Application of a Systems Approach to Distance Education

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Introduction

The general idea of distance education is fairly simple: students and teachers are in different places for all (or most) of the time that they learn and teach. As a result, in a distance education program, the parties must depend on some kind of technology in order to interact with each other.

Being a student who is learning at a distance is also different—requiring different study skills, as well as communication skills that are more suited to the locations of the parties. Students learning at a distance frequently need different kinds of support and have problems that frequently differ from those of their on-ground peers. In addition, schools have to find new ways to manage and administer programs provided at a distance (often resulting in the creation of new policies and departments), and offer additional faculty and staff training (Moore & Kearsley, 2005, p. 1). When one begins to think about all of the implications of the separation of learners from their instructors, an idea that at first seems very simple becomes, in fact, quite complicated.

Understanding the complex nature of a distance education system can best be accomplished through the adoption of a systems-oriented approach— a perspective which provides tools for understanding relationships between things and does not look for a single answer to a problem within the confines of a single discipline (Moore & Anderson, 2003, p. 11). While understanding the whole involves understanding the parts, it also requires an examination of the inter-relations *between* the parts. In fact, a critical aspect of the systems approach is that all components of a system are inter-related and inter-dependent.

Ackoff (1981) suggests that any set of inter-dependent problems constitutes a system of problems—which he refers to as a "mess". Like any system, the mess has properties that none of its parts has which means that if one component of the system is changed, that change will likely affect other components as well. As a result, if one attempts to design or implement a distance education program without taking into account these inter-dependencies, the program will likely fail or be ineffective (Banathy, 1993/1996; Reigeluth & Garfinkle, 1994).

With the adoption of a systems view of distance education, this paper which seeks to: (1) identify the systems and sub-systems involved in a distance learning program, (2) compare and contrast a traditional learning program with a distance learning system based on the author's personal experience; and (3) establish the relevance of a systems view to creating a more comprehensive understanding the complexity of the inter-relationship of these components.

Defining Distance Education

Distance education has been characterized and defined in a variety of different ways; as a result, it is important to be clear about what is included in the scope of the issue. For purposes of this paper, the following definitions are adopted:

> *"Distance education is the planned learning that normally occurs in a different place from teaching, requires special course design and instructional techniques, communication through various technologies, and special organizational and administrative arrangements."* (Moore & Kearsley, 2005, p. 2).

Peters (1967) defines distance education as follows:

> *"Distance study is a rationalized method—involving the division of labor—of providing knowledge which, as a result of applying the principles of industrial organization as well as the extensive use of technology, thus facilitating the reproduction of objective teaching activity in any numbers, allows a large number of students to participate in university study simultaneously, regardless of their place of residence and occupation"* (p. 125).

Moore & Anderson (2003) have also recently described distance education as a complex, hierarchical, nonlinear, dynamic, self-organized, and purposeful system of learning and teaching (p. 12).

A Systems View of Education

Banathy (1996) argues that the application of a systems view in an educational context creates one of the strongest uses for this approach. A systems view enables us to explore and characterize the system of our interest, its environment, and its components and parts. It empowers us to think of ourselves, the environments around us and the groups and organizations in which we live in a new way: the systems way (p. 47). This new way of thinking and experiencing enables us to explore, understand and describe the following (Banathy, 1996, p. 47):

- Characteristics of the "embeddedness" of educational systems operating at several inter-connected levels (e.g. institutional, administrative, instructional, learning experience levels);
- Relationships, interactions, and mutual inter-dependence of systems operating at those levels within educational systems;
- Relationships, interactions, and information/matter/energy exchanges between educational systems and their environments;
- Purposes, goals and the boundaries of educational systems as those emerge from an examination of the relationships and mutual inter-dependence of education and society;
- Nature of education as a purposeful and purpose-seeking complex of open systems, operating at various inter-dependent and integrated system levels;
- Dynamics of interactions, relationships and patterns of connectedness among the components of systems;
- Properties of wholeness and the characteristics that emerge at various systems levels as a result of systemic interaction and synthesis; and
- Systems processes (i.e. the behavior of education as a living system, and changes that are manifested of systems and their environments over time).

