INTERDISCIPLINARY TEACHER EDUCATION: REFORM IN THE GLOBAL AGE

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This dissertation is a conceptual study of interdisciplinary teacher education and fulfills the requirements of the Ph.D. program in Educational Leadership at Miami University.

The Global Age can be understood as an Age of Interdisciplinarity, as complex global problems increasingly require interdisciplinary approaches. Interdisciplinarity is a relatively nascent curricular approach yet one increasingly needed in the field of education. This study advocates postsecondary interdisciplinary teacher education reforms that effectively integrate discipline-based coursework with interdisciplinary courses to prepare future teachers to utilize interdisciplinary curricular approaches in P-12 education. This is a study of interdisciplinarity but also an interdisciplinary study. It conceptualizes interdisciplinary teacher education based on a constructivist theoretical approach indebted primarily to Maxine Greene, and focuses especially on literature in the field of interdisciplinary studies, published in the United States since 1997. The confluence of interdisciplinary and constructivist approaches, as well as interdisciplinarity and disciplinarity are examined. Existing interdisciplinary teacher education programs, interdisciplinary teaching strategies, and curricular designs are explored. This study provides a conceptual model that addresses teacher professionalization, interdisciplinary vision, global consciousness and wide-awakeness, and the democratic dimensions of interdisciplinary teacher education. It conceptualizes critical and socioculturally relevant education, learning communities, student-centered education, novice and non-specialist interdisciplinary inquiry, Deweyan cognitive disequilibrium, interdisciplinary research questions and questioning skills, interdisciplinary integration, and alternative academic structures and resources in interdisciplinary teacher education.
INTERDISCIPLINARY TEACHER EDUCATION: REFORM IN THE GLOBAL AGE

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To Tom, Elise, and Ben
As you go into the world, always know how truly, deeply you are loved, and that you too earned that new puppy.
INTERDISCIPLINARY TEACHER EDUCATION: REFORM IN THE GLOBAL AGE
CHAPTER ONE: THE AGE OF INTERDISCIPLINARITY

Introduction

Interdisciplinarity has burgeoned worldwide at an unprecedented pace and scope during the Global and Information Ages, coinciding since the late twentieth century (Apostel, Berger, Briggs & Michaud, 1972; Beck & Kosnik, 2006; Lattuca, 2001; Pinar, Reynolds, Slattery, & Taubman, 2004). During this era, human beings have increasingly encountered and benefitted from interdisciplinarity, so much so that the Global Age can be understood in part as a new or revalorized Age of Interdisciplinary. Increasingly, problems are gauged, solutions are discovered, and human expressions are manifest through interdisciplinary endeavor. There are many explanations for the particular phenomenon and timeliness of interdisciplinarity in the Global Age. Miller and Boix Mansilla (2004) state

In a world where most of the important dilemmas refuse to fit neatly into disciplinary boxes, fostering the capacity to synthesize knowledge from multiple perspectives, to capitalize on distributed expertise, and adapt to changing disciplinary and professional landscapes becomes an essential aim in our efforts to prepare young professionals for effective participation in contemporary life. (p. 15)

Similarly, Davies and Devlin (2007) find, “Certain conceptual issues demand new perspectives to provide breakthroughs. These insights can certainly come from different disciplines” (p. 4). Interdisciplinarian Ronald Jones (n.d.) explains the need for interdisciplinarity, which he finds linked in this epoch to the “fundamental shift in western culture from an object-based to an information-based culture wherein information networks distribute knowledge and influence on a global scale” (http://varutstallning08.konstfack.se/interdisciplinary-studies/ronald-jones.html). In the Global Age, it has become increasingly necessary to understand and act upon issues through the integration of multiple discipline-based forms of knowledge and experience, what The National Academies (2005) refer to as “deep knowledge from different perspectives” (p. 17). Removing disciplinary and academic barriers through interdisciplinary pursuit facilitates the development of the fluency and skills required to engage complex issues, to create conditions that enable flashes of understanding from one field to illuminate another, and to utilize and revalorize knowledge that draws upon expertise from and interface with more than one disciplinary perspective.

Interdisciplinarity addresses dire twenty-first century social and environmental crises, including global warming, famine, terrorism, and pandemics, as well as diminishing food, environmental, and energy resources, for major contemporary problems are not disciplinarily, culturally, or geopolitically bound, and require interdisciplinary solutions. Former United Nations Secretary-General Kofi Annan (2003) states, “The challenges of our age are problems without passports; to address them we need blueprints without borders” (n.p.). The global issues and calamitous problems for which human beings are largely responsible have reached unprecedented levels of complexity. Interdisciplinary inquiry examines the problems and wonders of the world, cultivating creativity and inspiration that fires the human imagination, affirming meaningful connections between human existence and the world, and helping human beings transcend what divides us. It has become increasingly necessary to engage in interdisciplinary inquiry and problem
solving, which extends knowledge beyond the confines of traditional disciplinary approaches and ways of knowing, and affirms the value of the interminable forms of knowledge and understanding (Greene, 2001). As Klein (2002) states, “Interdisciplinarity…has become more important because the needs it serves, although varied and even conflicting, are pervasive” (p. 9). In the Global Age, interdisciplinary is implicated at every turn as an essential mode of research and education, a phenomenon that “has delivered much and promises more” (The National Academies, 2005, p. 1) in terms of initiating critically important human understandings and undertakings that would otherwise be inaccessible or unachievable, yet upon which the survival of humanity depends.

The National Academies (2005) identify four factors, or drivers, of interdisciplinarity: The inherent complexity of the natural and human social world (see also Newell, 2002 and 2006), the quest to explore problems and issues that are not confined to a single discipline, the need to solve social problems, and the (generative) power of new technology. Notably, during the Global Age, new technologies increased the efficiency of processing, storing, and transmitting information, which contributed to transforming existing fields of study and generating new ones (The National Academies, 2005, p. 35-6). Yet, twenty-first century interdisciplinarity emphasizes the utilization, not the accumulation of knowledge.

Klein (2002) explains “the emergence of interdisciplinary fields has altered the landscape of knowledge” (p. 4), spawning newly minted disciplines, interdisciplines, and fields of study, such as international, cultural, and women’s studies, as well as biochemistry, bioengineering, nanotechnology, metamusicology, neuroeconomics, enviro-history, and, of course, interdisciplinary studies (Weld and Trainer, 2007). Repko (2008) asserts interdisciplinary cross-fertilization between different knowledge formations and research cultures has produced breakthroughs of lasting importance. Interdisciplinarity has fostered multiculturally diverse and globally infused poststructural art and aesthetics, burgeoning, for example, in much contemporary architecture, cinema, literature, dance, music, and cuisine. There are seemingly endless forms of pluralistic disciplinary cross-fertilization, hybridity, synthesis, fusion, and integration, and flourishings of knowledge and understanding (trans)formed through interdisciplinary work in the Global Age. Interdisciplinarity is in part the response to the complex vistas and wild frontiers to be explored, understood, solved, and appreciated, and also part of “the capacity to surpass the given and look at things as if they could be otherwise” (Greene, 1988, p. 3). Revolutionary breakthroughs and paradigm-shaking advancements in virtually every contemporary discipline and field of study attest to knowledge increasingly realized though interdisciplinary human inquiry and expression. Thirty-five years ago, interdisciplinary education was insightfully described as the tip of something huge that no one could accurately predict (Apostel et al., 1972). Today there are clear indications that interdisciplinarity is burgeoning with no end in sight. These conditions may not necessarily predict the future, yet the scope and context of interdisciplinarity appears by many measures to be evolving and expanding exponentially and internationally, particularly in academe.

As colleges and universities worldwide encounter the ongoing challenges of thinking deeply about how to serve the needs of contemporary students and what kinds of learning students ought to achieve to meet the challenges of our complex world
(AAC&U, 2002; Newell, 1983; Bruner, 1977; Cornwell & Stoddard, 1999), a resounding response from academe has been to initiate and expand opportunities for interdisciplinary course and program offerings, as well as grant and research opportunities, through which students “are encouraged to understand and pursue multiple disciplines and to address complex problems from the perspective of multiple fields in their undergraduate and graduate studies” (The National Academies, 2005, p. 30). Klein (1999) finds interdisciplinarity gaining a new momentum in the academy, particularly in undergraduate general education, “the fastest growing site of interdisciplinary approaches today… a major sector of innovation in the postsecondary part of the curriculum” (Klein, 2002, p. 7; see also Newell, 2002). Moreover, Newell (2002) states “Over half of all colleges and universities now have an interdisciplinary component to their liberal education requirement” (p. 119). Interdisciplinary education, once a “marginal site for innovative scholarship” (Kleinberg, 2008, p. 2), is moving from the “radical fringe to the liberal mainstream” (Newell, 1986, cited in Klein, 1999, p. 2). In fact, Kleinberg (2008) regards interdisciplinarity as the major educational paradigm of twenty-first century higher education. Interestingly, the claims of Klein and The National Academies seem complementary, not in conflict. Klein (2002) states, “Even in the absence of extensive empirical proof, there is mounting evidence that integrative and cooperative approaches enhance learning and retention” (2002, p. 6). The scientific community of The National Academies unequivocally embraces interdisciplinary education and research, proclaiming their book, Facilitating Interdisciplinary Research (2005) a “call to action’ for all those who perform, administer, support and organize interdisciplinary research and training” (p. xii). In 1970, J. R. Gass, Director for the Centre for Educational Research and Innovation predicted, “Creative change in university education and research calls increasingly for an interdisciplinary approach to teaching” (p. 10). A growing and substantial body of scholarship suggests the quality of postsecondary education can be improved substantially through interdisciplinary approaches integrated into every major (Smith & McCann, 2001). Through its success and viability in creating pathways and intersections that bring “faculty and students together for the common endeavor of intellectual exchange” (Kleinberg, 2008, p. 11), interdisciplinarity at the postsecondary level in the Global Age continues to gain institutional status. Kleinberg (2008) maintains interdisciplinarity in higher education is currently at a critical crossroad, adding, “Interdisciplinary departments, programs, and centers are poised to lead the university in a new direction” (p. 11).

During the Global Age, scholars in the field of education have advocated interdisciplinary approaches to teaching and learning. Curricular theorists Pinar et al. (2004) assert that teacher education, like many fields of knowledge, requires interdisciplinary applications of knowledge to problem solve in the social and public world (p. 164). Late twentieth century curricular theorists Laurel Tanner and James Beane are influential advocates of integrative forms of curriculum, finding them indispensable in advancing the progressive democratic aims of education and in confronting the issues and solving the problems of our increasingly globalized contexts (Pinar et al., 2004, p. 164). In particular, Beane’s Curriculum Integration: Designing the Core of Democratic Education (1997) endorses curriculum integration at all levels of education as part of a comprehensive educational philosophy tied to democratic social integration, and provides a valuable connection between curriculum integration and the
field of curriculum studies (p. 35). Further, multicultural educator Christine Sleeter (1999, 2006) supports the development of teacher education through interdisciplinary epistemologies, research paradigms, ideologies, and experiences. Sleeter is among the contemporary educators whose ideas are compatible with those of interdisciplinarian William H. Newell (2002), who states “Students should graduate from college trained in both a specialty, quite possibly a discipline, and in interdisciplinary studies” (p. 137). Increasingly teacher educators are among the scholars who “regard interdisciplinarity as essential for teaching and learning in the twenty-first century” (Klein, 2002, p. 1), and endorse education that perpetuates knowledge of and through the tradition, vocabulary, methods, and theory of interdisciplinarity.

Klein (2002) states, “Interdisciplinarity has become more central to knowledge. It should not be peripheral to teacher education” (p. 201). Yet, as much scholarly work focuses on interdisciplinarity, only a fraction deals explicitly with conceptualizing interdisciplinary teacher education programs. There is wide support for developing in future educators the skills to understand complex issues and problem solve through interdisciplinary strategies and approaches, particularly amid the forces of globalization (Klein, 2002; Sklair, 2000; Boix Mansilla & Dawes, 2004; Boix Mansilla & Gardner, 2007 Apostel et al., 1972; Beck & Kosnik, 2006; Lattuca, 2001; Pinar, 2004, The National Academies, 2005). More specifically, a substantial body of scholarship advocates interdisciplinary teacher preparation (Boix Mansilla, 2004; Dillon, 2001; Hinde, 2005; Klein, 2002; Mewborn, Beckmann, Davion, Desmet, Hudson-Ross, Oliver, Preisssle, and Rappersburg, 2002). While Spaulding (2002) claims, “Interdisciplinary teaching has been one of the more popular curriculum reform efforts of the past decade” (p. 699), it appears that cultivating the relationship between the fields of interdisciplinary studies and teacher education has received comparatively little attention, and that interdisciplinary teacher education programs are rare. There appears to be a need to develop the interdisciplinary teacher education discourse and to conceptualize interdisciplinarity not necessarily as a panacea for change but as a recommended set of methods and methodologies from which to integrate insights from the disciplines and to stimulate innovation in future educational research and practice (Gass, 1970; Jacobs, 1989; Adler, 2001; Klein, 2001; Newell, 2006).

Statement of the Problem

If, as Goubeaud and Wenfan (2004) suggest, “Student achievement depends to a large extent on the skills and practices of K-12 teachers, and teachers depend on the preparation they receive from teacher educators” (p. 13), then future educators require postsecondary interdisciplinary teacher education programs that help them not only to integrate their coursework but also to utilize interdisciplinary practices and principles in P-12 education. Klein (2002) maintains that interdisciplinary approaches are essential for teaching and learning, adding “Future teachers should have some experience with interdisciplinarity in their own studies and when student teaching in schools” (p. 201). Yet, Klein and Newell (2002) state, “many educators are not prepared for interdisciplinary teaching, administration, and curriculum development” (p. 141). This study supports these claims and addresses the need for research that conceptualizes interdisciplinary teacher education. While interdisciplinary education is a relatively nascent curricular approach, this study regards it as an essential shift, not to break but to
build teacher education curriculum and pedagogy as it evolves to meet the challenges of being educated and in turn educating in the Global Age. This study provides a rationale for developing teacher education programs predicated on constructivist and interdisciplinary theoretical compatibilities. It advocates interdisciplinary teacher education programs that explicitly integrate discipline-based coursework through interdisciplinary curricular approaches. Such theoretical and disciplinary integrative work enables future educators to experience interdisciplinary patterns, approaches, and perspectives, as well as construct meaningful and evolving connections between past knowledge and experience, present coursework, future teaching, and lifelong learning. This study is predicated on the idea that interdisciplinary teacher education programs are required in the Global Age to adequately and practically prepare educators to make informed decisions, generate research, understand the depth (verticality) and breadth (horizontality) of disciplinary knowledge, and in turn transform education that will shape the future. At this point, interdisciplinary teacher education appears as vital as it is overlooked.

Significance

This is a study of interdisciplinarity but also an interdisciplinary study, integrating the fields of interdisciplinary studies and teacher education with constructivist methodology and learning theory to conceptualize interdisciplinary teacher education. This study attempts to cultivate a relatively new field, interdisciplinary teacher education, and examine practical questions to broaden and deepen the field of teacher education, and ultimately strengthen P-12 international education.

This study recognizes the confluence of constructivism and interdisciplinarity, holding that when interdisciplinary “instruction becomes more integrative, it also becomes constructivist” (Klein, 2002, p. 14). The common ground of constructivism and interdisciplinarity can be described as constructivist pedagogy, based on interdisciplinarian Lattuca (2006):

Constructivist pedagogy doesn’t relieve the teacher of the responsibility to teach; it expands the definition of teaching. Teaching is not about delivering content. It is the act of designing experiences that encourage and enable learning… constructivists begin with the assumption that students, no matter how inexperienced, have knowledge and beliefs that form the basis for their understandings of the world. These beliefs must be surfaced, reflected upon, critiqued, discarded, or elaborated and refined in our curricula. (p. 355-356)

Constructivist pedagogy can be understood as predicated on “a relativist ontology (relativism), a transactional epistemology, and a hermeneutic, dialectical methodology” (Denzin & Lincoln, 2003a, p. 247), which privileges “more pluralistic, interpretative, open-ended” perspectives (Denzin & Lincoln, 2003a, p. 24). It endorses democratic forms of education, which value individuals in the social purposes of democracy (Beane, 1997). It involves the critique of “how structures, language, activity, and meaning-making come about” (Fosnot and Perry, 2005, p. 34). Constructivist pedagogy, the common ground between constructivism and interdisciplinarity, presupposes “an epistemology of pluralism that provides access [to social power] without people having to erase or leave behind different subjectivities,” which Desautels, Garrison, and Fleury (1998) assert, “has to be the basis of a new norm” (p. 259).
Lattuca, Voigt, & Fath (2004) provide a framework that can be applied to defining constructivist pedagogy, based on the following seven factors. First, constructivist pedagogy forges connections to the prior knowledge and experience of individuals. It stresses learning as a socially interdependent and intersubjective process of constructing knowledge based upon what individuals already know (Phillips, 2000; Phillips & Soltis, 2004). It considers the relations between what the students know and what is being taught, as well as between the students’ individual purposes and what the teacher is trying to teach (Henderson, 1992, as cited in Pinar et al., 2004). It rejects “the hierarchy of teacher as the autocratic knower, and learner as the unknowing, controlled subject studying and practicing what the teacher knows” (Fosnot, 2005, p. ix). It regards teachers as facilitators of students who take ownership of knowledge and are thereby empowered as active participants in their own learning. Second, constructivist pedagogy cultivates in educators a depth and breadth of knowledge in subject areas relevant to the field of teacher education. Further, it supports approaches that provide “concrete, contextually meaningful experience…through which…[students] can search for patterns; raise questions; and model, interpret, and defend their strategies and ideas” (Fosnot, 2005, p. ix). Third, it develops greater awareness and understanding of perspectives on knowledge and learning, or thinking about thinking (Geertz, 1980). It is directed more toward understanding than knowing. Such understanding is not contingent upon inference or historical-traditional philosophical theory (Greene, 2005), but on thinking and learning that respects multicultural diversity and cultural patterns (Gardenfors, 2007). Fourth, it develops thinking skills. Further, it supports thinking contingent upon representation and interpretation (Wubbels & Girgus, 1997) that rejects false binaries and either-or ways of thinking. Fifth, constructivist pedagogy develops the abilities “to recognize, evaluate, and use differing (multiple) perspectives” (Lattuca, Voigt, & Fath, 2004, p. 44). It recognizes that knowledge is “constructed, negotiated, propelled by a project, and perpetuated for as long as it enables its creators to organize their reality in a viable fashion” (Larochelle et al., 1998, p. 8). It considers knowledge in light of evolving historical and theoretical developments (Kroll, 2005), and maintains that knowledge can never be viewed as the only possibility for understanding a complex problem, topic or issue. It maintains that teachers must allow students to generate and test their own hypotheses, as well as “defend and discuss them in communities of discourse and practice” (Fosnot and Perry, 2005, p. 34). Sixth, it engages student interest and increases motivation, and, finally, engages constructivist and active learning strategies that center on students as active inquirers (Phillips, 2000).

This study endorses highly contextualized approaches (Ellsworth, 1989) to conceptualizing interdisciplinary teacher education, particularly in localized contexts. It advocates approaches to interdisciplinary reform linked to localization, an anthropological concept in obverse relation to globalization. Localization refers to how phenomena, that presents itself through the forces of globalization, are modified or transformed within highly localized community contexts (Anderson, Hey, Peterson, Toops, & Stevens, 2008, p. 5). It can correspond to glocalization or a new localism (Gruenewald & Smith, 2008), which involves thinking globally and acting locally. This study seeks to underscore the significance of the local amid the forces of globalization, as it advocates local responses to global influences and advances a global vision in higher education (Edwards & Usher, 2000; Gruenewald & Smith, 2008).
Throughout decades of experience as a postsecondary learner and educator, it has been alarming to witness the lack of curricular integration and interdisciplinary imagination in traditional teacher education programs. In my experience, students and faculty rarely seek, much less find, the opportunity to explicitly make meaningful curricular and pedagogical connections or integrate deep understandings about the various disciplines and courses they engage. It is usually left to students to make any such critical interconnections for themselves. This research will hopefully participate in developing strong interdisciplinary teacher education programs that facilitate students in making meaningful integrated connections between and among their own coursework, teaching practice, and life experience.

While a great deal has been written about interdisciplinarity, particularly in the latter part of the twentieth century, interdisciplinary teacher education has not been the focus of professional education associations. For example, the American Educational Studies Association (AESA) is a cross-disciplinary professional association that has been in existence since 1968 and boasts over six hundred active members, mostly from the field of postsecondary teacher education. While its annual conference in 2006 titled *Affirming Diversity/Challenging Inequality: Are We ‘Making Progress?’* included approximately three hundred and fifty presentations, none of the session themes or presentations centered on interdisciplinary or interdisciplinary education. At the 2007 AESA conference, two of the approximately three hundred fifty presentations contained the word *interdisciplinary* in their titles, hardly indicative of a trend. In another example, the American Educational Research Association (AERA) describes itself as “the national interdisciplinary research association for approximately 25,000 scholars” (<https://www.aera.net>), yet in 2007 it did not have an interdisciplinary assembly among its one hundred seventy Special Interest Groups (SIGs). Only five of the one hundred and seventy AERA SIGs -- Adult Literacy and Adult Education, Disability Studies in Education, Educational Change, Research on the Education of Asian Pacific Americans, and Technology, Instruction, Cognition & Learning – acknowledge their support of interdisciplinary perspectives, discussions, and research (<https://www.aera.net>). Further, only two of the twelve AERA divisions — Division C: Learning and Instruction and Division L: Educational Policy and Politics — specifically invited interdisciplinary research in their respective calls for proposals.

