A Systems Definition of Educational Technology in Society

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ABSTRACT

Conceptual development in the field of Educational Technology provides crucial theoretical grounding for ongoing research and practice. This essay draws from theoretical developments both within and external to the field of Educational Technology to articulate a systems definition of Educational Technology in Society. A systems definition of Educational Technology in Society is characterized as a goal oriented problem-solving approach utilizing tools, techniques, theories, and methods from multiple knowledge domains to: (1) design, develop, and evaluate, human and mechanical resources efficiently and effectively in order to facilitate and leverage all aspects of learning, and (2) guide change agency and transformation of educational systems and practices in order to contribute to influencing change in society. This paper offers valuable theoretical grounding to help guide researchers and leaders in the field.

Keywords

Definitions, Educational Technology, Systems theory, Society

Introduction

> I firmly believe that the future of Educational Technology is now in the hands of the thinkers. What is needed is a handful of experienced people who have thought widely and deeply, and who are literally obsessed by the problems posed. These people must have the ability to analyze and synthesize, and, in effect, to invent whole new conceptual frameworks. If they do not have this latter ability, they will soon be reduced merely to improving what is (AECT, 1977).

This statement appearing in the preface to the *1977 AECT Definition of Educational Technology* publication presents a glimpse of the conceptual work that must be invested for preserving and advancing the field. The statement also sets the tone for the type of inquiry pursued in the present article.

The aim of this theoretical article is to render visible a systems definition of Educational Technology in Society for guiding activities connected to current and future developments in Educational Technology. This is accomplished by (1) discussing influences outside the field of Educational Technology that impacted its conceptual development, (2) discussing influences within the field of Educational Technology that impacted its conceptual development, and (3) articulating a systems definition of Educational Technology in Society.

View From Outside

Theoretical Grounding in the Social Sciences

The field of Educational Technology shares many of the same struggles in defining itself and substantiating its foundations, as do other social sciences and applied social sciences. Part of the problem is that certain fundamental concepts required for theoretically grounding any acceptable definition of Educational Technology are clouded by discourses taking place outside the field. One problem can be broadly described as a problem of comparing apples and oranges arising from a preoccupation of the social sciences with emulating methods of the natural sciences. Winch (1990) provides a thorough account of how conceptions of social sciences involve a set of concepts logically incompatible with explanations offered in natural sciences. He examines how social and natural sciences differ in terms of what is being accounted for. In natural sciences, the experimental results are the focus, whereas social sciences include the social context of study as well. Winch (1990) states, “So to understand the activities of an individual scientific investigator we must take into account two sets of relations:

first, his relation to the phenomenon which he investigates; second, his relation to his fellow-scientists." Similar analyses that concentrate on research methods are found in Gould's (1981) *The Mismeasure of Man* and in Meehl's (1967) *Theory testing in psychology and physics: A methodological paradox.* For instance, Gould attributes to social scientists a tendency towards "physics envy" in their effort to reduce everything to basic and quantifiable causes that generate the complexity of the non-physical world. This is a problem because social sciences and natural sciences deal with very different subject matter and social reality cannot be understood solely through observation and explanations of a scientific mode of discourse.

One of main outcomes of this and other discussions within the philosophy of science is an increased attention to the importance of theoretical grounding within the social sciences. Winch (1990) argues, "Any worthwhile study of society must be philosophical in character and any worthwhile philosophy must be concerned with the nature of human society." Winch's text clarifies differences between natural and social sciences providing a framework for defining social science research based on theoretical foundations integral to the study of the human condition.

The Concept of Technology

It is necessary in defining Educational Technology or Educational Technology in Society to distinguish how engineers' and social scientists' varying use of the term "technology" creates confusion. Important distinctions are made in how the term "technology" is employed in the fields of engineering (*Latin root ingeniare meaning to create*) and the social and applied social sciences. Engineers, technologists and technicians are closely related in their view of technology as the process of material construction based on systematic engineering knowledge of how to design artifacts. This conception associates technology very closely with machines or physical systems of some sort.

Social science scholars typically view technology in broader terms, extending what is understood of material construction to take social significance into consideration. First, social science scholars' employment of the term "technology" refers to material construction uses as well as the intellectual and social contexts. It refers to the organization of knowledge for the achievement of practical purposes as well as any tool or technique of doing or making, by which capability is extended. For instance, Solomon (2000) defines technology as the systematic application of all sources of organized knowledge (i.e., literature, science, the arts), suggesting that art, craft, and science all have roles to play in technology application. Second, social science scholars view technology as interrelated with social values. For instance, Braham (1977) highlights the importance of environment in defining technology as the organization of activities designed to assist human adaptation to, participation in and utilization of the environment. McGinn's definition of technology highlights technology as a value-laden human activity connected to socio-cultural and environmental influences in its conceptualization. Moreover, McGinn (1978) points out five ways in which technology is value-laden. These can be summarized as:

(1) The value of a technique reflects the values of who make it and use it.
(2) Technology is optimistic in assigning value to "technological progress."
(3) Technology is value laded insofar as use of resources for advance may preclude their use in other work that may improve life.
(4) The institutionalization of modern technology allows the direction of technology to be influenced externally by companies rather than by practitioners
(5) Products of technology are expressions of individual and cultural values of designers.