Banathy (1996) suggests that the systems view generates insights into ways of knowing, thinking, and reasoning that enable us to apply systems inquiry in educational systems (p. 47). He also strongly suggests that systemic educational change will become possible only if the educational community elects to develop a systems view of education and apply that view in its approach to creating changes to the system (Banathy, 1996, p. 47).

Banathy's three models that portray education as a system are of significant import in the understanding of distance education from a systems perspective (1996, p. 48). It is through these models—acting as "lenses" that help view the system—that we can look at educational systems and understand, describe, and analyze them as open, dynamic and complex social systems. These models (Banathy, 1996, p. 48) are briefly described as follows:

Systems-Environment Model

This model describes an educational system in the context of its community and the larger society. The concepts and principles that are included in this model help to define systems-environment relationships, interactions, and mutual inter-dependencies.

Functions-Structure Model

This model focuses attention on what the educational system is at a given moment in time. It projects a "still picture" image of the system, enabling one to describe the goals of the system, the functions that have to be carried out to attain the goals, to identify the components of the system that can carry out the functions, and also provide for the arrangement of the components that constitute the structure of the system.

Process-Behavioral Model

This model concentrates its inquiry on what the educational system *does* through time. As opposed to the functions-structure model of a "still picture", this model generates a "motion picture" image of the system, helping one to understand how the system behaves as a changing and living social system, how it processes and transforms input, guides the transformational operations and makes adjustments in the system if required.

While no model can completely capture a comprehensive image of education as an open and human system, Banathy's three models, when viewed jointly, can greatly assist in that effort (Walton, 2004).

A Review of the Systems References in Educational Literature

Application of Systems Thought to Distance Education

Distance education is a human activity system—it gives to individuals the authority to act for the collective, as well as on behalf of the system. In his last book titled Human Activity Systems Are Different (1983), systems philosopher Geoffrey Vickers discusses the characteristics of human systems as open systems. A summary of their open nature follows:

- Open systems are nests of relations that are sustained through time by their relations and by the process of regulation;
- Open systems depend on and contribute to their environment; and
- Open systems are wholes, but are also parts of larger systems, and their constituents may also be constituents of other systems.

In addition to their nature as both human and open systems, distance education programs manifests a number of other systems-related characteristics, which include the following:

Complexity: Human organizations, including those involved in distance education, are complex. In the words of Briggs & Peat (1989): "Every complex system is a changing part of a greater whole, a nesting of larger and larger wholes leading eventually to the most complex dynamical system of them all, the system

that ultimately encompasses whatever we mean by order and chaos—the universe itself" (p. 148).

Hierarchical: Living complex systems are hierarchical. Ahl and Allen (1996) stated: "We defined a complex system as one in which fine details are linked to large outcomes" (pp. 29 – 30). James (1907) conceptualized the idea of hierarchy as "innumerable little hangings-together of the world's parts within the larger hangings-together, little worlds" (p. 61), and Briggs & Peat (1989) referred to "a nesting of larger and larger wholes" (p. 148).

Dynamic: Live, complex systems are dynamic; they change in time and evolve. In contrast, static systems remain unchanged (Roberts, Andersen, Deal, Garet & Shaffer, 1983).

Nonlinearity: Living organisms manifest nonlinear behavior, which is "qualitatively different from that of the sum of individual parts" (Thelen & Smith, 1994, p. 45).

Self-organizing: Complex, dynamic and nonlinear systems manifest adaptive behavior, "an emergent property which spontaneously arises through the interaction of components" (Thelen & Smith, 1994, p. 45).

Chaotic and ordered: "The basic idea is that nothing novel can emerge from systems with high degree of order and stability, such as crystals. On the other hand, completely chaotic systems, such as turbulent fluids or heated gases, are TOO formless. Truly complex things—amoebae, bond traders, and the like—appear at the border between rigid order and randomness" (Horgan, 1995).

Review of the Literature on the Use of Systems Concepts in Education

With these concepts and applications in mind, the following is a review of literature on the use of systems concepts, specifically as developed in an educational context:

Strauss (2002) analyzes a system theory from the standpoint of several philosophic questions: (1) the one versus the many; (2) the whole-parts relationship; (3) constancy versus change; and (4) vital force. His position is that any particular system may have aspects of more than one system type, which is why complex systems defy atomization.