Moreover, in 2006 and 2007, there were only two interdisciplinary AERA-sponsored publications, including a music education series self-described as interdisciplinary and one article in the November 2007 issue of its journal, the *Educational Researcher*, on developing interdisciplinary researchers (Bullough, 2006). Interestingly, the brief website introduction of two major AERA officers mentions they support or engage in interdisciplinary education. Interdisciplinarity has been popular in university strategic planning efforts in recent years (Sa, 2007). This research suggests *interdisciplinarity* is a popular academic buzzword, clearly part of the mystique, the literal and symbolic capital of the current *academic cool*. Yet, these examples are indicative of what Andrew Abbott (2002, as cited in Feller, 2007) refers to as the cloud of “perpetual hazy buzz” (p. 47) encircling cross-disciplinary work, and a critical gap in research and understanding of postsecondary interdisciplinary teacher education. While there has been an increase since 2006 in the number of published articles on interdisciplinary teaching and learning, there are precious few specifically on the subject of interdisciplinary teacher education. Based
on these indications, interdisciplinary teacher education seems a timely, significant, and overlooked research subject.

This research frames interdisciplinary approaches as a kind of antidote to reductionist teacher education reforms that aim to train as opposed to educate teachers (Eisner, 2002, 1991), to raise test scores and support educational standardization, perspectives which undermine the democratic goals in education (Brady, 2004; Kohn, 2004; Cochran-Smith, 2006; Cochran-Smith & Fries, 2005) and facilitate the cultural “mechanisms designed to chill discourse and curtail diversity” (Benston, 2005, p. 107). This research endorses interdisciplinary teacher education programs that provide rich opportunities to learn in ways that stretch creative and imaginative thinking, develop analytical skills, as well as prepare teachers for the normative work of teacher education (Davies & Devlin, 2007; Desautels, Garrison, & Fleury, 1998). The Challenge of Connected Learning, 1991). In the context of this study interdisciplinary teacher education is advanced as an effective countermeasure to the oppressive forces of educational standardization and high-stakes testing.

Methodology

This section provides a rationale for the qualitative research design approach (Emerson, Fretz, and Shaw, 1995) to data analysis employed in this a priori conceptual study (Phillips, 2000). This interpretative study is predicated on a constructivist grounded methodology (Charmaz, 2003), focusing on major strands of constructivist epistemology theoretically steeped in the writing of Maxine Greene. Based on a review of the literature and document analysis of interdisciplinary studies and teacher education programs, this study provides solid descriptive data (Janesick, 2003) that explores the current status of research in the field of interdisciplinary teacher education, as well as the established ideas and theories in the field of interdisciplinary studies that pertain to conceptualizing interdisciplinary teacher education. To insure research data crystallization (Janesick, 2003), the review of the literature is supported by an analysis of documents, including website resources, conference programs, university catalogs, and other documents that describe interdisciplinary teacher education programs and professional educational associations. Document analysis is considered pragmatically useful for evaluating and interpreting qualitative research (Denzin and Lincoln, 2003b). This research design illuminates the unique structures and institutional policies, as well as the normative orientations and curricular approaches, of interdisciplinary teacher education programs. Further, this study provides a model for conceptualizing postsecondary interdisciplinary teacher education, and forms conclusions based on this research. It investigates the concentric and interwoven relations in education of the disciplinary and interdisciplinary as well as the cultural and the individual, amid “the radiating spheres of public life that can either enrich or threaten our shared ‘search for truth’” (Benston, 2005, p.107).

The first chapter introduces this study, and the second examines key concepts from the field of interdisciplinary studies that are relevant to conceptualizing interdisciplinary teacher education. More specifically, the first chapter of this study provides an introduction and the statement of the research problem. It examines the significance, constructivist methodology, key definitions, and limitations of, as well as the justification for, this study. The second chapter provides a review of the literature on interdisciplinary studies. This chapter provides an introduction, discusses various types of
interdisciplinarity (including multidisciplinary and transdisciplinary), defines and examines the concept of the disciplines, and explores major aspects of interdisciplinary studies. Instrumental, conceptual, and critical forms, as well as full and partial variants of interdisciplinarity, are distinguished. Further, the aims and goals of interdisciplinarity, *deep understanding*, and interdisciplinary *habits*, dispositions, and skills are explored. In addition, this chapter examines such interdisciplinary concepts as boundary work, the *test* of interdisciplinarity, common ground, interdisciplinary integration, and integrative leverage. Finally, an analysis of key aspects of the disciplinary and interdisciplinary relationship is provided.

The third, and fourth chapters of this study focus on conceptualizing interdisciplinary teacher education. The third chapter provides an introduction and justification for conceptualizing interdisciplinary teacher education programs and for adhering to a constructivist theory of learning advanced by Maxine Greene. It examines the state of the field of interdisciplinary teacher education and interdisciplinary teacher education reform. Moreover, chapter sections examine interdisciplinary teacher education curriculum and curricular strategies, as well as an analysis of curricular designs that achieve various levels of integration. The fourth chapter provides a model of interdisciplinary teacher education that addresses such topics as teacher professionalization, interdisciplinary vision, expanding global consciousness and *wide-awakeness*, as well as the democratic dimensions of interdisciplinary teacher education. It examines topics, including critical and socioculturally relevant education, learning communities, student-centered education, novice and non-specialist interdisciplinary inquiry, Deweyan disequilibrium, provocative questioning, interdisciplinary integration, and alternative academic structures and resources in interdisciplinary teacher education. This chapter also addresses the limitations of this study and potential directions for future research. The fifth and final chapter forms conclusions based on this research.

*Constructivist Grounded Theory*

Denzin and Lincoln (2003b) provide an overview of constructivist methodology, explaining that constructivism is an interpretive research paradigm that maintains a subjectivist epistemology, corresponding to the ways in which the researchers and respondents reflexively co-construct understanding and meaning through their encounters. It assumes a relativist ontology, which holds that there are multiple realities, and a naturalistic (indicative of the physical or material world) set of methodological approaches, including interpretative reading. Constructivist research findings are presented in terms of grounded or pattern theories (Charmaz, 2003), defined in terms of *trustworthiness*, *credibility*, *transferability*, and *confirmability*, instead of positivist criterial attributes, including internal and external validity, reliability, and objectivity (Denzin & Lincoln, 2003b, p. 35). These key points will be addressed in the context of this methodology.

Constructivism is a nuanced and complex epistemological perspective that can be described as having multiple *flavors* (Magee, 1999), family resemblances (Magee, 1999), and a dozen or so basic forms, including extreme and postmodern variants (Vadeboncoeur, 1997) that range from social to radical, as well as weak to strong forms (Schwandt, 2007). Constructivism can be utilized as a theory of learning (Fosnot, 2005) and a methodology, usually in qualitative research applications. Maxine Greene (2005)
explains “a whole variety of streams have fed into what is now called constructivism… Existentialism, phenomenology, interpretivism, experientialism, certain modes of idealism… have been the sources of constructivist thinking” (p. 111). Theoretical perspectives from multiple disciplines, including “psychology, philosophy, science, and biology” (Fosnot, 2005, p. ix), as well as the field of education, have cultivated twenty-first century constructivist grounded theory (Charmaz, 2003). For example, Michel Foucault’s work is significant in that it not only marks the transition “from objectivist to constructivist theories of knowledge” (Klein, 2005, p. 37), but also has linkages to critical constructivist (and interdisciplinary) work that crosses and blurs disciplinary borders and interrogates the social structures of power/knowledge, corresponding to “the matrix of power codified in subjects, objects, and categories of knowledge” (Klein, 2005a, p. 37).

Further, mathematics educators Larochelle, Bednarz, and Garrison (1998) endorse constructivist approaches in educational research “in particular, its contribution to the development of new ways of conceiving and carrying out education action” (p. viii). Computer science and mathematics educators Desautels, Garrison, and Fleury (1998) find constructivism does not seek clues for understanding human cognitive activity through psychology or religion, but through the sedimentation of social and historical forms of meaning-making.

Interdisciplinarian Lattuca (2002) explains that sociocultural theories, including constructivism, provide a multidimensional and multifocal analytical approach to understanding how individuals and contexts interact and are mutually constitutive. Constructivism is useful because it acknowledges that knowledge is embedded in the immediate and larger intersecting social, historical, and cultural contexts in which it occurs (Lattuca, 2002). Teacher educators Howe and Berv (2000) find that while constructivism is not part of the philosophical lexicon, it is concerned with many of the same questions addressed by philosophy. Teacher educator Kincheloe (2001, 2005) articulates critical constructivism, predicated on advancing social justice and equity through teacher education that takes a critical view of political cultural forces and their domination of knowledge and the processes of knowledge construction. Philosopher of science Ian Hacking (1999) finds there are three broad categories of that which is socially constructed: Ideas; knowledge, facts, and reality; and conditions, states, actions, behaviors, experiences, and relations that exist in the world. Schwandt (2003) points out, “in a fairly unremarkable sense, we are all constructivists if we believe that the mind is active in the construction of knowledge” (p. 305; see also Schwandt, 2007). Yet, constructivism is a term with different and nuanced meanings depending on the discursive and disciplinary context (meaning something different in the fields of mathematics and logic, experimental psychology, literature and the social sciences); in the social sciences it extends well beyond the concept of merely constructing knowledge. In general, all constructivist research strives to ascertain common ground, where “confluence is possible, where constructive rapprochement might be negotiated, [and] where voices are beginning to achieve some harmony” (Lincoln & Guba, 2003, p. 265).

While there is significant disagreement about whether or not there can be a constructivist ontology and whether or not human constructs are required to sustain reality, this research design supports constructivism as an epistemological methodology and learning theory that regards reality as constructed not ontological, or corresponding to presuppositions of what is absolute, universal, or really real. This research design
maintains that constructivism generally does not see the world as ontologically unreal, but finds ontological conceptualizations are social constructs that cannot be definitively confirmed or denied based on truths they may or may not disclose. Magee (1999) supports this constructivist view, stating, “we know since Einstein that very different theories and very different interpretation are…possible…Thus reason is capable of more than one interpretation. Nor can it impose its interpretation upon nature once and for all time” (p. 187-8). This methodology supports Magee (1999) claim:

Although we can never have grounds for believing in the truth of a theory, we can have decisive grounds for preferring one theory to another…therefore the rational way to behave is to base our choices and decisions on ‘the best of our knowledge’ while at the same time seeking its replacement by something better. (p. 189)

Our experience and understanding are useful to help us make sense of and function in the world, but do not presume to describe a universal reality (Dewey, 1929/1960; Vadeboncoeur, 1997). If there is a single reality that is transmissible or waiting to be discovered, human beings will never definitively know, since we cannot definitively prove that we are capable of discerning universal laws or objective truths from social artifacts or cultural conventions. Any distinctions between the world and our conception of it produces a false dualism between the world and the human construction of it, and such dualisms, as Howe and Berv (2000) affirm, are fatally compromised and flawed from the start. This research design takes the view of Gergen (as cited in Lincoln and Guba, 2003a, p. 306), a so-called “radical social constructionist” (Schwandt, 2003, p. 310), finding constructivism is mute on or indifferent toward matters of ontology, neither affirming nor denying truth or the real world as it is. There are no unambiguous demarcations between the world and the human construction of it. The world is as stable and permanent as the one human beings perceive and construct.

In “A Constructivist Perspective on Teaching and Learning in the Arts,” Greene (2005) writes

From the vantage points of our several fields of study, we speak of making meanings today, not of finding or unearthing them. We speak of interpreting texts, not simply of describing or analyzing them; we speak of reading paintings, not simply of detecting in them renderings of what lies outside. We ponder the form-giving and generative powers of consciousness and language; we probe the significance of persons articulating what they think of as their shared ‘realities.’ (p. 110)

For constructivists like Greene, knowledge is actively constructed by human beings (Greene, 2001; Magee, 1999) and all acts of knowing are acts of interpretation (LeCompte, 1993) based on representable sets of phenomena that are not the same for everyone and cannot be objectively known (Greene, 2005). Constructivism centers on “the constructed nature of the various realities we inhabit, the fields we study, the discourses in which we engage” (Greene, 2005, p. 121-122). All questioning and sense-making are “from a grounded vantage point, an interpretive vantage point, in a way that eventually sheds light on the commonsense world, in a way that is always perspectival and therefore forever incomplete” (Greene, 1988, p. 128), correlating with Fosnot’s (2005) view, which finds knowledge is transmitted through the self-regulated struggles between existing knowledge constructions and new encounters that engage individuals in utilizing cultural tools and symbols to interpret and understand knowledge, “and further
negotiating such meaning through cooperative social activity, discourse, and debate in communities of practice” (Fosnot, 2005, p. ix). As Greene (1995) explains:

There have to be disciplines, yes, and a growing acquaintance with the structures of knowledge, but at the same time, there have to be the kinds of grounded interpretations possible only to those willing to abandon already constituted reason, willing to feel and to imagine, to open the windows and go in search. (p. 104)

Further, as we continue to grow and build upon our knowledge, we test, modify, and extend what we already know (Agne & Clarke, 2002, p. 96; see also Richardson, 1996), thereby constructing knowledge in light of new knowledge and experience (Greene, 2001). Knowledge construction develops over time and involves individuals regulating and restructuring their schema, paradigms, and understandings (Kroll, 2005), creating personal meaning and truths but not facts (Agne & Clarke, 2002; Charmaz, 2003). While “Meanings are layered or sedimented once human beings move into the life of language and begin thematizing or symbolizing their worlds” (Merleau-Ponty, 1964, cited by Greene, 1988, p. 21), Pepin (1998) finds, “There is no constructing phenomenon unless it has already figured in the field of experience” (p. 177).

Constructivist epistemology highlights the sociocultural and contextualized nature of knowledge (Lattuca, 2002), which finds our cognitive processes occur against a backdrop of shared language, understandings, and rituals (Denzin and Lincoln, 2003a), the interconnected public social (Magee, 1999) and private spheres, “within the matrix of social, economic, cultural, and psychological conditions” (Greene, 1988, p. 80). This research design recognizes that intersubjective encounters, as well as prior knowledge and experience, translate into “the vehicles by which social values and ideology are expressed in inquiry and become subtly inscribed in theories, hypotheses, and models defining research” (Longino, 1993, as cited in Denzin and Lincoln, 2003, p. 309).

Knowledge stems from socially mediated experiences and practices, which typically involve dialogic negotiation and action (Howe and Berv, 2000) that seek “to build knowledge in a given field” (Tobin & Tippins, 1993, p. 15). It recognizes the inherent social nature of knowledge, which is not discovered or revealed but constructed (Greene, 1988; Pinar, Reynolds, Slattery, & Taubman, 2004; Beck and Kosnik, 2006; Richardson, 1997). Knowledge and meaning are co-constructed through intersubjective encounters of individuals in the social milieu. Knowledge is not, in Dewey’s words, an “immobile solid” (Dewey as cited in Greene, 1973, p. 100) but an incomplete and evolving social construct (Klein, 2005a). Knowledge is not passively imprinted onto the mind, nor is it waiting to be discovered, but is constructed interminably by human beings interacting in the world. Further, knowledge is not formed in isolation nor does it occur in a vacuum; it is mediated and guided by social participation, and is emergent and contested in various sociocultural contexts.

This research design aims for interpretative understandings of multiple social realities (Charmaz, 2003; Feller, 2007; Lampert, 1997; Larochelle, Bednarz & Garrison, 1998; Vandeboncoeur, 1997), for “In a multifarious culture, no single schema or category can be sufficient for organizing the flux of reality” (Greene, 1973, p. 9). As Greene (1973) explains, we must consider multiple vantage points, for “there is no single and uniform power of thought, but a multitude of different ways in which specific things — things observed, remembered, heard of, read about — [which] evoke suggestions or ideas
that are pertinent to a problem or question and that carry the mind forward to a justifiable conclusion” (p. 55). Human beings can know in unique ways, and understanding becomes “increasingly multiplex, as more perspectives are taken, more texts are opened…” (Greene, 1988, p. 23). While Dewey maintains that human beings are on an interminable search for absolutes, Greene (1988) finds humanity in search of solidarity not objectivity. Denzin and Lincoln (2003b) acknowledge the likelihood of contradictory categories, since not all conceptual schemes will yield commensurate understandings of knowledge and reality.

This research design analyzes the data based on the constructivist tenet situatedness (Greene, 2005) in terms of the contextualized characteristics of individuals in a particular and diachronic setting (Greene, 1988, 2005). Burbules (2000) explains, “Our efforts at understanding the world always occur at a distinct time and place and under a set of circumstances that motivate and influence our choice of questions, methods, and reference groups for cross-checking our understandings” (p. 323). Research involves not only the researcher’s subjectivity but also “the subjectivities of his [or her] contemporaries, and the intersubjective reality they mutually create” (Greene, 1973, p. 134). As Vadeboncoeur (1997) explains,

Cognitive functions emerge from situated actions and are therefore dependent upon, and, to some extent, determined by the social context surrounding the individual…[so that] human development is never totally free of cultural influence and human beings are not autonomous with respect to societal forces. (p. 281).

It is not necessarily relativistic but is apparently inevitable, that “every person or group is by definition situated differently from every other” (Burbules, 2000, p. 323). Yet, human action is locally and temporally shaped (Greene, 2005; Lincoln and Guba, 2003; Burbules, 2000; Vadeboncoeur, 1997; Larochelle et al., 1998). Larochelle et al. (1998) maintain “the appropriation of knowledge is as much a function of the immediate context of interaction as of the surrounding representations and beliefs which serve to define ‘the immediate existing’” (p. 10). Greene (2005) asserts that through intersubjective encounters, conscious and reflective individuals collectively become ever “aware of the constructed nature of the various realities we inhabit, the fields we study, the discourses in which we engage” (p. 121-122), as meanings thus produced extend beyond the immediate encounter, radiating intersubjectively through future experience.

Constructivist research evidences transferability, credibility, confirmability, and trustworthiness (Denzin & Lincoln, 2003b), yet it holds there are no fixed or unified stable meanings, so research and research data are human constructions “susceptible to reinterpretation and change” (Greene, 1988, p. 83). Theories can be replaced by better theories. Greene (1995) maintains “fixed and final frameworks remain inconceivable” (p. 197) and that new research should prevail over “old dualisms and discontinuities” (Greene, 1988, p. 42). Human beings use “powers of insight and imagination to create theories that get us nearer to the truth than the theories we already possess” (Magee, 1999, p. 119). Yet, as Magee (1999) states, “Human knowledge is human…[It] can always be refuted or corrected by reality in the form of new experiences, new observations, new discoveries – and then replaced by a more accurate or informative theory” (p. 52). In other words, while knowledge has no ultimate foundation, it is not foundationless. Magee (1999) points out that theories can be replaced by other theories,
and there are no self-sufficient premises or ground-floor certainties on the level of argument. Moreover, what counts as truth is already a function of our system of representation; in other words, our perceptions are in a sense the projection of our socially-mediated symbol systems of representation (Greene, 2001; Vygotsky, 1962; Dimitriadis & Kamberelis, 2006; Magee, 1999).

To develop a constructivist ground theory, Charmaz (2003) explains, requires going beyond surface or presumed meanings for “views and values…acts and facts…beliefs and ideologies as well as situations and structures” (p. 275). Therefore, this normative research model values multiple perspectives. It does not seek to displace or reject ways of analyzing or understanding but rather to privilege the democratic exchange and dissemination of knowledge (Dewey, 1916/1921). In particular, it is linked to democratic norms and values, which “cannot conceive of democratic freedom apart from critical thinking, hypothetical inquiry, the open exchange of ideas” (Greene, 1988, p. 43).

This research acknowledges the significance of the relationship between the researcher and the subject of the study, centering on the concept of Verstehen (Schutz, 2004), which Greene (1973) describes as “the ability to imagine oneself in another person’s skin” (p. 79), and a mode of understanding (Greene, 2000) or “some ability to look through others’ eyes, an amount of identification, even empathy” (www.maxinegreene.org). First, it acknowledges the logical interdependencies between the researcher and the research subject, as well as between the researcher and the data in a qualitative study. It is impossible to separate the researcher from the research subject, or to define the researcher as such independently of the research subject as such (Guba and Lincoln, 1989; Schwandt, 2003). Through qualitative interpretative strategies, we are grafted onto that which holds meaning for us, thus “caught up in the very thing we are producing” (Iser, 1980, as cited in Greene, 2005, p. 118). Through our interpretative strategies, we shape our symbols and tools as they shape us. Similarly, the data (e.g., the collection of information gleaned from a review of the literature) defines the researcher, and vice versa. The research data are a synthesis of “The angle from which an entity is seen, the values of the researcher that shape the questions he or she asks about it, and what the researcher considers important are all factors in the construction of knowledge about the phenomenon in question” (author’s italics, Kincheloe, 2001, p. 342). Second, it reflects a practical concern for acquired and applied Verstehen. This concept corresponds to acquiring empathetic understanding of the subject but also to gaining and applying knowledge of “the systems of meanings” (Schwandt, 2007, p. 298), such as interdisciplinary nomenclature and curricular approaches. Moreover, Verstehen corresponds to applying an interpretivist research method “peculiar to the social sciences” (Schutz, 1962, cited in Schwandt, 2003, p. 299), which calls upon the researcher to contextualize the social actions and discern the constitutive and intentional meanings that motivate social actions (Schwandt, 2003). Verstehen, then, is disclosed in this study through a review of the literature and analysis of documentation through which the researcher attempts to understand the part-to-whole relation of a social action (part) to its constituent (whole) context, based on a host of implicit preconditions, intentions, beliefs, acts, and so on. This conceptual study of interdisciplinary teacher education is the sum of the interpretations and understandings of the research by a researcher at a particular point in time, since knowledge is continually in a state of flux. Articulation is not as important as interpretation, or how meaning is understood, reconstructed, and
applied (Beck & Kosnik, 2006, p. 32). This research design is predicated on an interpretive approach to data collection and analysis that draws from research processes and analyses that are not quantitatively measured or objectively assessed. The data do not presume to represent the world or external reality; knowledge is a perpetually incomplete human construction, negotiated in, not discovered from, external reality (Schwandt, 2003).

