Teaching with Technology in the Modern Classroom: A Learning Systems Model

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Abstract

Rapid advances in technology, an expanding non-traditional student body, and paradigm shifts

are profoundly changing education. With Federal initiatives targeting ways to help students,

educators feel the pressure to do more teaching with technology. However, educators may tend

to adapt a piecemeal approach, without recognizing the wider implications for education as a

total system. The Learning Systems Model expands and tailors a process model for teaching

that identifies the interrelated components of education at the levels of individual, institution,

and the wider society. In particular, elements within the model emphasize the needs of a multi-

cultural and diverse student body, as well as the implications of utilizing technology as a tool in

education. The discussion ends with specific teaching skills and techniques to help the educator

adapt to the modern classroom.

Teaching with Technology in the Modern Classroom
A Learning Systems Model

Modern educators face numerous challenges. From outside their institutions, educators must answer to constituencies who demand greater accountability for the time, effort, and money spent on the educational process. Internally, educators must adapt to rapidly changing technology, to an expanding non-traditional student body, and to changing paradigms of the educational process. In reacting to pressure from one or other of these dimensions, educators may react too quickly, reaching for a single cure-all as a quick solution. But as a modern proverb has stated, "When you're up to your knees in alligators, it's hard to remember that the original objective was to drain the swamp."

The proverb is now dated, of course, written before the advent of the Environmental Protection Agency and the preservation of wetlands; however, the proverb does remind us to focus on the broader picture.

Among the changes impacting education, technology provides the greatest challenge. The Clinton Administration, especially under the initiative of Vice-president Al Gore, has emphasized the need to adapt technology to education, not only through a focus on connecting schools to the Internet but also by creating an elite Technology Corps to bring technical expertise to students (Baker, 1995). *Change* Magazine sees that technology can serve as

either a means or an excuse for educational change, but it sees that change as developing slowly.

> The integration of information technology into teaching and learning is inevitable and well under way, but it will not be sudden. Although we cannot predict all the changes, we can still influence them. That is our responsibility and challenge (Gilbert, 1995, p. 6-7).

Perhaps change in the modern classroom will come slowly because individuals or institutions are reluctant to change. But in this transition, educators must avoid focusing too narrowly on one aspect of the educational process, especially to new technology, resulting in a piecemeal approach. Rather, educators must approach education as a systems endeavor, which requires them to identify the interrelationship between elements prior to incorporating new technology. Such interrelationships can help answer some pressing questions for the proper integration of technology: What are the teaching skills and pedagogy for the future? "How can schools teach technology better, and who will do that teaching? Also, how can industry and schools work more cooperatively to ensure that graduates are 'workplace literate?'" (Baker, 1995, p. 42)

This paper presents a series of heuristic models that identify the interrelated teaching components of the broader educational process. With this heuristic method, educators can better guide the changes occurring within their own institutional settings. The discussion begins by briefly examining the purpose and limitations associated with models as a means of analysis. Building on the systems' perspective, the Basic Systems Model forms the foundation for subsequent models. Expanding on this Basic Model, a more comprehensive Rhetorical Process Model identifies the broad set of elements that underlies any communication-related activity. This expansion distinguishes the more subjective from the more objective parts of the process.

Since the educational process extends the rhetorical process, developing the categories more completely yields the Educational Process, identifying the interrelated elements that comprise an educational system. Elaborating these teaching elements forms the bulk of our discussion.

Models as Perspectives on Education

Theoretical models help to explain an unknown by providing a schema that helps visualize or conceptualize some given phenomenon. A theoretical model uses the known to parallel the unknown phenomenon that one needs to understand. In more precise terms, according to Hesse, a model

depends on some system of thought epistemologically prior to and independent of the particular phenomena that the model explains (Hesse, 1967). According to Kates, a model must identify the elements, the linkages that connect the elements, and the principles that underlie the elements and linkages. Practitioners can use such models as laboratories for examining the practical import of any changes within the system (Kates, 1971). Even those who distrust theory and models tend to rely on conceptual schemas to organize data: as Richard McKeon summarized, "We are suspicious of systems of being and of knowledge, but we organize and systematize information and raise questions and draw new consequences from schematized data, facts, and relations" (McKeon, 1971, p. 44).

Along with their usefulness, however, models have significant limitations. Models can help the theorist in visualizing the education process only to the extent to which the model's assumptions reflect the applicable process. Inexact models, outdated models, or models based on inappropriate analogies can serve as blinders that prevent users from seeing the total reality. But even with the most precise model, the very construction of the model itself involves a significant drawback:

> Since a model is a static replication, a model of a dynamic process is inherently inexact. Any communication model will conceptually violate the transactional

requirement as the model isolates and labels components for the sake of clarification and discussion.

People perceive the models in a static manner, even if the reality reflected by the model is a highly dynamic event. In any communication event, people can simultaneously integrate many discrete activities: perceive, interpret, and respond to multiple aspects of a situation while remaining aware of multiple levels of meaning and implication. A model, however, makes these components discrete. While clarifying the specific elements involved, a focus on discrete elements creates a static perspective at odds with the reality itself. As long as users of the model recall this limitation, the model can serve as a useful tool for studying, understanding, and discussing the communication process related to teaching skills in the classroom.

For a teaching model to be effective in examining educational change, it must be comprehensive, identifying the relevant elements from education as a system. Only then can the model serve as the basis of educational change. According to Michael Holzman (1993), the failure of many attempts at educational reform stem from "the lack of a systematic approach: the failure to include all areas of the system in decentralized behavior" (p. 18). Unfortunately, a comprehensive approach runs the risk of appearing too complicated; furthermore, such a comprehensive approach challenges the quick-fix mentality of

Americans in general and educational bureaucrats in particular: "It's simply easier for educational bureaucrats to grab the latest quick fix and abandon it when the next sure thing comes along" (Kean, 1993, pp. 13-16). But avoiding the instant solution proves especially important when incorporating technology into the modern classroom.

Developing a model for educational change requires building a model on a solid foundation, then incorporating all of the interrelated elements that affect the teaching and educational process. It also must incorporate the dynamics of change within the entire system.

The Education Process Expands a Basic System

To examine education, we can benefit from two interrelated focal points: education is ultimately a communication process; and both communication and education are best seen as systems of interrelated components. As systems, both education and communication involve inputs, specific activities aimed at reaching objectives, outputs of products and services, and feedback to evaluate the process. This underlying process appears as the Basic Systems Model, shown in Figure 1 attached.

The Basic Systems Model provides a starting point, but its categories are very broad. By dividing the model both horizontally and vertically, the Basic Model expands into the Rhetorical Process Model.

The horizontal separation divides inputs into both status and assumptions, integration into purpose and method, and outputs into product and interpretation. The bottom half represent the more objective elements (status, method, and product), while the top half represents the more subjective elements (assumptions, purpose, and interpretation). The vertical division divides each of the central elements: purpose into intentions and audience, and method into genre and process. Figure 2 presents this expanded Rhetorical Process Model.

For communication, the process begins with status and assumptions. Status includes the historical facts about a given communicator, such as background, education, experience, and role for the given communication (educator, student, board member). Assumptions include both conscious and unconscious attitudes that underlie the encounter, including self confidence, attitudes toward others in the communication process, and cultural expectations.