Technology of Educational Technology

McGinn's breakdown of technology into form and activity captures an important component of technology that is often overlooked due to an overemphasis on technological hardware without examining the big picture. That is, there are common fundamental aspects of technologies that are themselves value-laden and wrapped up in socio-cultural influences. This characterization of technology is fundamental for the field of Educational Technology. McGinn asserts that there is much to do in the way of elaboration and analysis of technological activity in socio-cultural structure, what he refers to as the, 'design of socio-technical systems'. This is closely aligned with what many educational technologists consider to be the proper work of Educational Technology carried out in the real world.

What is suggested from viewing Educational Technology from the "outside" is that it is influenced by sources outside the field. This requires strict attention to how the field is delimited and how the notion of "technology" is

understood. In comparing the above mentioned descriptions of technology, key themes related to Educational Technology include the following: (a) an emphasis on mental processes and products (b) an emphasis on processes and knowledge which are adaptive (Braham, 1977), systematic (Solomon, 2000), material making, or transforming (McGinn, 1978) to serve human purposes, and (c) an emphasis on the environmental, social, or intellectual influences (Braham, 1977; McGinn, 1978).

View From Inside

In looking back over the past four decades, field of Educational Technology has struggled in defining itself. This is partly due to its status as an applied social science and the difficulty in establishing the field's credibility. Finn (1972) argues that the field needs to gain the credibility with professional educators for it survive and grow and that establishing an intellectual territory for would accomplish this. The task of defining a field is challenging and Ely (1970) even suggests that the first steps in defining Educational Technology is not to arrive at a final definition but to promote further discussion among the personnel of the field.

In the time since Finn and Ely issued invitations to analyze the field, many scholars of Educational Technology are participating in the discussion by contributing to the definition building effort (AECT, 1972, 1977; Januszewski, 2001). Januszewski's (2001) review of the supporting documentation behind the early definitions of Educational Technology suggests that there are four underlying considerations for the AECT's creation of a formal definition:

(1) To legitimize the field of Educational Technology; to carve out a niche or establish a territory to make the field distinct from closely related areas such as Library Studies and Curriculum
(2) To allow individual professionals to consider themselves "in the field"; this also meant that the field could be defined by what members of the professional organization did.
(3) To provide specific language for laws and legal documents; these definitions often helped determine the allocation of the funding for educational programs at federal, state, and local levels.
(4) To establish guides for curriculum development that would aid in preparing future professionals for the field. (Januszweski, 2001)

Educational Technology

Ongoing efforts to define Educational Technology originate with the definition committee created by the Association of Educational Communications and Technology (originally the Department of Audio-Visual Instruction). One popular conception of Educational Technology is linked to the maturation of the audio-visual movement in education and instructional training programs beginning in the First World War with developments arising out of master learning and programmed instruction trends in the fifty's spearheaded by individuals like B.F. Skinner, and James Finn (Morgan 1978; Reiser, 1987). Early definitions of Educational Technology are definitions of audiovisual communication. Ely (1963) states, "Audiovisual communication is that branch of educational theory and practice primarily concerned with the design and use of messages, which control the learning process." Common to these conceptions is the view of Educational Technology as synonymous with audiovisual communication and instruction.

The emphasis on instruction is more accentuated in more recent definitions offered by AECT, which employs the term "instructional technology" instead of "educational technology. "Instructional technology is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning (AECT 1994).

Educational Technology scholars and practitioners contributing to the field over the past four decades realize that formally defining Educational Technology is challenging for a number of reasons. First, defining an applied field like Educational Technology is more difficult than defining any of the social science disciplines. The reason is that there is no single knowledge base to ground Educational Technology as is the case in the social sciences. In an applied field, by its very nature, multiple knowledge bases are employed. The development of new knowledge causes shifts in thinking and introduces change and in the field of Educational technology multiple knowledge bases lead to multiplying change. This compounds the challenge of creating a viable definition. Second, defining Educational Technology as a process also creates dissonance between the popular notion of technology as state-of-the-art equipment and the older idea of technology as a process. This dissonance surrounding technology gives rise to definitions that are not easily understood within the field or widely embraced outside of the field of Educational Technology.