While this methodology does not endorse all truths as empirically verifiable, it upholds the critical connection between knowledge and direct experience, and recognizes a shift in late twentieth and early twenty-first century constructivist methodology, distinguishing older and newer forms of empiricism. Constructivist epistemology links knowledge with observation, an idea associated with Kant: “The world as we know it is our interpretation of the observable facts in the light of theories that we ourselves invent” (Magee, 1999, author’s italics, p. 187). Greene (1973) explains that while “older empiricisms were functions of a mathematically ordered world, this more modern empiricism is a function of an open universe in which changes are continually taking place and novelty is inescapable” (p. 128). Constructivist Charmaz (2003) endorses the empirical claim that all knowledge of the world must begin with firsthand experience or direct observation and seeks to reclaim from positivism the value of direct observation “to form a revised, more open-ended practice of grounded theory that stresses… emergent, constructivist elements” (p. 250-1). This research design privileges knowledge linked to direct experience, as that which discloses truth but not necessarily reality as it can never be translated completely into words or conveyed in any form its entirety from one human being to another (Greene, 2001; Magee, 1999).

While this research design emphasizes trustworthiness, credibility, transferability, and confirmability (Denzin & Lincoln, 2003b), it critiques viability, centering on the question: How viable is the construction of new knowledge? On this point, Pepin (1998) notes a paradox of constructivism: If at every moment we are who we are and we know what we know, how can we, through constructivist learning, simultaneously gain multiple perspectives and thereby become Other-wise (Pepin, 1998, p. 177)? The viability of existing and new knowledge is a problematic constructivist epistemological issue because depending on the circumstances, the same knowledge could be viable or not in that, for example, it could be possible or impossible to validate, as well as a predetermined self-fulfilling prophecy or novel product (Pepin, 1998).

Constructivism can be considered a “fashionable and fruitful paradigm” but also the most dangerous intellectual tendency to guide educational practice and research (Phillips, 2000, p. 2-3). It rejects the existence of representable sets of phenomena that are the same for everyone and can be known objectively (Greene, 2005), as well as knowledge as fixed and universal, as foundationalism (Vadeboncoeur, 1997) or empiricism assert. It represents attempts to dislocate reason from its socio-historical foundations, if not, as von Glasersfeld (1996) states, “an irrevocable break with the generally accepted epistemological tradition of Western civilization, according to which the knower must strive to attain a picture of the real world” (p. 6). While constructivist epistemology is generally described as anti-foundational, rejecting perennial, unvarying standards by which truth can be universally known (Lincoln and Guba, 2003; Denzin and Lincoln, 2003b), this study could be considered compatible with postmodern approaches in that it acknowledges the value of knowledge from multiple perspectives yet rejects the
exclusivity of positivism or any single theoretical approach. This methodology is compatible with the idea that postmodernism can inform rather than serve to justify abandoning firsthand direct experience (Charmaz, 2003).

Interestingly, Fosnot (2005) claims, “Most contemporary neurobiologists and cognitive scientists agree: Knowledge is actively constructed” (p. x). This echoes Phillips’ (2000) claim that most pedagogical research is based on studying, teaching, and learning in the fields of science and mathematics, adding that if constructivism can take root in these disciplines, it can take root anywhere. Phillips’ (2000) argues, “[T]he epistemology of science is inadequate and needs to be replaced by a more social epistemology” (p. 281). Howe and Berv (2000) find that constructivism aligns more seamlessly with the prevailing epistemology of social science than it does with “the philosophy of natural science or of epistemology generally” (p. 28). Phillips (2000) explains that if bodies of knowledge are not significantly shaped by the external nature they appear to be about, but are determined by social forces or that which is socially constructed, then “the contents of these bodies of knowledge can only be accounted for in sociological terms. In effect, sociology of knowledge replaces epistemology... Philosophers (and many scientists) cannot be expected to take this news lying down” (Phillips, 2000, p. 87-88).

This study employs Foucauldian discourse analysis (Gubrium & Holstein, 2003), examining how sociohistorical “power/knowledge” (Foucault, 1984) constitutes and constructs “form the objects [and subjects] of which they speak” (Foucault, 1972, p. 49), notably the disciplines and field of study and the practices that reinforce boundaries to serve certain interests (Foucault, 1984). It distinguishes articulation as the locus of discursive power, deployed not just to describe a subject but also to perpetuate commonsense understandings that imply the whole discourse, or its articulated part, cannot be understood in any other way. Knowledge and meaning are not entirely dependent upon power/knowledge organization and control, but upon social and individually variegated interpretative practice that reveal the potential for social transformation through “the constructive fluidity and malleability of social forms” (Gubrium & Holstein, p. 241). Moreover, this research design resists the Foucauldian notion that it can be understood as any artifact, representing and thereby advancing the power/knowledge regime, or hegemony (Gubrium & Holstein, 2003). Further, this research takes a constructivist approach to defining interdisciplinarity as a situated discursive practice that evidences the postmodernism trend toward “linguistic and rhetorical analysis” through the reflexive “interplay of discourse and discursive practice” (Gubrium & Holstein, p. 241). Moreover, this design privileges research that “explicitly treats author’s works as constructions” (author’s italics, Charmaz, 2003, p. 281). Through discourse analysis, this study interprets and constructs data in specific linguistic, social, and historical contexts as it advances critique, transformation, and reform (Schwandt, 2007).

In sum, based on a qualitative research design, this study is informed by the constructivist theory provided by Maxine Greene, who finds that the researcher, as a social actor, participates in actively constructing knowledge in social and historical contexts. This interpretive study is forged from the researcher’s understanding of the perspectival and contextualized work of individual scholars, part of the social milieu, situated in the fields of interdisciplinary studies and teacher education (Denzin &
Lincoln, 2003b). This qualitative research design emphasizes knowledge as socially constructed by human thought and interaction, through which social experience is created and appropriated meaning (Denzin and Lincoln, 2003b). Data, interpreted by the researcher, cultivate personal knowledge and experience through exposure to a multiplicity of constructs, scaffolding a new ordering of knowledge and experience onto old, which has the potential to diversify perspectives and contribute to a progressively more meaningful understanding of the world (Greene, 1973, p. 8-9). While this research draws from and exemplifies the “historical, theoretical, critical, and ethical scholarship that many members of the education research community would not call ‘science’… for making good decisions about teaching and teacher education” (Cochran-Smith, 2006, p. 212), it advances a critical and practical concern for “teacher learning in communities and… the preparation of teachers for a diverse society, which come from critical and multicultural perspectives intended to interrupt the norms of conventional teacher education” (Cochran-Smith, 2006, p. 212). Greene (1973) reminds us “worlds remain to be explored” (p. 37) and a whole civilization to be remade. Greene finds as we become ever “aware of the constructed nature of the various realities we inhabit, the fields we study, the discourses in which we engage” (Greene, 2005, p. 121-122), “we must adjust to the new knowledge somehow – even the knowledge of what we cannot know. We must confront our human situation in a universe lacking guarantees” (Greene, 1973, p. 38).

Key Definitions

This section provides brief introductions and clarifications of key terms used in this study, including P-12, preservice teacher education, curriculum, discipline, and interdisciplinary. Some of these terms will be explored in greater depth in this study, but the purpose of this section is to introduce major concepts and clarify key terms central to this research. This study follows the common practice of using P-12 to refer to preschool through twelfth grade levels of education. Preservice teacher education refers in general to a course of study designed for undergraduates majoring in education and seeking initial state certification to teach in preschool through twelfth-grade classrooms. It can also refer to graduate-level programs that may or may not include practicing teachers as students. Finally, curriculum is defined as the subject matter as well as relevant cultural, social, political, and psychological dimensions within the classroom, the university culture, and the culture at large (Eisner, 2000).

Discipline Defined

A study of interdisciplinarity should involve the careful examination of how individuals appropriate the cultural tools required for interdisciplinary work, and among the most crucial are the disciplines (Lattuca, 2002). This study refers to a discipline, subject, and field of study interchangeably, finding that discipline corresponds to an academic department of instruction or a branch of knowledge, a science or art in its educational aspect (Oxford English Dictionary, 1989). Davies & Devlin (2007) define academic disciplines as areas of study or structures of knowledge with their own theories, methods, and content. Academic disciplines are “cultural phenomena…embodied in collections of like-minded people, each with their own codes of conduct, sets of values, and distinctive intellectual tasks” (Becher, 1981 cited in Davies & Devlin, 2007, p. 1).
Disciplines come from existing academic disciplines and fields (Lattuca, 2002). They are recognized by institutional structures that include distinct faculty divisions, departments, administrative personnel, and courses that function as largely discrete and autonomous, not homogeneous, entities that train and socialize according to certain foundational ideas and principles (Tobin, 1998). They are in part comprised of sets of discourses, defined as the facts, skills, terminology, concepts, understandings, and meanings that are constructed with language and other symbolic systems, typically through academic social situations or activities (Tobin, 1998). The disciplines are vehicles of socialization (Lattuca, 2002). Mansilla & Gardner (2003) explain “disciplines comprise rich collections of theories, accounts, and findings believed to be acceptable within specifiable scholarly communities at a particular time” (p. 3). Mansilla (2004) finds disciplinary understanding involves a command of the methods and content of current disciplinary knowledge, just as it employs the goals and forms of communication typically utilized in the discipline. Disciplines and their discourses establish a common set of axiomatic assumptions, beliefs, practices, understandings, and preconceptions. In other words, a discipline includes instrumental, theoretical, and metaphysical commitments shared by those who participate in disciplinary discourses and communities of practice (Augsburg, 2005; Repko, 2008; Davis, 1995). Despite Kuhn’s assertion, as expressed by Keith S. Taber (2006), that there are not clear-cut disciplinary structures or approaches, this study finds that a discipline represents deep and resilient institutional academic structures and understandings of “reality in conceptual form” (Carson, 2006, p. 299). Further, this study positions discipline in relation to the regulation of human conduct and norms that are integrally tied to the structures of social power (Foucault, 1980; Lattuca, 2002). Disciplinarians typically approach a complex task from the narrow perspective of their specialty and fail or are unable to consider the relevant perspectives of other disciplines, professions, or interested parties (Repko, 2008, p. 8). Well-established disciplinary boundaries exist, as well as institutional and intellectual divisions that encourage and reward insularity along disciplinary lines. Bullough (2006) maintains, “disciplinary boundaries are historical creations, habits of mind, and are subject to change over time despite faculty allegiance to and self-investment in them” (p. 9). In sum, Davies and Devlin (2007) list five qualities of academic disciplines: The presence of a community of scholars, a tradition or history of inquiry, a mode of inquiry that defines how data are collected and interpreted, definitions of what constitutes knowledge, and the existence of a communications network (p. 1). Disciplines, then, are largely culturally and historically fixed academic subject areas and discrete, autonomous communities, with distinct conceptual boundaries that are rarely permeated.

Interdisciplinarity Defined

This study refers interchangeably to interdisciplinarity, interdisciplinary education, interdisciplinary studies, and interdisciplinary understanding. Interdisciplinarity is defined based on a compilation definition provided by interdisciplinarians, including Davis (1995), Klein and Newell (1996), Boix Mansilla, Miller, & Gardner (2000), and The National Academies of Sciences, National Academy of Engineering, and Institute of Medicine (known collectively as The National Academies, 2005). While interdisciplinarity is simultaneously a field of study, a research method or way of engaging a problem, and a form of education connected with a range of
curricular innovations (Newell, 2002), this study focuses on interdisciplinarity as it applies to teaching, learning, and researching in the context of postsecondary teacher education programs.

Amid twenty-first century interdisciplinary programs and experts, there is no shortage of definitions for interdisciplinary, just as there is no conventional usage or consensus on the meaning of the term, a phenomenon illustrated by the following definitions. This analysis begins with Davis’s (1995) definition of an **interdisciplinary course** as

A course that combines two or more disciplinary perspectives, including in the broad definition of a discipline, not only traditional fields such as biology, psychology, history, etc.; but also professional fields an sub-fields, such as law, social work, and education; or occupational fields, such as graphic design, law enforcement, or computer technology. (p. 156)

Repko (2008) refers to what he calls the **emerging consensus definition of interdisciplinary studies** proffered by Klein and Newell (1996), who broadly define **interdisciplinary studies** as

a process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession...[it] draws on disciplinary perspectives and integrates their insights through construction of a more comprehensive perspective. (p. 393-394)

Relatedly, Boix Mansilla, Miller, & Gardner (2000) explain **interdisciplinary understanding** as

the capacity to integrate knowledge and modes of thinking in two or more disciplines or established areas of expertise to produce a cognitive advancement—such as explaining a phenomenon, solving a problem, or creating a product—in ways that would have been impossible or unlikely through single disciplinary means. (as cited in Boix Mansilla & Duraising, 2007, p. 219)

Finally, The National Academies (2005) define **interdisciplinary research (IDR)** as

a mode of research by teams or individuals that integrates 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 the scope of a single discipline or area of research practice. (p. 2)

Interdisciplinarity is defined in this study based on several salient features of these definitions. These definitions build upon discipline-based knowledge that has been scrutinized by experts “using commonly agreed upon methods and validation standards” (Gardner & Boix Mansilla, 1994; Boix Mansilla & Gardner, 1999, as cited in Boix Mansilla & Duraising, 2007, p. 219; Repko, 2008). These definitions emphasize a process (Repko, 2008) and inquiry-based mode of research. Further, these definitions agree that interdisciplinarity involves the integration not just the juxtaposition of insights from multiple disciplinary perspectives (Repko, 2008). As The National Academies (2005) maintain, “Research is truly interdisciplinary when it is not just pasting two disciplines together to create one product but rather is an integration and synthesis of ideas and methods” (p. 27). Further, these definitions implicitly or explicitly acknowledge an epistemological view that is contextual and constructivist in that what is considered knowledge is subject to scrutiny, interpretation, evaluation, and rejection by
individuals who participate in learning communities (Hacking, 1999). Further, these definitions emphasize collaboration through democratic learning communities (Dewey, 1916/1927) and research teams representing multiple perspectives. In addition, these definitions point up the capacity to use, not just accumulate knowledge, thereby underscoring pragmatic epistemology in that the knowledge most worth knowing is applicable “accurately and flexibly in novel situations” (Boix Mansilla & Duraising, 2007, p. 219). Finally, in curricular and pedagogical contexts, these definitions emphasize interdisciplinarity in a sense as a verb rather than a noun, privileging the cognitive processes, capacities, and acts of engaging and integrating disciplinary knowledge more than arriving at a final product or end result.

Therefore, this study defines interdisciplinarity as the integration of interdisciplinary insights — constructed from the information, data, techniques, tools, perspectives, concepts and theories of two or more disciplines — to address a problem, issue, or topic, and advance a more comprehensive understanding beyond the scope of a single discipline or area of research practice.

**Limitations**

Repko (2008) states that the ability to acknowledge the limitations of any research endeavor may contribute to a more comprehensive understanding or solution. In that spirit, this study acknowledges its limitations as it seeks to cultivate the development of interdisciplinary teacher education programs and expand the interdisciplinary teacher education discourse worldwide. Among its limitations, this study is based on a review of literature pertaining to interdisciplinary teacher education, and published primarily between 1997 and 2008 in the United States in English.

This study proffers a conceptual model for interdisciplinary teacher education. While it appears to offer, in highly contextualized settings, a potentially fruitful vantage point from which to engage research and innovation in postsecondary teacher education, as well as important practical, theoretical, and methodological implications, the model is not a panacea for change or blueprint for success (Gass, 1970; Jacobs, 1989; Adler, 2001; Klein, 2001; Newell, 2006).

Further, among its methodological limitations, this study does not employ action research, defined by Denzin and Lincoln (2003a) as research that engages “collaborative dialogue, participatory decision making, inclusive democratic deliberation, and the maximal participation and representation of all relevant parties [for the purpose of producing]…radical, democratizing transformation in the civic sphere” (p. 48). Action research is compatible with constructivism in that action research regards the research subjects as co-participants with a stake in the inquiry process and action plan, as well as praxis (defined as the transformation that occurs through the integration of theory and practice), and outcomes directed toward solving legitimate problems (Denzin and Lincoln, 2003a). This limitation reflects the need for future study of interdisciplinary teacher education through action research.

This study is methodologically framed in constructivism, an educational theory that could be viewed as a limitation of this study, considering Phillips (2000) warns that constructivist labels can be misleading. Constructivist theory is nuanced and complex, depicted as the most dangerous intellectual tendency as well as a “fashionable and fruitful paradigm” to guide educational practice and research (Phillips, 2000, p. 2-3). It is subject
to radical and anti-foundational representations (Denzin and Lincoln, 2003b, p. 273) that reject perennial, unvarying standards by which truth can be universally known (Denzin and Lincoln, 2003b, p. 273). Constructivist representations can lack clarity and are susceptible to “appropriation by the most authoritarian of pedagogies” (Paul Ernest, 1995 cited in Howe and Berv, 2000, p. 31). “The enactment of any curriculum is, in all of its dimensions, a sociopolitical project which can be more or less emancipatory for people and the community,” Desautels, Garrison, and Fleury, (1998) maintain, adding “Ignoring this idea can easily lead constructivism to become just a better way to sustain social injustice in furthering particular social interests through our educational practices” (p. 255). In the following passage, Beck and Kosnik (2006) describe how constructivist educational theory has been misconstrued:

- some identify it just as an activity approach, overlooking its role in empowering learners and critiquing prevailing ideas and social practices. Others understand it as unstructured ‘discovery learning,’ where anything goes. Still others interpret it as a highly subjective and individualistic process that neglects experience of the world and collaboration with others. Misunderstandings of these kinds give constructivism a bad name and create obstacles to gaining support and resources for constructivist teaching and teacher education; they also make implementation of the approach difficult even under ideal conditions. (p. 7)

Similarly, as Fosnot (2005) asserts, “various interpretations of constructivism still abound, often confusing it with ‘hands-on’ learning, discovery, and a host of pedagogical strategies “resulting in “ public attacks by the media, by parents, and even at times by various groups in the academic community” (p. x). A limitation of this study is utilizing constructivism as methodological framework and educational theory that is highly susceptible to (mis)interpretation.

In sum, educational theory is perpetually in the making, evolving into new approaches to conceptualizing and initiating curriculum and pedagogy. Kuhn (1983) asserts that every paradigm, at any given moment, generates disciplinary perspectives — the corresponding questions, theories, principles, practices, and solutions associated with a discipline — as well as challenges as these perspectives are contested, rejected, and co-opted by diverse and divergent forces inside and outside of academe. While this kind of evolution is a necessary condition to exercise and develop knowledge, it poses research limitations and requires the perpetual redefinition of conditions necessary to give it currency (Larochelle, Bednarz, and Garrison, 1998, p. vii).

**Justification**

Pinar et al. (2004) state, “The point of contemporary curriculum research is to stimulate self-reflection, self-understanding, and social change” (p. 56). Building upon that assertion, this study provides a justification for conceptualizing interdisciplinary teacher education through programs that prepare future teachers and scholars personally and professionally in becoming proficient interdisciplinarians (Augsburg, 2005) with the capacities to take on leadership roles that cultivate P-12 interdisciplinary education. This study links interdisciplinary teacher education with lifelong learning, emancipatory knowledge construction, social justice, political change, and global responsibility (Vadeboncoeur, 1997), predicated on the idea that symbiotic relations between interdisciplinary and teacher education are indispensable to teach future educators and
prepare them to teach effectively amid the complexities of teaching in the Global Epoch, for as Adler (2001) states, “whether a fragmented system of education can in any effective way produce integrated beings is perhaps the most significant question confronting practitioners of ... education today” (p. 151). The following subsection provides a justification for this study and asserts interdisciplinary teacher education reform is the necessary response to global issues that affect all social institutions, including “issues of community, personal engagement, life-long learning, diversity, and institutional change” (Smith & McCann, 2001, p. 113). This study maintains that educators must have the kind of broad academic knowledge and experience that is possible only through interdisciplinary approaches to teaching and learning. It supports the academic development and establishment of interdisciplinary teacher education as a timely curricular reform to educate the whole person — the teacher in the world and the world in the teacher — as well as counter the increasing fragmentation, specialization, and compartmentalization of knowledge, disciplines, programs, and departments in academe.

