

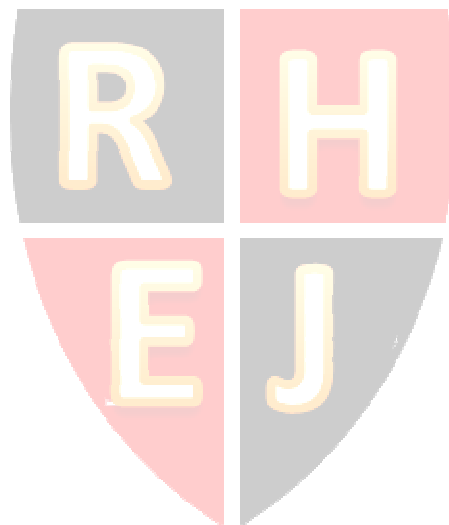
Transdisciplinary higher education curriculum: a complicated cultural artifact

Eunsook Hyun
University of Massachusetts Boston

ABSTRACT

The author discusses higher education curriculum as a cultural artifact reflecting human knowledge, which is also continuously shaped by the needs and demands of contemporary society. The transdisciplinary approach and the call for a paradigmatic shift to a transdisciplinary curriculum and research engagement are introduced as part of the academy's social responsibility.

Keywords: Transdisciplinarity, Transdisciplinary Higher Education Curriculum, Cultural Artifacts



INTRODUCTION

Artifacts are products of the activities and conceptions of humans. Each artifact represents an epistemology of its historical context. Culture is the artifact that reflects human knowledge and activities, both of which are artificial products. It is constantly shaped by a body of learned behaviors common to a given society. Simultaneously, culture shapes collective ways of knowing, behavior, values, beliefs, and consciousness as well as meaning-making, decision-making, and problem-solving approaches and perceived reality from generation to generation.

The relationship between what is taught and what is learned is not absolute because some of what is taught is lost through intersubjectivity or generational amnesia while new discoveries continuously result from human activities and emerge from agencies such as universities; therefore, culture exists in a constant state of flux. In a human culture, members of the society must agree to epistemological relationships between a word, behavior, or other symbol and its corresponding significance or meaning. To the extent that culture consists of systems of meaning and meaning-making, it also consists of negotiated agreements and its processes (Hyun, 2006b; Miraglia, Law, & Collins, 1999) (e.g., in the higher education setting the process of reviewing new scholarship of discovery either to accept or dispute knowledge). The university is the most legitimized social agent creating, discovering, conveying, disputing, accepting, and disseminating epistemology and its agreement process. The university, an institutional organization, is a cultural artifact. Among the most traditional of all institutions, it has been known as the one most responsible for changes in human history (Seymour, 1988).

Within the parameters of the university, curriculum is the center of reasoning, the artifact of the university. Consequently, higher education curriculum represents the characteristics of the university that are continuously influenced by external, internal, and organizational aspects (Hyun, Kretovics, & Crowe, 2006; Stark & Lattuca, 1997).

- External influences: transcultural global phenomena, globalization, laws, history, policies, wars, demographic changes, technology, economy, geopolitically engineered grants, natural disasters, the desires of the public, the needs of the human community, accreditation, etc.;
- Internal influences: faculty grant-seeking behaviors and research activities, teaching, curriculum content, pedagogical practice, student learning, faculty socialization and social-cultural capital, identity and disciplinary orientation of the faculty, etc.;
- Organizational influences: formation of academic departments, degree-granting programs, Carnegie Units and credits, academic majors, scheduling, the structure of the academic unit that is single disciplinary, interdisciplinary, multidisciplinary, or transdisciplinary, etc.

In particular external influences have directly shaped the course of change in internal and organizational curriculum matters of modern-day higher education institutions (“Conceptualizing,” 2005; de Wit, 2002; Hyun, 2010; “Liberal,” 2005; Lucas, 1994; Rudolph, 1977; “Transforming,” 2002; U. S. Department of Education, 2006).

If curriculum is the center of reasoning in the university, questions to explore might be What is curriculum? What does the curriculum do to individuals and human society? and Why is an infusion of transdisciplinary curriculum and research into academic affairs an inevitable consideration?

CURRICULUM

Curriculum Is and Does

As discussed in Hyun's work (2006a), the term curriculum means different things to different people, each with its own form and purpose. In other words, every representation of what curriculum is and does signifies a cultural-historical choice about how to approach the education of learners (e.g., see endnote 1) for the society. Educators who engage in discussions about curriculum too often fail to define it as much more than content knowledge to be taught and learned (Stark & Lattuca, 1997). What is curriculum? What is it supposed to do or accomplish? What does curriculum have to do with human learning individually as well as collectively? Is it a scope-and-sequenced-based academic plan? Is it a representation of our cumulative wisdom that some authorities believe all students should acquire? (Bennett, 1984, 1995, 1997; Cheney, 1989; Hirsch, 1987). Is it a set or series of intended learning outcomes? (Goodlad 1966; Tyler, 1949). Is it a collective expression of what is important for students to know and experience? (Johnson, 1967, 1977). Is it a set of courses offered to students? Is it the content of specific disciplines? Is it a contextualized timeframe within which teachers provide education? Is it a series of experiences that will lead to the healthy growth of an individual? (Dewey, 1938a, 1938b). Is it an institutional condition, capacity, or sociocultural intention meant to prepare the performance of the next generation? Is it a personal journey of autobiographical learning experiences in a holistic context? (Greene, 1978, 1995; Hyun, 1998, 2006a; Kincheloe, Slattery, & Steinberg, 2000; Noddings, 1992, 1995a, 1995b, 1995c; Pinar & Grumet, 1976; Pinar, Reynolds, Slattery, 1995). Is university curriculum an academic affairs' condition or capacity, representing collective epistemology, geopolitical agenda, or politically engineered sociocultural and social-economical intention to prepare the next generation for engagement that may lead to socially responsive and humanistically sound action for sustainable human community? In this paper, what curriculum is and does are manifested in this last inquiry.

Higher education curriculum might be a cultural and systematic human capacity to bring opportunities to do the following:

- present and reinforce the disciplinary knowledge, skills, and dispositions believed to be the best representation of the needs of the current human society (cultural transmissionism/behaviorism);
- discover (i.e., construct, de-construct, re-construct, newly construct) new sets of human knowledge for both individual and collective (social constructivism);
- present and make clear historically/culturally/tentatively established core knowledge and values (cultural transmissionism);
- learn about and appreciate those with different ideas who have succeeded in human society (intertwined with cultural transmissionism and social constructivism);
- address and extend the knowledge, skills, and dispositions inherent in each human being (hereditarianism/individualism);
- learn and appreciate the value of a well-rounded life (intertwined with cultural transmissionism and hereditarianism/individualism);
- realize and illustrate humankind collectively promoting social progress (social constructivism);

- transgress disciplinary boundaries and integrate different disciplinary perspectives, simultaneously deepening the existing disciplinary knowledge for problem solving (social constructivism);
- expose and overlap the awareness and ability of each learner to question critically what is in light of what might be (intertwined with social constructivism and hereditarianism/individualism); and
- realize and illustrate how individuals can come together to promote the social good (intertwined with social constructivism and hereditarianism/individualism).