The integration portion of the process, the center of the model, begins at the top with purpose, focusing on both intentions and audience. In any communication encounter, participants begin by determining their purpose: i.e., what they want to achieve (intentions) from a given audience. The purpose can include to gain a willing listener, to ensure understanding, to fulfill legal requirements, or to provide the basis for a long-term relationship. With a
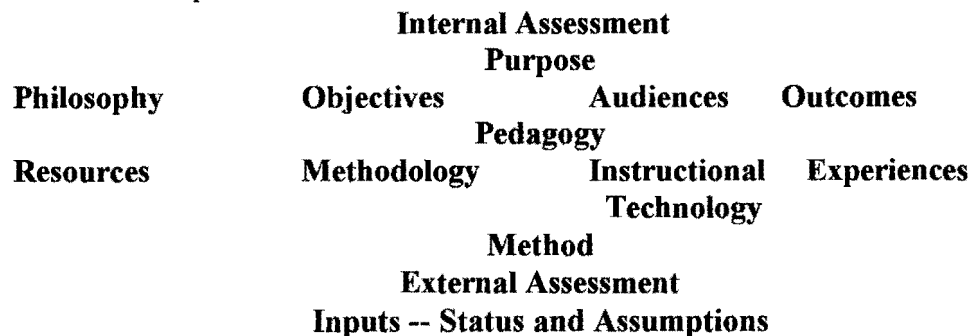
clear purpose, the communicator determines the method to use. The genre portion of method includes the types of communication, such as conversation, lecture, group discussion, written document, or workshop. The process part of method includes the sequence of ideas, word choice, visual or auditory accompaniment, and approach toward drafting or testing ideas. Although this central integration usually begins as a sequence (intention, audience, genre, process), these four elements tend to interact and cross field.

Ultimately, the interaction of purpose and method results in or embodies a communication product, the objective output. The output product is something seen or heard either directly or through some recorded medium. However, the real effect of the communication is not the output itself but the interpretation of that output. The interpretation actually ends the process, whether or not that interpretation matches the intended message of the sender or reflects a different message altogether. The communicator often verifies the actual vs. the intended interpretation through feedback from the other party, through questions of a test of knowledge or skills. Feedback that matches the expected result may indicate successful communication, whereas unexpected feedback means that the communicator must regroup and continue the process.

The Education Process Expands from the Rhetorical Process

Both as a communication process and as part of an organizational system, the education process follows the same pattern as that displayed in the Rhetorical Systems Model. Figure 3 presents the Education Process Model which identifies the specific elements of this basic rhetorical process as they apply to Education. The following sections briefly describe each element of the Model, with illustrations of the concepts coming from recent educational theorists and practitioners.

Rhetorical Model adapted:

Internal Assessment

Purpose

| **Philosophy** | **Objectives** | **Audiences** | **Outcomes** |

Pedagogy

| **Resources** | **Methodology** | **Instructional Technology** | **Experiences** |

Method

External Assessment

Inputs -- Status and Assumptions

The educational inputs include both the objective status and the subjective assumptions. The status components concern the resources while the assumptions involve the philosophy for the process.
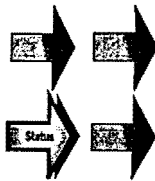
The process begins with the objective status elements; these elements represent the "givens or limitations within the educational process. The organizational structure examines all of the components of the school, from the division of labor among teachers to the physical layout of the educational setting. And the community linkages indicate the ways in which a given educational program relates to the wider society and specifically those most affected by it.

Faculty qualifications reflect the background and experience of those primarily responsible for the process. Faculty come under increasing scrutiny as society demands greater accountability; and faculty often counter with an emphasis on tenure issues as a way to ensure academic freedom. Thus, the teacher's freedom to expand the realms of knowledge without hindrance encounters the public's need to

ensure the competence of student graduates. The focus on faculty can incorporate innovative approaches to faculty training, as seen in John Centra's (1994) discussion of teaching portfolios and the need to emphasize specific skills that faculty need to improve, such as motivational, interpersonal, and intellectual skills (pp. 555-570). Others seek to more closely integrate research into the learning process, changing the faculty role from that of knowledge transmission to learning facilitation. Through this shift, faculty move from the *Quality A's* (quality assurance, accountability, audit, and assessment) to *Quality Enhancement* (empowerment, enthusiasm, expertise, and excellence) (Kember & McKay, 1996). Professional teachers want more than a job: professionals have a passion for learning, taking opportunities themselves and challenging their students (Carr, 1997).

Another significant input into the educational process is the organizational structure. Structure includes the physical facilities representing the space in which interaction occurs, ranging from a dedicated campus, specific building, meeting room, or cyberspace with Internet connection. Physical space can foster or inhibit the learning process (Taylor, 1993). Since education most often takes place within schools or colleges, it occurs within some organizational structure; and like other organizations, schools work with, through, and in spite of the structure. In particular, a bureaucratic structure tends to limit decision

making by the teachers involved (Palardy, 1994). But from a systems perspective, structure is not just one more element in the educational process. "Our ability to restructure schools," states Cardellichio (1995), "depends on our ability to understand the complex and dynamic relationships between teaching methodology, the structure of school, and types of learning" (pp. 629-632). Similarly, Richard DuFour (1995) concludes that, "Those who seek to bring about meaningful change in a school must address both structure and culture to create the best climate for improvement" (pp. 33-36). Furthermore, organizational structure must realize how to incorporate technology, not just as add-ons to traditional curricula but as integral shifts to the structure of education (Kinnaman & Dyrli, 1995).

At the broader level of input, community linkages indicate the way in which the educational process fits within the wider community, whether as a public or private institution, part of a corporate training program, or even home-schooling. Linkages suggest that educational institutions are not self-contained, isolated dispensers of knowledge; rather, education is art of a wider system that not only provides the student inputs but also uses the resulting output product. Because of this interrelationship, campus reorganization should include discussions with multiple constituencies, including businesses, alumni, parent advisory groups, and citizen advisory groups; and perhaps most significantly, such

discussion needs a sense of humility on the part of the educators involved (Wresch, 1995). Professional societies provide an alternative mechanism for school-industry partnerships (Hemminger, 1994). By fostering such relations with the local community, schools can better serve community needs while gaining an ally from within the community.
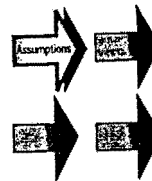
The subjective inputs involve a greater range of interpretation, so they bring a greater degree of uncertainty into the process. Assumptions include aspects that educators consciously select, as well as those unconsciously accepted as the unquestioned starting point for actions. Assumptions begin with the philosophy of education and the learning paradigm that guides the overall process in any situation. Just as significantly, it includes the rather amorphous category of campus culture as well as the changing social paradigms in the wider society.

The assumptions begin with the philosophy espoused by the educator. This starting assumption, which significantly

affects the overall process, may reflect such differences as those between Plato and Aristotle, Dewey and Skinner, or idealism and postmodernism. Even positions no longer held may prove insightful; as Becker (1994) indicates, "Although the underlying idealist philosophy has since been repudiated, the vision of unity is still a valuable way of resisting the postmodern trend toward fragmentation" (pp. 177-189). The philosophy may be more limited in scope and related to a given academic discipline. For example, in promoting a liberal democratic approach to teaching, Brunson and Vogt (1996) suggest that an empowering educational philosophy can create a tolerance for ambiguity through an environment of trust and collaborative learning. But as with any other aspect of the process, educators must recognize the difference between sound philosophy and the latest fads -- common sense formalized with a buzzword label where the wheel of education "goes around and around, and we keep recycling" (Kean, 1971). A recent approach to philosophy is the learning paradigm, distinguishing whether students learn by imitation or by self discovery, thus whether the teacher provides information or provides materials for students to employ. The Learning Paradigm by Barr and Tagg (1995) outlines one of the more recent examples of this element. Their work has become the impetus for an annual North American conference on this topic. But a similar discussion can appear under different labels. For example, an article in *Adult Learning* proposes a new assumption about learning based on collaboration and dialogue, where one's relationships within a societal context form an integral part of the educational experience (Willets, Boyce and Franklin, 1995).