Bruner (1977) states, “Each generation gives new form to the aspirations that shape education in its time” (p. 1). Future educators will have a new role in the Global Age, and profound interdisciplinary reforms in teacher education are necessary to insure that aspiring teachers are prepared for their expanding roles. This study maintains that if we wish future educators to be well-educated teachers, citizens, and leaders, then strong interdisciplinary teacher education programs are critical. For example, interdisciplinary approaches are recommended particularly in the Global Age as the nested communities of the local and global depend to a great extent upon the ability of teachers to enter into meaningful public dialogue about the value and interests of teacher education practices and policies. Increasingly, teachers need to be educated so that they are prepared to take strong and thoughtful stands on issues, to persistently question and develop a healthy skepticism regarding solutions to problem solving, to make informed decisions, and to work to bring responsible goals to fruition in local and global contexts. The most critical challenges facing education currently — including the achievement gap, high-stakes testing, language and literacy, and international educational policy — need to be studied and addressed in light of multiple disciplinary perspectives and through intense interdisciplinary collaboration. A justification for this study, then, is based on the assertion that interdisciplinary knowledge and experience are necessary in the Global Age to augment the short- and long-term personal and social transformations that are possible through the efforts of prospective educators and their future students.

This study is intended to contribute to the pragmatic purposes of interdisciplinary teacher education reform and discourse development, for if, as Boix Mansilla, Miller, & Gardner (2000) maintain, “interdisciplinary exchange has become an intrinsic part of knowledge production” (p. 35), then “Explicit linkages between progressive thinking and interdisciplinary theory could enhance K-16 teaching” (Newell, 2002, p. 137). Repko (2008) finds interdisciplinary teachers and students need interdisciplinary resources as much as, if not more so, than teachers and students of any field or discipline. Yet, relatively few twenty-first century published works address the intersections of these two fields of study, interdisciplinarity and teacher education, or regard interdisciplinary perspectives on pedagogical research as “equally important dimensions of interdisciplinary scholarship” (Lattuca, 2001, p. 20). Further, Boix Mansilla, Miller, &
Gardner (2000) find “The reconceptualization of disciplinary knowledge in schools…emphasize[s] its generativity and dynamism…[in ways that invite educators] to see disciplinary and interdisciplinary work as mutually enhancing” (p. 35).

This justification underscores a point introduced in the Significance section of this chapter; that is, there is a critical need to cultivate understanding about what interdisciplinarity is and is not. Despite the fact that the mission statements or goals of some interdisciplinary teacher education programs refer variously to interdisciplinarity, including phrases such as “integrating knowledge” or “educating the whole person,” it appears that these programs may make little or no attempt to integrate through interdisciplinary approaches as described in the texts, notably written by Boix Mansilla, Klein, Newell, and Repko, germane to the contemporary field of interdisciplinary studies. It is not clear if these programs use interdisciplinary processes to integrate disciplinary insights or if the disciplines are simply juxtaposed not integrated. In the context of teacher education, is interdisciplinary a misnomer for programs or courses more aptly described as multidisciplinary, and just how interdisciplinary should teacher education programs be? Part of the justification for this research is based on exploring those questions and addressing the perceived need for conceptualizing interdisciplinary teacher education programs that teach interdisciplinarity, not necessarily to be interdisciplinary.

This research contributes to the developing discourse in interdisciplinary teacher education but also to rethinking the traditional nineteenth century models of departments, divisions, colleges, and schools, which need greater accessibility to, not replacement by, diverse approaches to interdisciplinarity. There is a growing consensus that the disciplines should not be studied in isolation from other disciplines, and that multiple disciplinary insights need to be integrated to address complex current issues, yet current academic structures are not conducive to interdisciplinary pursuit. This study is justified on the basis that it identifies and examines these sorts of academic structural issues, and thereby facilitates conceptualizing interdisciplinary teacher education that bridges the organizational and epistemological structures that separate and divide academic departments and the disciplines themselves.

A justification for this study is that it links interdisciplinary teacher education with cultivating the personal and professional development of future educators through lifelong learning. Through interdisciplinary approaches, new forms of understanding and ways of perceiving problems and issues not only create new data but also “alter practice by changing researchers’ understandings of themselves” (Bullough, 2006, p. 9). This study conceptualizes interdisciplinarity in relation to educators as lifelong learners and to teacher education as more than preparation for a career. This study justifies teacher education as a potential platform for individual growth and responsibility as well as learning extended beyond its immediate context. This study is justified on the basis that interdisciplinary teacher education cultivates educators, including prospective teachers and their postsecondary faculty, as individual lifelong learners in their search for self and social meaning (Beane, 1995). If, to paraphrase Alfred North Whitehead (1957/67), Education is what remains after you’ve forgotten the facts, the most practical and valuable aspects of teacher education are the personal, moral, and intellectual qualities that benefit society as they enrich the personal and professional lives of educators.

Further, this study is justified because it cultivates active participation in various communities educators will inhabit during their lifetimes. Interdisciplinarity deepens
democratic and pluralistic understandings as it forges more meaningful connections between the individual and “the radiating spheres of public life that can either enrich or threaten our shared ‘search for truth’” (Benston, 2005, p. 107). The Global Age is marked by the increasing interdependence of self and community; interdisciplinarity cultivates connections, but also forges new relationships and identities, in response to the confluences of local, state, national, and global communities. While there are nationwide efforts to integrate the wider responsibility of higher education to democracy and citizenship, this study asserts interdisciplinarity provides unique and inherently democratic opportunities to facilitate student opportunity, achievement, and success as it is instrumental in preparing graduates to participate in democracy as educators and citizens (Larrivee, 2007).

This study justifies the need for educational research that counters high-stakes testing and standardization in education that is by many measures undermining public education in the United States. This research frames interdisciplinary approaches as a kind of antidote to the marketization of education (Davidson, 2004) and reductionist perspectives on teacher education reforms that aim simply to prepare teachers to raise test scores and support educational standardization, perspectives which undermine the democratic goals in education (Kohn, 2004). This study asserts that we rethink learning outcomes and reject those narrowly defined solely by standardized testing and instead embrace interdisciplinary approaches and assessments in teacher education (Boix Mansilla, 2204a, 2004b; Boix Mansilla & Dawes, 2004; Boix Mansilla & Duraising, 2007; Boix Mansilla & Gardner, 2003; Eisner, 1991; Brady, 2004). This research is devoted to providing students in teacher education programs rich opportunities to learn, not just opportunities to be held accountable for high-stakes testing outcomes in their future students (The Challenge of Connected Learning, 1991). The increasing standardization in U.S. education is included among the cultural “mechanisms designed to chill discourse and curtail diversity” (Benston, 2005, p. 107). This study is predicated on the idea that it is critical to develop interdisciplinary teacher education to counter the forces of standardization that increasingly encroach upon K-12 public education.

This study is justified on the basis that interdisciplinary teacher education empowers learners and validates their knowledge and experience, as it counters the over-professionalization and specialization of the disciplines, described by Adler (2001):

We are increasingly being confronted with the fact that the important issues regarding human life, our coexistence with nature and the planet, the proper allocation of natural, social, and human resources, and our judgments about the uses of our immensely powerful technological tools cannot and should not be left to specialists alone” (p. 158).

Improving the enterprise of teacher education serves a practical function, considering that education touches every aspect of human activity and helps to insure the health and future of society. Yet, Grossman (2005) points out that most research on postsecondary teacher education focuses on what is taught rather than how prospective teachers should be taught. Therefore, this study is justified on the basis that it promotes interdisciplinary teacher education, through which future educators learn firsthand how to apply interdisciplinary approaches to their own learning, and are hopefully encouraged to apply it to their own P-12 curricular and pedagogical practice.
This study recognizes that a major goal of educational research should be to inform classroom practice as mandated by the increased complexities of phenomena in the social and physical world, as well as the forces of globalization (Sklair, 2000), yet the research on interdisciplinarity has not generally been transferred into postsecondary teacher education curriculum and pedagogy. Therefore, this study is justified on the basis that it conceptualizes and fortifies a close, meaningful link between interdisciplinarity and teacher education, reinforcing Davis’ (1995) assertion that the overarching goal of interdisciplinary studies is “to find and then introduce students to new perspectives” (author’s italics, p. 150), or new ways of seeing and knowing. This study justifies interdisciplinary teacher education as a kind of life-changing platform or progressive laboratory for social change devoted to education, that does not focus on training as described by Eisner (2002), but teacher education as preparation for participating in democratic citizenship, lifelong learning, and social transformation. In addition, this study does not endorse a singular, definitive approach to interdisciplinary teacher education for it recognizes that the diversity of students and communities makes some degree of variety and contextualization an imperative for democratic education, notably in relation to curriculum development. In light of the current challenges to democratic forms of education in the United States (Larrivee, 2009), and the anti-democratic manifestations that persist during the post 9-11 war on terrorism, interdisciplinary teacher education works to counter what Bentson (2005) describes as the “mechanisms designed to chill discourse and curtail diversity” (p. 107) on campuses across the United States. The need for understanding the strata of the individual, and making meaningful and purposeful connections between and among the complexities of the world through the integrating insights from the disciplines and fields of study, further serves to justify interdisciplinary teacher education. The cultivation of internationally relevant and responsible interdisciplinary teacher education curriculum and pedagogy, and the capacity to transform relationships and partnerships within academe as well as between the academy and extended local and global communities, contributes to cultivating future educators with an indelible commitment to teach responsibly to achieve the goals of global social justice, change, responsibility, and transformation (Cochran-Smith, 2006). Interdisciplinary teacher education, thus conceived, necessarily supports the progressive, democratic, and international aims of the kind of teacher education required in the Global Age.
CHAPTER TWO: INTERDISCIPLINARY CONCEPTS

Introduction

This study begins by acknowledging that while the discourse of interdisciplinary teacher education may not be a well-developed scholarly province, it clearly does not start from scratch or occur in a vacuum. This study explores, from a constructivist theoretical viewpoint, the intersections of the fields of interdisciplinary studies and teacher education as they are evolving in the Global Age. It aims not only to broaden and enrich the fields of education and interdisciplinary studies but also to inextricably connect them. This conceptual study focuses on a review of current interdisciplinary scholarship, especially work published in the past ten years (from 1997 to 2008). This chapter aims to define key terms and concepts in the interdisciplinary discourse, disclosing crosscutting issues and implications for conceptualizing interdisciplinary teacher education. This study refers to quotations, anecdotes, references, and evidence from the review of the literature that contributes to laying the conceptual groundwork for a model of interdisciplinary teacher education. This chapter investigates and summarizes some of the foremost interdisciplinary issues, themes, trends, concepts, and debates, as it develops findings based on this research.

Klein (2005a) reminds us that any nomenclature is a reflection of reality but also a selection and deflection of it, finding interdisciplinary terminology inextricably bound to “differing views of the purpose of research and education, the role of the disciplines, and the role of critique” (p. 54). Differences between terms such as **interdisciplinary** and **crossdisciplinary** are often subtle yet significant, and the same word can be variously interpreted. For example, in the field of teacher education the term **interdisciplinary** is frequently used to refer to what the majority of interdisciplinarians would consider more aptly described as **multidisciplinary**. Davies and Devlin (2007) find that interdisciplinarity is “used increasingly in the rapidly changing context of higher education…[yet] it is often used loosely, and is frequently confused with ‘multidisciplinary’ and ‘cross-disciplinary’” (p. 1). As Repko (2008) states, “many disciplinarians use the terms multidisciplinary and interdisciplinary interchangeably and are unaware of the role of integration and the goal of the interdisciplinary enterprise” (p. 25). For example, the National Center for Education Statistics (NCES) classification of instructional programs defines multidisciplinary and interdisciplinary studies programs interchangeably as “Instructional programs that derive from two or more distinct programs to provide a cross-cutting focus on a subject concentration that is not subsumed under a single discipline or occupational field” (National Center for Education Statistics, 2002). Further, a review of the literature bears out that it is not uncommon practice for a program or course involving more than one discipline to be considered by default interdisciplinary. Klein (2002) states that a lack of shared knowledge about “the tradition, vocabulary, methods, and theory of interdisciplinary education” (p. 2) has impeded interdisciplinary work at national and local levels and led, even on an international scale, to a proliferation of self-styled haphazard interdisciplinary practices, which Klein (2002) describes as “good intentions gone astray,” “improvised,” and “ill-considered” (p. 2). Therefore, this chapter is justified in seeking to clarify and distinguish key interdisciplinary concepts that are particularly relevant to conceptualizing interdisciplinary teacher education.
This chapter is divided into five sections: Introduction, Proximal Interdisciplinarity, Disciplines and Disciplinary Insights, Conceptualizing Interdisciplinarity, and Disciplinary and Interdisciplinary Relationships. After an introduction to the chapter, the second section constructs definitions for specific terms, including *multidisciplinarity*, *crossdisciplinarity*, *pluridisciplinarity*, and *transdisciplinarity*. The third section centers on providing a definition for *discipline*. It examines the limitations of a single disciplinary perspective yet establishes disciplinary insights as integral to interdisciplinary work. The fourth section begins with a brief introduction that includes a discussion of the antecedents of present-day interdisciplinarity and a justification for interdisciplinary work. It elaborates on the definition of interdisciplinarity initiated in the introductory chapter, providing further analysis of a range of attributes of interdisciplinarity that are significant in the context of conceptualizing interdisciplinary teacher education. Further, it explores assumptions about interdisciplinary engagement, the three basic types of interdisciplinary approaches according to Repko (2008), as well as Newell’s (2002) distinction between full and partial interdisciplinarity. It also provides an examination of the aims of interdisciplinarity as well as interdisciplinary *habits*, dispositions, and skills. Further, this section provides an analysis of related concepts, such as boundary work, interdisciplinary issues and topics, common ground, integration, and integrative leverage. The fifth and final section of this chapter focuses on summarizing research by examining key questions and answers that clarify aspects of the disciplinary and interdisciplinary relationship. In sum, this literature review strives to create a flexible construction of interdisciplinarity that can apply to conceptualizing interdisciplinary teacher education and illuminate paths to crafting and implementing interdisciplinary teacher education programs that ultimately strengthen P-12 education.

**Proximal Interdisciplinarity**

While there are multiple ways and levels from which to engage the disciplines, various interdisciplinary approaches, Klein (2005a) tells us, “speak as separate voices” (p. 55). To cultivate a shared understanding of interdisciplinary terminology relevant to conceptualizing interdisciplinary teacher education, this subsection distinguishes *interdisciplinary* from related terms, including *multidisciplinarity*, *crossdisciplinarity*, *pluridisciplinarity*, and *transdisciplinarity* (Klein, 1990, 2002). This section analyzes the typology of words that are closely related to but distinct from interdisciplinarity, acknowledging these terms can be understood relationally as degrees of interdisciplinary engagement, variants of interdisciplinarity (Davies & Devlin, 2007), and allied concepts distinguished from interdisciplinary (Apostel et al., 1972; Jacobs, 1989; Klein, 1990, 2002), for the purposes of clarifying the general perception of what interdisciplinarity is and is not in the context of this study.

*Multidisciplinarity* is additive not integrative in that it involves yoking two or more disciplines without any attempt to synthesize their insights (Klein, 1990, Repko, 2008). Multidisciplinarity entails the juxtaposition not integration of disciplinary insights, and “the most basic distinction” (Klein, 2005a, p. 55) among terms of interdisciplinarity is the difference between multidisciplinarity and interdisciplinarity. In describing multidisciplinarity, Klein (1990) states,
Even in a common environment, educators, researchers, and practitioners still behave as disciplinarians, with different perspectives. Their relationship may be mutual and cumulative but not interactive, for there is ‘no apparent connection,’ no real cooperation or ‘explicit’ relationships, and even, perhaps, a questionable ‘eclecticism’ The participating disciplines are neither changed nor enriched, and the lack of ‘a well-defined matrix’ of interactions means disciplinary relationships are likely to be limited and ‘transitory.’ (p. 56)

The major distinction between interdisciplinarity and multidisciplinarity generally hinges on integration. Whereas interdisciplinarity works to achieve discipline-based integration, multidisciplinary courses and programs engage multiple disciplines without integrating their insights. Without integrating insights, the endeavor is multidisciplinary, not interdisciplinary, exemplified by a multidisciplinary course team-taught by a professor of science and a professor of social science, who make no attempt to synthesize their insights from disciplinary perspectives, or require students to do so.

A host of interdisciplinary scholars define multidisciplinarity and provide a clearer picture of its distinctive characteristics. Newell (2002) distinguishes multidisciplinarity as a form of partial interdisciplinarity that draws on more than one discipline yet makes no explicit attempt to integrate their insights. In the words of Boix Mansilla, Miller, and Gardner (2000) “What is lost in multidisciplinary understanding is the possibility of enriching each disciplinary perspective through fruitful exchange [and extrapolation] of concepts or modes of thinking across disciplines” (p. 33). Further, multidisciplinarity makes no attempt to be critical of the disciplines or status quo, as the disciplines unquestionably retain their original identity (Klein, 1990). Davis (2007) finds multidisciplinary involves skipping back and forth between disciplines, or “a kind of sequential movement back and forth from one discipline to another, like serving eggs followed by mushrooms rather than a mushroom omelet” (p. B9). Similarly, Davies and Devlin (2007) find multidisciplinary approaches do not require disciplinarians to discuss the subject matter with each other, and explain multidisciplinary as “the co-existence of a number of disciplines…no more intellectually, or academically, illuminating than what typically exists in higher education degrees” (p. 3).

**Pluridisciplinarity**, a term fading from use in more recent interdisciplinary literature (Newell, 2008c), generally engages the concepts, principles, and methods of two or more highly correlative disciplines or fields of study, like chemistry and physics or Greek and Latin (Klein, 1990). Pluridisciplinarity, not unlike like bad party etiquette, involves hosting conceptually and methodologically similar disciplines but does little more than extend a formal invitation and usher in guests. Pluridisciplinarity leaves students to fend for themselves, to make disciplinary connections and integrate disciplinary insights in a largely implicit, untutored way, if at all. Pluridisciplinary work avoids the processes of integrating disciplinary insights or assessing students in those processes. Just as interdisciplinarity correlates with integration, and multidisciplinary with juxtaposition, pluridisciplinary corresponds to employing correlated disciplines in the absence of explicit attempts to integrate them (Klein, 1990).

In general, **Crossdisciplinarity** involves utilizing one discipline to study another. In other words, one discipline is employed to examine, view, or peer into another (Davies & Devlin, 2007; Jacobs, 1989a), such as studying the history of mathematics or the physics of music (Jacobs, 1989a). Crossdisciplinarity generally works across the
disciplines but differs from interdisciplinarity in that its goals do not include, for example, integrating or reconciling the insights from the disciplines, inviting other disciplinary paradigms into the context of a discipline-specific course, inventing new research paradigms or disciplines, or creating a new context for understanding issues or solving problems (Augsburg, 2005; Vess & Linkon, 2002). Newell and Green (1982) critique the disciplinary dominance associated with crossdisciplinary approaches:

Crossdisciplinarity points out that interactions across disciplines are not always cooperative or complementary; one can find disciplinary imperialism as well in which one discipline attempts to take over the characteristic subject matter of another discipline in a way that ignores or rejects its contributions. (p. 15)

Crossdisciplinarity can be understood as a foreign approach through which the discipline being scrutinized “becomes a passive object of study rather than an active system of thought” (Vess & Linkon, 2002, p. 90).

Through an analysis of the word crossdisciplinary, Klein (1990) discloses the layers of meaning represented by the term and illuminates issues associated with using terms in the absence of well-developed theory. The term crossdisciplinary corresponds at once to using one discipline to view another, to the subjugation of one discipline to another, and to revalorizing traditional approaches to problem solving instead of cultivating new solutions or disciplines. It also is used as a generic descriptor for multiple types of “discipline-crossing activities” (Klein, 1990, p. 55) as well as all activities involving disciplinary interaction. Klein (1990) reminds us that knowledge as conflicting and non-neutral, clearly demonstrating that discursive practices disclose the power/knowledge constructs that pervade linguistic nomenclature, which can not only reflect, but also select and deflect meaning.

Transdisciplinarity, considered by Davies and Devlin (2007) as the most radical form of interdisciplinarity, is usually equated with concepts, theories, schools of thought, and methods, such as Marxism, that cut across disciplinary lines (Newell, 2006, p. 251). Klein (2005a) describes transdisciplinary as “a comprehensive framework that transcends the narrow scope of disciplinary worldviews through an overarching synthesis” (p. 59). Klein (1990) finds that compared to interdisciplinarity, transdisciplinarity is “far more comprehensive in scope and vision” (p. 65) and “a more thorough assimilation of knowledge” (p. 67). Terms closely related to transdisciplinary include postinterdisciplinary, antinterdisciplinary, nondisciplinary, adisciplinary, metadisciplinary, supra-disciplinary, and omnidisciplinary, as well as transc-specialization and supra-discipline (Klein, 2005a, 1990). These terms correspond to what Klein (1990) regards as a rare conceptual totality that transcends disciplinary confines, disobeys the disciplinary rules of etiquette, aspires to reveal the interconnectedness of all aspects of reality, and renders the disciplines “irrelevant,” “subordinate,” or “instrumental” to the larger framework” (p. 65-6). Newell (2006) stresses that transdisciplines, like interdisciplines (two or more disciplines that produce a new field of study or discipline, such as Women’s Studies, International Studies and biochemistry), have their own core beliefs and approaches that form alternative orthodoxies from which various theoretical positions can evolve. A distinctive quality of much transdisciplinary work, Klein (2005a) notes, is its focus on creating “a common ethical and political language” (p. 100). Klein (2005a) explains that transdisciplinarity and interdisciplinarity differ in that transdisciplinarity critiques and even de-disciplines the disciplines upon
which interdisciplinarity is based. Klein (1996) adds, “the term ‘transdisciplinary’ usually labels a paradigm or vision that transcends narrow disciplinary worldviews through overarching synthesis” (p. 11). Repko (2008) concurs, explaining that transdisciplinarity starts with a topic and applies discipline-based knowledge to engage the topic above and beyond disciplinary constraints; “Transdisciplinarity does not rely on the disciplines but transcends them and seeks to replace them by attempting to develop comprehensive worldviews of reality like Marxism and feminism” (p. 9). Repko (2008) states that the goal of transdisciplinarity is to unify knowledge through a unified concept of the world (p. 122). Further, Beane (1997) equates transdisciplinary with supradisciplinary, corresponding to curricular approaches that attempt to use current issues as catalysts for discussion and research without regard for disciplinary or subject-area distinctions. Transcending disciplinary perspectives and approaches may be the ultimate goal of interdisciplinary pursuit, yet Klein (1990) points out, “There is no inevitable progression from ‘multidisciplinarity’ through ‘interdisciplinarity’ to ‘transdisciplinarity’” (p. 71).