With the manifestation of what curriculum is as listed above, one might see what curriculum does, supposedly, in the following:

- prepare learners for what their culture and society needs currently (social efficiency, cultural transmissionism);
- introduce learners to the best their culture and society have to offer (cultural transmissionism);
- enable learners to become leaders in tomorrow's world and its transformation (cultural transmissionism and social-constructivism);
- enable learners to become all that they possibly can become (learner-centered, hereditarianism/individualism);
- enable learners to realize and appreciate a good life (cultural transmissionism);
- enable learners to become the best citizens possible (intertwined with cultural transmissionism and social constructivism);
- prepare learners to shape and control their own world (social meliorism, individualism); and
- enable learners to thrive and contribute to a pluralistic society (individualism and social constructivism) (Hyun, 2006a).

With regard to the various aspects of what curriculum is and does, one of the issues related to academic affairs in higher education might be whether current university curriculum has the capacity to prepare the next generation for socially and globally responsive and humanistically meaningful engagement. Such engagement aims at building an ecologically sound and borderless human community, which is also beyond the artificial boundary of monodisciplinary skills, knowledge, and dispositions.

Reductionist Artifact of Higher Education Curriculum and Its Innate Challenges

Science is basically a cognitive facility for the purpose of explaining the development of natural things, including human beings. Traditionally, science and scientific explanations have been based on principles relating to natural things, which Aristotle (384-322 BCE) viewed as universal and unchangeable, thus "truth." In his view human beings are capable of capturing evidence of the first principles of natural things through contemplation—thus conceptually—which ancient Greeks called *theoria*. Theory originally denoted knowledge about self-evident principles on which scientific demonstration is based; however, they are viewed as useless in everyday life (not to mention theory is still an interpretation of humans' way of knowing based on contemplated observation, which is another cultural artifact of the time the individual spends on a topic, or *épistémè*). In human life, people need skills to work (action, *praxis*) and to produce (production, *poïesis*), and they need the disposition (deliberation, *phronēsis*) that would allow

them deliberately to make culturally congruent, good, healthy, and ethical choices. A scientific discipline is based on a dissociation of knowledge from the various aspects of practical life knowledge that is organically grounded in natural and social-ecological phenomena. Knowledge from traditionally defined scientific disciplines more than often represent a fragmented, compartmentalized, monodisciplinary, and mostly quantified paradigm, which leads to “blind spots” in humans’ way of knowing. Thus, artificial boundaries with blind spots inevitably result among the monodisciplines when we attempt to apply discipline-specific knowledge to a complex task of real-life problem solving (e.g., the BP oil disaster in the Gulf of Mexico in 2010).

Influenced by Western ideology, the academic unit at the university, historically responsible for the organization of its curriculum, was based on ideas of Aristotle and Descartes, who hypothesized the world view from an isomorphic, reductionist perspective (see endnote 2) that disregarded the ongoing organic process of interaction. Their view resulted in the overspecialization and fragmentation of overall academic affairs that engendered the territorial way of thinking and ultimately led to the formation of academic departments.

Nicolescu (2002) stated that this isomorphic, reductionist perspective derived from the three axioms of classic Cartesian logic: the axiom of identity (A is A, physics is physics); the axiom of noncontradiction (A is not non-A, physics is not non-physics); and the axiom of the excluded middle, which states that there exists no third possibility at all other than A and non-A (A excludes the middle interaction between A and non-A, both physics and not physics) (Montuori, 2008; Nicolescu, 2002, 2008). Therefore, what remains is the fundamental risk of pondering in a limited fashion what lies between A and non-A, between “physics” and “biology,” or between “physics” and “psychology” in real life. This departmental specialization has been emphasized (e.g., Wilshire, 1990) as part of the academic capacity of the modern university, where junior faculty members are advised to remain “pure,” not “polluted” by the perspectives of other disciplines, and to reject interdisciplinary engagements. Consequently, borderless transdisciplinary collaboration among faculty members from various disciplines in pursuit of a real life-based inquiry may not have been under deliberate consideration.

In addition, the dualism of binary pairs, for example, subject vs. object, matter vs. consciousness, simplicity vs. complexity, diversity vs. unity, has signified the history of human epistemology for millennia. It has perpetually and fundamentally limited human education and ways of knowing. The dualism of binary pairs, which usually excludes the middle intersection, has also been segmental and fragmented with limited capacity for understanding the complex, uncertain, and pluralistic human, social, and natural phenomena, all of which are organically interconnected and interdependent in real-life phenomena. This traditional dualism has led to artificial boundaries separating the real-life matters from discipline-specific research inquiries (as the “appropriate” approach), limiting the articulation of complex real life-based examination for real problem solving (Nicolescu, 2002), which would be more meaningful to an ever globalized and complex human society. Because of the dualism of binary pairs in many cases, cultural transmissionistic approaches to curriculum articulation, delivery, and its instruction-oriented engagements, not pedagogy-based approaches, (Hyun, 2006b) have been dominated in education throughout the K-16 educational system and beyond. In addition because of the artificial boundaries in disciplinary thinking reflected through school curricula that are nonnatural instead of real-life oriented, many children and youth with nonbinary epistemological aptitudes have already lost meaningful learning experiences and have dropped out of school, giving up their

basic human rights to learn to live, long before they could discover their potential to contribute to society.

ACADEMIC DEPARTMENT

The Academic Department: A Complicated Cultural Artifact

The world has problems, but universities have departments (Brewer, 1999).

The pursuit of research within university departments has given rise to the ongoing specialization of disciplines and thematic fields with fuzzy, somewhat arbitrary, shifting boundaries. The high degree of compartmentalization of scientific knowledge is due to two interacting factors. Institutional structures and incentives in academia result in an “ethnocentrism of disciplines” (Campbell, 1969).