Sterman (1994) states that "the challenge facing all is how to move from generalizations about accelerated learning and systems thinking to tools and processes that help us understand complexity, design better operating policies and guide organization and society-wide learning" (p. 292).

Frick (1995) applies systems theory to education and describes a plan to develop educational theory in a simulation environment. He proposes to build software simulations of the complex interrelations within an educational system and to use these

simulations to help educators and administrators to introduce innovations into their systems.

The book chapter by Banathy & Jenlink (2004) discusses how systems approaches have been used in education. The authors refer to "the application of the intellectual technology of comprehensive systems design as an approach to the transformation of education" (p. 47) and describes how system models should be used in educational research, policy-making and in the visioning and design of new systems for the future.

Banathy is widely credited for his voluminous work focused, in large part, on the application of a systems approach in the visioning and design of new educational systems (2004/1996/1995/1994/1992a/1992b/1991) and this author extends her deep appreciation for the impact of Banathy's work on her developing view of systems. One of the other best known discussions about the use of systems theory is Moore & Kearsley (1996/2005). These authors focus specifically on the application of systems theory in a distance education context. They offer a single-tiered taxonomy of attributes of a distance education program under the title—"a systems model for distance education" (2005, p. 14).

Anderson (2004) offers the beginning of a theory of online learning. Building on the work of Moore (1996/2005), Anderson elaborates on a model of the interaction between the three "agents" in educational interactions: (1) teacher, (2) learner, and (3) content, creating six possible interactions (e.g. learner-teacher, teacher-content, etc.). Next, he describes a more complex model that includes the "knowledge-content interface" (p. 49) and aspects of communication and outside support. Although Anderson does actually not use the term "systems theory", this model could easily be adapted to help begin to build a systems theory of on-line learning (Shaffer, 2005).

Saba (1999) calls for a "systems theory of distance education". He sees systems theory as "the quintessential (pragmatic) tool for understanding relationships between things and not looking for a single answer to a problem within the confines of a dogma" (2003, p. 11).

Smith & Dillon (1999) contend that it is necessary to develop an overall model of the distance educational processes, noting:

> *" . . . we argue that distance education must be examined as a system, but to do so requires looking at the system and the variables that make up the system, sometimes a few at a time"* (p. 34).

Shaffer (2005) argues for a system dynamics approach to distance education and presents a preliminary model. In his paper and through the special website that he has structured for the development of a collaborative working model of distance education, he calls upon fellow scholars to help develop a standard system dynamics model of distance education (p. 11). He notes that his interest in developing such a model is not entirely

selfless; his hope is to have a more stable base of theory upon which to perform his future research.

Components of a Distance Education System

Moore & Kearsley (2005) have identified some of the macro-factors that impact and interact with each of the more immediate parts of the distance education system. Their conceptual working model includes the following component parts: technology, learning, teaching, course design, management, policy and organization (p. 10). All of these discrete systems interact *on* and interact *with* each other in a distance learning program.

As a result of the interaction of these discrete systems, any comprehensive distance education program must include an overall macro-system which accommodates all (or at least most) of the following elements (Moore & Kearsley, 2005, p. 10):

- A source of knowledge that is to be taught and learned;
- A subsystem to structure this into materials and activities for students that are called courses;
- Another subsystem that delivers the courses to the learners;
- Teachers who interact with learners as they use these materials in making their knowledge;
- Learners in their different environments;
- A subsystem that monitors and evaluates outcomes so that interventions are possible where failures occur; and
- An organization with a policy and a management structure to link these different components together.

These elements—content/knowledge, design, communication technologies, interaction, learning environment, and management—are essential sub-systems in every distance education organization (Moore & Kearsley, 2005, p. 18).