What is revealed from exploring ET from the "inside" is that Educational Technology is an applied and decision-oriented field developing from multiple sources identified by accrued literatures produced in the field. This complicates efforts to define Educational Technology and demands a broad and multi-faceted approach to defining Educational Technology capable of clearly delineating underlying governing principles, multiple roles, and multiple knowledge bases associated with the field.

A Systems View

A number of pivotal developments within the field help ground conceptualizations of Educational Technology. Hard systems thinking dominating the systems science in the 1960s and 1970s treats systems as deterministic entities. This is eventually replaced in the late 1980s and 1990s by soft systems thinking and postmodernist ideals where design problems are treated as ill defined and systems are subject too change (Checkland & Scholes, 1995). This movement forces experts to question system boundary conditions, changing conditions, and whether or not it is possible to ever arrive at lasting truths in the world. It also allows scholars to extend their understanding of systems as the sum total of parts interrelated within one another and the whole structure to systems as human networks and social organizations (Banathy, 1996). At the same time this allows Educational Technology scholars working within a systems approach to reconceptualize the purpose of Educational Technology and question its boundaries, particularly in the area of social systems and values. Is Educational Technology concerned with advancing efficiency and effectiveness or is there more? Is Educational Technology a value-neutral and based solely on factual knowledge or is it value-laden with socio-cultural meaning? Is one theory of Educational Technology as good as the next? Should educational technologists be concerned with social change if the community is unjust? To whom are educational technologists responsible?

A systems view Educational Technology describes learning development and management processes used for designing and evaluating instruction (Banathy, 1996; Mitchell, 1972; Pals & Plum ,1989) . Pals and Plomp (1989) define Educational Technology in terms of three interacting dimensions: ET1, ET2 and ET3. ET1, centering on physical media developed to assist in the teaching/learning process. ET2 includes processes, used for developing, designing and evaluating instruction. ET3 is attributed a philosophical and holistic orientation whereby problems are analyzed and solved in their own context through a consideration of as many facets and their interrelationship as possible. The holist commitment to the whole as being greater than the sum of the parts entails that individuals are part of the system in which they observe and, therefore, cannot achieve complete knowledge of the whole. From the AECT Definition Committee (1972), "Educational Technology is a field involved in the facilitation of human learning through the systematic identification, development, organization, and utilization of learning resources and through the management of these processes" (AECT 1972). Similarly, Mitchell (1972) describes Educational Technology as, " an area of study and practice (within education) concerned with all aspects of the organization or educational systems and procedures whereby resources are allocated to specified and potentially replicable educational outcomes." The importance of systems theory and efforts to extend the range of Educational Technology beyond instructional aims is apparent in AECT's 1977 conception:

> Educational technology is a complex and integrated process, involving people, procedures, ideas, devices, and organization for analyzing problems and devising, implementing, evaluating, and managing solutions to those problems, involved in all aspects of human learning (AECT 1977)

Other conceptions of Educational Technology are concerned with the possibility of leveraging changes in society by transforming educational systems and practices (Duchastel, 1989). This view of Educational Technology involves ideas of change agency and the possibility of contributing to organizational transformations within society. Educational technologists are considered change agents and the focus of Educational Technology includes the possibility of effecting major changes in society by transforming educational systems and practices. This view of Educational Technology highlights the importance of systems theory, people, and the notion of change agency within public and private institutions. In a similar vein, Davies and Schwen (1971) ascribe to Educational Technology a "conceptual framework able to deal with problems stemming from the needs of an education or training system to survive, grow and develop the capacity to adapt and manage change ." Adding to this, Davies (1978) attributes the elements of criticism, evaluation, and a problem-solving to the Educational Technology approach. Mitchell (1975) introduces the educational technologist (or discernible educational technologist) who acts as a learning consultant, an educational materials producer, a manager of learning resources or a systems developer and planner. Other conceptions of Educational Technology based in semiotics, critical theory, and modern and post structural theory (Belland, 1991; Nichols & Allen-Brown, 1996; Yeaman, Hlynka, Anderson, Damarin, & Muffoletto, 1996) emphasizing interrelations of the educational technologist and contextual influences in what is being studied (or interpreted). Descriptions of Educational Technology that

acknowledge the role of the educational technologist and contextual influences in Educational Technology are consistent appear to address criteria for conceptualizing technology concerned with mental processes and products to serve human purposes embedded in socio-environmental contexts (Braham, 1977; McGinn, 1978). Drawing together key components identified by the reviewed selection of Educational Technology definitions to articulate a systems definition of Educational Technology in Society reveals the following. See Figure 1