At the same time the concepts, theories, and methods used in basic research are becoming ever more sophisticated. (Campbell, 1969; Hadorn et al., 2008, p. 4)

Human beings both intentionally and unintentionally form groups and subgroups, which are sometimes mutually cooperative or disputatious (or even combative) (Nicolescu, 2002). Discipline is traditionally rooted in the early conception of “science”; refers to subject area, field of study, bailiwick, or area of specialized knowledge; and is usually represented by different groups of academic departments (e.g., biology, physics, sociology, psychology, accounting, education, law). Through artificially divided academic departments and their own individual departmental curriculum structure, universities continuously educate new generations and produce the workforce. As a result, college graduates are knowledgeable in their own discipline, but in many cases, they are limited in understanding, applying, and connecting that disciplinary knowledge with other disciplinary knowledge in real life problem-solving tasks (e.g., we cannot solve the global issue of limited water supply by depending on a single discipline or fragmented disciplines). They can speak to one another, but they do not have the language to communicate fully to understand the problem at hand in not only a reactive manner (“interventionist”) but also, more importantly, in a proactive and preventive fashion for sustainability. Globally, the demand is great for a new workforce whose members hold sophisticated disciplinary knowledge along with the ability to transgress disciplinary thinking and practice in real-life situations to advance humanity in a proactive manner. What is the university’s fundamental responsibility to reduce or ultimately eradicate this limitation for current and subsequent generations?

Disciplines shape scientific engagement by forming the primary institutional units in academia, on which the internal differentiation of science into specialized curricular, professions and research activities is based. Through discipline-specific socialization and its systems, members of a discipline are identified as specialists who build and participate in a scientific community with a discipline-specific “monoepistemology” and thus exclusive cognition and language. Through their discipline-specific monocommunity, members communicate and share basic assumptions and examples about problems, standards for reliable and valid methods considered as “good” or “appropriate” means to the solution of a problem. Today, boundaries that separate disciplines are constantly shifting both because of increasing specialization through internal differentiation within the discipline and because of the integration of disciplines, including the social sciences (e.g., from physics, biology, chemistry, mathematics, psychology, sociology, and law *to* biomedical engineering, biochemistry, green chemistry, environmental

science, environmental education, science education, mathematics education, business accounting, international business management, school counseling, family counseling, counseling and school psychology, public policy). Occasionally migration and collaboration by faculty from different disciplines, which have taken place as interdisciplinary engagement in research activities, have changed the university's traditional landscape of disciplines through the transformation of existing disciplines and the emergence of new ones (e.g., American Studies, Asian American Studies) (Brewer, 1999). One academic department at UMass Boston—Environment, Earth and Ocean Sciences (EEOS) in the College of Science and Mathematics—is composed of faculty from biology, chemistry, oceanography, public policy, law, management, economics, engineering, political science and international relations, global governance, ecology, medical geology, bioinorganic chemistry, serology, geographic computer information science, environmental science education, and many more. The faculty members in this department constitute a transdisciplinary academic unit on campus. Like a single academic department, they work with other faculty members from different departments in the College of Education and Human Development, College of Management, Graduate School of Public Policy Studies, and College of Liberal Arts. They have recently created a new joint transdisciplinary Ph.D. program in Global Governance and Human Security with the Graduate School of Public Policy Studies, College of Management, and College of Liberal Arts.

Derived from the binary worldview, the gap between natural/technical sciences and the humanities/social sciences, has been the fundamental root of the fragmentation of the modern university's departmental organization, curriculum, and disciplinary thinking as well as research methodology (both inquiry and research methods). As a result, it has brought a deep and critical continuation of fragmented human epistemology, limiting ways of realizing, understanding, problematizing, and approaching the challenging and complex problems in contemporary society. Many transdisciplinary researchers (e.g., Darbellay, Cockell, Billotte, & Waldvogel, 2008; Nicolescu, 2002, 2008) have argued that “super monodiscipline-specific specialization” in the natural sciences is a direct consequence of the reductionist approach to research, influenced by the division of labor that prevails in all human endeavors, where it supposedly increases the capacity of human understanding, thus productivity and efficiency; but in reality, it has not. Furthermore, specialization has been institutionalized through the higher education curriculum by excessive departmentalization. It allows an institution perpetual convenience that is “manageable,” “easy to control”: a “clearer” or “clear-cut” or “linear” conceptual framework for evaluation of the individual faculty members' performance for tenure and promotion, an easier attribution of resources, and straightforward professional and public recognition. Faculty structures, academic organizations, special meetings, conferences, and publication vehicles have all followed the same path, resulting in a crippled 21st-century scientific world that is monodiscipline-oriented, specialized, and unfortunately uncommunicative to the human community (Darbellay et al., 2008, xxi). In that regard, university personnel have a serious ethical obligation to interest themselves in borderless transdisciplinary and transcultural connections and to engage in curriculum, teaching, research inquiry, and methodological transformation in a transgressive mode, which will produce the organic clues needed to solve the complex problems of contemporary society and beyond (e.g., Ernst, 2008). And that is one of the fundamental responsibilities of the modern university and its curriculum transformation.

CURRICULUM TRANSFORMATION

Toward a Curriculum with a Transdisciplinary Orientation

As a result of globalization, emergent problems of human society have become increasingly complex, interconnected, and interdependent in nonlinear modes. For example, Kenyans' community health issues result not from their diet but from deeply rooted colonialism and globalization; the BP oil disaster in the Gulf of Mexico forced Louisiana's Cajun population to relocate, resulting in ecological, cultural, economical, social, and historical displacement. These kinds of problems are neither confined to particular sectors or disciplines nor easily predictable. Human beings face nonlinear dynamics, uncertainties, and high geopolitical stakes in decision making coupled with ethical dilemmas and their complexity. As legitimized social agencies, higher education institutions have a major role to play in preparing the kind of well-educated, critical, knowledgeable, and flexible workforce necessary to the contemporary and futuristic economic, social, transnational, and transcultural endeavors in the complex global human society. In the 1970s and again in the 1990s, the focus was on challenging the unrealistic and ineffective higher education curriculum that lacks full integration of disciplines necessary to understand and solve real complex human problems. Researchers have discussed how the mono- or inter-/multidisciplinary curriculum has led to limited capacities in preparing new workforces to deal with multiple layers of complex human problems in the current transnational and transcultural human society. Higher education curriculum clearly reveals a need to transform beyond the single/monodisciplinary, transgressing disciplinary boundaries and leading toward transdisciplinary, borderless engagement (e.g., Hadorn, Bradley, Pohl, Rist, & Wisemann, 2006; Hammer & Söderqvist, 2001; Klein, 2004; Lawrence, 2004; McWilliam, Hearn, & Haseman, 2008; Nicolescu, 1996, 1997; Ramadier, 2004; Wickson, Carew, & Russell, 2006). Historically, discourse on change in higher education curriculum has moved from the single/monodiscipline specific to the interdisciplinary and/or multidisciplinary and transdisciplinary that reflect the new emerging understanding of complex social ecology of the changing human world. See Table 1 (Appendix), which briefly illustrates conceptual comparisons among different disciplinaryities.