There is clearly a great deal of interaction and inter-dependence among these elements. For example, the exact nature of the course design, the communications technology to be used for delivery and the nature of the interaction between the learner and the instructor all depend upon the sources of knowledge, upon student needs, and upon the learning environment for a particular course. In addition, selection of the delivery technology depends on the content to be taught, the learners who are to be taught, and where the learning will actually take place. Design of the instructional media depends upon the content, the delivery technology, the kind of interaction and the learning environment. All of these will, of necessity, be influenced by the policy and management of the distance education institution. As a result, it is readily apparent that changes in one component of a distance education system will have immediate effects on all of the other elements.

Inputs and Outputs

Another way of looking at the inter-relationships among the components in a distance education system is to use a common technique in systems modeling—viewing the system in terms of "inputs" and "outputs". Moore & Kearsley (2005, p. 20) have identified the following inputs and outputs in a distance education system:

Inputs
The primary inputs of a distance education system include:

- Student characteristics including knowing how to study at a distance;
- Instructor experience of distance teaching;
- Understanding of administrative staff about distance learning;
- Quality of course design skills;
- Quality of course production;
- Cost of course design and production;
- Technology chosen for the course;
- Accessibility of support services;
- Frequency and quality of evaluation data; and
- Financial investment.

Outputs
The central outputs of a distance education system include:

- Student satisfaction ratings;
- Student achievement scores;
- Student completion rates;
- Total enrollments;
- Quality assessments;
- Accreditation results;
- Tuition and other revenue generation; and
- Staff reputation and turnover.

All of the factors listed in the input column effect, at least in some way, the output variables. Few of the relationships are direct, as one might expect given the inter-related nature of the sub-systems in every system; however, they are multiple in nature. For example, student characteristics affect many of the output variables and student completion rates are a function of many of the input factors (Moore & Kearsley, 2005, p. 19).

Traditional vs. Distance Education Systems Based on My Personal Experience

Impact on Teaching and Learning

Teaching and learning in an online environment is very different than in a traditional classroom setting. The teaching process is spread out over time instead of being restricted to a specific time slot on a certain day. As a result, there is no need to try to cover a lot of material in a short amount of time. In addition, online teaching does not involve a "performance" like that involved in typical classroom instruction. Instead, it involves the structure and organization of the class (which is best accomplished early and up-front), definition of assignments, responding to student questions and grading their work, and trouble-shooting technical problems. There is also a great deal of one-on-one discussion with individual students about their work and the course content via email and through postings in the discussion threads.

Like Kearsley (1997), I believe that the online learning experience is much richer for the student than in a traditional classroom setting. Since students are required to write responses to questions and problems on a regular basis, as well as read and respond to the responses of their classmates. As a result, they spend a lot of time thinking about the content of the course.

In a traditional classroom setting, if I ask a question, I might get 3-4 students who elect to respond with their spontaneous ideas—and it is generally the same few students that respond during each class session. In the online environment, however, students get a chance to think about the questions posed and compose their response over a longer time period (e.g. hours or even days). Moreover, every student is expected to make a response and is graded on the quality and frequency of their responses as well, so students actually do participate more in online classes. Not only does this encourage reflective thought, but it also accommodates students who have difficulty expressing themselves in a spontaneous classroom setting (especially if they are foreign students with limited English speaking proficiency).

Being able to participate in classes from any location where there is Internet access accommodates travel on other projects. While online activities do increase the workload of teachers and students, they also make it possible to be much more efficient in terms of getting the actual work done. In the space of 2 - 3 hours online, I can usually accomplish all my daily teaching and professional responsibilities, leaving me free to pursue other professional and personal interests for the balance of the day.

The fact that online education allows for intensive interaction among students, as well as with the instructor, is probably the single biggest benefit from an instructional perspective. It is difficult to imagine how this could be accomplished in a traditional setting, except perhaps with very small class sizes—which traditional university settings do not typically have. Furthermore, it is easy to include others (such as guest experts or students from other institutions) in an online class—as well as allow students to access resources and information anywhere in the world. One of the greatest assets of online education is that it really does remove the boundaries of the traditional classroom

Another key benefit of being an online instructor is that such an individual is somewhat sheltered from the political and organizational turmoil of educational institutions (not to mention, face-to-face faculty meetings!). Many of the issues that result in heated disputes (e.g., facilities, staffing, raises, supplies) are often not relevant to someone who teaches online and has no physical presence at the institution.

