have an impact on people, society, culture, and the environment which must be assessed and w1derstood. Hence, the other adaptive systems are affected by, and are used to evaluate, technology.

Also, the improved ways to create, implement, assess, and manage technology contribute to the domains of knowledge.

Technology has an effect on people's values, which must be considered in the assessment and shaping of technology in a global society. This interaction must be understood and practiced within the human adaptive systems in order to use and control technology effectively.

The individual in today's world faces unprecedented change which requires the ability to continually cope and adjust. The inability to make these adjustments can cause individuals to be out of harmony with the very technology they worked to create and maintain. Technology has the potential to threaten and alter our cultural mores and customs, as well as our views of ourselves.

An understanding of technology can allow individuals to cope with, adjust to, invent, and innovate in this technological world. literally, ignorance of how technological systems are designed and function leads to inadequacy and a lack of productivity. These traits limit one's ability to function as a consumer, producer, decision-maker, worker and planner.

Survival of the human race and its natural environment relies on individuals who:

(1) see themselves intrinsically involved in nature,
(2)do not deny that there are problems created by technology and are willing to consciously add to the solution,
(3) do not see themselves as a single entity, but rather as part of an interdependent world, and (4) realize that there is a pattern of relationships that provides opportunity for individuals in a technological society.

The study of technology over time has resulted in the· identification of universal attributes[7, 9]. They are:

- People create technology.
- Teleology responds to human wants and needs.
- People use technology.
- Technology involves actions to extend human potential.
- The application of technology involves creating, implementing, assessing, and managing.
- Technology is implemented through the interaction of resources and systems.
- Technology exists in a social/ cultural setting.
- Teleology affects and is affected by the environment.
- Technology affects and is affected by people, society, and culture.
- Technology shapes and is shaped by values.

Innovation Theory

One of the most acclaimed authors regarding school change and reform is Michael Fullan[10, 11]. Fullan has many books and articles over the past decade and has become a popular voice and renowned expert on the topic. in this section, I will try to capture some of the most common ideas from Fullan, particularly those that will further my knowledge on the subject.

Fullan and Miles [11] work to reveal the conditions in which reform (change) fails. The following is a summary of the seven basic reasons for reform failure:

1) Faulty Maps of Change: The authors make the point that institutions may inaccurately represent themselves by postulating inaccurate or limiting “maps” of their situations. For instance, a “map” such as “every school is unique” is true in the abstract, but not enough to provide guidance for change. Or, a “map” like “keep it simple, stupid: go for small, easy changes rather than big demanding ones” seems to be obvious, but studies have shown that multiple problem change efforts are actually more likely to succeed.
2) Complex Problems: Here, the authors identify that there are many complex problems involved in schools, and as many of them have never been solved before, it is destructive and folly to think that problems of such magnitude can be solved in short order.
3) Symbols Over Substance: Fullan & Miles identify that in many cases, educational institutions will adopt external innovations with only symbolic benefit. While the authors believe that, “symbols are essential for success”, they will often fail if there is not enough grassroots support for change. Symbols, in many cases are provided only to achieve political success, and less so to achieve reform.
4) Impatient and Superficial Solutions: The authors argue that many solutions are introduced with little though, may be the result of faddism and then implemented too quickly. An example of this could be when a school board purchases computers for every classroom. While it may seem that connectedness is an excellent idea, it almost always creates more problems than it solves.
5) Misunderstanding Resistance: The authors suggest that administrators may be misreading what they equate to being resistance. In fact, what may seem like resistance from individuals is more likely their natural responses to the recent transitions. If we misread these responses as resistance, reformers may run the risk of providing inadequate support to those that are having difficulty with change.
6) Attrition of Pockets of Success: Fullan & Miles suggest that there are many examples of innovation success in classrooms, but these examples often become difficult to sustain as receive little support from the institution. In order for such changes to become sustained, they need to be brought to attention and supported through the school culture. “Reform fails unless we can demonstrate that pockets of success add up to new structures, procedures, and school cultures that press for continuous improvement” .
7) Misuse of Knowledge About the Change Process: This statement refers generally to point #1. Many of the initial propositions can be viewed as only half-truths, and unless more is understood about the change process, there can be little progress expected.