The term transdisciplinarity was introduced by Jean Piaget (1970) in his awareness and acknowledgement of and thus attempts to understand the current world with an imperative overarching unity of knowledge. Transdisciplinarity is a principle for unity of knowledge beyond disciplines, and its approach implies full interaction between, among, and beyond disciplines from a real-life problem-based perspective. Transdisciplinary vision is also transcultural and transnational, encompassing ethics, spirituality, and creativity. Infusion of transdisciplinarity into the curriculum requires the following: (a) single disciplinary scientific knowledge to be deepened by the individual; at the same time the knowledge needs to be deconstructed and reconstructed in relationship with other disciplines in order for knowledge of complexity to be contextualized, practically reflecting on the organic reality of human living and its phenomena; and (b) borderless concepts to be generated collectively among the disciplines to play the role of "linking operators." To this end a curriculum with a transdisciplinary orientation demands a politics of academic civility in the context of discourse among faculty from various disciplines (Hammer & Söderqvist, 2001; Klein, 2004). More importantly, it also requires top administrative-level support to promote this type of transgressive borderless discourse on the campus.

Individuals oriented toward the transdisciplinarity attempt to overcome the artificial boundaries among disciplines, and thus they have a capacity of prevailing over the mismatch between knowledge production in academia and in real-life problems: They are receptive to the demand for knowledge to solve societal problems. Addressing societal demands for knowledge by educating people (e.g., college students, the new workforce for human society), designing research methods, and restructuring academic organizations in a transdisciplinary mode have several major implications: Perpetual borderless engagement by transgressing boundaries between different academic cultures, such as between humanities and the natural science, becomes necessary. Furthermore, faculty members and researchers must step into problem fields and engage in mutual learning with people in the real-life world of the human community. In doing so, single disciplinary standards of knowledge production are forfeited or less emphasized and re-articulated interdependently and interconnected in relationship to various other disciplinary thinking and knowledge. Therefore, developing a state of the art for transdisciplinary forms of academic systems, organizations, curriculum, teaching, learning, and research is necessary. This could be best done by learning from experiences in the real world context (Hadorn et al, 2008) with, for, and in the human communities and which has to be one of the main features of higher education and its transformative direction. The ivory tower is no longer a single prestigious artifact of human affairs; instead it is a deliberate human artifact for human society in and with its community.

The transdisciplinary approach is not a new stand-alone discipline or subdiscipline. It is instead the science and art of discovering bridges, interconnectedness, and interdependence among different areas of knowledge (hard, social, and applied sciences). It concerns possibilities in the natural and social ecology of human living in a socially responsible way to respond to and deal with emergent human and natural problems. The fundamental task is elaboration of new language, logic, and concepts to permit genuine dialogue in order to construct a new epistemic culture and its reflective structure for the sustainable and organic. Thus, the transdisciplinary approach entails socially responsible human engagement. This kind of human commitment must be well established, both inherently and pervasively in any form of human learning. The university, a contemporary cultural artifact, bears the fundamental responsibility of carrying out this particular expectation. For that matter, academic affairs at higher education institutions must be reexamined with regard to the infrastructure supporting faculty hiring, tenure and promotion, various faculty reward systems, and overall academic culture to build or strengthen the transdisciplinary scholarship of discovery, curriculum transformation, teaching, application, implementation, and engagements as well as the culture of faculty socialization, starting at the departmental level. Institutions must have an inherent capacity for members to transgress disciplinary boundaries for continuous growth.

Always coincident with transdisciplinary methodology, the transdisciplinary curriculum experience is about learning, inquiring, researching, realizing, and articulating real life-based problems to solve in a transgressive manner. The transdisciplinary approach is usually taken with the explicit intent to solve complex and multidimensional social-ecological problems, such as those involving an interface of humans, their society, and its natural systems (see endnote 3). In terms of higher education curriculum, developing and offering transdisciplinary degree programs that encompass relevant scientific *épistémè* with the human knowledge of the real-life world (i.e., *praxis*, *poïesis*, and *phronēsis*) would be a critically and socially responsive practice. In this regard, academic departmentalization, its fragmentary structures, and curricula are mostly based on the traditional *mono-épistémè*, which should be challenged. Consequentially,

transdisciplinary-oriented curriculum and its approaches are to reengage *épistémè*, that is, to engage in the knowledge of the real world with *praxis* (action), *poïesis* (production), and *phronēsis* (deliberation) (Nicolescu, 2007).

In learning, teaching, and research, those who understand and value transdisciplinarity and have been successfully involved in transdisciplinary engagements (a) grasp the complexity of problems and phenomena, (b) take into account the diversity of scientific and societal views of problems and phenomena, (c) link abstract and real-life case-specific knowledge, and (d) constitute knowledge with a focus on problem solving for what is perceived to be the common good. To these ends, the transdisciplinary approach promotes acts of human agency, such as collaboration among scientists, as essential for scientific progress and for the sake of societal benefit (e.g., Bacon, 2000); and this particular practice reflects systems thinking (see endnote 4).

Infusion of Transdisciplinary Research into the Curriculum

Contemporary global-transcultural human ecology and its epistemology have inspired the realization that most emerging social and ecological problems are complex and extensively interconnected. Thus, it is uncertain that we really know what we need to know to understand such problems fully, how to develop approaches needed to solve them, how and why they may interconnect with other issues, and what and how to project and prevent the future possibility of the reoccurrence of the same and similar problems as well as new ones. In this context, the development of a sophisticated and knowledgeable workforce is critical, and the call for individuals with transdisciplinary knowledge, skills, and critical and creative minds is essential. As a complex cultural artifact, the university, which bears the most responsibility for producing that knowing and sophisticated workforce in the current human society, must undergo changes in its curriculum and research capacities. More critically, intertwined with systems thinking, the transformative curriculum in higher education should include a transdisciplinary research component in its pedagogical approach, characterized, for example, by the following:

- systems knowledge (*épistémè*), that is, questions about empirical processes, which have clarified current emerging problems and might influence the future development of a solution (e.g., What are the consequences of the 2010 Haitian earthquake for the natural environment?);
- target knowledge (*praxis*, *poïesis*), that is, questions about values and norms that are contextually acceptable as a basis for determining the proper goals of the problem-solving process (e.g., How can communities recover from traumatic experiences and/or transnational displacement and large-scale loss occasioned by natural disasters, such as war, political upheavals, discriminatory practices, disruptions in basic services, corporate malfeasance, economic setbacks, family crises? In addition, how can a university like UMass Boston—with its long historical engagement with Haiti and the Haitian American community in Boston and emerging understanding of transdisciplinary curriculum and research emphasis—facilitate the recovery process of Haiti’s clean/safe water reservation and management with a transdisciplinary team of faculty members (and students) whose research activities have been in, for, and with the community?); and
- transformational knowledge (*phronēsis*), that is, questions about whether and how a given situation can actually be transformed and improved in various contexts (e.g., How can the international community construct an effective system of global

governance to achieve the UN's millennium development goal of reducing by one half the number of people without access to clean and safe water by the year 2015? How was Boston impacted by and how did the city respond to the Haitian earthquake of 2010? How is Boston expanding its transnational status? How is UMass Boston expanding its transnational status with the global and urban communities?) (see endnote 5).