The campus culture, the second element of assumptions, recognizes that the groups involved (students, administrators, teachers, employers) contribute toward creating a unique environment for any educational encounter. The term *culture* is used here in the anthropological sense, combining all of the "givens" of our daily life in a community. Educators can have an influence on that culture, but they can have no absolute control over it, since all participants contribute toward creating the culture. Focusing on the classroom culture is part of the impetus of the learning paradigm, a well as the empowerment approach mentioned above; as Brunson and Vogt continue, "Such an atmosphere can create fundamental change in traditional classroom power relationships because instructors find opportunities to learn about themselves as teachers/learners and students become liberated to explore themselves as learners/teachers" (1996, p. 73).

The concept of culture recognizes real differences among various educational settings. As indicated in the *Journal of Counseling and Development*, "We are fast becoming a multi cultural, multiracial, and multilingual society. Such demographic changes are having a major impact on the

economic, social, legal, political, educational, and cultural systems. For business and industries to survive, they will need to meet the inevitable challenge of cultural diversity" (Sue, 1991, pp. 99-105). Assumptions have a significant impact on the educational process. By their very nature, assumptions are slow to change, since assumptions tend to reflect either the unquestioned basis for actions or the basic values that people hold with tenacity. These assumptions can change, but only if one is willing to clarify and question their underlying assumptions.

Purpose -- Intention and Audience

Central to the education process are the purpose and method elements. Here the purpose elements drive the process, where purpose includes clarifying the intentions and the audience for education.
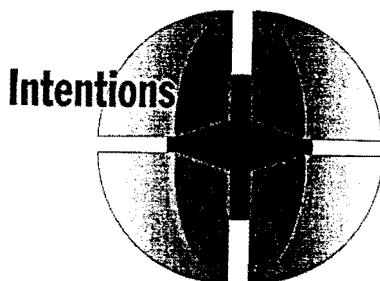
Intentions

At the lowest level, intentions involve the course objectives that underlie specific

classroom activities. These short-term activities contribute to the overall program objectives. Together, the activities of all educational entities come under the mission statement for a given program, school, or college. While the mission statements provide the focus for the types of activities, academic standards represent depth to which one carries the process and the quality focus that guides these activities.

At the individual class level, lesson objectives describe the intended outcomes of a given class hour. The objectives determine the desired outcomes, which ideally guide the construction of educational activities. Although lesson planning is ingrained within primary and secondary education, it is more problematic in higher education, as stated most clearly in an opinion column in *The Chronicle of Higher Education*:

- Higher education rarely deals with the goals of instruction directly and has avoided stating them in measurable terms.
- Courses and programs are rarely designed to provide each student with the chance to attain the competencies we agree on.
- Faculty members receive little reward for devoting significant amounts of time and energy to improving courses and curricula.

- Many people in higher education do
  not know how to design
  courses and curricula very
  well (Diamond, 1997, p. B7).

Whereas primary and secondary education require its teachers to learn how to design courses, higher education only requires that professors be subject matter experts. Knowing a subject and planning lessons, however, are two distinct abilities. To improve this area, colleges may provide faculty development; but often faculty are left on their own for planning. The increasing availability of the Internet provides alternate sources to assist in class planning (Lovely, 1990).

Educators select activities designed to meet individual course and lesson objectives which cumulatively will lead to fulfillment of the program objectives or the institutional mission. The intention of program design is to ensure that learners "experience interest, meaning, and purpose in teaching-learning situations" (Ediger, 1994, pp. 636-639). The stated mission of the program becomes the starting point not just for instruction but for assessment as well; without a clear sense of mission, the institution has no method of evaluating its effectiveness or progress in reaching the mission. For all levels of education, developing the mission or setting the vision becomes a significant step in the educational change process (Weller, Hartley and Brown, 1994).

The third element of intention in the model is determining academic standards. This topic plays a key role in the Goals 200 project for American education, challenging teachers to exact higher standards, to challenge with more difficult texts, and to apply higher-order thinking skills (Curley & Strage, 1996). Without standards, or with weak standards, educators have no reliable way to measure success (Gandal, 1995). For higher education in particular, many analysts decry the lack of or decline in standards. "US colleges academic standards have been compromised by federal subsidies, competition for tuition money, and the idea that all Americans are entitled to a college education" (Gottfried, 1995, pp. 18-20). Gerald Kreychte (1994) goes even further, "Institutions of higher learning have changed radically, making John Cardinal Newman's classic, *The Idea of a University*, an anachronism. Today Americans experience a clear-cut case of academic prostitution" (p. 98). By enforcing standards, teachers can be prepared to deal with a diverse student population (Bennett, 1995), and the challenged students will likely rise to the occasion, breaking the cycle of self-fulfilling prophecies (Shokraii, 1996).
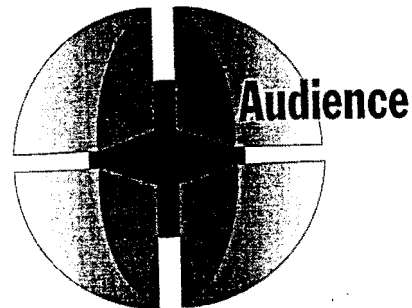
The audience segment of purpose obviously begins with students, the prime target of the educational process. However, the audience involves a wider constituency, including educational leaders and administrators, as well as the employers of graduates as the direct audience.

The focus on students is the first and foremost concern in the education process. Nationally, the student focus appears as a call for greater accountability in public education. At the primary and secondary level, Paul Peterson (1997) states, "If public education in the United States were a business, investors would long since have put their money elsewhere" (pp. 29-33). Other researchers have expressed concern that increased spending in education has not resulted in a parallel increase in student performance; as Hanushek (1997) reports, instances of increased performance "are simply not determined by teacher training, class size, or overall level of spending" (p. 63). Of concern in this equation is the fact that a teacher's career usually does not depend on how well the teacher's students perform. But any change must not be simplistic; for as Hanushek also recognizes, "those who initiate educational reforms must accept that there are varied approaches to learning, and what works for one teacher or student might not work for another" (p. 64). Researchers must continue to clarify how students learn and what motivates them to improve. Teachers must learn to recognize the multiple intelligences of students, thus

finding ways to better meet their needs. Advances in artificial intelligence, while seeming to replace human understanding, actually provide insight into how the mind works. With a systems focus, Harp, Samad, and Villano's (1995) modeling of student knowledge provides engineering insight into the psychology of learning.

Educational leaders comprise the organizational level of the process. At a given school or college, such leaders include department chairs or college deans. But leaders go beyond this lower level, to include institutional executives and particularly the governing boards, which may consist of lay members rather than trained educators. In facing today's issue of quality education, we need leaders at every level to muster vision, courage, and polit161ical will in facing these issues. Our modern society at times seems to cry out, "Where are our leaders?" (Kunde, 1994, pp. 17-24). For educational purposes, these leaders need "to get beyond the high-tech phobia," as indicated by Gretchen Cook (1996, pp. 262-266). They need to be taking the forefront to ensure that instructors are prepared with high-powered interactive presentations, interactive brochures, interactive Web sites, taking advantage of the technology that is available. For them to do this, they must invest in searching for funding, securing training, and taking the forefront in translating technology to meet educational objectives and to enhance teaching skills. From an institutional perspective, administrators must

be included in the training process (Brooks, 1998, p. 54). In becoming the driving force behind the process, administrators need a complete understanding of these opportunities so they can make effective decisions. They cannot be above the process, they need to be part of the process. In that way, they can become the driving force so that teachers have the skills to use technology in the modern classroom.

The third audience is that of the employers who hire the students. For our purpose, *employer* includes not only business and industry but also the next level of educational institutions who assume what students have learned earlier. Educators in general may tend to assume that they have a corner on the education market; however, these educators fail to recognize that "the largest educational system in the United States is neither the public schools nor institutions of higher education. It is the education and training workers receive from their employers or in the private marketplace" (Hood, 1996, p. 14). Although employers provide significant education, they still rely on higher education to provide the starting point. Consequently, higher education must begin to focus on the needs of non-traditional students, especially older students forced back to school because of obsolete skills amid technological advances (Baker, 1993). While the local community and society in general form the wider audience of graduates, employers become a crucial factor in the educational process.