The previous points are fairly general and often intended for the institutional level, but can be used as guiding principles in helping to understand some of the key reasons why a particular reform may fail.

Also, within this article, Fullan & Miles[11] developed seven propositions for success. They present these as the “seven basic themes or lessons derived from current knowledge of successful change” and in some ways, are presented as a foil to the previous points discussed (reasons for failure). The propositions for success have been paraphrased below:

1) Change is Learning: Change is a process of finding and adjusting to personal meaning, and therefore is a learning process. As it is a learning process, it needs to be approached with this light.

2) Change is a Journey, Not a Blueprint: Fullan & Miles admit that rational planning models for change cannot address complex human processes. The message here is basically that reformers can plan, but more than likely, they will have to plan again for the unexpected (planning is continuous).

3) Problems Are Our Friends: Problems arise from the change process and these are natural and expected. Reformers must be assertive in identifying, discovering and solving problems (or attempting to solve problems).

4) Change is Resource-Hungry: Reformers must be prepared to the growing costs of the change process. Fullan & Miles warn that to sustain a large- scale change process, often much time is spent on identifying and acquiring additional resources to feed the engine of change.

5) Change Requires Power to Manage It: Here, the authors put forth the idea that change (specifically what they refer to second-order change) in the culture of schools requires a local body to manage it. Fullan & Miles advocate putting school boards and schools in the position of negotiation for the management of change as complex problems often cannot be solved at a distance.

6) Change is Systemic: In understanding systemic change, one must focus on two primary aspects. First, one must look at reform in the development of the many interrelationships within a complex system (curriculum, teachers, students, community, etc.). Second, reform must not focus simply on “structure, policy, and regulations, but on deeper issues of the culture of the system. While Fullan & Miles do not explicitly explain how this is done, they emphasized the importance of this complex undertaking.

7) All Large-Scale Change is Implemented Locally: The authors here conclude saying that the six previous postulates cannot be served by bureaucratic decisions made from a distance. They conclude, “any interest in system-wide reform must be accompanied by a preoccupation with how it plays itself out locally” .

Rogers also offers a very scientific approach to understanding the rate of adoption. Rogers [12] has developed five variables which affect the adoption rate of any particular innovation. These include

1) perceived attributes of innovations (discussed earlier),

2) type of innovation-decision,

3) communication channels,

4) nature of the social system, and;

5) extent of change agents’ promotion efforts.

Rogers’ model could help a researcher to consider the basic forces which affect both adoption rates, and the factors which may lead to the rejection of an innovation. However, in its own simplicity, which may be ironically its strength, it is limited in explaining complex human systems.

III. Problem Solution

A. 3.1 Technological Method Model

The Technological Method Model is presented in Figure 2-1. This model graphically displays the essential model for "doing" technology, as well as for contributing to the body of knowledge about technology. It is, therefore, a theory and practice model.

This model can be used at the personal, organizational, institutional, or global levels; it identifies a means for engaging in individual or collective technological action. Technological practice is most often driven by humans who are confronted with problems and/or opportunities. Utilizing the problem solving method, humans draw upon technological processes and resources to achieve meaningful outcomes. These outcomes result in consequences which may be either desirable or undesirable. As a result, technological practice has to be properly managed and assessed. Feedback is the mechanism whereby technological practice is managed and assessed. The nature of feedback is graphically displayed in the model presented in Figure 2 by arrows which show the interactive relationships of the various elements.

Even though figure 2 shows one microcosm of technological practice, it must be realized that outcomes generally lead to additional/new problems and/or opportunities which in turn may lead to new technological practices. The evolution of technology involves the continual interaction of models such as these, often interconnected one to another.