The online instructor typically has a fairly weak allegiance to any particular institution given that she may be working for several online institutions at the same time. However, she does have a very strong connection to both students and to the profession. In fact, it has been my surprising experience to find that my phone and electronic involvement with colleagues at distance institutions has been greater and more intensive that with those in my on-ground institution.

There are, however, disadvantages to not having a physical presence at an institution. These include problems such as being left out of meetings and other events that occur during on-site interaction. Interaction with university personnel online or by telephone can result in less bonding or connection among the online faculty member and the institution's on-ground faculty and staff.

Though the schedule flexibility is greater, teaching in an online classroom also requires a greater time commitment—responding to student postings and actively engaging them with questions throughout the unit week is quite time-consuming. In addition, figuring out how to deal with the inevitable hardware and software problems that arise, as well as the complexities of networks and telecommunications, requires a fair amount of trouble-shooting activity; however, it has been my experience that there are usually good technical support staffs available to assist faculty at most large online institutions.

Impact of a Distance Learning System

There is no doubt that being an online teacher or student emphasizes certain skills and abilities. Online interaction requires good communications skills (especially a strong writing ability). Good computer skills are also needed, although this does not need to be at a highly technical level. The ability to learn to use new computer software and troubleshoot problems is undoubtedly one of the most important technology-related skills required.

There are certain personality characteristics (such as patience and independence) that appear to be important in an online teaching or learning environment which some teachers or student may lack. However, the research is just beginning to evolve to confirm the attributes of successful and unsuccessful online teachers and learners and more studies are needed.

A very important aspect of online learning and teaching are the implications for the nature of educational institutions. Since online faculty (and their students learning at a distance) do not require classroom or other facilities (e.g., auditoriums, cafeterias, gyms, housing, parking lots, etc), what exactly is the role of the institution? Obviously, the provision of computing facilities is critical— although these could be obtained privately. Libraries that can get materials out to students are needed, although an increasing amount of current technical and professional literature is becoming available via the Internet. At

some point in the not too distant future, traditional libraries may only be needed for reading older literature.

Educational institutions will continue to have two functions that are still needed in online education—administration (processing of admissions, course registrations, fees, scholarships and grades) and accreditation (which requires both staff and management and is handled at an institutional level, not an individual one). Both of these functions create the need for an online instructor to have an institutional affiliation. However, it is conceivable that in the future, online teachers could operate through small professional corporations, similar to physicians or lawyers, which could address the administrative and accreditation needs without requiring the large-scale institutional infrastructure of a university or college system. In fact, there are a number of new "virtual" colleges that appear to be following a model like this (except at present, they are operating without accreditation or are contained within the jurisdiction of their "parent" institution).
The practice of online teaching and learning is bringing about significant changes to our educational system. My experiences over the past three years as an online faculty member have been overwhelmingly positive in terms of the being able to teach more effectively and efficiently. Whether this will be true for most other teachers remains to be seen. However, I believe most will find this a compelling way to teach, and will end up preferring an online environment over traditional classroom settings.

Conclusions

Approached from a systems view, distance education is the macro-system which subsumes other forms of education, including what is generally known as traditional classroom education. The growth of distance education programs is exploding—creating significant changes in the delivery of education and the acceleration of that growth is not expected to abate anytime soon. Because we live in a time of dynamic change, it will not be enough to focus our efforts on the improvement of existing systems— this kind of limited focus will only allow us to adjust or modify the old designs in which our systems are still rooted (Banathy, 1996, p. 50). Instead, we must discard our old ways of thinking and embrace a systems view in order to deal with the increasing complexity of our educational delivery systems.

To paraphrase Albert Einstein: we can no longer solve the problems of education by engaging in the same level of thinking that created them. Rather, we must learn to think about distance education as a system and become systemic in our approach to creating educational systems that will “nurture learning and enable the full development of human potential” (Banathy, 1996, p. 48). Anything less will just leave us with a “mess”.

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As a current doctoral student at Fielding Graduate University, I certify that this paper is my work and that no part of this paper is the work of my instructors, supervisors or other advisors.

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May 2006