Repko (2008) expands on a paradox of transdisciplinarity, which endeavors to look through or distill a singular unifying theory, ideology, metaphor, or lens, at the risk of perpetuating knowledge fragmentation and creating “a closed system of thought that includes certain kinds of knowledge while excluding others” (p. 9).

Disciplines and Disciplinary Insights

Building from the definition of discipline introduced in the first chapter, this study considered more deeply the ways in which the term is variously represented and interpreted by interdisciplinarians in the Global Age. Newell (2006) uses discipline to refer to disciplines, sub-disciplines, transdisciplines, and interdisciplines (hybrids of two disciplines, like biochemistry, that have become disciplines in their own right), as well as schools of thought and specialties. Newell (2002) writes that the academic disciplines are expanding collections of insights at once powerful, by virtue of their disciplinary resolution and depth, but limited, due to their disciplinary tunnel vision, which constrains vision and restricts assumptions. Newell (2002) states, “Where a discipline stands (the assumptions it makes), the lens through which it looks (its perspective), what it chooses to look at (its characteristic subject matter), and why it chooses to look there (its values) all limit as well as define that discipline” (p. 123). Newell (2006) maintains,

When a discipline is brought to bear on a complex problem, it immediately redefines the problem more narrowly in a way that allows it to make use of its distinctive concepts, theories, and methods. The result is that each discipline offers powerful but limited and skewed insights into the overall problem. (p. 245)

Boix Mansilla (2004) explains that the disciplines “have survived the scrutiny of expert communities using commonly agreed upon methods and validation standards” (p. 219), and are foundational, for example, in the processes of designing and crafting courses, integrating the curriculum, and assessing student learning. While the disciplines are taught and learned as a static array of universal facts, truths, laws, and principles, they are widely regarded as an evolving socioculturally and sociohistorically embedded constructs of ideologically-infused human understandings subject to change (Greene, 1998; Grossman, Wineberg, and Beers, 2000; Klein, 1990; Lattuca, 2001; Beane, 1997). Greene (1988) explains that the disciplines are among the traditional languages and modes of sense-making that “continue resonating and reforming in the light of new undercurrents,
new questions, new uncertainties” (p. 127). As Bullough (2006) explains “disciplinary boundaries are historical creations, habits of mind, and are subject to change over time despite faculty allegiance to and self-investment in them” (p. 9). Newell (2002) finds the disciplines created potent but bounded insights, powerful because of the greater focus, resolution, and penetration made possible by disciplinary lenses, but limited because the price of that power is narrowed range of vision and restrictive assumptions…Where a discipline stands (the assumptions it makes), the lens through which it looks (its perspective), what it chooses to look at (its characteristic subject matter), and why it chooses to look there (its values) all limit as well as define that discipline. (p. 122-3)

Klein (1990) defines the disciplines as the “source of instrumental and conceptual materials for problem solving, the base for integration, and the substance for meta-critical reflection” (p. 106). The disciplines are comprised of established epistemic communities and consensus “upon what constitutes excellence in a field” (Klein, 1990, p. 107). Lattuca & Creamer (2005) acknowledge that disciplinary terminologies, methodologies, methods, and conventions are essentially cultural tools, adding, “our forms of inquiry and the kinds of questions we ask of the world are shaped by prevailing cultural conditions, practices, and beliefs” (p. 4).

While the disciplines represent human sociocultural constructions, institutionalized and dogmatic “public bodies of knowledge” (Phillips, 2000, p. 6), they can also be understood as representing official knowledge (Apple, 1993) and disciplinary hegemony (Klein, 1990, p. 52), or institutionalized bodies of expertise prepared to tell us what the facts are (Repko, 2008). They can be regarded as tools that implicitly and explicitly reinforce the structures of social and academic power as they influence “students’ views about what is known, what is valued, and what is capable of investigation” (Davies and Devlin, 2007, p. 2).

Newell (2006) explains that the disciplines are bound by their respective “characteristic perspective or worldview” (p. 251), which can be described as an ideology, a way of thinking that is largely implicit, shared yet distinctive, and integral to the socialization processes within the field (Klein, 1990; Newell, 2002; Davies & Devlin, 2007). Newell (2002) contends “While the clear-cut dichotomy between disciplinarity and interdisciplinarity is being eroded, an important distinction remains: Researchers in each discipline are borrowing concepts, theories, and methods from other disciplines while still holding on to its characteristic world view” (p. 123). Davies and Devlin (2007) elaborate:

Art historians, geologists and economists, for example all differ markedly in terms of how they substantiate their knowledge and their methodologies used…Academic disciplines can have substantial differences in regard to standards of justification and evidence, degrees of certitude in what constitutes knowledge, and in their understanding of the structure of knowledge itself. (p. 2)

The physical sciences and the social sciences typically utilize different types of experiments and research methods based on their respective disciplinary methodological traditions. Yet, each discipline has its own theoretical calling card, or set of traditions, principles, answers, and perspectives illuminating, for example, different facets of complex problems. Disciplinarians tend to approach a complex task from the limiting perspective of their specialty and are unable (or fail) to consider the relevant perspectives
of other disciplines, professions, or interested parties (Repko, 2008). In fact, one discipline may not even concede a problem or issue that is apparent to another, corresponding to \textit{theory-dependent observation}, or how “Quite literally, two opposing disciplinarians can look at the same thing and not see the same thing” (Petrie, 1976, p. 35). Newell (1983b) states, 

Because the insights of a discipline reflect its world view, and because the world views of disciplines are often contradictory, interdisciplinarians must typically reconcile conflicting insights before they can be synthesized. This task of reconciliation [or forging common ground] involves the explicit examination of the often implicit assumptions underlying each discipline’s world view. (p. 246)

While the distinctive worldviews may blur, the implicit disciplinary assumptions do not disappear, becoming readily apparent, for example, through interdisciplinary team teaching or when they are violated in a manuscript submission to a disciplinary journal (Newell, 2002). Therefore, as part of the interdisciplinary process, interdisciplinary work should include explicitly identifying as well as comparing and contrasting the worldviews embedded in disciplinary insights (Newell, 1983; Klein, 1990).

Disciplinary mapping, is a common metaphor corresponding to the construction of discipline-based knowledge through interdisciplinary work. Davies and Devlin (2007) elaborate on how the disciplines shape our understanding of the world and essentially encode the cognitive maps we construct through disciplinary, as well as interdisciplinary, research processes:

Practitioners understand the world in terms of the cognitive models they possess; they ‘see’ things differently. Disciplinary-based concepts are necessary for viewing the world in a certain way. In the normal course of events, of course, students learn these cognitive maps when they are inducted into a discipline. This is part of what it means to become ‘educated.’ Once this has occurred, it becomes difficult for those inducted to see things any other way. (p. 5)

The disciplinary map metaphor is found in work by Klein, including her monograph \textit{Mapping interdisciplinary studies} (1999). Similarly, Newell (1998) equates narrow disciplinarity with conceptually overlapping maps, as opposed to a broad interdisciplinary, as he recommends introducing students to interdisciplinary thinking and methods through courses that are “narrowly but fully interdisciplinary…rather than broad but partially interdisciplinary” (p. 125). Further, Petrie (1976) describes disciplinary maps as the “basic concepts, modes of inquiry, what counts as a problem, observational categories, representation techniques, standards of proof, types of explanation, and general ideas about what constitutes the discipline” (p. 35). Petrie (1976) asserts interdisciplinarity is more successful when its cognitive maps overlap, as in the physical sciences, as opposed to maps that ideologically are miles apart, as may happen by teaming humanists with scientists (p. 36). Yet, Petrie (1976) maintains interdisciplinarians must familiarize themselves with at least a part of the maps of the disciplines on which they draw to appreciate “the relevance of their colleagues’ points of view to the problem at hand…[and convert] multidisciplinary work into interdisciplinary work” (p. 35). Petrie (1976) acknowledges the need to engage the insights of disciplines, yet expresses concern about what he considers the risk of disciplinary cognitive maps obstructing interdisciplinary inquiry.
Conceptualizing Interdisciplinarity

“At the start of the twentieth century,” Klein (2002) states, “the word ‘interdisciplinary’ was not even in the English language…yet at the start of the twenty-first century, it is pervasive in education and research” (p. 197). The field of interdisciplinary studies has its own traditions, vocabulary, methods, and theories (Klein, 2002) and has progressed to the point at which it can begin to conceptualize itself (Newell, 2002, 2006; see also Kleinberg, 2008). While the field has developed substantive and canonical bodies of work, Grossman, Wineburg, and Beers (2000) point out that the meaning of interdisciplinarity continues to evolve. Interdisciplinary is a relatively new term that Newell (2006) finds to be somewhat problematic, claiming “the term ‘interdisciplinary’ probably places too much emphasis on the disciplines and not enough on the other available sources of perspective. Were it not so infelicitous, one might better speak of ‘interperspectival studies’ instead” (Newell, 2006, p. 251). The multiplicity of representations and interpretations of interdisciplinarity is indicative of the different and at times conflicting views on the purpose and meaning of interdisciplinarity as well as its role in academe (Klein, 2005a). Newell (2007b) underscores the importance of defining interdisciplinarity, since “Different definitions of interdisciplinary studies reflect different conceptions of interdisciplinary studies, which result in different curricular and pedagogical decisions, which result in different intellectual activities that have different learning outcomes” (p. 2). Further, Newell (2007b) finds interdisciplinary courses “can be highly motivational when they are based on a clear definition of interdisciplinary studies which mandates that the course focus on issues…and follow an identifiable process…that leads to more efficacious behavior” (p. 2). A precise language never awaits interdisciplinarity, a twentieth century neologism. Yet, while complete agreement on a definition seems unlikely it has narrowed considerably (Newell, 2007b).

Interdisciplinarity generally involves examining a common denominator – a problem, issue, topic, or theme – by deploying two or more relevant (not arbitrary) discipline-based foci that are meaningfully integrated, based on practical need or curiosity (Boix Mansilla, 2008a; The National Academies, 2005). Interdisciplinary studies draws upon disciplinary ways of knowing (Gardner & Boix Mansilla, 1994), engaging research and curricular processes that combine two or more academic disciplines, professions, departments, subjects, or fields of study in ways that integrate, or engage differences between, traditional disciplinary approaches, worldviews, epistemologies, discourses, curricula, practices, principles, and methods (Augsburg, 2005; Klein, 2002; Newell, 2006; Spaulding, 2002). Interdisciplinarity engages a topic that serves as a common denominator through which the insights of more than one traditional discipline, disciplinary approach, worldview, or discourse are engaged to illuminate deeper understanding (Repko, 2008; Augsburg, 2005; Klein, 2002; Newell, 2006; Spaulding, 2002, Boix Mansilla, 2004). “Interdisciplinarity,” Klein (2005a) explains, “integrates disciplinary data, methods, tools, concepts, and theories in order to create a holistic view or common understanding of a complex issue, question, or problem” (p. 55). Klein and Newell (1997) find interdisciplinarity does not stand alone or supplant the disciplines, but derives from, complements, and even corrects the disciplines (p. 394). In the following quote, Newell (2002) articulates the need for interdisciplinarity:

If all phenomena studied by disciplines followed the same underlying principles, operating according to the same rules and thus yielding their secrets in response to
the same methodologies, there might be many specialties but only a single
discipline. If relationships among those phenomena were additive, so that the
whole were equal to the sum of its parts, then those specialties could successfully
follow the divide-and-conquer strategy implicit in reductionist scholarship. The
disciplines cannot collectively see the…[problem] as a whole, however, because its
parts interact multiplicatively as well as additively: The interdisciplinary whole
is greater than the sum of its disciplinary parts. For example, the income, status,
power, country of origin, and education of public housing residents are all
interrelated. The…[problem] requires interdisciplinary study to be better
understood as a whole: The various aspects not only look different from each
vantage point, they follow different principles as well. Each discipline
reconstructs its distinctive set of principles; interdisciplinary study uses them to
develop an answer to a particular question, an answer that provides a glimmer of
new insight into the whole – a more comprehensive understanding. (p. 122)
Kleinberg (2008) provides two models of interdisciplinarity. The first model
centers on a program, or series of classes, based on a large, cohesive interdisciplinary
theme. For example, Kleinberg (2008) explains that over the course of three years, the
College of Letters at Wesleyan University requires students to take five interdisciplinary
team-taught perennialist colloquia, based on the “great books” from Western antiquity to
the present day. The second model of interdisciplinarity addresses a specific issue or set
of issues, as reflected in course titles that include “Science in Society” and “Feminist,
Gender, and Sexuality Studies.” Kleinberg (2008) finds this model “protects the program
from becoming another ‘discipline,’ while the importance of the project itself protects
against dilettantism” (p. 11). In the context of discussing these models, Kleinberg (2008)
points out that major aims include destabilizing authority and authoritative
pronouncements, not in the service of promoting relativism but for the sake of creating a
space in which students can actively participate in dialogue, exchange, and the infusion
of new ideas based on the disciplines. Further, Kleinberg (2008) distinguishes
amateurism from dilettantism, explaining that this model of interdisciplinarity engages
students as active participants in their own learning processes and leads to “creativity and
fosters new and exciting research” (p. 11).

Interdisciplinarity, then, engages problems, topics, issues and questions that draw
from the disciplinary knowledge of multiple disciplines or fields of study (Newell, 1983;
Klein, 2002). It forges common ground between the disciplines and integrates
disciplinary insights. It provides a more comprehensive understanding of an existing
complex situation or solution to a problem too immense or multifaceted to be addressed
sufficiently addressed via a solo discipline or profession (Newell, 2006, p. 248;
Augsburg, 2005).

Through interdisciplinarity, Klein (2002) maintains, “Subjects and disciplines are
no longer isolated or self-justified; they become tools for a new purpose” (p. 9). As Klein
(1999) explains,
The heart of interdisciplinarity is the interplay of perspectives that occurs in
balancing depth, breadth, and synthesis. Depth insures the necessary disciplinary,
professional, and interdisciplinary knowledge and information for the task at
hand. Breadth insures a multidisciplinary variety of perspectives. Synthesis
insures integrative process and construction of a holistic perspective that is greater
than the simple sum of its parts. (p. 16; see also Klein and Newell, 1997; Newell 1983b, 2002)

Further, Klein (2002) states, “Interdisciplinarity interrogates and even disturbs existing categories of knowledge and institutional structures” (p. 8). It advances knowledge through work that produces new disciplines and fields of study but also deliberately cuts across but integrates established disciplines, making it possible to access knowledge and experience unreachable through traditional disciplinary means (Newell, 2007a). Interdisciplinarity is a polymorphic set of methods and ideals (Kleinberg, 2008) enabling those who engage in interdisciplinary work to “multiply their perspectives, extend their visions, and strive for new ways of apprehending the world” (Greene, 2001, p. 49).

Repko (2008) finds the prefix inter reflects three essential aspects of interdisciplinarity, corresponding to the contested space between disciplines; the integration of, or the action taken as the result of discipline-based insights; and the final product that is new and additive to knowledge engendered by the integration process. Interdisciplinarity occurs in the contested space within and between the disciplines, from the foundations to the frontiers of the disciplinary interface and integration (Repko, 2008). Interdisciplinarity engages processes, Davis (2007) adds, that “involve subjecting disciplines and the rules by which they operate to a thorough scrutiny, and it would require scholars to listen to those critiques” (p. B9). Through interdisciplinarity, traditional disciplinary boundaries are reinforced, blurred (Geertz, 1980), and crisscrossed as discipline-based knowledge is integrated and enriched (Spalding, 2002).

Repko (2008) acknowledges that interdisciplinary approaches are not required to study all topics, yet there are assumptions about the topics and preconditions that necessitate interdisciplinary approaches. According to Repko (2008), four factors, singly or in combination, necessitate interdisciplinary engagement: The issue is complex (Newell, 2002), the issue has generated interest from at least two disciplines, no single discipline has been able to comprehensively explain or resolve the issue, and the issue is broadly or ill-defined.

Repko (2008) describes five assumptions about interdisciplinarity accepted by the majority of interdisciplinarians. First, interdisciplinary approaches are required to address real-world complex problems, and to counter the gaps in and fragmentation of human knowledge. Second, interdisciplinarity essentially requires the disciplines, so interdisciplinarity stands not as a rejection of the disciplines but a corrective to them. Repko (2008) explains that interdisciplinarity is simultaneously complementary to and critical of the disciplines. Third, singular disciplines are inadequate to address contemporary problems and issues. Fourth, disciplinary perspectives reveal as they conceal relevant aspects of reality, so interdisciplinary pursuit requires cognitive decentering, defined by Repko (2008) as “the intellectual capacity to consider a variety of other perspectives and thus perceive reality more accurately, process information more systematically, and solve problems more efficiently” (p. 40). Finally, integration engenders cognitive advancements that would be impossible within the confines of a single discipline.

Interdisciplinary Approaches: Instrumental, Conceptual, & Critical
All forms of interdisciplinary work disclose the shortcomings of the existing discipline-based knowledge structures. The following section examines three predominant forms of interdisciplinarity: Instrumental, conceptual, and critical (Klein, 1996, 2005a; Repko, 2008). Repko (2008) finds these three interdisciplinary approaches are not mutually exclusive and that more than one can be employed in an interdisciplinary pursuit. These approaches reflect different claims, demands, needs, and assessments of interdisciplinary work (Klein, 1996; Gordon, 2007; Schilling, 2001). The following paragraphs provide an overview of these three distinct interdisciplinary approaches, based on Repko (2008), Lattuca (2001), Newell (2007), and Klein (2005a).

First, instrumental interdisciplinarity is a problem-centered or pragmatic approach that centers on utilizing research and methodological borrowing through interdisciplinary work that addresses societal needs and technological problems (Repko, 2008, Klein, 1996). What distinguishes it from other forms of interdisciplinarity is its aim to solve real-world problems (Repko, 2008). Unlike critical forms of interdisciplinarity, instrumental forms seek to overcome bias, asserting that it is possible to transcend socioeconomic and political issues and concentrate exclusively on the practical business of solving real-world problems (Newell, 2008c). An instrumental perspective holds that the major aim of interdisciplinary work is to understand the disciplines, and not necessarily to challenge or critique them (Klein, 1996, Lattuca, 2001). Instrumental interdisciplinary can be understood as an extreme point on a continuum, with instrumentalism, or empirical problems, at one end and epistemology, or theoretical problems, at the other (Klein, 1996). Klein (1996) adds that interdisciplinarity typically focuses on instrumental forms, or “bridge building,” rather than epistemological forms or “restructuring” (Klein, 1996, p. 10). Lattuca (2001) describes interdisciplinary courses of the late twentieth century as predominantly instrumental, taught by faculty who cross disciplinary borders more in the role of trespassers than warring parties (Lattuca, 2001, p. 3). Newell (Dec 2007) asserts the need to prepare students in the twenty-first century through interdisciplinarity conceived as being “instrumental rather than merely comparative, exploratory, or contemplative” (p. 2). Yet, Klein (1996) critiques instrumentalism on the grounds that it “minimizes critical reflection. It retards or altogether ignores analysis of ends and means, even when impediments to efficient problem solving are acknowledged” (p. 14).

Second, Repko (2008) describes conceptual interdisciplinarity as a pragmatic approach emphasizing knowledge integration and questions that require the engagement of multiple disciplines (Lattuca, 2001). This form is essentially an epistemological endeavor “involving internal coherence, the development of new conceptual categories, methodological unification, and long-term research and exploration (Salter & Hearn, 1996 cited in Lattuca, 2001, p. 11). Repko (2008) explains this type of interdisciplinarity occupies the space between disciplines, so its aims include establishing new disciplines in addition to critiquing disciplinary understandings of a topic.