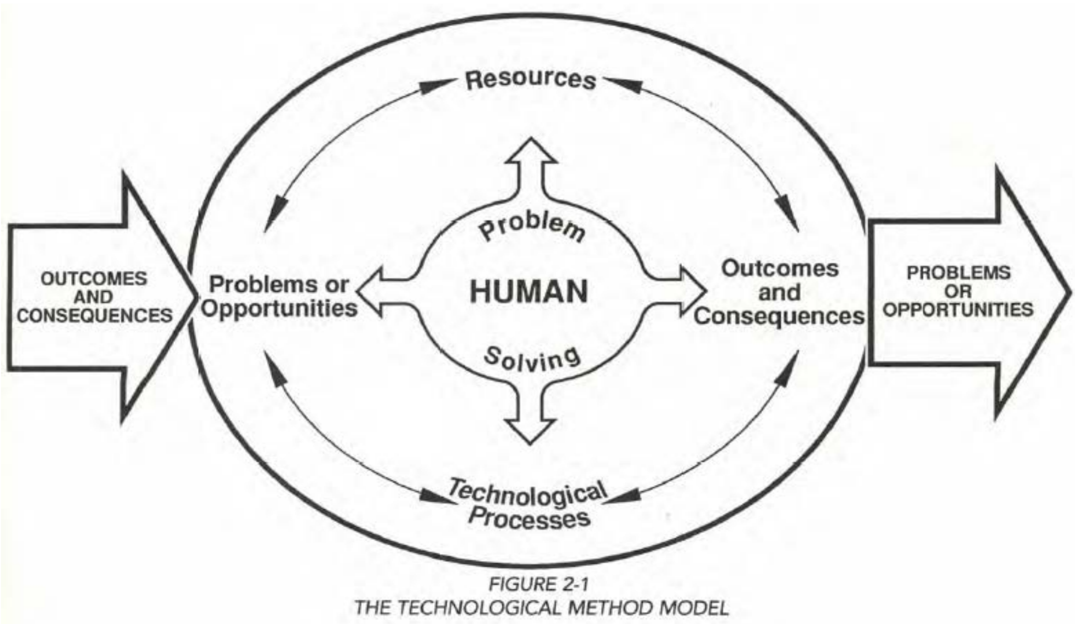

Fig. 2 The Technological Method Model [7]

The basic topical elements of the Technological Method Model are shown below. The following sections describe what each element is and its function in the model.

Table 1 Elements and function in the model

HUMANS
Needs
Wants
CHALLENGES
Problems
Opportunities
PROBLEM SOLVING
Defining the Problem
Developing Alternate Solutions
Selecting a Solution
Implementing and Evaluating the Solution
Redesigning the Solution
Interpreting the Solution
RESOURCES
People
Tools/Machines
Information
Materials
Energy
Capital
Time
TECHNOLOGICAL PROCESSES
Bio-related Technology Processes
Communication Technology Processes
Production Technology Processes
Transportation Technology Processes
ACCOMPLISHMENTS
Consequences
Outcomes

A. Connection between Technology Learning and Innovation

Human beings stand at the pinnacle of all living things. They take this position because of their complexity. This makes humans not better than other life forms, but simply capable of a greater range and complexity of behaviors. It is the human brain that identifies the single most important difference between humans and other organisms. That brain enables people to think, to store huge quantities of information available for retrieval at a moment's notice, and to fashion cognitive strategies that lead to ·survival, and to create conditions for a better life, represented by such things as better health, greater wealth, improved housing, or more nutritious foodstuffs- to mention but a few.

Human beings, and the culture they create, seem to run counter to the principle of entropy-the tendency for things to gravitate toward disorder or randomness. In contrast, humankind creates order, structure, and consistency in all of its endeavors.

Order, structure, and consistency are both good and bad. They are good in the sense that they enable people to live in a predictable world and also to behave consistently. They are bad in that they make change and adaptation to new situations somewhat difficult. It is this very aspect of human traits that makes it necessary for people to be adept at problem solving. The more skilled humans are at problem solving, the better the possibility of adjustment to their world.

Problem solving is a thinking skill and reaches its very highest form in humans. The ability to solve problems is at the root of technology, for as human needs or wants emerge they are satisfied by those cognitive strategies known as problem solving. The process of problem solving provides the parallel in technology to the scientific method in science.

Problem solving has been recognized for a long time as having significance in human learning and adaptation. Aristotle was one of the first to comment on the importance of solving problems.

It was George Polya [13, 14], a mathematician, who, in the 1950's, first devised a schema for solving problems. His was a four step process involving understanding the problem, devising a plan for solving the problem, carrying out the plan, and looking back.