Method -- Genre and Process

The method portion of the education process involves the genres and specific processes used to create the education effort.
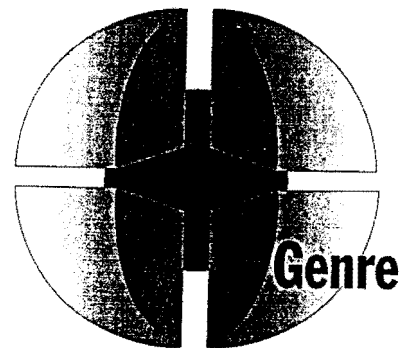
The genres focus on the structural components or the mode through the process occurs. These components include instructional technology, interconnectivity, and technological innovations within the society.

Technology involves access to information and the ability to manipulate data in the forms of text, numbers, and laboratory experiments. Technology can include reference books, laboratory equipment, audio/video equipment, computer processors, student networks, Internet connections, and video conferencing. Technology in education has become a significant political issue, with pledges to wire classrooms to the Internet.

The availability of technology has brought expanded possibilities for education (Orlando-Morningstar & Buchanan, 1996), as well as increased expectation for a wider range of classroom applications ("What Do We...", 1995). But technology is not the end in itself; although advanced computers have gone beyond voice recognition and can translate thoughts into words on a screen, they still have limitations. "Obviously computers are quite incapable of original creative thought. The critical issue is that they cannot understand the meaning of their output" (Smith, 1988). Using technology requires changes among faculty, especially those whose personality sees these machines as making education too impersonal (Robbin, 1997).

Using technology requires institutions to conduct extensive orientation and training (Orlando-Morningstar & Buchanan). The difficulty of integrating technology was described in a 1996 Campus Computing Survey: "Instructional integration and user support are the two most important IT [instructional technology] issues that American colleges and universities will confront over the next two to three years" (Weinstein, 1998, p. 1). Some resources identify many practical ways that instructors can incorporate technology into the classroom (Oehring, 1994). Also, discipline-specific applications have expanded at an ever-increasing rate (Monagham, 1993; Hermanson & Kerfoot, 1994; Velleman & Moore, 1996).

Ultimately, technology must be integrated into the educational process, serving as tools rather than masters. A century after he wrote them, the words of Alfred North Whitehead remain true today: "The best education is to be found in gathering the utmost information from the simplest apparatus" (Whitehead, 1929, p. 11).

Interconnectivity tries to link students, teachers, and institutions more widely in the educational process. Most recent discussions focus on technology as the means of interconnectivity, such as using e-mail to create a community of learners (Parson, 1997), using on-line virtual classrooms (Hiltz & Wellman, 1997), and even teaching through the World-Wide Web (Wildstron, 1997). These approaches try to gain the most out of technological innovation. However, the advent of technology raises other connectivity concerns as well. To begin with, institutions must invest in training so that teachers can better employ this technology for the advancement of students (Hurst, 1994). But perhaps even more importantly, technology must become a link that expands available genres while not necessarily replacing teachers themselves (except as students become life-long learners who have the basics and now merely keep up on their own). As David Hurst (1994) continues, "I firmly believe that computer technology can never replace teachers. As a colleague recently told me, computers are nothing more than a new kind of chalkboard, a tool

to help teachers make their instruction more effective and learning more inviting for a generation weaned on Nintendo, VCRs, and home PCs" (pp. 74-76).

Interconnectivity plays a significant role in the educational process; but beyond technology, student interaction ranges more widely to include such behavior as teacher-student and student-student interaction. Different degrees of interaction would depend on the educational philosophy and specific learning paradigm emphasizing a teacher-centered, student-centered, self-discovery, cooperative-discovery process. This focus provides one way to instill motivation into the process.

Increased interaction can help student performance, but for it to work requires that teachers win students' trust through listening and discussing (Govindarajan, 1991). Even large classes designed as college lectures can benefit from adding time for small-group interaction (Russo, 1995). Interaction takes students out of passive roles, requiring active participation. Interconnectivity begins with one's place within a historical and social context. In identifying the key characteristics of the current "postmodern" age, Zoreda (1970) indicates that "Perhaps the most outstanding trait is the affirmation that there are no ahistorical assumptions; every facet of human culture is a social construction" (pp. 923-935). As this society moves toward the 21st Century, perhaps the most significant social construct is that of

technological innovation.

Changes in technology have accelerated with the introduction of the personal computer in the late 1970s, especially with the drop in cost for machines with increasing capacity that permitted a rapid processing of complex data. With the constant change in machine capability, technological innovation have appeared most significantly in the educational approach to library resources and in how to use the Internet. Gertrude Himmelfarb (1997) describes the library as the heart of the educational institution, where the recent technological changes are the most significant since the invention of the printing press. Technology has permitted a transcending of distances as more courses become available on the World Wide Web (Hayden & Ley, 1997). But more than just availability, push technology will enable a refinement in offerings, thus enhancing the utility of the Internet, especially in saving time during searches (Weinstein, 1998). Such technological changes not only permit educators to explore new options but require them to rethinking the nature of the process:

> With dramatic advances in networking technologies, distance education has taken on a new meaning that emphasizes interactivity in learning. However, computer networks are primarily designed for distributing

content. . . . While this new electronic approach increases distribution efficiency, it does not exploit the full potential of the technology as an enabler of a reengineering of the educational process itself (Chellappa, Barua and Whinston, 1997).

As Gilbert (1995) indicates, "The purpose of educational institutions is to make better connections than would otherwise be possible among people who want to learn, people who want to teach, and the world of information and ideas. Let's embrace technologies that can improve these connections" (p. 7).
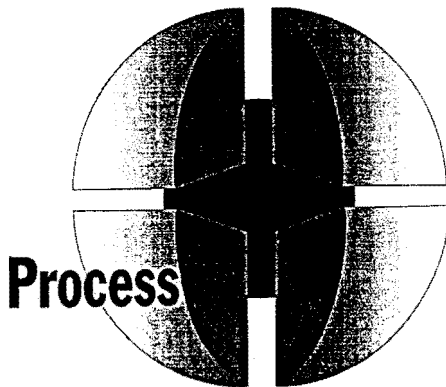
The process of education examines the sequence of activities and how the parts interact. Traditionally, these elements belong to the category of methodology, the way in which an educator prepares and guides activities for the educational encounter. Process also involves how the current educational activities fit within a

broader pattern, such as a class fitting within an entire course, course fitting within a program, and program fitting into career patterns. Taken together at the societal level, process concerns the wider availability of educational opportunities.

Methodology determines the linkage between the spoken word, the written word, and access tools in a given encounter. Traditional methodology includes combinations of lecture, individual student reading, completion of worksheets, work in small groups, and laboratory experiments. But methodology that reflects the learning paradigm must work with the multiple intelligences of students, reflecting their individual capacity and learning style. Such a methodology will allow for different ways of expressing what has been learned, leading to "performance-based, student-centered education" (McClaskey, 1995, pp. 56-59). Alternate methodology includes multi-sensory methods of teaching, as advocated by E. D. Hirsch, Jr. (1997); and it includes learning contracts, which give students more control over the process, thus improving in knowledge, skills, and responsibility (Greenwood, 1995). For the sciences, alternate methods include laboratory experiences that inspire students to change the way they think about scientific concepts (Westbrook & Rogers, 1996). Such alternatives do not eliminate the teacher; rather, teachers must relate meaning to the information provided, giving students the opportunities for working with the material.

This approach focuses on student understanding rather than pat answers to rote questions or canned experiments (Coppola, Ege and Lawton, 1997): "This approach empowers students by making them active participants in the learning process while the focus is on process rather than seeking a predetermined answer" (Ege, Coppola and Lawton, 1997, pp. 74-83). Methodology thus becomes a significant element in structuring an educational experience.