Finally, critical interdisciplinarity aims to “dismantle the boundary between the literary and the political, treat cultural objects relationally, be inclusive of low culture, and question the premises of dominant practices” (Klein, 2005a, p. 58; see also Repko, 2008, p. 18). While Repko (2008) states that the aim of critical interdisciplinarity is to “interrogate existing structures of knowledge and education, raising questions of value and purpose” (p. 18), Klein (1996) declares, “radical change is the goal” (p. 211). Klein...
(2005a) presents a more graphic interpretation of critical interdisciplinarity as a distinctive form, typified by its characteristic “rhetoric of interpenetration” (Klein, 1996, p. 211), part of the “new rhetoric” (p. 5, 55, 56) or orthodoxy of academe in the 1990s. Klein (1996) describes critical as a less common and more radical form of interdisciplinarity that critiques disciplinary knowledge and questions “the boundaries of genre, discourse, discipline, practice, and theory” (p. 14). Klein (2005a) explains that the poststructural critical imperative — critiquing any concept or theory that systematizes knowledge, culture, or society (Klein, 1996, p. 14) — emerged from an “expanding backlash against older forms of interdisciplinarity” (p. 57; see also Klein, 1996, p. 14-15). Klein (2002) writes that in some new fields of study the purpose of interdisciplinarity is not to combine existing disciplines but to perpetually debate, interrogate, and disturb disciplinary structures. Critical interdisciplinarity can be described as a prospective rather than reflective form of interdisciplinarity. It seeks the transformation of existing structures of knowledge and education by challenging, interrogating, and attacking reflexive forms of interdisciplinarity associated with unity, synthesis, practical or instrumental purposes (Klein, 2005a). While Lattuca (2001) does not explicitly recognize critical interdisciplinarity as one of the essential interdisciplinary approaches, she asserts that all interdisciplinary scholars are “revolutionary in their ideas and ideals and are eager to interrupt disciplinary discourse and to challenge traditional notions of knowledge and scholarship” (p. 3). Davidson (2004) states, “Discipline cultures and their pedagogies can be both valued and critiqued in approaches that facilitate conversations between disciplines, whilst retaining the integrity of those disciplines” (p. 302). Critical forms of interdisciplinarity advance Magee’s (1999) assertion that “criticism does more than anything else to bring about growth and improvement, including the growth and improvement of our knowledge” (p. 185).

Full and Partial Interdisciplinarity

“Instead of a monolithic conception of interdisciplinarity, it is becoming useful to think in terms of a spectrum between disciplinarity and full interdisciplinarity, with varying stages of partial interdisciplinarity in between” (Newell, 2002, p. 123; see also Newell, 1998). Full interdisciplinarity can be understood as engaging topics through more than one discipline, comparing disciplinary assumptions and insights to establish common ground, as well as integrating newly forged understandings that are applicable to practical problem solving, whereas partial interdisciplinarity engages some but not all of these three points (Newell, 2002; Repko, 2008).

Interdisciplinary Aims

What are the general aims of interdisciplinarity? The answer to some extent depends, for example, on the interdisciplinary approach in question and the interdisciplinarian responding. This study finds the majority of interdisciplinarians concur that the general goals of interdisciplinarity include cultivating disciplinary accuracy and clarity, as well as creating new knowledge and meaning (Klein, 1996). For example, Boix Mansilla and Gardner (2003) assert that the primary aim of interdisciplinary work is to integrate the knowledge and approaches of two or more disciplines “into a functioning or unified whole” (p. 1). Yet, beyond the processes of integrating knowledge, interdisciplinarity ultimately participates in this form of unity by creating a product,
solving a problem, or providing an explanation in ways that would not have otherwise been possible (Boix Mansilla & Gardner, 2003). Typically, the aims of interdisciplinarity engage the creative dialogue and tension that exists between and among the disciplines and illuminate the inevitable relationships and disjunctures disclosed by integrating one field with another. Among the aims, according to Klein (2002), is the cumulative effect of interdisciplinary studies has been “to call into question all forms of knowledge, while generating new categories of knowledge and education” (p. 8). Geertz (1980) maintains an essential aim of interdisciplinarity is to alter the way we think about thinking, which can be interpreted as an aim to teach students how to think, not what to think. Similarly, aims include altering the way we learn how to learn (Klein, 1990). Further, aims may involve “Building a methodology for integrating nomenclature from different disciplines” (Apostel, et al., 1972, p. 66), and developing fluency in multiple disciplinary languages, a kind of disciplinary bilingualism or Creole language (Repko, 2008). According to Repko (2008), while interdisciplinary work aims to extend human knowledge and develop new, more comprehensive understandings of or holistic solutions to problems, the ultimate aim of interdisciplinary pursuit is to address a practical problem or social need. Repko (2008) asserts that interdisciplinarity is more concerned with the problems, issues, and intellectual questions than with disciplinary engagement; the disciplines are a means to an end. Similarly, interdisciplinarity aspires to integrate not unify knowledge, yet integration is a means to an end (p. 20). Through interdisciplinarity what was not recognized is brought into the circle of the known, yet the ultimate aim is to effectively apply interdisciplinary knowledge, for example, to critical and reflective thinking, community building, and global problem solving. Interdisciplinarity teacher education aims include these goals, as well as aims associated with cultivating critical consciousness, leadership skills, and democratic education (The Evergreen State College Master in Teaching Program Guidebook to Policies, Procedures, and Resources, 2007).

Deep Understanding

Through individual and collaborative scholarship, Boix Mansilla (2004; see also Boix Mansilla, Miller, & Gardner, 2000; Boix Mansilla & Duraising, 2007) has developed concepts of interdisciplinary understanding, referring in particular to deep understanding, which is one of the most profound aims of interdisciplinary work. Boix Mansilla and Duraising (2007) describe deep understanding, achieved through the synthesis of disciplinary and interdisciplinary knowledge via interdisciplinary work, as follows:

the capacity to integrate knowledge and modes of thinking in two or more disciplines or established areas of expertise to produce a cognitive advancement – such as explaining a phenomenon, solving a problem, or creating a product – in ways that would have been impossible or unlikely through single disciplinary means. (p. 219; see also Boix Mansilla, 2006, p, 16; Boix Mansilla, 2005, p. 16; Boix Mansilla, 2004, p. 4)

Further, Boix Mansilla (2004, 2005) identifies four premises of interdisciplinary understanding. First, interdisciplinary understanding does not center on having or accumulating knowledge but on using or applying it. In this way, the ability to understand a concept stems from its pragmatic thought and application in the context of new encounters and exceeds the requirements of disciplinary information recall. Second,
interdisciplinary understanding is derived from the disciplines, which represent the most
reliable information about the natural and cultural world as determined by disciplinary
experts, emphasizing a sharp distinction between understandings built upon common
sense and interdisciplinary understandings build upon the disciplines, thus reinforcing the
centrality of discipline-based knowledge in interdisciplinary pursuit. Third,
interdisciplinary understandings involve the integration (not the juxtaposition) of
disciplinary perspectives. Further, this premise corresponds to the idea that the
disciplinary whole comprises more than the sum of its parts (Boix Mansilla, 2004); in
other words, the whole can explain the parts but the parts cannot explain the whole.
Interestingly, this is an idea found in social constructivism (Vygotsky, 1962, 1978), but
pertaining to human beings, not disciplines. Fourth, interdisciplinary understanding is a
means to an end not an end in itself in that it facilitates cognitive advancement, or “a new
insight, a solution, an account, an explanation” (Boix Mansilla, 2004, p. 6; see also Boix
Mansilla & Duraising, 2007) through multiple possible types of disciplinary integration
and synthesis. Based on these principles, interdisciplinarity supports improved
understanding. Interdisciplinary work requires the selective use of disciplinary
knowledge and the utilization of more or less compatible disciplinary approaches, as
students navigate disciplinary blind spots, as well as competing and methodological
differences (Boix Mansilla, 2004). Despite how problematic these processes can be,
engaging them provides opportunities to build deep understanding. The unique
challenges of interdisciplinary work include selecting and representing appropriate
disciplinary knowledge, balancing disciplinary breadth with interdisciplinary “deep
understanding,” and a critical perspective toward the proposed integrations (Boix
Mansilla, 2004).

Interdisciplinary Habits, Dispositions, & Skills

Interdisciplinary dispositions can be equated with what Dewey (1921) refers to as
habits. Dewey (1921) explains,
Any habit marks an inclination – an active preference and choice for the
conditions involved in its exercise...A habit also marks an intellectual
disposition...Above all, the intellectual element in a habit fixes the relation of the
habit to varied and elastic use, and hence to continued growth. (author’s italics, p.
48)
Greene (1973) explains that Dewey’s concept reflects the idea that habits can motivate
sagacity and judgment, just as Lattuca (2001) equates Dewey’s concept with “entrenched
ways of thinking that are so second nature to individuals that they are virtually
subconscious…” (p. 225). While habits could be equated with disciplinary entrenchment
and close-mindedness, this study associates the concept of habits with the dispositions to
engage and value interdisciplinary work, as well as the behavioral tendencies cultivated
in interdisciplinary teacher education students and faculty. Newell refers to
interdisciplinary habits, claiming interdisciplinary work fosters an “integrative habit of
mind” (Newell, 1983, p. 245-6) and “interdisciplinarians develop the habit of detached
critical interrogation of all perspectives, making it easier to recognize their own biases
and engage in self-examination of their own perspective” (p. 252). Newell (2002) adds,
“educational researchers consistently find that interdisciplinary courses promote critical
thinking skills” (p. 128). Similarly, Augsburg (2005) acknowledges the need to cultivate
future educators to hold certain interdisciplinary pedagogical dispositions and abiding commitments that prepare them to be interdisciplinarians and perpetuate interdisciplinarity across P-12 education. In addition, Klein (1996) explains that interdisciplinarity is associated with cultivating desirable character traits, behaviors, skills, and abilities in individuals. Klein (2002) finds that through interdisciplinarity, students “develop the capacity to locate and work with pertinent information, to compare and contrast different method and approaches, to clarify how difference and similarities relate to a task, and to create an integrative framework and a more holistic understanding of a theme, question, or problem” (p. 16). Klein (1996) writes of interdisciplinary approaches cultivating problem posing and solving capacities. Klein (1990) cites research that identifies character traits associated with interdisciplinarians, including “reliability, flexibility, patience, resilience, sensitivity to others, risk-taking, a thick skin, and a preference for diversity and new social roles,” and “a high degree of ego strength, a tolerance for ambiguity, considerable initiative and assertiveness, a broad education, and a sense of dissatisfaction with monodisciplinary constraints” (p. 183). Klein (1996) maintains that interdisciplinary programs cultivate students with a greater tolerance for ambiguity and paradox…sensitivity to [the] ethical dimensions of issues…ability to synthesize or integrate…ability to demythologize experts…humility and sensitivity to bias…enlarged perspectives or horizons…critical thinking and unconventional thinking…empowerment…creativity and original insights… [and the] ability to balance subjective and objective thinking. (p. 19)

Further, research associates interdisciplinary with certain behavior types, such as those who tend to be divergent and analogic thinkers, described as “academic intellectuals” and “adventurous scientific minds” (Klein, 1990, p. 183) with “a strong degree of epistemological reflexivity” (Klein, 1996, p. 214). Klein (1990) refers to particular skills associated with interdisciplinary individuals, including a broad predisposition for appreciating topics from multiple angles and for “differentiating, comparing, contrasting, relation, clarifying, reconciling, and synthesizing” (p. 183).

Echoing Klein, Repko (2008) asserts interdisciplinary studies systematically trains the mind and develops character, and identifies traits and skills cultivated through interdisciplinarity. First, interdisciplinarity fosters a set of traits, beginning with enterprise, associated with an entrepreneurial willingness to assume risks to achieve objectives. Interdisciplinarity cultivates a love of learning, tolerance for ambiguity and paradox, receptivity to other disciplines and disciplinary perspectives, and a willingness to develop basic proficiency in discipline-based knowledge that is relevant to the interdisciplinary topic. Moreover, interdisciplinarity fosters an appreciation for diversity and a willingness to work cooperatively and collaboratively. Repko (2008) finds interdisciplinary endeavors teach humility, gleaned through the experiences of affirming mastery of a discipline as well as encountering the limits of one’s education and expertise. Second, Repko (2008) identifies a set of skills associated with interdisciplinary work, including the ability to communicate competently and engage in nonlinear thinking. Repko (2008) finds interdisciplinary also cultivates the ability to think abstractly, dialectically, creatively, and holistically.

*Boundary Work*
Boix Mansilla (2004) writes of the selective borrowing among disciplines that have been chosen for the grounding of an interdisciplinary project. Increasingly the disciplines borrow from each other, evidenced by scholarship described as “boundary work” (Klein 1996). Klein’s book Crossing Boundaries; Knowledge, Disciplinarities, and Interdisciplinarities (1996) describes three elements to interdisciplinary boundary work. First, the topic or subject is detached from existing disciplinary frameworks. Second, researchers “fill gaps in knowledge from lack of attention to the category” (p. 5; see also Repko, 2008). Finally, if the endeavor reaches “critical mass,” disciplinary knowledge is reconfigured to reflect this new understanding. Klein (1996) finds boundary work commences with the selection of terms, itself an act of boundary work:

Calling a given boundary crossing a subdisciplinary exchange, a multidisciplinary affiliation, an interdisciplinary solution, an integrative approach, a collaborative project, a transdisciplinary paradigm, or a cross-disciplinary critique is itself a form of boundary work. The claims codified in terminology reflect differing notions of what constitutes a discipline, philosophical and sociopolitical viewpoints, and opinions about whether interdisciplinarity is primarily an issue of research, education, or administration. (p. 10)

The book contains a chapter titled “Boundary Work in Inter/Disciplinary Relations,” in which Klein claims boundary work is integral to all interdisciplinary endeavors. Klein (1996) examines boundary work in terms of the dynamics, on the one hand, of crossing disciplinary borders and borrowing disciplinary tools and, on the other, of forming new hybrid disciplines, or interdisciplines.

The “Test” of Interdisciplinarity: Complex Issues & Topics

Newell (2007a) finds “the defining characteristic of human existence is complexity” (p. 1), so to better comprehend the myriad complexities of our existence, interdisciplinary approaches are indispensable. Complexity is also the defining rationale for interdisciplinary pursuit, for, as Newell (2006) asserts, the problem has to be complex to warrant interdisciplinary study. Interdisciplinary work requires not only addressing complex issues but also developing research topics that are adequately complex. To effectively engage complex issues and integrate them from multiple disciplinary perspectives requires topics to meet a criterion, or what is referred to as the test of interdisciplinarity. Newell (2004) explains,

The test of interdisciplinarity of a problem is not its distance from the heart of each contributing discipline but whether the problem is fundamentally multifaceted; i.e., whether or not it is complex. If it takes several (actually, more than one) disciplines to understand the problem because each has major insights into its nature, but any one discipline offers not only an incomplete but a more or less misleading interpretation, then that problem is complex and requires an interdisciplinary approach. (p. 2)

The test of interdisciplinarity, then, generally centers on the twofold question: Is the issue sufficiently complex for interdisciplinary engagement, and does a broader, deeper understanding of the issue require the integration of disciplinary insights from more than one discipline? In other words, if it is necessary to examine the topic, and even subtopics, meaningfully from a range of disciplines and disciplinary perspectives, then it passes muster as an appropriately complex subject for interdisciplinary endeavor, for, as Newell (2002) states, “interdisciplinarity is necessitated by complexity” (p. 122). After
determining the topic is complex, Newell (2006) contends, one must consider the scope of the topic. We must resist conceiving the topic too broadly – “that everything is connected to everything else” – or it becomes unmanageable. Newell explains that a topic “can be narrowly defined and still be complex: The test of complexity is not breadth but the predominance of nonlinear linkages between sub-systems” (p. 249). Further, another benchmark of a sufficiently complex topic is if it is provocative to and resonates with the interests and concerns of students. If the topic is sufficiently complex, there should be latitude, for the duration of the interdisciplinary project, within the topic and disciplines selected, for the emergence of the questions and responses initiated by individual students. The topic should be sufficiently complex so that the project can evolve if need be, or change directions through the processes of the student’s engagement, however prolonged, with the topic. Finally, the topic should be sufficiently complex to invite thoughtful reflection, particularly from the student engaged in the interdisciplinary pursuit, but also by others, such as patrons appreciating the art produced through interdisciplinary engagement.

Common Ground

While interdisciplinary integration processes reveal conflicting discipline-based concepts or assumptions, in due course some reconciliation and reciprocity emerges as common ground forged between the disciplinary perspectives, chiefly in the latter stages of an interdisciplinary endeavor. Common ground is the prerequisite for integration. Repko (2008) defines interdisciplinary common ground as “theories, concepts, and assumptions by which conflicting insights can be reconciled and integrated” (p. 272). Common ground precedes interdisciplinary integration. It is an integral precondition to the integrative process (Newell, 2001b, 2005; Repko, 2008). Common ground is integral to the interdisciplinary process and the starting point for mutual interdisciplinary communication (Repko, 2008). As Newell (2002) explains,

The interdisciplinary common ground might be poverty for the economist and sociologist, and it might shift to inequality when political science is included. Thus the very subject matter of interdisciplinary studies is determined through multiple disciplinary perspectives integrated by the creation of common ground” (p. 133).

Repko (2008) explains, “The key to performing integration and producing an interdisciplinary understanding...is creating or discovering the underlying common ground between conflicting insights” (p. 272). Common ground presupposes, and would be unnecessary without, controversy and conflict. Common ground is created or discovered from the lowest common denominator, usually based on common assumptions held between the disciplines, such as a theory or unifying idea (Repko, 2008). Since it requires multilogical thought, evidenced in creative products and processes as well as honed analytical skills, Repko (2008) finds creating common ground the most challenging part of the interdisciplinary process. Repko (2008) acknowledges, “the greater the epistemological differences between disciplines, the more difficult it is to create common ground between their insights” (p. 274). Further, Repko (2008) explains that integrating disciplinary and theoretical insights in the quest for common ground typically requires integrative techniques, such as identifying areas of similarity, overlap, common interest, or compatibility. Newell (2002) points out that the disciplines have
extensive areas of nonoverlap that can obscure important commonalities, the common ground that interdisciplinarity strives to produce. Moreover, integrative techniques vary depending on the topic but can involve, for example, redefining, expanding, extending, or in some way modifying theory for the sake of constructing common ground. Interdisciplinarity, then, does not necessarily strive for discipline-like consensus but for achieving sufficient common ground upon which to build a more comprehensive understanding. Interdisciplinary common ground is not synonymous with consensus; rather, it is the realization or reconciliation that emerges when the perspectives – even those of otherwise conflicting positions -- are modified to overlap or have some common aspect.

Newell (2005) first set out Repko’s (2008) four basic approaches to integrating the insights from the disciplines through the establishment of interdisciplinary common ground, based on redefinition, extension, organization, and transformation. First, redefinition involves modifying, reframing, or redefining disciplinary concepts that apply to the topic under interdisciplinary scrutiny. While redefinition should not be drastic and should not privilege one discipline over another, it may be necessary to reframe definitions to construct coherent understandings and forge common ground (Newell, 2001b). Second, extension corresponds to enlarging concepts so that they can cross disciplinary boundaries to reveal that an idea can have currency in more than one disciplinary domain. Third, organization corresponds to processes that involve (re)arranging or (re)aligning disciplinary concepts to disclose their patterns and relationships. Finally, while some arguments are unavoidable and some assumptions irreconcilable, transformation corresponds to a method for reconciling diametrically opposed assumptions. For example, transformative strategies can involve identifying opposing suppositions -- beliefs, best guesses, and hypotheses -- as variables not absolutes (Newell, 2005). Redefinition, extension, organization, and transformation are processes through which discipline-based patterns and connections become apparent. They are the basic strategies available in the literature so far to extend and enrich the disciplinary and theoretical scope of the interdisciplinary endeavor and to achieve common ground. These approaches to achieving common ground are responses to conflict that seek inclusion and collaboration. Newell (2005) states, “intellectual flexibility and playfulness are more useful than logic at this step in the integrative part of the interdisciplinary process” (p. 20).

**Interdisciplinary Integration**

Interdisciplinary work is integrative work (Klein, 2002). Integration is the most demanding and critical component of the interdisciplinary process; it is what Klein (1990) refers to as the “complex actuality of doing interdisciplinary work” (p. 184; see also Klein, 2002). While integration is in general defined as a synthesis of elements into a unified or functional whole, more specifically interdisciplinary integration refers to combining discipline-based knowledge, theoretical insights, and modes of thinking to yield a better explanation than what is possible via a single disciplinary perspective (Boix Mansilla & Gardner, 2003). Boix Mansilla (2004) contends, “The merit of an interdisciplinary integration is to be assessed against the very goals of each interdisciplinary enterprise” (Boix Mansilla, 2004, p. 7). Klein & Newell (1997, p. 404, 406) explain that integration corresponds to evaluating disciplinary commonalities and
differences. Integration translates into analyzing discipline-based discourses, perspectives on a topic, or solutions to a problem, as well as distinguishing the respective disciplinary insights and integrating them in some form. While Lattuca (2001) finds interdisciplinary integration typically begins with comparing and contrasting between and among the disciplines, examining the same object, phenomenon, issue, problem, or topic from different disciplinary perspectives does not by itself constitute interdisciplinary work. Klein (2002) points out that simply engaging so-called interdisciplinary themes or juxtaposing disciplines or subject does not automatically guarantee integration (p. 12). Integration should be part of initial and ongoing steps in the conceptualization, development, and assessment of interdisciplinary work. While Klein (1996) finds that integration has occurred when a more comprehensive understanding is achieved (p. 223), integration corresponds to the ongoing processes and final products of interdisciplinary endeavor, and does not necessarily emphasize the product more than the process of interdisciplinary engagement.