For the common good and a greater demand for equity than utility as the basic justifying principle of societal institutions, transdisciplinary research addresses demands for transnational knowledge as it relates to problem solving in complex societal situations, including political justice on the one hand and both collective and individual well-being on the other (Lawrence, 2004; Nicolescu, 2007). Transdisciplinarity is a principle that promotes the unity of knowledge beyond disciplines and an integrative form of research that comprises a family of methods for relating traditional scientific knowledge (positivistic paradigm), constructivistic social science, and nontraditional scientific experience and practice in problem solving. With this understanding, transdisciplinary research addresses issues of the real world, not issues of origin and relevance only in positivistic scientific debate.

By infusing transdisciplinary research approaches into the teaching and learning process, transdisciplinary curriculum in higher education will bring opportunities to realize and illustrate humankind collectively promoting social progress in borderless human engagement and to expose and overlap the awareness and ability of each learner to question critically what is in light of what might be. Thus, the curriculum has a capacity to enable individuals to become citizens of a borderless world so that they can (a) articulate complex human problems intertwined with nature and human ecology, (b) engage in collectively responsive problem solving, (c) develop new knowledge that is transnational and transcultural as well as transgresses disciplinary boundaries, and (d) enable individuals to thrive and contribute to a pluralistic society.

Academic affairs at higher education institutions should have both internal capacities (via curriculum and faculty) and organizational capacities (e.g., nondepartmentalized structure of academic affairs) to address these kinds of research questions in a transdisciplinary way, in which the complexity of problems is freely examined and the diversity of real-world and scientific perceptions of those problems, meaningfully, adequately, and collectively addressed, are taken into account. Thus, abstract knowledge and real case-specific knowledge are linked, and that knowledge and practice are developed, promoting what is perceived to be the common good that elevates equity over utility (Hadorn et al. 2008).

Transdisciplinary research engagement is not an easy task: It can emerge only if the participating individuals are willing to interact in an open dialogue with civility and fluency in multiple perspective taking (one of the most complex and challenging metacognitive functions), accepting each perspective as equally important and relating the various perspectives to one another. A group of faculty members from different disciplines working collaboratively and borderlessly in a transdisciplinary mode will find such a task difficult because participating faculty (scholars and scientists) can be easily overwhelmed by the amount of information in everyday practice and because of incommensurability of specialized languages in each of the fields of expertise. Therefore, losing the emerging momentum of transdisciplinary engagements among faculty is always a risk. Maintaining engagement in transdisciplinary research and curriculum practice, which will lead to sound institutional academic affairs, requires individuals' (at least a faculty-moderator's) ability to exercise multiple perspective taking coupled with moderation, mediation, association, and conveyance in order to promote constructive and

sustainable dialogue. A key element of successful transdisciplinary discourse in academic affairs is the in-depth knowledge of one's own discipline and of the various disciplines involved, more importantly knowledge of how one's own discipline is, can, or should be connected with other disciplinary thinking to understand and solve real-life problems.

CONCLUSION

As a result of uncontrollable transnational globalization, ever increasing numbers of natural disasters worldwide, and the awakening realization of real-life problems that are complex, deeply interconnected, and interdependent in multidimensional modes, the emergence of the transdisciplinary orientation has been one the most recent steps in higher education curriculum discourse and research activities. It signifies that exploring and promoting the transdisciplinary approach is part of the contemporary university's social responsibility for humanity (Hadorn et al., 2008). How does the university, as a contemporary cultural artifact, evolve and simultaneously revolutionize human society and its history? What medium does the university use to act on this responsibility? As a cultural artifact of the historical period, curriculum is the medium, representing its demands and needs. In the transformative curriculum work of higher education, faculty members must engage in borderless transdisciplinary interaction to construct a collective and coherent understanding of disciplinary interconnectedness and interdependency, which will serve as the foundation for teaching, research, and engagement. At the same time, personnel at the top administrative level in academic affairs must acknowledge, support, and create a "safe zone," where faculty members can engage in the transdisciplinary, borderless transformation of the curriculum.

As indicated above, university curriculum is viewed as a condition or capacity of academic affairs, representing collective epistemology, geopolitical agenda, or politically engineered sociocultural and socioeconomical intention to prepare the next generation to engage in work that may lead to socially responsive and humanistically sound action for sustainable human community. Higher education curriculum is a complicated cultural artifact that reflects emergent epistemologies, intents, interests, and values driven by history, geopolitical ideology, nationalism, globalization, transnationalism, and national social engineering. The contemporary phenomenon of transdisciplinary curriculum discourse in higher education is inevitably and paradoxically influenced by industry-driven globalization; thus, it could be a reactive cultural artifact. It is, however, also a socially responsive transformative movement that deserves our collective attention. And that attention is overdue.

REFERENCES

- Aristotle, *Physica*. Trans. R. P. Hardie & R. K. Gaye. Oxford, UK: Clarendon Press, 1930.
- Bacon, F. (2000). *The new organon*. Cambridge, UK: Cambridge University Press.
- Banks, J. (1994). *Multiethnic education: Theory and practice*. Boston, MA: Allyn & Bacon.
- Bennett, W. (1984). *To reclaim a legacy: A report on the humanities in higher education*. Washington, DC: National Endowment for the Humanities.
- Bennett, W. (1995). *Book of virtues: A collection of moral stories*. New York, NY: Simon and Schuster.
- Bennett, W. (1997). *The James Madison Elementary School: A curriculum for American students*. Washington, DC: U.S. Government Printing Office.