Since individual classes are not self contained elements, the program sequence reflects how a class fits into a wider course of instruction, and how courses relate to other courses in a broad program of instruction. "Educators need to pay careful attention to sequence in curriculum development," where the sequence determines when activities occur, and the scope determines the breadth and depth of instruction at a given time (Ediger, 1996). One approach to sequencing emphasizes core knowledge, where

> a coherent focus on content leads to higher-order thinking skills more securely than any other approach.... As an added benefit, children acquire knowledge that they will find useful not just in next year's classroom but for the rest of their lives (Hirsch, Storm and Frazee, 1993, pp. 23-30).

An alternative approach incorporates integrated projects into the curriculum, whereby students learn concepts as needed during a given phase of the project. Such an approach "minimizes the content-driven mind set so that needed skills can be taught and reinforced within the context of a legitimate application" (McFaden, Nelson and Randall, 1996, pp. 1-6). Regardless of which approach, the educator must provide the unifying sequence so that students can relate new objectives with knowledge already acquired. New training sessions must be offered at multiple levels: introductory, intermediate, and advanced. And because of the rapidly changing technology in society, these sessions must be continuous, looking toward open entry and open exit so that teachers are always prepared to bring the latest technology into the modern classroom.

The entire educational process needs to be broadly conceived rather than narrowly constrained. This process needs to recognize multiple levels in society and that adults need to update training throughout their life span, especially in changing careers. In providing these opportunities, we must include business connections as well as technological experts and mentors in meeting their needs for continual training. A model for providing this multilevel approach to education and training appears in the partnership established between the faculty of Celebration School and the Stetson University Center at the Celebration Teaching Academy. This particular

endeavor merges professionals and educators, as well as students of all levels. In particular,

> Learners access information in a variety of formats including audio, video, text, graphics, and animation, and demonstrate their understanding using these media in a nonlinear form. Technology can imaginatively enrich the lives of all learners by supporting personalized learning, communication, organization, multi-media productions, and authentic forms of assessment (Leinsing, Rosen and November, 1997, pp. 31-37).

Embodiment -- Pedagogy

Within the education process, the elements discussed so far do not occur in a linear sequence. Rather, they mutually interact to create or to embody the final education product. In the words of Emerson in "The American Scholar, There is never a beginning, there is never an end" (p. 79).
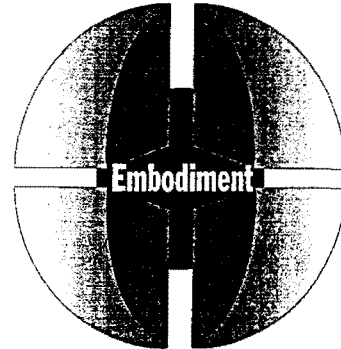
The embodiment element reflects the continual interaction of purpose and method. The initial focus on a student group may change after considering the impact of new instructional technology. Likewise changes in technology may bring about changes in the pedagogy used, which in turn may change the lesson or program objectives. As educators employ the various purpose and method elements, the interactive synergy will yield new insights that ultimately create new educational products. And for the students,

> The mind does not perceive just detailed bits and pieces, but is constantly weaving a large pattern from our experiences. If you feed it with multi-impressions that are harmonized and orchestrated to achieve a specific objective,

there's practically nothing it cannot learn (Rose, 1987, p. 116).

Beyond reflecting its own social conditions, pedagogy provides the way educators sequence diverse elements of the educational process to achieve the greatest benefit for the students. One recent approach to change focuses on excitement in the process: "The Models for Change project team wanted to make equity education interesting, zealous, challenging, exciting and perhaps -- forgive us -- fun" (Ruemper, 1996, pp. 317-333). These educators wanted to add excitement to higher education, believing that "Excitement and interaction stimulate intellectual thinking if participants acknowledge one another, listen to their views, and value their contribution" (Ruemper). Teachers essentially design the process, and their design can focus heavily on teacher presentation, student individual work, or student group work. But the teacher should strive toward the process described by Alfred North Whitehead (1929):

Let the main ideas which are introduced into a child's education be few and important, and let them be thrown into every combination possible. The child should make them his own, and should understand their application here and now in the circumstances of his actual life. From the very beginning of his education the child should experience the joy of

discovery (p. 2).

Output -- Products and Interpretation

All of the assumptions, preparation and decisions ultimately lead to the educational product itself. But the product is not just the objective product but the interpretation of that product.
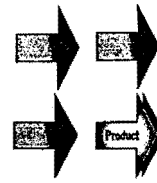
The outputs from the education process are primarily the classroom itself, the element over which the educator has the greatest impact. From the student's perspective, the output product is the learning experience, which involves how the student assimilates the entire process, both inside the classroom and outside. And finally, the output is the wider curriculum of instruction, usually measured in academic credits, learning hours, or degree programs.

The product begins with the actual classroom instruction itself, whether that instruction is the teacher's lecture, a class workshop discussion, a laboratory assignment, or an individualized computer tutorial. The instruction may include

computer-based training, which some see as a way to reduce learning time and improve learning (Maul & Spotts, 1993). Kinnaman (1995) advocates a blending of resources: "Teachers and technology should be blended to create a balance between the critical and unique contribution of each to the learning process" (p. 98) This blending appears in another research finding, which indicates that "When averaged together, the different kinds of classroom instruction and climate had nearly as much impact on learning as the student aptitude" (Wang, Haertel and Walberg, 1993, pp. 74-79). Ultimately, classroom teaching is an art more than a science: "The art of teaching is defined by the non-quantifiable elements of the transaction between teacher and student that ultimately determine the quality of the student's educational experience. It is not programmable. It requires human intelligence and interaction" (Kinnaman, 1995, p. 98).

The classroom instruction forms part of the wider realm of learning experiences, that include student homework preparation, the class itself, and the mingling of classroom and real-life experiences. Technology has expanded the types of experiences available, and telecommunication has also expanded the nature of the learning experience (Saunders, 1995). However, schools expect teachers to incorporate increased technology while failing to provide sufficient training for teachers (O'Neil, 1995). Only as schools use technology as a mechanism for change will

they take advantage of technology's potential. As alternative educational opportunities, work-based learning experiences (Hamilton, M. & Hamilton, S., 1997) and service-based learning (Lewis, 1996) provide the way to expand the learning process by integrating it directly into life experiences. Whether called internships, experiential learning, or cooperative education, these applied learning experiences permit students to test possible career choices while continuing their education (Stalberte, 1996). Overall, the learning experience portion of the educational product range beyond the classroom instruction.

Within the broader educational context, the product is the educational curriculum, ranging from a short-term update workshop to a multi-year degree sequence. A curriculum usually reflects the educator's best efforts at organizing a learning sequence. Successful design depends on appropriate needs assessment, audience design, instructional design, curricular management, and materials selection (Wagner, 1995). Organizations can enhance curriculum development by providing tool kits of exemplary tasks, templates, design criteria, and assessment criteria (Wiggins, 1992). However, modern curriculum development must incorporate the interests of students (Reissman, 1995), even enlisting students in curricular design (Nelson & Frederick, 1994). In catering to students, educators must recognize the

reality of modern society: "New educational technologies designed as much to entertain as to inform present challenges to curriculum design" (Trotter, 1992, pp. 3-7). Differing needs, new technology, and alternative expectations all effect the changing nature of the educational curriculum.