Newell (2002) describes interdisciplinary integration in terms of points on a continuum, finding that there are degrees of integration, just as some students are more adept than others in terms of their abilities to engage in integrative work. Newell (2002) explains integration…is neither automatic nor easy. It happens only when teachers and scholars make it possible. They must value synthesis in a world that focuses on analysis, creating space for it in educational institutions and assisting their students in developing the requisite skills. (p. 124) Newell (1990) explains that he used to think of integration as analogous to completing a jigsaw puzzle. Yet, through his experiences in interdisciplinary teaching and learning, he has come to realize that the pieces do not necessarily fit together seamlessly, as articulated in the following quote:

the external reality scholars confront is often complex, variegated, and contradictory, so that mutually incompatible assumptions can all be ‘correct’…I now see integration in interdisciplinary study as essentially holistic thinking, in which the different facets of a complex reality explored through disciplinary lenses are combined into a new whole that is larger than its constituent parts, that cannot be reduced to the separate disciplinary insights from which it emerged. Whether we call it integration, synthesis, or synergy, this process is more organic than mechanical, involving the coordination as well as cooperation among disciplinary perspectives. It requires an act of creative imagination, a leap from the simplified perspectives that give the disciplines power to a more holistic perspective of a richer, more complex whole. The leap is motivated by a dissatisfaction with the partial insights available through individual disciplines. (p. 74)

Klein (1996) maintains integration is not necessarily a streamlined or sequential process or the finale of interdisciplinary work: “Synthesis is not reserved for a final step. The possibilities are tested throughout, moving in zigzags and in fits and starts as new knowledge becomes available and new possibilities and limits arise” (p. 223).

Interestingly, while integration may in theory be the goal of interdisciplinary endeavor, in practice it is not, for as Klein (1996) maintains, creating a working relationship between
disciplinary-based differentiation and combination is an ongoing process that does not necessarily achieve closure through interdisciplinary integration.

*Interdisciplinary Integration Based on Repko*

Repko (2008) defines *interdisciplinary integration* as “the process of creatively combining ideas and knowledge from disciplinary and other sources to produce a more comprehensive understanding or cognitive advancement” (p. 123). Repko (2008) explains that integration is “the part of the research process that seeks to reconcile conflicting disciplinary insights…that results in “something altogether new, distinctive, apart from, and beyond the limits of any discipline, and, thus, additive to knowledge” (author’s italics, p. 6). Repko (2008) describes integration as a triangular scale tipping between three points: Interdisciplinary integration, disciplinary depth, and disciplinary breadth. Integration, an ongoing internal assessment of the interdisciplinary process, corresponds to the processes of combining in novel ways two or more objects, ideas, theories, etc. to create a new product, arrive at a new solution, or form a new, more complex whole (Repko, 2008). Repko (2008) claims that an integrated work can be assessed as a product and a process, yet recommends assessments based on two product-centered criteria: How effective is the work at conveying the phenomena it claims to explain, and does the interdisciplinary endeavor produce a sum that is by some measure greater than its constituent disciplinary parts? Repko (2008) finds that integration is a means to an end, which is a novel and more comprehensive understanding of the topic.

Linked with the *synthesis* level of Bloom’s Taxonomy, interdisciplinary integration refers to the nature of the *new whole*, the cognitive activities that are integral to integration, and the contribution of discipline-based knowledge to the generation of integration (Repko, 2008). First, the new whole refers to insights that do not necessarily fit together cleanly or according to prescribed patterns. While the *new whole* can be understood as an interdisciplinary product, with constituent parts fitting together more like a highly interpretive collage or bricolage (Denzin & Lincoln, 2003b, p. 6) than a jigsaw puzzle, Lattuca (2001) provides an insightful metaphor, comparing interdisciplinary work to “a seamless woven garment that stands in contrast to the patchwork quilt of multidisciplinary work” (p. 11). Second, integration requires a kind of balance between taking a stance, or discipline-based perspective, and thinking holistically. Throughout the processes of the interdisciplinary endeavor, those engaged must evaluate their own biases, assume the role of a disciplinarian in the process of gleaning disciplinary insights, yet also receptive to new or unfamiliar knowledge (Repko, 2008). Finally, holistic thinking corresponds to thinking broadly and fluidly, not limited to the confines of a particular disciplinary perspective, for the sake of generating a more comprehensive understanding of the topic engaged.

Repko identifies four criteria of integration: Integration is the result of research, it involves utilizing a set of operations, it is a creative endeavor involving assembling elements to form some sort of whole, and it engages a process that maximizes the chances of coming up with an effective solution. Repko (2008) finds integration a difficult and extremely complex mental process that requires the triangulation of breadth, depth, and integration of discipline-based knowledge. Echoing Newell (1983b), Repko adds that integration surpasses by some measure the sum of its constituent parts.
In sum, Repko (2008) claims that virtually all interdisciplinarians agree on what integration should encompass, and regard integration as the salient feature of interdisciplinary work and an indispensable aspect of the interdisciplinary process. Repko (2008) concludes there is a “growing recognition of the importance of integration to interdisciplinarity studies and its ability to produce new knowledge” (p. 47).

Disciplinary and Interdisciplinary Relationships

Newell (1998) finds “understanding the role of disciplines in interdisciplinary studies should be central to a full understanding of interdisciplinarity” (p. 541), yet what is the nature of the relationship between disciplinary and interdisciplinary education? Interdisciplinarity can be understood as being in a symbiotic or complementary “rather than competitive or antagonistic” (Newell, 1983, p. 245) relationship with the disciplines. The disciplines are stretched and developed by interdisciplinary pursuit, not simply for the sake of descriptive or analytic ends but to advance knowledge and revalorize the significance of the disciplines and their theoretical underpinnings in contemporary contexts. Yet, Klein (1990) writes of the interdisciplinary paradox, that interdisciplinary work essentially must be disciplinary. Based on a review of the literature, the following section addresses these and related ideas through a series of questions that have emerged to disclose significant understandings about the affiliation of disciplinarity and interdisciplinarity in the context of conceptualizing interdisciplinary teacher education.

In general, what are some of the major justifications for interdisciplinary education? Newell (2006) finds that interdisciplinarity produces knowledge that would otherwise be inaccessible. Feyerabend (1975) asserts interdisciplinarity generates new knowledge and understanding that was not formerly “part of the existing perceptual world” (p. 32). Further, Bullough (2006) explains that interdisciplinarity requires crossing “well-established intellectual divisions and social and institutional boundaries – divisions and boundaries that tend to encourage and reward insularity” (p. 9). Dewey (1927) claims that “thinking deprived of its normal course takes refuge in academic specialism” (p. 168), yet interdisciplinarity complements disciplinary specialization and counters disciplinary myopia, cultivating theories that are otherwise highly restrictive or incomplete, thereby contributing to the healthy development of the disciplines (Repko, 2008). In addition, interdisciplinarity can help to resolve theoretical impasses within and between the disciplines (Repko, 2008; Gerdes, 2002). Seipel (2002) states,

Contradictory conclusions and accompanying tensions between disciplines may not only provide further understanding, but could be seen as a healthy symptom of interdisciplinarity. Analysis which works through these tensions and contradictions between disciplinary systems of knowledge with the goal of synthesis – the creation of new knowledge – often characterizes the richest interdisciplinary work. (p. 3)

Further, interdisciplinarity acknowledges the evolution of the disciplines and promotes the development of new, relevant disciplines and fields of study. Moreover, The National Academies (2005) advocate educational and research opportunities that support educators in becoming conversant in ideas and languages from other disciplines and claim multiple benefits of interdisciplinary approaches, namely their “essential and growing role in permitting researchers to venture beyond the frontiers of their own disciplines and address questions of ever-increasing complexity and social urgency” (The National Academies, 2005, p. xi). Further, not only does interdisciplinarity illuminate relationships
among various disciplines, but it also provides parallel exposure to solutions from one field that could be applied and advance research in another field. Moreover, Newell (2006) points out that “Disciplines typically redefine a complex problem so they can address it using the tools at their disposal” (p. 250), focusing on a problem and ignoring that which is inconvenient or outside the scope of phenomena traditionally studied by the discipline. Therefore, interdisciplinarity helps students understand how the disciplines employed (re)define the topic, and that it is essential to understand the respective biases and limitations of these disciplines, as well as the strengths and relevance of their insights on the topic (Newell, 2006). Further, interdisciplinary counters the inclination in traditional discipline-based courses to focus on problems that require “the expertise and interest only of faculty assigned to teach it, and the illumination only of the disciplines mandated for inclusion in the course” (p. 250). Davies and Devlin (2007) contend that while students need enough exposure to discipline-based knowledge and ideas to develop disciplinary fluency, they also need opportunities to integrate insights from the disciplines and obtain interdisciplinary assistance when necessary or appropriate.

What is the basis of interdisciplinary knowledge? Newell (2008c) explains that interdisciplinarity can be understood as having three sources: The disciplines, linkages that have yet to be explored by the disciplines, and “the integration of insights from disciplines and linkages” (n.p). Interdisciplinarity is the persistence of traditional disciplinary roots, commitments, and ideologies (Mewborn et al., 2002) linked to the integration of “variables studied by different disciplines, since these connections are typically unexamined by any discipline” (Newell, 2007a, p. 4). Newell (2002) states, “Disciplinary analysis requires interdisciplinary synthesis as its complement” (p. 122). Klein (2002) reiterates Newell’s claim, adding that interdisciplinarity is a “counterbalance and complement to disciplinarity” (p. 118). Newell (2002) states, “focused disciplinary scholarship should be guided and corrected by interdisciplinary perspective, which in turn becomes sharpened and more comprehensive as it draws on new disciplinary scholarship” (p. 122).

Does interdisciplinarity intend to de-discipline the academy? On this point Repko (2008) adamantly voices a claim that reverberates explicitly through the interdisciplinary discourse and is supported by virtually every interdisciplinarian cited in this study: “Interdisciplinary studies does not seek to minimize… or replace the traditional disciplines” (author’s italics, p. 10). While Davies and Devlin (2007) acknowledge the challenges of receiving an interdisciplinary education “without risking the strengths of a well-grounded education in the language of single disciplines independently” (p. 5), this study supports the need for discipline-based knowledge. As Davies & Devlin’s (2007) claim, “Graduating students will need to emerge from university with the required discipline-specific vocabulary in each of the disciplines in which they have studied” (p. 5). It supports Boix Mansilla & Duraising’s (2007) claim that one of the three pillars of interdisciplinarity is to sustain “disciplinary standards in interdisciplinary work” (p. 219). Although each discipline “is not a static repository of universal truth or method…the content or subject matter of disciplines is immensely valuable and must be taught” (Russell, 2006, p. 175). Moreover, while this study recognizes that students need discipline-based knowledge, it asserts that such knowledge should be attained in some measure through interdisciplinary endeavor. Interdisciplinarity does not aspire to dissolve the disciplines but to utilize them in inclusive, not exclusive ways. This study holds that
interdisciplinarity does not endorse abolishing the disciplines or being nondisciplinary (Klein, 1990), nor does it advocate presenting condensed, essentialized disciplines, for example, in a course that presumes to teach everything students need to know about multiple disciplines in one semester. Those aims are unwarranted, untenable, and unrealistic. The aim is to integrate disciplinary insights that are significant in teacher education curricula and research projects, and to think across the disciplines in inclusive, not exclusive ways. The development of interdisciplinarity does not come at the expense of compromising disciplinary integrity. The aim of interdisciplinarity is to teach, learn, and research through processes that consummate the integration discipline-based knowledge.

Must we be disciplinary before we can be interdisciplinary? Whether or not disciplinary knowledge is a precondition of interdisciplinary work, and whether or not novices can engage in interdisciplinary work are the subjects of intense debate. Yet, this study rejects this argument as a false binary, asserting students do not necessarily have to have a thorough grounding in disciplines to engage them. Disciplinary and interdisciplinary novices are capable of contributing significant insights and understandings that advance knowledge. Adler (2001) addresses the need for non-specialists to engage in research:

> We are increasingly being confronted with the fact that the important issues regarding human life, our coexistence with nature and the planet, the proper allocation of natural, social, and human resources, and our judgments about the uses of our immensely powerful technological tools cannot and should not be left to specialists alone” (p. 158).

Similarly, Myers and Haynes (2002) find “Many of our strongest and more creative successes in [interdisciplinary] student research have come from teams of science and nonscience students in which the nonscientists added an unexpected strength” (p. 188). Further, Klein (1990) acknowledges the hostility towards interdisciplinarity by those who judge “it ‘an amateur threat to professional interest’” (p. 106). Kleinberg (2008) elaborates on this point,

> There is an aspect of amateurism in…interdisciplinary work that is often troubling to the traditional disciplines, but this should not be confused with dilettantism. One cannot be expert in everything, and ideally it is the question of the informed amateur or the conflation of two disparate approaches that leads to creativity and fosters new and exciting research. (p. 10)

This study supports students in developing disciplinary grounding but emphasizes meaningfully integrating disciplinary insights into their work. It recognizes the need for what Klein and Newell (2002) refer to as collective generativity, the support and colleagueship on local and broader levels, to promote and sustain interdisciplinarity. Further, this study rejects the notion that any disciplinary or interdisciplinary endeavor can provide the definitive account or that its outcome should be unequivocally accepted (Taber, 2006). Interdisciplinary research “leaves one still searching but greatly helped forward in the search” (Magee, 1999, p. 92), not only by what is disclosed, but also by the critical reactions and reflections that transcend normative structural hierarchies that distinguish so-called novices from experts.

Can interdisciplinary approaches be utilized in all disciplines and fields of study, and can all disciplines and fields of study utilize interdisciplinarity? Newell (1983b)
points out that disciplinary and interdisciplinary approaches need not be mutually exclusive, for, “it is pragmatic as well as philosophically sound…to think of interdisciplinary studies in symbiotic relationship with the disciplines, complementary to the disciplines rather than competitive or antagonistic” (Newell, 1983, p. 245). Newell (2007a) maintains “interdisciplinarity is fully complementary to the disciplines, embracing them as it draws insights from them, while transcending them as it integrates those insights into a more comprehensive understanding” (p. 4). Boix Mansilla, Miller, & Gardner (2000) acknowledge that some disciplinary paradigms are complementary and others are mutually exclusive, and therefore advocate a wide range of interdisciplinarity approaches and assessments that may differ from those employed in other forms of scholarship (Gordon, 2007). In addition, Jacobs (1989b) addresses the either/or argument about using either disciplinary or interdisciplinary approaches. Jacobs (1989) finds the essentialist attack on interdisciplinarity regards interdisciplinary studies as nothing more than an interesting diversion. Yet, this viewpoint contributes to the ignorance of the American public, Jacobs (1989b) asserts, adding, “Discounting interdisciplinary efforts as attempts at relevancy at the expense of the classics is simplistic and only heightens the polarity” (p. 5). At issue is not whether we should teach the classics, but whether or not we make effective and relevant connections – no matter what the content – between fields of knowledge through their disciplinary insights.

Is it the function of interdisciplinary work to critique the disciplines and their supporting social and organizational structures within academe? From an instrumental interdisciplinary perspective, the answer is no, and from a conceptual interdisciplinary viewpoint, the answer could be yes or no, or yes and no, but from a critical interdisciplinary perspective, the answer is resoundingly yes. Klein (2005a) explains that it is the function of critical forms of interdisciplinarity to critique the social and disciplinary structures upon which interdisciplinary work is based and which may very well impede it (see also Lattuca, 2001). Further, if, as Alfred North Whitehead (1929/1978) states, “Knowledge does not keep any better than fish” (p. 98), then interdisciplinary work can be understood as filling a genuine need to enliven and invigorate the disciplinary provinces and their constituents through the novel and “fruitful exchange of concepts or modes of thinking between and among disciplines” (Boix Mansilla, Miller & Gardner, 2000, p. 35; see also Davies & Devlin, 2007).

Does interdisciplinarity strive for the unification of all knowledge and disciplines? The idea that there is an underlying unity of all knowledge if one could manage to crack the code has successively passed from classical antiquity, through the Enlightenment, and into the early twentieth century (Cat, 2007). Based on a review of the literature, such unification theory is rarely explicitly acknowledged, so, in general, the field of interdisciplinary studies rejects the notion of the unification of all knowledge and all disciplines.

Should all courses be interdisciplinary? It could be argued that interdisciplinarity is an invaluable curricular innovation that should permeate all levels of education because it reconciles, integrates, and applies disciplinary insights, achieving solutions and arriving at answers too large to be adequately addressed by a single disciplinary approach (Newell, 1983). Yet, Newell (1983b) views the relationship between disciplinary and interdisciplinary work as complementary or symbiotic in that “each is most effective only with the help of the other” (Newell, 1983, p. 246). Further, interdisciplinary integration
should be vital at undergraduate and graduate levels of education, as well as within and between courses, in part, Newell (1983) argues, because it is practical to do so. Newell (1983) claims, interdisciplinary curriculum “can be simply more efficient at presenting introductory disciplinary material that can separate disciplinary courses” (p. 247). Newell (1983) maintains that as students “come to recognize that any one discipline is a powerful but limited tool…because it captures only one aspect of reality” (p. 247), interdisciplinary pursuit provides “the best answers currently available” (p. 248) and “intellectual revitalization” (p. 250), cultivating informed decisions and choices that affect a range of concerns, from choosing college majors to deepened understandings of current events and issues.

Further, Newell (2002) supports the claim that not every course should necessarily be an interdisciplinary course and not every program should be comprehensively interdisciplinary. There should be flexibility in the planning and implementation of interdisciplinary curriculum, which acknowledges the number of interdisciplinary courses or projects may vary from student to student. While students should experience multiple interdisciplinary courses, and interdisciplinary methods should permeate between and among requisite coursework, the purpose of interdisciplinary work is to cultivate students who “go beyond logical skills to become critically reflexive about the nature of disciplines and themselves” (Klein, 2002, p. 16).
CHAPTER THREE: CONCEPTUALIZING INTERDISCIPLINARY TEACHER EDUCATION

Introduction

As this study maintains that there is a need for research in the field of interdisciplinary teacher education, it attempts to bridge the scholarship of interdisciplinary studies and teacher education and support efforts to conceptualize interdisciplinary teacher education. This is a study on and of interdisciplinarity that establishes common ground between the fields of teacher education and interdisciplinary studies as well as a conceptual framework for developing interdisciplinary teacher education programs. This study advocates, “interdisciplinary relationships formed for the purposes of teaching and learning” (Davies & Devlin, 2007, p. 4), and advances the claim that interdisciplinarity is helping to shape the academy in the Global Age (Humphreys, 2002). Interdisciplinarity “should not be peripheral to teacher education” (Klein, 2002, p. 201). “The focus of interdisciplinary educators must expand from exploring interdisciplinary topics to include the training of students in interdisciplinary study” (Newell, 2002, p. 136). While interdisciplinary curriculum enriches “the quality of undergraduate and graduate education” (The National Academies, 2005, p. 157), The National Academies (2005) state:

Educators should facilitate interdisciplinary research by providing educational and training opportunities for undergraduates, graduate students, and post-doctoral scholars, such as relating foundation courses, data gathering and analysis, and research activities to other fields of study and to society at large. (The National Academies, 2005, p. 5)

Further, this study endorses cultivating interdisciplinary pre-cultures that prepare future educators to do transformative interdisciplinary work in P-12 education (Klein, 2002). It examines how teacher education can be enriched and expanded across interdisciplinary epistemologies, research paradigms, ideologies, and experiences (Sleeter, 1997, p. 2), focusing on issues of primary importance in conceptualizing interdisciplinary teacher education. It advocates teacher education programs that address a practical twofold purpose: To explicitly foster preservice teachers in making useful connections between and among their required coursework, and in learning firsthand interdisciplinary approaches they can in turn pass along to their future students (Fiume, 2005). In addition to this introduction, this chapter situates Maxine Greene as its major theoretical referent, who provides a constructivist framework suitable for conceptualizing interdisciplinary teacher education. It finds support for interdisciplinary work in the scholarship of curriculum theorists and teacher educators. It addresses the state of the field, including a survey of various forms of interdisciplinary teacher education programs in the United States. It considers the uncertain future of interdisciplinary studies programs and advocates the need for developing interdisciplinary teacher education reform and curriculum. This study can be understood as a response to an imperative derived from Klein (2002), who finds the ultimate goal of interdisciplinarity is “To reconstruct what is taught and how it is taught” (p. 8).

A Constructivist Theoretical Framework for Conceptualizing Interdisciplinary Teacher Education

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Both the constructivist methodology and theory of learning utilized in this study are derived from Maxine Greene, recognized for her highly developed aesthetic sensibilities and philosophical scholarship, but also her decades of intellectual leadership in the field of education, “groundbreaking interdisciplinary research” (Baum, 2003), and staunch support of interdisciplinary thinking and education (Teacher’s College, 2005; Noppe-Brandon, 2005). Greene is an interdisciplinary educator who integrates parallel concepts and forges common ground based on insights gleaned, for example, from philosophy, literature, economics, politics, and current events. Pinar (1998) writes, “Maxine has inspired an entire generation of scholars to think in politically engaged and powerfully interdisciplinary ways” (p. 5), adding that her work “dissolves traditional disciplinary boundaries” (p. 5).

Greene (1976) provides a theoretical framework for conceptualizing interdisciplinary teacher education, which enables individuals “to make sense of their lived lives, to make connections, to construct meanings” (p. 90), and argues that education is “a process of awakening diverse persons and enabling them to develop their talents and work with one another to help bring into existence a better and more just social order and a more meaningful way of being in the world” (www.maxinegreene.org, 2007). Greene (1988) writes,

It is through and by means of education… that individuals can be provoked to reach beyond themselves into their intersubjective space. It is through and by means of education that they may become empowered to think about what they are doing, to become mindful, to share meanings, to conceptualize, to make varied sense of their lived worlds. (p. 12)

Greene (2001) writes of the need “to discover the kind of knowledge…that effectively responds to what students at different levels want to know…We want to create situations in classrooms that will release our students for live and informed encounters. We want to make the richest sorts of experiences possible; we want choices to be made” (p. 27). Greene (2001) conceives of teacher education as cultivating qualities and skills that include the desire to learn and the passion to teach, a more active sensibility and awareness of our surroundings and students, the quality of our attending to and communicating with our students, and the provision of learning experiences that broaden and enrich students’ lives and allows them to inquire, discover, and make personally relevant choices. Greene (2001) endorses education that empowers individuals to come together in learning communities to share their situated perspectives and create meanings integrally tied to processes of constructing and reconstructing the untidy and intersubjective world. She maintains that educators “have to break, as much as we can, with the technical, the measurable, with the fearful ideas of effectiveness and efficiency. We have to make discovery possible again, and exploration” (p. 62-3).