Since Polya's work focused on matl1ematics, it does not address the fabrication and testing of apparatus (technical means) which is the element tl1at separates technology from other human activities. Therefore, a more complete model for technological problem solving might include the following six steps which have been generalized from the work of several scholars [15]:

l.Defining the problem: Analyzing, gathering information, and establishing limitations that will isolate and identify the need or opportunity.

2.Developing alternate solutions: Using principles, ideation, and brainstorming to develop alternate ways to meet the opportunity or solve the problem.

3.Selecting a solution: Selecting the most plausible solution by identifying, modifying, and/or combining ideas from the group of possible solutions.

4.Implementing and evaluating the solution: Modeling, operating, and assessing the effectiveness of the selected solution.

5.Redesigning the solution: Incorporating improvements into the design of the solution that address needs identified during the evaluation phase.

6.Interpreting the solution: Synthesizing and commlll1icating the characteristics and operating parameters of the solution.

For solving problems, change must be carried. It is the major connection between innovation and applying technology.

B. Findings

Problems/Opportunities

Human wants and needs lead to the identification of technological problems and opportunities. Problems are questions or matters involving doubt, uncertainty, or difficulty. They deal witl1 choices of action which might ameliorate unsatisfied Hunan needs and wants. Opportunities, on the other hand, are future oriented. That is, they can be planned and, in fact, created.

Problems facing humans involve personal, social, and environmental issues. Solutions to these problems may utilize technological, social, and educational means.

Resources

Resources are needed to accomplish technological ends. They are people, tools/machines, information, materials, energy, capital, and time. The use of these resources must be optimized to ensure efficiency and renewability where appropriate. Constraints must be considered, taking into account physical limitations and regulation.

The problems, needs, and opportunities perceived by people stimulate the development of technology. People design and create technology by combining previous knowledge with new ideas. People make policy decisions that promote or constrain technological research, development, and growth. People also provide the labor upon which some industries depend. Finally, people are consumers and users of the products and services of technology. People, using tools and machines, direct and control the processing of materials, energy, and information as the basic resources of teleology.

Tools, including hand tools and machines, provide the means for humans to process and change the basic resources of materials, energy, and information. As we seek to employ tools in the technological process, we must consider constraints such as availability, access, or whether suitable tools have yet been invented to undertake the desired processes.

Technology has developed rapidly because of the information explosion. The first of these explosions, represented by the production of books using the printing press, laid the foundation for the technological upheaval that started in the Middle Ages and culminated in the Industrial Revolution. Information in this form was largely symbolic and static. During the past few decades there has been a new information explosion resulting in a doubling of technological information every five years. Information has taken on more dynamic forms, such as signals that can be transmitted electronically for purposes of communication or control. The ever-increasing information base must be effectively managed.

Materials represent the physical entities from which technological devices, structures, and systems are made. Materials come in natural and synthetic forms. Synthetic or manufactured materials far outnumber the relatively few raw materials that serve as natural resources for the finished products and artifacts of technology. Raw materials can be classified as renewable or nonrenewable.

Synthetic materials can be developed (engineered) to fit specific requirements and provide improved properties and characteristics. As we are constrained by our limited resources, we must ensure that the development of new synthetic products is controlled.

Energy creates the power to drive tools and machines, to process materials into manufactured products and to create structures. Power can be generated from selected nonrenewable energy sources such as coal, oil, and gas. Energy can also be converted back and forth into different forms, such as chemical, thermal, light, and sound. It can also be converted into useful electrical, fluid, and mechanical power in response to the demands of an identified problem. Energy forms found naturally, such as solar, gravitational, and geothermal provide the capability for renewable energy. Proper management of energy resources is essential to world market competition success.

Any form of wealth (e.g., shares of stocks, cash, land, buildings, equipment) is a capital resource. Modern technological enterprise rests upon the use of large amounts of capital, such as sophisticated machinery and equipment, large scale production and storage facilities, and stores and stocks of finished and unfinished material.

In prehistoric eras, time was measured in periods based upon the rising and setting of the sun. In the agricultural era, time was measured in days and seasons. In the industrial era, time was measured in terms of hours, minutes, and seconds. In the information era, time is measured in terms of smaller and smaller fractions of a second. Time represents an essential resource when all the other resources are brought together to support a process. Processes, as sequences of actions and change that yield results, require time.