At the societal level, the output of the educational process is providing a wide-ranging community enrichment. However, the society is facing demographic change along with decreased Federal spending, all of which requires increased local responsibility for the educational process. This reduction requires developing effective methods for working with diverse communities, if the community members are to take part effectively in the political process. In particular, communities need to develop skills for working in a multi cultural environment if community members intend to take an active role in their changing society (Gutierrez, Alvarez, Nemon and Lewis, 1996). As the broader outcomes of the educational process, both teachers and adult learners are using the Internet, "learning to ride the technological wave of the future." On this wave, the Internet can help teachers communicate with colleagues, pursue professional development, search on-line databases, interact with students in the classroom, and search for new jobs (Rosen, 1996). Ultimately through the modern educational process, we are leading toward a knowledge-based social order, interweaving homes, schools, offices, and communities

into a "web of intelligent communication services offering unparalleled opportunities for accelerating scientific progress, economic development, education, and other revolutionary changes" (Halal, 1992, pp. 10-15).
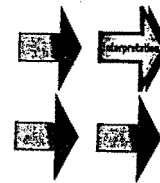
Interpretation of the education efforts depends on the student and the wider constituencies. Most people see knowledge as the primary purpose of education, closely followed by competencies. In these two areas, people look for what a student can do (or do better) as the result of an educational process. But the attitude is also a significant interpretation, reflecting the student's approach to education, to broadening life experiences, and to libeling learning. From the institutional perspective, interpreting the educational output reflects in the relative standing of institutions, as well the seamless link between all educational levels from preschool to university to corporate training.

Knowledge is obviously the desired output of the educational process. According to a series of educational

experiments, "Contrary to popular belief, the results of all three experiments suggest that students remember a great deal of what they learn in college courses" (Semb, Ellis, and Araujo, 1993, pp. 305-316). While knowledge or understanding are the preferred outputs, educators often face a significant difficulty: "Memorizing facts and being able to recall them upon demand is frequently the concept of learning perceived by government and regulatory agencies with jurisdiction over the educational system" (Coker, White and Barton, 1993, pp. 242-246). Rather than this limited perspective, educators and regulators must recognize multiple approaches to learning and must avoid using only their own preferred mode of learning (Bachler, 1997). To determine the competencies that students have achieved, educators have recently turned to portfolio assessment as a culmination tool in disciplines as diverse as art, writing, and business; however, portfolio assessment is relatively new in many of the educational disciplines (Karp & Huinker, 1997).

Often overlooked are the attitudes resulting from the process. Attitudes include attitudes about the self, about the subject matter, and about the educational process. "Teachers help students develop taste, discernment and judgment contributing to the growth of perspective" (Kinnaman, 1995, p. 98). Attitudes affect student motivation (Orpen, 1994), and student perceptions of caring from their teachers relates to students' evaluation of teachers, their affective

learning, and their perceptions of cognitive learning (Teven & McCroskey, 1997). The nonverbal immediacy of teachers "has been demonstrated to be substantially associated with increased cognitive and affective learning in students" (McCroskey, Richmond, Sallinen, Fayer and Barraclough, 1995, pp. 281-292). With ever-changing technology and adapting organizations, most educators and employers recognize the need for lifelong education. The attitudes developed from a given educational experience will significantly impact both students and the wider society.

Beyond the level of the individual, the outcomes of the educational process will lead to a new type of standing among educational institutions. Because the technological revolution is so new, as of yet there is no set sequence of who is ahead, who is behind, and who is right on. But preliminary findings indicate that students using interactive styles perform better than those using alternate means of education (Brown, Scalise and Ripley, 1989). These findings are indicative of how the change in the learning paradigm can affect institutions. Through this process of change, teachers need an increasing range of skills so that they can become innovators and remain in the forefront of the educational process. Most importantly, technology alone will never be the solution to improved education. Rather, teachers who can incorporate technology can bring the best out of the learning process and bring the best out of students. Thus, schools

must implement extensive teacher training, improved curricular materials, and major changes to educational models before it can benefit from increased use of computers.

Feedback -- Assessment and Accountability

Feedback gives multiple perspectives on the overall education process. Such feedback comes internally from those close to the process, as well as those external to the process who serve as an objective review.

The first type of feedback is the internal assessment, driven by self-study of the educators involved. Some of the feedback on students comes in the form of performance on standardized tests, such as Iowa tests of basic skills, the College Boards, and professional engineering or accounting exams. Based on the feedback,

educators can review and modify their process. Ideally, educators integrate assessment with learning as a way to achieve reform (Diez, 1977). Success in such an endeavor requires a systems perspective, with a close examination of educational philosophy and institutional culture. Using a perspective from anthropology, Audrey Kleinsasser (1995) identifies a key distinction in this process: the culture of testing vs. the culture of assessment. In the testing culture, the teacher is judge, evaluator and scorekeeper; however, an assessment culture blurs the distinction between testing and learning, celebrating achievement rather than creating fine lines of distinction between abilities.

A true internal assessment goes beyond standardized tests and teacher input; assessment needs input from class graduates as well as employers of those graduates. Student input often takes the form of end-of-course or end-of-program questionnaires, and such documents often focus heavily on assessing the teachers. Such feedback provides significant input into the assessment process, as long as the data is used appropriately ("Student Ratings of Teacher...," 1977). More recent assessment approaches have expanded the audiences involved in the process to include administrators, employers, parents, as well as students themselves (Reilly, 1995). Such a broader approach views educational not as a self-contained process but as part of the wider social environment.

External assessment comes from those somewhat further removed from the educational process. Community agencies examine how the process fulfills local or state requirements. Regional accrediting agencies examine the entire process, usually focusing on consistency between stated objectives and the actual process. Professional societies focus on the subject matter, determining how well the program reflects industry or professional standards. Assessment has become a significant political issue this decade, ranging from the words used to describe the process to a debate on national testing. Education Secretary Lamar Alexander changed the way of talking about educational achievement, from a focus on the crisis of declining achievement toward a view that "achievement levels are not what they need to be to meet the challenges of the coming decades" (Ralph, Keller and Crouse, 1994, pp. 144-150).

Given the current political climate, politicians and educators recognize that educational effectiveness is a hot political topic. President Clinton pushed for a "voluntary" national testing program in his second administration; but some critics see significant problems in implementing such a system (Schrag, 1997). Not only do the logistics of such a program create an administrative nightmare, but such a program perpetuates a testing rather than an assessment culture. A broader perspective of assessment includes such variables a

classroom assessment, instructional evaluation, accountability and monitoring, counseling and development, and the needs of students, parents, and their community (Cizek, 1995). Implementing such an assessment must start with a "clear vision of the meaning of academic success"; and in this process, schools must do more than rank order students from the highest to the lowest achievers; rather, schools must meet the growing demand for highly competent citizens (Stiggins, 1995, pp. 238-245).

External Assessment comes from a wide range of sources: accreditors, include boards of education for school districts, state agencies who monitor higher education, boards of directors for corporate training programs, as well as the traditional accrediting agencies for geographic regions or for academic specialties. All of these entities provide some means of accountability external to the institution itself. These various accrediting audiences may become a dominant force in the process. As Angela Sewall (1996) indicates,

> The issue is whether we will
> make the 1990's a decade, not
> of pubic criticism of
> education nor one of
> governmentally mandated
> standardization of education
> but rather a decade in which
> educators took hold of their
> destiny and made systemic
> changes which placed
> American students and

American education head and shoulders above that of other nations without loss of academic freedom or damage to the principles upon which American public and higher education has been based since the early 19th century (pp. 325-332).

Assessment of performance should become a guide to more effective programs and a means to increase student achievement. To become such a guide, as Sewell continues, "We must know where we are now and why we are teaching, researching, and serving as we are. We must be able to measure what we are doing in a manner which is clear and understandable to the public as well as ourselves" (Sewall, 1996). Contrary to self-imposed standards is imposition by accrediting agencies. The recent imposition of a political agenda by various accrediting agencies has resulted in a backlash from some institutions. In particular, private colleges with distinct missions geared to a specified student body have challenged the position that some centralized body could impose a political agenda at will (Dillon, 1995). For institutions whose existence revolves around a specific academic philosophy, the imposition of national standards pose a significant risk. What schools need is a "genuinely open and collegial system of accreditation, one that allows governments to catch fraud and abuse and yet steers clear

of political correctness" (Dillon, 1995, p. 42).