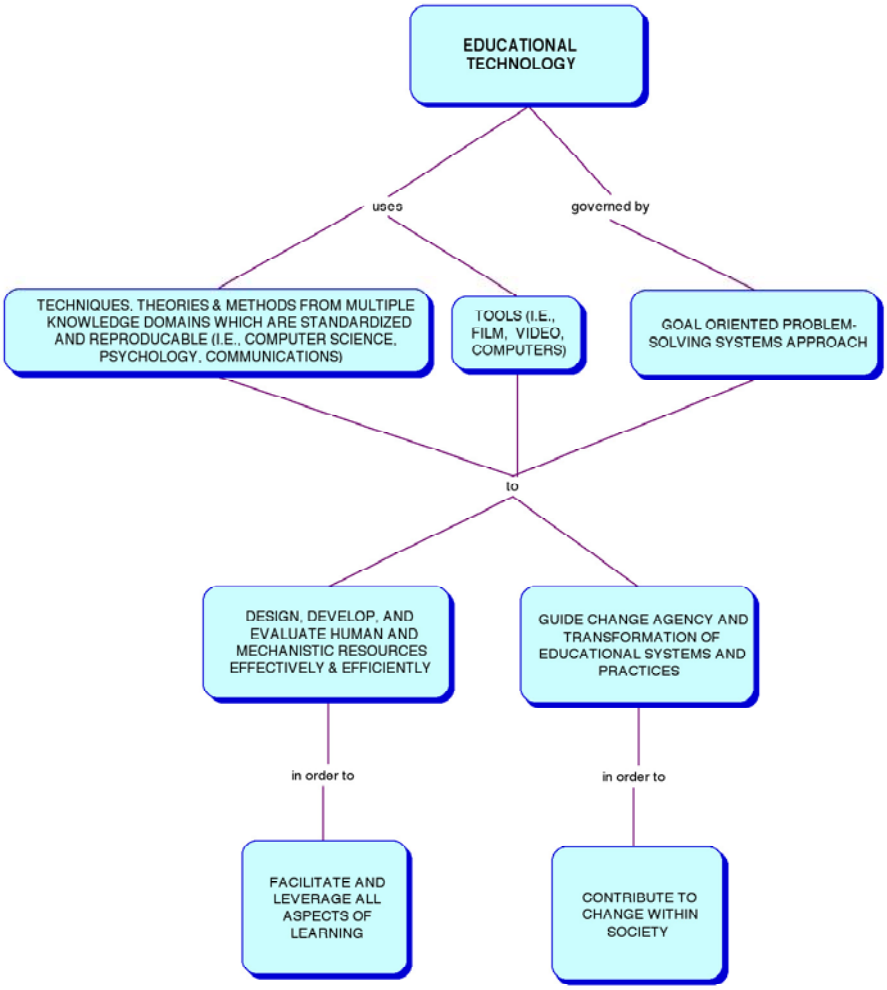

Figure 1. A Systems Definition of Educational Technology in Society

Conclusion

A systems definition of Educational Technology in Society addresses theoretical grounding concerns (view from outside) and accommodates multiple uses and governing principles expressed in the field (view from inside). Drawing together key themes identified in the discussion(view from outside), criteria for conceptualizing technology in the field of Educational Technology revolves around concerns with mental processes and products to serve human purposes embedded in socio-environmental contexts. These criteria are key components to a definition of Educational Technology for society. Connecting definitions and analyses provided in this article suggests a systems definition of Educational Technology as goal oriented problem-solving systems approach utilizing tools, techniques, theories, and methods from multiple knowledge domains, to: (1) design, develop, and evaluate, human and mechanical resources efficiently and effectively in order to facilitate and leverage all aspects of learning, and (2) guide change agency and transformation of educational systems and practices in order to contribute to influencing change in society.

In looking to the future of Educational Technology, much of the key theoretical work required to ground the field depends on the excavation of historical/theoretical texts applied to new areas of development. The reason

for this is, and what this article attempted to demonstrate, is that defining something as complex as a field, even a relatively young field, requires an understanding of where the field has been in order to gauge its current state and make intelligent predictions concerning its future. The excavation of historical/theoretical texts, both from outside and inside the field, applied to new areas of development is one area where a systems definition of Educational Technology contributes significantly.

Terms

Educational Technology: is the field concerned with the design, development, utilization, management, and evaluation of processes and resources for learning.

Educational Technology in Society: is a goal oriented problem-solving systems approach utilizing tools, techniques, theories, and methods from multiple knowledge domains, to: (1) design, develop, and evaluate, human and mechanical resources efficiently and effectively in order to facilitate and leverage all aspects of learning, and (2) guide change agency and transformation of educational systems and practices in order to contribute to influencing change in society.

System: the sum total of parts interrelated within one another and the whole structure or organization

Systems Approach: a logical process or complex strategy to identify needs, analyze problems and possible solutions, or design procedures to improve systems operations and eliminate needs.

Technology (process): construction uses and the organization of knowledge for the achievement of practical purposes in intellectual and social contexts.

Technology (tool): material construction and operation of physical systems based on systematic knowledge of how to design artifacts.

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