Major Areas of Technological Process

Throughout history, people have employed technological systems as the means to adapt the environment to human needs and wants. Our technological world can be viewed from many perspectives.

Swyt [16], identifies the content of technology as physical, including motion, power and work; material, representing matter in non-life forms; information, such as data, information, and knowledge; and bio, relating to biologically-active agents. The Chicago Museum of Science and Industry classifies technology as the Physical World, the Information World, and the Living World. This document addresses technology through the content reservoirs of Bio-related Technology, Communication Technology, Production Technology, and Transportation Technology.

Each of these major systems is basic to every society. Bio-related technologies provide the means to preserve and process food, propagate plants and animals, diagnose and treat medical disorders, and most recently, to synthesize vaccines and to engineer genetically life forms. Communication technologies enable us to process data and information into forms that are meaningful to humans. Production technologies, which include Manufacturing and Construction, assist people to create products or structures in a factory, workshop, or on site. Transportation technologies provide the means to move people and goods from one location to another through the air, across water, over land, and in space.

When humans are engaged in technological practice, they utilize technological processes in an ordered way to produce technological outcomes. Each major area of technology (Bio-related, Communication, Production, Transportation) has within it unique processes which are used to convert forms of matter, energy, and information into other forms.

Bio-related Technology applies biological organisms to make or modify products. The system includes the production process techniques relating to the products of agriculture, medical technology, and the biological processes tied to fuel and material production. Proper management of tl1ese techniques can result in a higher quality of life for all members of our global society.

Table 2 Process of the Bio-related & Communication Technology

Technology	Process
Bio-related Technology	• Propagating, • Growing • Maintaining • Harvesting • Adapting • Treating. • Converting
Communication Technology	• Encoding • Transmitting • Receiving • Storing • Retrieving • Decoding

Table 3 Process of the Production & Transportation Technology

Technology	Process
Production Technology	• Primary Processing • Constructing (e.g., homes, buildings, bridges, railways, roads, tunnels, canals, and dams). • Manufacturing • Maintaining
Transportation Technology	• Receiving • Holding/Storing • Loading. • Moving • Unloading • Delivering

Mismanagement or misunderstanding can result in serious damage to ourselves and our environment. Following are the process techniques of bio-related technology:

- Propagating-To develop a living entity. The implications in the health and agriculture fields are obvious with respect to humans and animals. Fermentation and protein applications in foods, beverages, and materials also apply.
- Growing-To develop living tl1ings or increase them in size, by synthesis, intake, or manufacture. Humans, plants, and animals are all "growth monitored." Crystal manufacture for the electronic industry also applies.
- Maintaining-To support normal conditions for healthy existence. The need for sufficient nutrition and an appropriate environment are essential for the success of this process.
- Harvesting-To gather and store entities. In the clinical sense, this technique relates to "giving birth" in human and animal entities, as well as accumulating products of agricultural and bio-process manufacture.
- Adapting-To adjust to a change in the environment. This is the essence of technology; to adapt to our natural environment. Through processes of protection, enhancement, management, and development, people in health care and services, agriculture, food and material production, waste management, and regulation have enabled and, at times, directed our adaptation to our environment.
- Treating-To apply a specific procedure to cure or correct a disease or patl1ological condition. When the hun1an, plant, or animal output is improper, the necessary corrective measures must be taken. This is also true for materials in cases such as oil spills.
- Converting-To change into something of different form or property. Experiments across species, such as combining potatoes with algae to produce a more nutritious product, are common today.

Communication Technology focuses on the processes and techniques of encoding, transmitting, receiving, storing, retrieving, and decoding graphic and electronic messages. Our global society is interconnected with communication networks that are superior to any communication system in the past. Systems of the past and present, as well as models of futuristic communication systems, should be studied to allow students to develop an understanding of how they work, why we depend on them, and how they can be improved.