The Learning Systems Model

The Educational Process Model identifies (Figure 4) the elements involved in any educational system, ranging from elementary and high school, to corporate training, and to college degree programs. As a model, it indicates relationships between elements rather than the details that apply to any specific educational program. Teachers and administrators can use the model to identify the broad categories they must consider in implementing any educational change.

Identifying the elements that apply to a specific school or program is a significant first step in change. Only through such identification can the educators marshal the support needed to implement any change. The implementation itself, however, is a separate but related issue. Implementation means that many individuals must come together and agree on the content and process of change. In engaging in communication to discuss and plan such a change, each individual brings his or her own rhetorical process into the picture.

In the classroom, the model of the future must incorporate a large variety of teaching techniques to accelerate student learning. This variety of teaching skills must be available to all classes because students

learn in a variety of ways. Many students
have not discovered that they have a
personal style of learning that can be used to
motivate and accelerate their learning
process. Table 1 lists a number of teaching
skills and techniques that educators can
adapt.

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Brainstorming            Models
Buzz Groups              News articles
Chalkboards/Whiteboa     Networking party
rds                      Overhead
  with color             transparencies
Charts                     in color
Data-presentation        Use of panels
shows                    Picture studies
Debate                   Problem solving
Demonstration            Project teams
Discussion--student      Quiz
lead                     Question & answer
Field trips              session
Films/video              Reports
Games/crossword          Review in game
puzzles                  format
Imagery                  Role-playing
Interview, in class      Skits
or in field              Storytelling
Internet                 Symposiums and
presentation             forums
Maps                     TV presentation
Memorization games       Visualizations
Mind-mapping
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Conclusion

The primary goal of education at all levels is that students learn how to learn. It is not merely mastering a body of knowledge. In contrast to earlier education, students learn best and most usefully not by being asked to master the conclusions of scholars about questions the students only dimly comprehend, but when they are given raw data, learn to ask their own questions, and come to their own conclusions (Brown, 1996, pp. 267-273).

The educational process has gone through numerous movements, described by buzzwords such as "competency-based education," "student-centered education," and "constructivist curricula," all of which vie for our attention. But ultimately we will recall that "The premium will remain on students learning how to learn, in order to be able to use information literally at their fingertips" (Brown, 1996). This process does not mean that they know everything possible, but that they know how to find information, how to access it, and how to use it. As indicated in *Computer* Magazine,

The technology revolution is shaping many aspects of society, including education. It is important for educators to aggressively pursue skills and methods required to produce designers of the complex information systems demanded. Reengineering the current infrastructure should aim to make the best use of advances in computing and communication technology to improve education (El-Rewini & Mulder, 1997).