- Brewer, G. D. (1999). The challenges of interdisciplinarity. *Policy Sciences*, 32, 327-337.
- Campbell, D. T. (1969). Ethnocentrism of disciplines and the fish-scale model of omniscience. In M. Sherif and C. W. Sherif (eds), *Interdisciplinary relationships in the social science* (pp. 328-348). Chicago, IL: Aldine.
- Cheney, L. (1989). *50 hours: A core curriculum for college students*. Washington, DC: National Endowment for the Humanities.
- Conceptualizing the Master's Degree. (2005). *ASHE Higher Education Report*, 31(4), 1-137.
- Costanza, R. (2003). A vision of the future of science: reintegrating the study of humans and the reset of nature. *Future*, 35, 651-671.
- Darbellay, F., Cockell, M., Billotte, J., & Waldvogel, F. (Eds.). (2008). *A vision of transdisciplinarity: Laying foundations for a world knowledge dialogue*. Boca Raton, FL: Taylor and Francis Group.
- Dewey, J. (1938a). *Experience and education*. New York, NY: Collier/Macmillan.
- Dewey, J. (1938b). *Logic: The theory of inquiry*. New York, NY: Holt.
- deWit, H. (2002). *Internationalization of higher education in the U.S.A and Europe: A historical, comparative, and conceptual analysis*. Westport, CT: Greenwood Press.
- Ernst, R. (2008). Societal responsibility of universities: Wisdom and foresight leading to a better world. In F. Darbellay, M. Cockel, J. Billotte, & F. Waldvogel (Eds.), *A vision of transdisciplinarity: Laying foundations for a world knowledge dialogue* (pp. 121-136), Boca Raton, FL: Taylor and Francis Group.
- Goodlad, J. (1966). *The development of a conceptual system for dealing with problems of curriculum and instruction*. Washington, DC: Cooperative Research Program, U.S. Office of Education. ERIC ED 010064.
- Grant, C. (Ed.). (1992). *Research and multicultural education: From the margins to the mainstream*. Bristol, PA: Falmer.
- Greene, M. (1978). *Landscapes of learning*. New York, NY: Teachers College Press.
- Greene, M. (1995). *Releasing the imagination: Essays on education, the arts, and social change*. New York, NY: Teachers College Press.
- Hadorn, H. G., Bradley, D., Pohl, C., Rist, S., & Wisemann, R. (2006). Implications of transdisciplinarity for sustainability research. *Ecological Economics*, 60, 119-128.
- Hadorn, H.G., Hoffmann-Riem, H., Bibger-Klemm, S., Grossenbacher-Mansuy, W., Joye, D., Pohl, C., Weismann, U., & Semp, E. (Eds.). (2008). *Handbook of transdisciplinary research*. Zurich, Switzerland: Springer
- Hammer, M., & Söderqvist, T. (2001). Enhancing transdisciplinary dialogue in curricula development. *Ecological Economics*, 38, 1-5.
- Hirsch, E. D., Jr. (1987). *Cultural literacy*. Boston, MA: Houghton Mifflin.
- Hyun, E. (1998). *Making sense of developmentally and culturally appropriate practice (DCAP) in early childhood education*. New York, NY: Lang.
- Hyun, E. (2006a) *Teachable Moments: Re-conceptualizing Curricula Understandings*. New York, NY: Lang.
- Hyun, E. (2006b). Transforming instruction into pedagogy in negotiation-oriented curriculum practice. *Journal of Curriculum and Pedagogy*, 3(1), 136-164.
- Hyun, E. (2009). A study of US Academic deans' involvement in college students' academic success. *International Studies in Educational Administration*, 37(2), 89-110.
- Hyun, E. (2010). Carnegie unit. In C. Kridel (Ed.), *Encyclopedia of Curriculum Studies* (Vol. 1, pp. 102-103). Thousand Oaks, CA: SAGE.

- Hyun, E., Kretovics, M., & Crowe, A. (2006). Curriculum characteristics of time-compressed course in a U.S. higher education institution. *Educational Research and Review, 1*(2), 29-33.
- Jantsch, R. (1972). Toward interdisciplinarity and transdisciplinarity in education and innovation. In Centre for Educational Research and Innovation (CERI) (Eds.), *Interdisciplinarity: Problems of teaching and research in universities* (pp. 97-212). Nice, France: OCED.
- Johnson, M. (1967). Definitions and models in curriculum theory. *Educational Theory, 17*, 127–140.
- Johnson, M. (1977). *Intentionality in education*. Albany, NY: Center for Curriculum Research and Services.
- Kincheloe, J., Slattery, P., & Steinberg, S. (2000). *Contextualizing teaching*. New York, NY: Longman.
- Klein, J. T. (2004). Prospects for transdisciplinarity. *Future, 26*, 515-526.
- Klein, J., Grossenbacher-Mansuy, W., Häberli, R., Bill, A., Scholz, R., & Welti, M. (Eds). (2001). *Transdisciplinarity: Joint problem solving among science, technology, and society: An effective way for managing complexity*. Basel, Switzerland: Birkhäuser.
- Kötter, R., & Balsiger, P. W. (1999). Interdisciplinarity and transdisciplinarity: A constant challenge to the sciences. *Issues in Integrative Studies, 17*, 87-120.
- Lawrence, R. J. (2004). Housing and health: From interdisciplinary principles to transdisciplinary research and practice. *Futures, 36*, 487–502.
- Liberal arts colleges and liberal arts education. (2005). *ASHE Higher Education Report, 31*(3), 1-148.
- Lucas, C. J. (1994). *American higher education: A history*. New York, NY: St. Martin's Press.
- Max-Neef, M. (2005). Commentary: Foundation of transdisciplinarity. *Ecological Economics, 53*, 5-16.
- McWilliam, E., Hearn, G., & Haseman, B. (2008). Transdisciplinarity for creative futures: What barriers and opportunities? *Innovations in Education and Teaching International, 45*(3), 247-253.
- Miraglia, E., Law, R., & Collins, P. (1999). *What is culture?* Retrieved from <http://www.wsu.edu:8001/vcwsu/commons/topics/culture/culture-index.html>
- Montuori, A. (2008). Foreword: Transdisciplinarity. In B. Nicolescu (Ed.), *Transdisciplinarity: Theory and practice* (pp. ix-xvii). Cresskill, NJ: Hampton Press.
- Nicolescu, B. (1996). *La Transdisciplinarité, Manifeste [Manifesto of transdisciplinarity]*. Paris, France: Le Rocher.
- Nicolescu, B. (1997). Project CIRET-UNESCO: Evolution transdisciplinaire de l'Université, Bulletin interactif du CIRTE 9/10.
- Nicolescu, B. (2002). *Manifesto of transdisciplinarity*. Albany, NY: SUNY Press.
- Nicolescu, B. (2007). *Transdisciplinarity and the unity of knowledge: Beyond the science and religion dialogue*. Retrieved from <http://www.metanexus.net/magazine/tabid/68/id/10013/Default.aspx>
- Nicolescu, B. (Ed.). (2008). *Transdisciplinarity: Theory and practice*. Cresskill, NJ: Hampton Press.
- Noddings, N. (1992). *The challenge to care: An alternative approach to education*. New York, NY: Teachers College Press.