The following are the process techniques of communication technology:

- Encoding-To recode or modify information into a desired format or pattern for a specific metl1od of transmission or storage.
- Transmitting- To convey information from one location to another.
- Receiving-To recognize and accept information tl1at has been transmitted.
- Storing- To record and file information for use at a later time.
- Retrieving-To recall information from a stored condition.
- Decoding-To convert recoded or modified information into an acceptable format for use.

Production Technology uses technological means to construct resources into goods, standard stocks, and structures. It includes content used to perform processing, constructing, and manufacturing operations. Production technologies are used to prepare or modify material resources by mechanical or chemical means so they become direct consumer products or serve as standard stocks for further production, communication, or bio-related operations. The outputs of production technologies include food, chemicals, power, and standard stocks, among others.

The following are the process techniques for production technology:

- Primary Processing- To transform natural or raw materials into products, including mining, extracting, refining, lumbering, and farming.
- Constructing- To produce goods to fill society's living, working, and transportation needs (e.g., homes, buildings, bridges, railways, roads, tunnels, canals, and dams).
- Manufacturing-To convert materials into useful products.
- Maintaining-To create services of economic value, including maintenance, repair, and education, through the use of human resources.

Transportation Technology is used to move people and products within a society. Transportation technology addresses four domains: terrestrial, marine, atmosphere, and space. Transportation options in a society can create opportunities for technological and cultural growth by enhancing mobility and providing product accessibility.

Following are the process techniques for transportation technology:

- Receiving-To acquire people, materials, and goods at a terminal, station, or random or fixed points.
- Holding/Storing-To reserve a facility for personalized and mass transit, or for materials/ goods warehousing.
- Loading-To put or place people and/ or products in or on a transportation device or vehicle.
- Moving-To change the position of goods and/ or people from one point to another, using some transportation device or vehicle.
- Unloading-To remove passengers and/ or products from a transportation device or vehicle.
- Delivering-To take people and/ or products to their intended destinations.

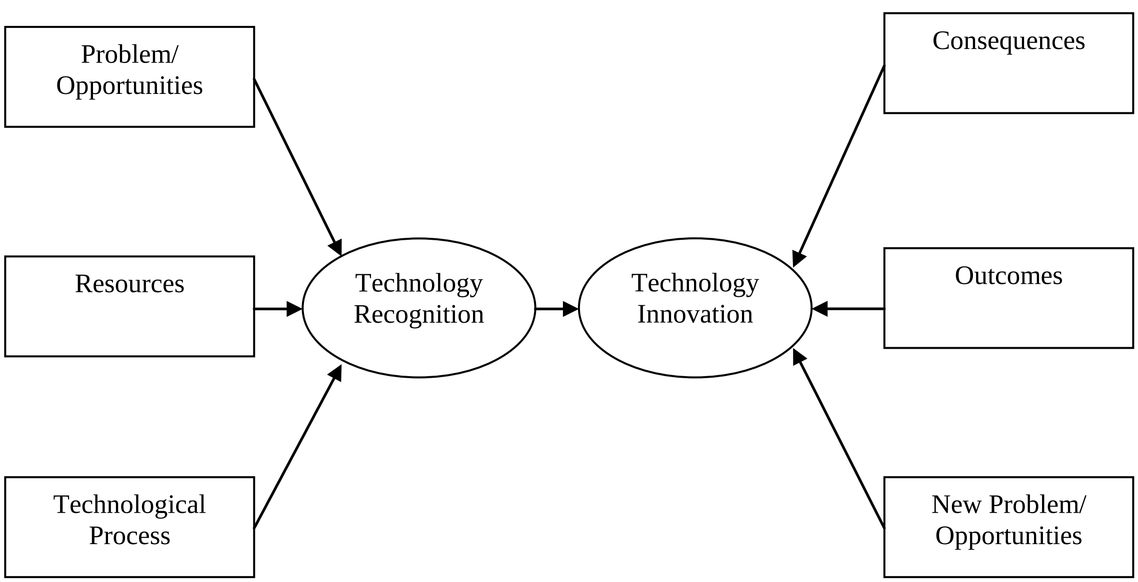

Fig. 3 Measurement Model of Innovation by Technology Education

I. Conclusion

Based upon technological method model, the connection structure was presented and illustrated in previous session. For the operating purpose, a measurement model was conducted as Fig. 3.

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