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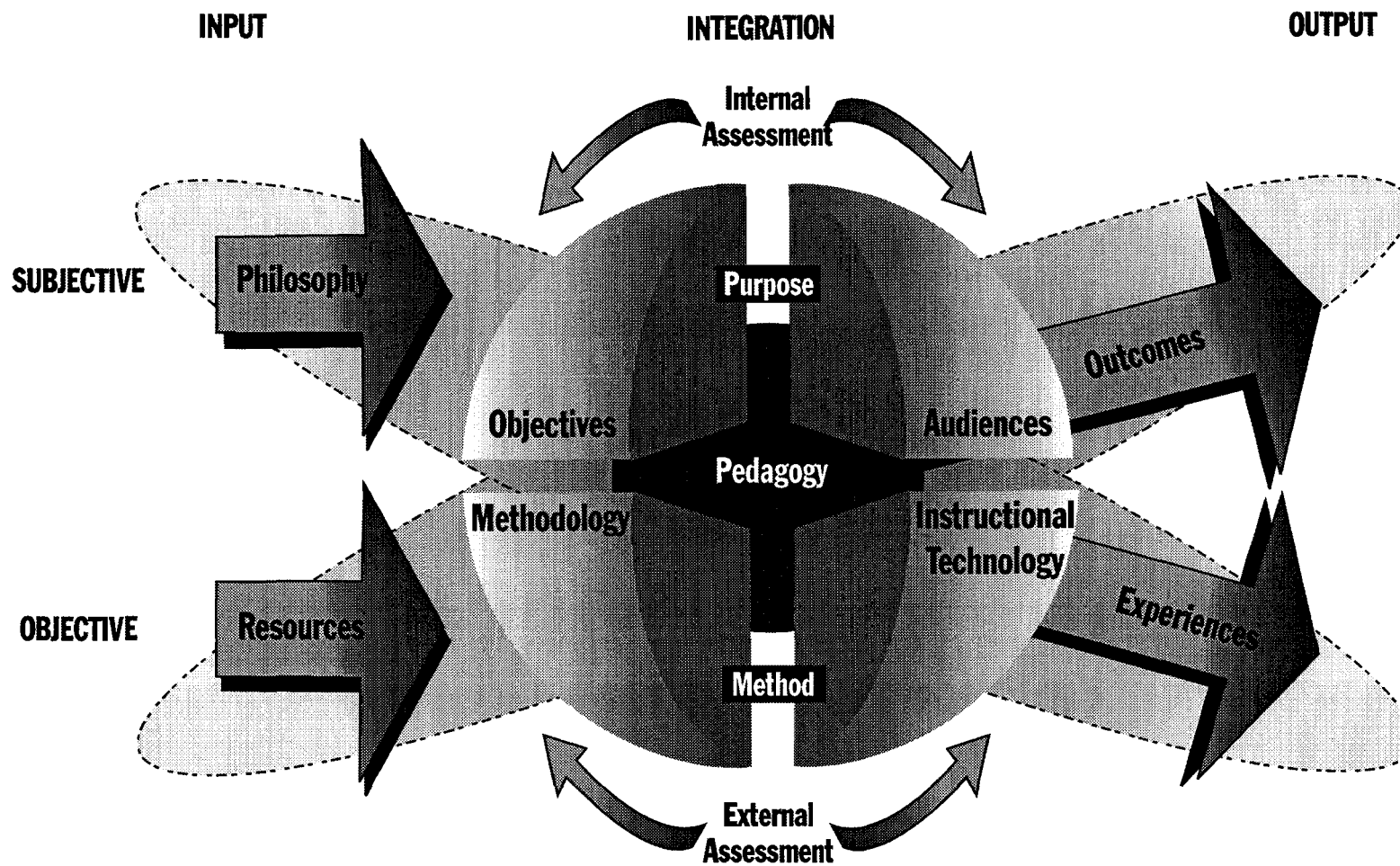
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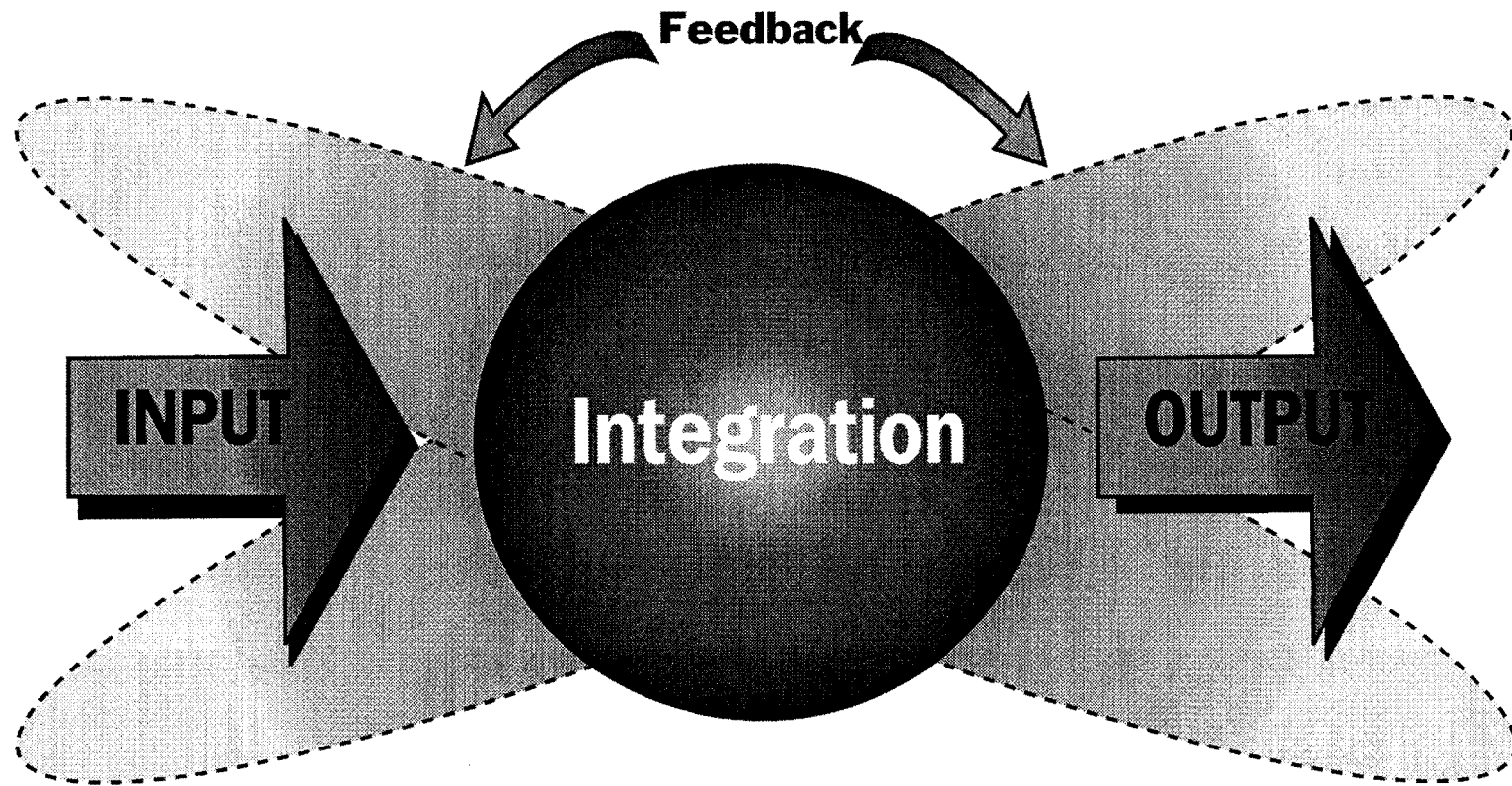
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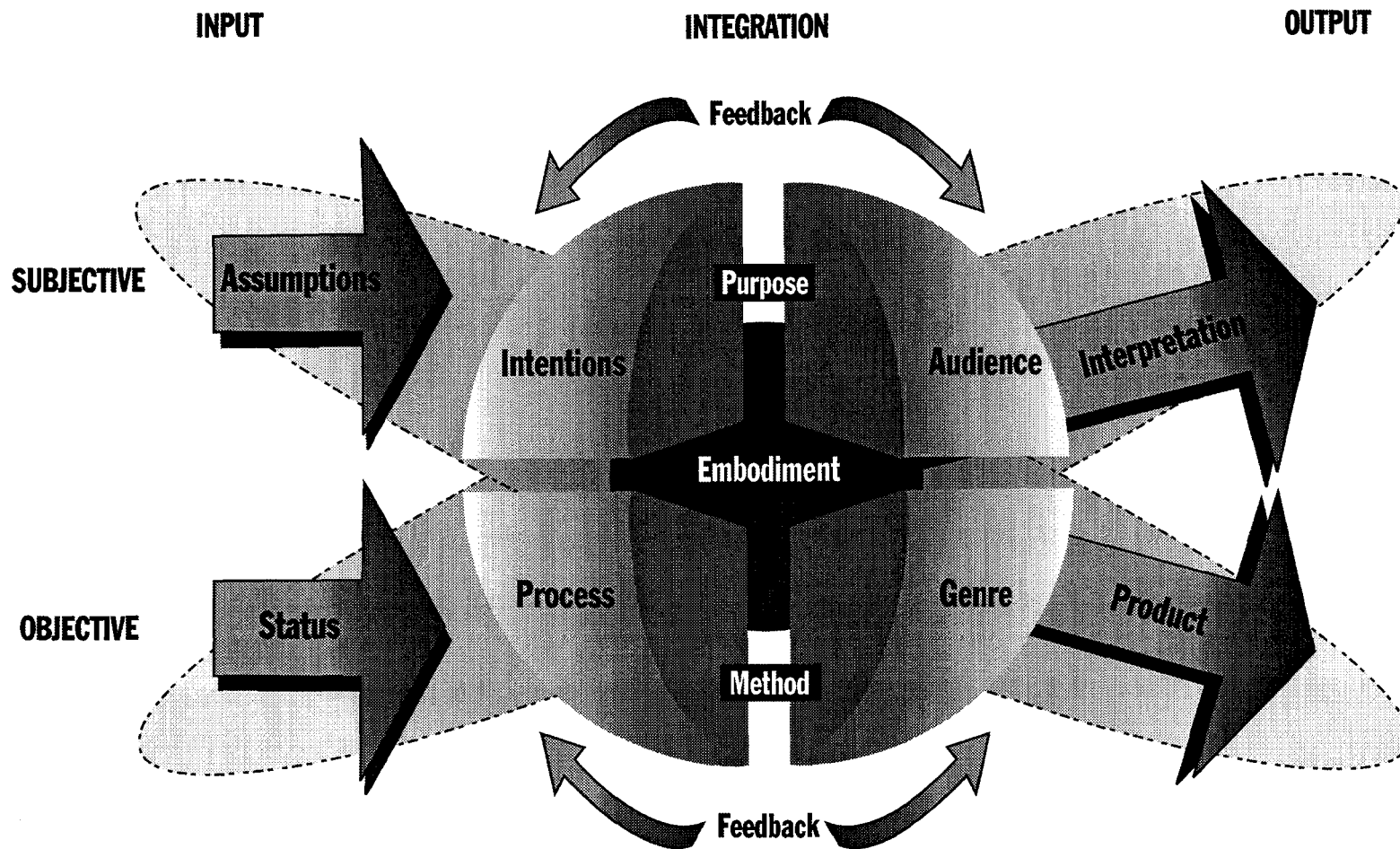
Figure 2: Rhetorical Process Model

Figure 3: Learning Paradigm Model

9.
Internal Assessment
9.1 Graduate Feedback
9.2 Self Studies
9.3 Employer Feedback

INPUT

OUTPUT

SUBJECTIVE

OBJECTIVE

2.1 Educational Philosophy
2.2 Campus Culture
2.3 Societal Values

3.1 Course Objectives
3.2 Academic Mission
3.3 Academic Standards

1.1 Faculty Qualifications
1.2 Organizational Structure
1.3 Community Linkages

6.1 Methodology
6.2 Program Sequence
6.3 Educational Opportunities

Purpose

Peadgogy

Method

4.1 Student
4.2 Administration
4.3 Employers

5.1 Instructional Technology
5.2 Interconnectivity
5.3 Technological Innovations

8.1 Competence
8.2 Academic Standing
8.3 Educational Levels

7.1 Learning Experiences
7.2 Curriculum
7.3 Community Enrichment

10.
External Assessment
10.1 Graduate Longatunial Studies
10.2 Academic Process
10.3 Community Responsiveness

1. Individual
2. Organization
3. Society