- Noddings, N. (1995a, January). A morally defensible mission for schools in the 21st century. *Phi Delta Kappan*, 76(5), 365–368.
- Noddings, N. (1995b). *Philosophy of education*. Boulder, CO: Westview.
- Noddings, N. (1995c, May). Teaching themes of care. *Phi Delta Kappan*, 76(9), 675–679.
- Piaget, J. (1970). L'épistémologie des relations interdisciplinaires. In *L'interdisciplinarité: Problèmes d'enseignement et de recherche dans les universités*. Proceedings of a workshop, Nice, France.
- Pinar, W., & Grumet, M. (1976). *Toward a poor curriculum*. Dubuque, IA: Kendall/Hunt.
- Pinar, W., Reynolds, W., Slattery, P., & Taubman, P. (1995). *Understanding curriculum: An introduction to the study of historical and contemporary curriculum discourses*. New York, NY: Lang.
- Pohl, C. (2005). Transdisciplinary collaboration in environmental research. *Futures*, 37, 1159–1178.
- Ramadier, T. (2004). Transdisciplinarity and its challenges: The case of urban studies. *Futures*, 36, 423–439.
- Rudolph, F. (1977). *Curriculum: A history of the American undergraduate course of study since 1636*. San Francisco, CA: Jossey-Bass.
- Seymour, D. (1988). *Developing academic programs: The climate for innovation*. ASHE-ERIC Higher Education Report, No. 3. Washington, DC: Association for the Study of Higher Education.
- Slattery, P. (1995). *Curriculum development in the postmodern era*. New York, NY: Garland.
- Sleeter, C., & Grant, C. (1994). *Making choice for multicultural education: Five approaches to race, class, gender* (2nd ed.). New York, NY: Macmillan.
- Sleeter, C., & Grant, C. (1999). *Making choices for multicultural education: Five approaches to race, class, and gender* (3rd ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.
- Stark, J. S., & Lattuca, L. R. (1997). *Shaping the college curriculum: Academic plans in action*. Needham Heights, MA: Allyn & Bacon.
- Stichweh, R. (1992). The sociology of scientific disciplines: On the genesis and stability of the disciplinary structure of modern science, *Sci Context*, 5, 3-15.
- Transforming the Curriculum. (2002). *ASHE-ERIC Higher Education Report*, 29(3), 1-101.
- Tyler, R. (1949). *Basic principles of curriculum and instruction*. Chicago, IL: University of Chicago Press.
- U. S. Department of Education (2006). *The test of leadership: Charting the future of U. S. higher education*. A report of commission appointed by Secretary of Education Margaret Spellings. Washington, DC: Author.
- U.S.National Academics (2004). *Facilitating interdisciplinary research*. Washington, DC: Committee on Facilitating Interdisciplinary Research, National Academy of Sciences, National Academy of Engineering, & Institute of Medicine.
- Wickson, F., Carew, A., & Russell, A. (2006). Transdisciplinary research: Characteristics, quandaries, and quality. *Futures*, 38, 1046-1059.
- Wilshire, B. (1990). *The moral collapse of the university: Professionalism, purity, and alienation*. New York, NY: SUNY Press.

ENDNOTES

1. This note briefly traces the history of higher education curriculum as a cultural artifact. The university and its curriculum represented geopolitically oriented “regionalism” in Europe during the 15th and 16th-centuries, when wandering scholars or students pursued learning to investigate and study other religions, cultures, and language in a null-structured study-abroad mode. Curriculum experience more likely started as incidental and individual academic affairs. During the 16th through 19th centuries the phenomenon of incidental and individual academic affairs continued (e.g., the Grand Tour, the student flow from global south to global north). Postmedieval European higher education provided the foundation of modern U.S. higher education during the colonial period (Lucas, 1994). Before WWII (1939-1945) and immediately afterward, curriculum and internationalization at higher education institutions became more structured into single discipline-specific departmental-level academic activities, projects, and programs that were driven by the geopolitical ideology coupled with nationalism. In the 20th century, especially influenced by the Cold War, internationalization of higher education was one of the main emphases driven by a serious geopolitical social engineering and best described as academic colonialism and academic imperialism. In addition during the 20th century, culturally distinctive phenomena emerged in higher education affairs, such as (a) the move from aid to trade (de Wit, 2002); (b) the development of European programs for research and development and for student exchange to increase educational mobility (e.g., SOCRATES, LEONARD; the Bologna Process announced in 1999, which is a European reform process aiming at establishing a European Higher Education Area by 2010 in response to globalization and employability); (c) the development of transnational education, transdisciplinary curriculum discourse, and transdisciplinary research methodology (Hammer & Söderqvist, 2001; Hadorn et al., 2006; Klein, 2004; Lawrence, 2004; McWilliam et al., 2008; Nicolescu, 1996, 1997; Ramadier, 2004; Wickson et al., 2006; and (d) the presence of internationalization in the universities’ mission statements, policy documents, and strategic plans in responding to the employability (e.g., Hyun, 2009) influenced by globalization (de Wit, 2002). During the 20th century, numerous semistrategic approaches and operational concepts emerged with regard to the internationalization of higher education, such as expanding academic mobility for students and faculty, building international linkages and partnerships, establishing transnational or transatlantic academic consortia for research and exchange programs for faculty and students, building offshore campuses and recruiting, creating branch campuses or franchises, and implementing various modes of distance learning (e.g., hybrid, web-blended, web-enhanced). In many cases, however, the integration of international, intercultural, transcultural and/or global dimension into the curriculum has basically occurred within the perpetual boundaries of artificial divides (e.g., national borders, majors, single-discipline specifics in teaching and learning, course credits, and required hours), limiting the understanding of the interconnectedness and interdependency of natural and social–ecological phenomena and ignoring the complexity of emerging problems that can be approached only through transdisciplinarity in borderless transnational, transcultural, and transdisciplinary human engagements (Brewer, 1999; Costanza, 2003; Darbellay et al., 2008; Hadorn et al., 2006; Hammer & Söderqvist, 2001; Jantsch, 1972; Klein, 2004; Klein, Grossenbacher-Mansuy, Häberli,

Bill, Scholz, & Welti, 2001; Kötter & Balsiger, 1999; Lawrence, 2004; Max-Neef, 2005; McWilliam et al., 2008; Nicolescu, 2002, 2008; Pohl, 2005; Ramadier, 2004; Wickson et al., 2006).

In the US during the colonial period, most of the early institutions of higher education were founded on the notion of religious (Christian) piety, and university curriculum was a clear reflection of this “Christianity-oriented universal” ideology. Curriculum resembled a warehouse of discipline-specific knowledge to be transmitted, absorbed, and memorized coupled with dualism of worldview (subject vs. object); no analyzing, criticizing, or questioning of the presented knowledge for further improvement occurred (Lucas, 1994). During the period of the American Revolution, dramatic philosophical changes influenced U.S. higher education curriculum, leading to vocationalism and vocational emphasis (Lucas, 1994) but still rooted in single discipline-based curriculum reflecting the dualism of binary pairs.

The Morrill Act of 1862, which established the Land Grant university system, ushered in the inclusion of women and Black students as well as elective curricula and graduate programs. In the 20th century, the goals of U.S. higher education institutions included growth, diversity, and focus on graduate degree programs with research activities, the direct influence of the German university model. At the same time a multiplicity of external aspects from social and political influences forced them to focus on the discipline-specific prescribed curriculum over time (Lucas, 1994). During the post-World War II period U.S. higher education institutions faced mounting government involvement, particularly with regard to the dramatic increases in enrollment brought by the Servicemembers’ Readjustment Act of 1944 (i.e., the GI Bill of Rights) as well as the Civil Rights Movement of the 1960s (Lucas, 1994; Rudolph, 1977). The issues of multiculturalism, education that is multicultural (ETM) (Banks, 1994; Grant, 1992; Sleeter & Grant, 1994, 1999), and “political correctness” influenced U.S. higher education curriculum, which led to the reform of the liberal arts education curriculum component. Diversity was accommodated, but a cluster of/list of courses offered by discipline-specific academic departments prevailed. As in the European context discussed above, public interest in higher education in 21st-century America focused on employability as a result of the influence of globalization; hence college and university curriculum reform, change, and innovation turned to satisfying societal needs (e.g., U. S. Department of Education, 2006).

2. Aristotelian and Cartesian philosophy dichotomized the natural object and the artifact, the object-focused (realist view) and the subject-focused (nominalist view), and the natural/technical sciences and the humanities/social sciences.
3. C.f. the multidisciplinary approach, in general, involves bringing separate theories, skills, dispositions, data, and ideas to bear on a common problem. The interdisciplinary approach involves bringing people from different disciplines and their ideas together to frame a problem jointly, concur on a methodological approach, and analyze data.
4. Systems thinking fundamentally acknowledges the structural complexity in the natural and social sciences and interrelated elements. It also presents various types of systems of scientific knowledge, human-belief systems of cultures, religions, and narratives along with systems that are constructed to realize humans’ desired states. The latter systems are shaped by uniting objectives and means, the parts of which are correlated on the basis of natural causalities and voluntary decisions by individuals. Consequently, human

agency becomes a subject of scientific knowledge: A cooperative act of human agency, the collaborative work of a discipline-borderless faculty, itself transdisciplinary, engenders new scientific knowledge, or *épistémè*, for the benefit of society.

The members of contemporary society have demanded a “better” or deeper understanding of scientific knowledge (*épistémè*) for its potential to provide ethically responsive, collective, and sustainable solutions to concrete issues in the real world (Hadorn et al., 2006; Hammer & Söderqvist, 2001; Nicolescu, 2007). This demand should function as a driving force in the systems thinking for transgressing traditional disciplinary boundaries and integrating various disciplinary perspectives in a borderless mode—

transdisciplinarity—that surpasses interdisciplinarity, which focuses primarily on a research methodological connection (see table 1) (Hadorn et al., 2008; Stichweh, 1992).

According to U.S. National Academics (2004), interdisciplinary research is conducted by teams of individuals who integrate information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond of the scope of a single discipline or area of research practice. Scholars who contest the need for transdisciplinary research practices and the transformation of higher education curriculum (e.g., Hadorn et al., 2008; Jantsch, 1972; Klein, 2004) have, however, claimed that transdisciplinarity is primarily a form of engagement that addresses and reflects issues in the real world. Transdisciplinarity is a theoretical unit of human knowledge that responds adequately to the demands for knowledge to solve problems in the real world (Max-Neef, 2005). It promotes the synchronization of all natural and social sciences in education and an innovative system based on a generalized axiomatic real world and its emerging epistemological (“synepistemic”) pattern (Hadorn et al., 2008; Jantsch, 1972). Thus, transdisciplinarity reflects systems thinking, and transdisciplinary engagement is more than a methodological integration, which has been known as interdisciplinarity or the interdisciplinary approach.

5. Facilitated by the author, these research questions were coconstructed by a group of faculty members from various disciplines—English, Chemistry, Computer Science, Hispanic Studies, Sociology, Business Management, Africana Studies, and Education—as they were studying transdisciplinarity and transdisciplinary curriculum and research approach as part of the UMass Boston’s strategic research-cluster workshop, entitled Transnational, Cultural and Community Studies.

APPENDIX

Table 1. Distinctions Among the Disciplinarity

Multidisciplinarity	Interdisciplinarity	Transdisciplinarity
<p>Multidisciplinarity concerns studying a research topic in not just one discipline but in several at the same time. Any topic in question will ultimately be enriched by incorporating the perspectives of several disciplines. Multidisciplinarity brings a “plus” to the discipline in question, but this plus is always in the exclusive service of the home discipline. In other words, the multidisciplinary approach flows over disciplinary boundaries while its goal remains limited to the framework of disciplinary research. The term multidisciplinarity refers to research in which each specialist remains within her or his discipline and contributes by using disciplinary concepts and methods.</p>	<p>The goal of interdisciplinarity differs from that of multidisciplinarity. It is concerned with the transfer of methods from one discipline to another. Like multidisciplinarity, interdisciplinarity overflows the disciplines, but its goal still remains within the framework of disciplinary research. Interdisciplinarity may even have the capacity to generate new disciplines like quantum cosmology and chaos theory. Interdisciplinary contributions can be interpreted as the bringing together of disciplines that retain their own concepts and methods, which are applied to a mutually agreed subject.</p>	<p>Transdisciplinarity aims at the unity of knowledge beyond disciplines. It concerns what is at once between the disciplines, across the different disciplines, and beyond all disciplines. Its goal is the understanding of the present world, one of the imperatives of which is the unity of knowledge. Transdisciplinarity is used for research that addresses the knowledge needed to solve complex societal problems. Interdisciplinarity can be considered as the mixing together of disciplines, whereas transdisciplinarity implies a fusion of disciplinary knowledge with the know-how of lay people that creates a hybrid different from any specific constituent part.</p>

(see Hadorn et al., 2006; Lawrence, 2004; Nicolescu, 2007).