The following passage reflects Greene’s (1988) commitment to and understanding of interdisciplinary teaching and learning:

Let us say young high school students are studying history. Clearly, they require some understanding of the rules of evidence where the historical record is concerned. They need to distinguish among sources, to single out among multiple determinants those forces that can be identified as causal, to find the places where chance cuts across necessity, to recognize when calculations are appropriate and when they are not. All this takes reflective comprehension of the norms governing
the discipline of history. But this does not end or exhaust such study. There is a consciousness now, as there was not in time past, of the significance of doing history ‘from the ground up,’ of penetrating the so-called ‘cultures of silence’ in order to discover what ordinary farmers and storekeepers and elementary schoolteachers and street children and Asian newcomers think and have thought about an event like the Holocaust or the Vietnam War or the bombing of Hiroshima or the repression in South Africa that continues to affect them directly or indirectly even as it recedes into the visualizable past. They need to be empowered to reflect on and talk about what happened in its varying connections with other events in the present as well as the past. And they may be brought to find out that a range of informed viewpoints may be just as important when it comes to understanding the Civil War, or the industrial revolution, or the slave trade, or the Children’s Crusade. Clearly, if the voices of participants or near-participants (front-line soldiers, factory workers, slaves, crusaders) could be heard, whole dimensions of new understanding (and perplexity and uncertainty) would be disclosed. (p. 127)

Based on this passage, Greene seems to resonate particularly to what Klein (2005a) refers to as critical forms of interdisciplinarity, notably in that the passage implies consciousness and politics cannot be separated from cognitive work (Greene, 2001), and education should cultivate “the capacity to look at things as if they could be otherwise” (Greene, 2001, p. 63). Pinar (1998) provides support to this claim, noting that Greene’s work “seems to conceive of intellectuality as very much a matter of political engagement, critical inquiry, and cultural criticism” (p. 5).

Among the most pronounced constructivist threads that run through Greene’s work and guide this study is the basic assumption that education enables people “to become different, to enter the multiple provinces of meaning that create perspectives…and look through the lenses of various ways of knowing, seeing, and feeling in a conscious endeavor to impose different orders upon experience” (Greene, 2001, p. 5). Greene (1995) recognizes that students endeavor “to make sense of their lived lives, to make connections, to construct meanings” (p. 90). While students are conscious and unique individuals at the center of the educational enterprise, Greene (1995) stipulates, “the individual does not precede community” (p. 197). Further, through various forms of community, Greene (2001) recognizes people “in their diversity…engage…against the background of their own lived lives” (Greene, 2001, p. 148). Greene (1995) asserts we must construct meaning and rewrite texts within the context of our shared experiences and stories, through which we gain a broader and enriched understanding of the world. Moreover, Greene writes of the human “hunger for community” (p. 23), and the need for emancipatory education through which “persons in their plurality…can become different, where they can grow” (p. 56). Our efforts to initiate change and transformation require the help of others (Greene, 1973). Various forms of learning communities (Gabelnick, Matthews, MacGregor, & Smith, 1990) and collaborations (such as interdisciplinary seminars) can lead not only toward social transformation but also self-discovery (Greene, 1978).

Our epistemological and ontological understandings are co-constructed from various viewpoints and understandings by individuals enmeshed in the social milieu (Greene, 1973). Knowledge is socially mediated and as such is inculcated with a range of
values, biases, and interests. Greene (1973) rejects “fixed principles, closed systems, and pretended absolutes” (p. 35), asserting we cannot rely on accumulated knowledge, conventional wisdom, or the knowledge transmitted by “experts” (p. 8), but must actively seek, create, and interpret the world for ourselves. Further, Greene (1988) maintains that traditional languages and modes of sense-making “must never be thought of as complete or all-encompassing, developed as they have been to respond to particular kinds of questions posed at particular moments in time” (p. 127). Greene recognizes human beings as socio-historically situated individuals, stating “Human beings, of course, devise their life projects in time – against their own life histories and the wider human history into which those histories feed” (Greene, 1988, p. 23; see also Greene, 1973). In addition, Greene (1988) finds that reality is perpetually emergent. Our understandings are “increasingly multiplex, as more perspectives are taken, more texts are opened” (p. 23). Yet, Greene (1988) maintains, “there can be no final agreements or answers, no final commensurability” (p. 134). Greene (1988) empowers us, maintaining that human beings have “the capacity to establish a reality of our own” (p. 56). Greene (1973) holds that reality is not directly knowable and that no matter what may be true about the nature of reality, human beings are part of whatever reality there is. Further, human beings are not detached observers looking at reality from the outside as something that exists apart from us, just as we are not passive vessels receiving knowledge or tabula rasas onto which knowledge is transcribed. Greene (1998) states, “It is never enough simply to label, categorize, or recognize certain phenomena or events. There has to be a live, aware, reflective transaction if what presents itself to consciousness is to be realized” (p. 30). In sum, Greene provides constructivist principles that support conceptualizing interdisciplinary teacher education curricular and pedagogical innovation, as evidenced in the points that follow.

Toward Conceptualizing Interdisciplinary Teacher Education

What is the curricular relationship and balance between disciplinarity and interdisciplinarity in the interdisciplinary teacher education program? To what extent would teacher education programs need to be restructured to become interdisciplinary? Must all or most teacher education courses be interdisciplinary, or would an interdisciplinary program component, such as an interdisciplinary thematic sequence, suffice? These and related sets of questions must be addressed by each program in light of numerous factors and objectives, notably fulfilling state and national accreditation requirements. Disciplinary courses and the integration of disciplinary insights are fundamental to the interdisciplinary teacher education program. Ideally, the program would strive for a balance between disciplinary and interdisciplinary-based courses through curriculum designed and co-constructed by all stakeholders, including students, faculty, and administration. Rather than triangulating interdisciplinary coursework — a configuration that might include a three-part thematic sequence, or interdisciplinary courses only at the beginning, middle, and end of the program — this study advocates more integral short- and long-term forms of interdisciplinary integration. Ideally, through continual, daily exposure to interdisciplinary approaches, preservice educators would learn firsthand to effectively engage interdisciplinarity and integrate the content of discipline-based general education courses in ways that are particularly relevant to their understandings as future educators. The interdisciplinary teacher education curriculum
must insure that preservice teachers have continual, explicit, and meaningful benchmarks for curriculum integration. Further, throughout the program, discipline-based courses should contain pronounced and ongoing interdisciplinary curriculum and assessments. Interdisciplinary teacher education is not a parallel but integrated curriculum (Shoemaker, 1991), which requires interdisciplinary assessments. For example, interdisciplinary assessments would be evaluated by interdisciplinary teacher education faculty in the context of ongoing portfolio development projects or interdisciplinary leadership seminars. In the context of interdisciplinary teacher education, being fully interdisciplinary corresponds to integrating general education and teacher education curricula, but also providing elective coursework, which should constitute the equivalent of approximately one term, or one-eighth, of the requisite hours in the interdisciplinary teacher education program. Preservice educators should have as part of a strong liberal education the latitude to inquire and discover in courses centering not only on professional development but also personal interest, curriculum that may or may not make any overt interdisciplinary connections to teacher education.

Education has been structured as inherently a multidisciplinary, not interdisciplinary field, yet during the Global Age, a growing and substantial body of research advocates interdisciplinary approaches to teaching, learning, and researching (Gass, 1970; Apostel et al., 1972; Beck & Kosnik, 2006; Lattuca, 2001; and Pinar, 2004, National Academies, 2005) and indicates that interdisciplinarity promotes learning (Lattuca, Voigt, & Fath, 2004). The National Academies (2005) argue that the general population of students is increasingly drawn to interdisciplinary courses that “feature problems of greater breadth, societal relevance, or public policy (such as global change)” (p. 158) because students desire the need for a more integrated curriculum. Davis (1995) finds “interdisciplinary courses…are well-suited to developing the problem-solving skills most needed in today’s society because they emphasize the development of comprehensive perspectives” (p. 39). This study acknowledges that students take interdisciplinary coursework for various reasons that may include, for example, to attain practical knowledge and experience through interdisciplinary inquiry, or to participate in more fully human being. If interdisciplinary skills are increasingly requested by and required of people in all fields of study and endeavor in the twenty-first century, then a goal of teacher education should be to conceptualize itself as an interdisciplinary field that exceeds the limitations of fulfilling national certification requirements and providing career or narrow specialist training.

Interdisciplinary teacher education programs strive to maintain as the rule rather than the exception the integration of disciplinary insights and curricular approaches, as well as highly localized understandings, experiences, and values, that re-complicate our knowledge and cultivate a healthy skepticism toward knowledge claims. Interdisciplinary teacher education is equated with “innovative approaches that promote dialogue and community, synthesis, critical thinking, problem posing and problem solving” (Klein, 2002, p. 14) and associated with curricular approaches that consciously apply “methodology and language from more than one discipline to examine a central theme, issue, problem, topic, or experience” (Jacobs, 1989a, p. 2; see also Klein, 2002, p. 9; see also Spaulding, 2002, p. 700). It can be described in part as “an undertaking involving continuous interpretation and a conscious search for meanings [through which] we come to see many connections between…multiple perspectives by means of the disciplines”
(Greene, 1995, p. 96). To achieve cognitive and functional objectives, interdisciplinarity advances understanding through “mutually informative networks of relationships” (Boix Mansilla & Gardner, 2003, p. 3) in ways that would not have been possible via a single discipline. Education engages ideas but has an obligation to use other modes of knowing, such as emotions, imagination, and intuition to educate, which interdisciplinarity allows us to access, but, moreover “to engage in satisfying work, function as lifelong learners who can cope with the challenges of a rapidly changing global society, recognize inequities in their everyday contexts, and join with others to challenge them” (Cochran-Smith, 2006, p. 199-2).

Conceptualizing interdisciplinarity in the context of teacher education is a relatively new and unfamiliar endeavor, which may in part explain why the work of interdisciplinary studies scholars cited in this study, and the relatively cohesive language of contemporary interdisciplinary studies, is not applied consistently or accurately in the field of interdisciplinary teacher education. Boix Mansilla and Duraising (2007) point out that a cohesive language is lacking, which impedes interdisciplinary work and assessment, a claim this study finds clearly evident in the field of interdisciplinary teacher education. This study finds the lack of awareness of and fluency in interdisciplinary studies that permeates the field of interdisciplinary teacher education is detrimental to its conceptualization and implementation processes.

In the Global Age, interdisciplinary approaches to education are explicitly endorsed by scholars in the field of teacher education. Pinar, Reynolds, Slattery, & Taubman (2004) maintain that teacher education, like many fields of knowledge, requires interdisciplinary applications of knowledge to problem solve in the social, public world (p. 164). Pinar et al. (2004) assert that teacher education, like many fields of knowledge, requires interdisciplinary applications of knowledge to problem solve in the social, public world (p. 164). Pinar et al. (2004) find the contemporary field of curriculum influenced by “the humanities, arts, and social theory” (p. 865), and describe the field as “a hybrid interdisciplinary area of theory, research, and institutional practice” (p. 865). The authors acknowledge problems of cross-discourse communication, yet issues of consolidating and integrating humanistic approaches to the curriculum, they state, “would be a worthy agenda” (Pinar et al., 2004, p. 865). Pinar et al., (2004) explain that Daniel Tanner finds many fields of knowledge require interdisciplinary “applications of knowledge to problem solve in the social, public world” (p. 164).

The State of the Field

It appears that while interdisciplinary studies programs are gaining momentum, making strides, and expanding rapidly throughout academe, the early twenty-first century finds interdisciplinary programs, like astronomical stars, being born as others are perishing or reinventing themselves. For example, since 2005, three flagship interdisciplinary programs — at Miami University, in Ohio; Wayne State University, in Michigan, and Appalachian State University, in North Carolina — are being reinvented elsewhere in the institution or have folded, apparently due to fiscal, structural, and political pressures within their respective institutions. Interestingly, as the interdisciplinary Western Program on the Oxford Campus of Miami University wanes, two regional campuses of Miami University initiated in 2008 a four-year interdisciplinary baccalaureate degree program in integrative studies.
Based on data collected in 2007 and 2008, it is evident that interdisciplinary teacher education programs vary widely in the United States (Newell, 1986; Fiscella & Kimmel, 1999; Edwards, 1996; Seabury, 1999; Kliewer, 2001). There are a growing number of postsecondary interdisciplinary programs, generally designed to meet the needs of nontraditional students or those who wish to develop their own college majors. There are relatively few programs specifically in interdisciplinary teacher education and of those several align more closely with the qualities of multidisciplinary not interdisciplinary programs. Further, there are undergraduate and graduate degree programs and a range of representations of interdisciplinary teacher education. For example, Western Michigan University offers an interdisciplinary teacher education program, but it is designed specifically for health professionals (http://www.wmich.edu/hhs/nurs/ITEP_index.html). Yet, in general, interdisciplinary teacher education programs pertain particularly or exclusively to coursework and competencies in the subject areas of Special Education or Early Childhood Education. Most postsecondary interdisciplinary teacher education programs, usually referred to as ITE programs, prepare teachers for state certification and competencies in Special Education or Early Childhood Education. Interdisciplinary teacher education as conceptualized in this study contrasts not only with traditional teacher education programs but also with many interdisciplinary teacher education programs offered at present at undergraduate and graduate levels in postsecondary institutions in the United States.

Recently one interdisciplinary teacher education program revised the description of its program and department to more accurately reflect that it is a special or early childhood, not interdisciplinary, program. Between 2007 and 2008, the Department of Interdisciplinary Teacher Education (ITE) at the University of Alabama officially changed its name to the Department of Special Education (SPEMA). The revised department title appears to more aptly reflect what the department was doing and offering all along. For example, based on a comparison of the new and old department mission statements, only the department name has changed; otherwise, the statements are identical:

The Department of [Interdisciplinary Teacher Education (ITE) or Special Education (SPEMA)] prepares upper division students to serve as reflective decision makers in instructional settings for diverse learners. The [ITE/SPEMA] faculty believe that a teacher preparation program should emphasize roles and responsibilities that integrate the strengths of learners, parents, general education teachers, special education teachers, related service professionals, and the community. A combination of learning opportunities that include a coordinated knowledge base, diverse school-based practicums, and internship experiences are designed to facilitate the development of logical, critical, and reflective thinking skills. These skills will enable students to synthesize information and conceptualize knowledge that prepares them as future educators to effectively plan, develop, problem solve, and implement programs for diverse learners. (http://uaops.ua.edu/right_arm.cfm?col=2&dpt=77)

In a related example, a current interdisciplinary teacher education program is analogous to special education, and not *interdisciplinary* as defined in this study.
Based on an analysis of its program descriptions (adopted in 1995 but revised in 2003), the Interdisciplinary Early Childhood Education program at the University of Kentucky (www.uky.edu/Registrar) appears at first glance to be interdisciplinary based on four factors. The program is interdisciplinary based on its name and the fact that it includes courses on special education, nutrition, and child development. Further, the program requires coursework from several disciplines to meet state certification requirements in special education. Finally, it requires students to develop proficiencies that can apply to various grade levels. Yet, it is not clear how these criteria correspond to interdisciplinarity based on the definition proffered by this study. Specifically there is no indication that students are taught to integrate insights from these three fields. Thus, on closer examination the program appears to be more multidisciplinary than interdisciplinary.

Further, three interdisciplinary teacher education programs center on fulfilling state certification and general education requirements, apparently at the exclusion of cultivating interdisciplinary work. The School of Teacher Education at the University of Northern Colorado offers a degree in Interdisciplinary Studies with an emphasis in Liberal Arts (Elementary Education). Based on the program description, this interdisciplinary program provides future elementary teachers with a broad academic foundation and balanced course of study in mathematics, science, language arts, and history/social science, and requires students to select an area of concentration for in-depth study in one of nineteen programs (http://www.unco.edu/idla/). In another example, the Bachelor of Science Degree in Interdisciplinary Studies degree offered by the Department of Curriculum and Instruction, at Tarleton State University in Stephenville, Texas, is designed to prepare students in the academic areas that comprise the elementary school curriculum. It includes a specialization in reading and fulfills state certification requirements in the field of Early Childhood Education (http://www.tarleton.edu/~catalog/2004-2005/COE%20C&I_04-05.htm). Similarly, Virginia Union University contains a School of Education and Interdisciplinary Studies program, yet it does not appear to devote attention to interdisciplinary work (http://www.vuu.edu/Academics/schooleofeducation.htm). These types of interdisciplinary teacher education programs appear to offer a broad-based general education directed at meeting state teacher certification requirements and to be interdisciplinary in name only. They do not communicate that their interdisciplinary teacher education programs, for example, devote effort to integrating coursework, synthesizing disciplinary insights, forging common ground, or assessing interdisciplinary work, presumably leaving those processes to students to get on their own, affirming Davis’ (1995) claim that in some so-called interdisciplinary programs, curriculum integration is considered “the student’s problem” (p. 143).

In contrast, the National University has locations in California and Nevada but also offers an online Bachelor of Arts with a Major in Interdisciplinary Studies degree. This program provides a broad-based education and a Preliminary Multiple Subjects Teaching Credential in the state of California. This study recognizes this program based not only on the fact that it is one of the few existing interdisciplinary teacher education programs, but also because it claims its graduates “Demonstrate an understanding of interdisciplinary theory and the practice of critical thinking for the collection, validation, analysis and synthesis of historical data and new information” (http://www.nu.edu).
One approach to interdisciplinary teacher education, found in established interdisciplinary studies programs (including the Western Program of Miami University), allows students to tailor their own program to suit their academic needs and interests. The Interdisciplinary Studies in Education Master’s degree program at the Teacher’s College of Columbia University is designed, presumably for teacher education majors, “who have interests in an area of specialization not offered at the College, but for which a coherent and integrated program may be developed through the selection of a combination of current course offerings from several different disciplines or programs (http://www.tc.columbia.edu/admissions/programs/?id=138). Based on the program description, the program appears to involve interdisciplinary integration, since students are required to complete one interdisciplinary seminar course or a thematic sequence and possibly an integrative project at the end of the program. They also assert that many of the areas of specialization “have a sufficient degree of flexibility to permit an interdisciplinary approach to a field of study” (http://www.tc.columbia.edu/admissions/programs/?id=138).

There is a range of interdisciplinary teacher education programs designed to supplement preservice teacher education curricula, as well as in-service professional development for P-12 faculty and administrators. These interdisciplinary teacher education programs include online courses and seminars, as well as traditional workshops, elective coursework, and summer institutes. For example, there are perennial weeklong summer programs that focus on interdisciplinary teacher education, including the Project Zero Classroom Summer Institute, at Harvard University (http://www.pz.harvard.edu/SI/Sympwork.cfm) and the National Summer Institute on Learning Communities, sponsored by the Washington Center for Improving the Quality of Undergraduate Education at The Evergreen State College (http://www.evergreen.edu/washcenter/events.asp).

The Master in Teaching (MIT) Program at The Evergreen State College, in Olympia, Washington, is the best example of a thriving progressive interdisciplinary teacher education program. While their success is not well documented in the professional literature, and staff is not necessarily active in the professional interdisciplinary studies association, the Association for Integrative Studies, the MIT program appears to be an exemplary program in interdisciplinary teacher education. In particular, four factors distinguish the program. It cultivates close ties among its community of faculty and forty to sixty full-time students. Rather than offering separate courses, classes are team taught by faculty representing various disciplinary perspectives and center on integrative interdisciplinary learning. The field-intensive curriculum, designed around a common theme, requires students to combine theoretical and practical experience. Critical thinking, reading, and writing are cultivated through homework and field experience in P-12 schools each week. Further, ongoing student assessment is based on student performance, portfolios, and narrative writing assignments that meet state certification requirements in teacher education (http://www.evergreen.edu/mit/home.htm).

Beck and Kosnik (2006) find that the strongest integrated preservice teacher education programs engage a relatively small group of faculty who do not necessarily share the same perspective on constructivist teaching yet work together in programs guided by constructivist pedagogy. Further, faculty demonstrate a high degree of
collaboration and mutual respect as a team, sharing perspectives and “building on the potential created by a shared philosophy” (Beck & Kosnik, 2006, p. 32). Developing community building around a constructivist “egalitarian ethos” (Beck and Kosnik, 2006, p. 34) results in a strong sense of camaraderie, cultivated through scheduled meetings, retreats, email correspondences, social events, and interpersonal forms of interaction involving faculty and students. For example, in “cross-program home groups” teachers find out what their counterparts are teaching in their courses, which can dovetail or support their own curriculum. Beck and Kosnik (2996) are critical of teacher education programs that leave it up to students to integrate knowledge on their own, stating, “in our view this would be asking too much of the students, who have such a brief period of preparation and are under intense pressure to do well in a climate often hostile to progressive approaches” (p. 35).

By some measures, the fate of interdisciplinary teacher education appears to hang in the balance. Some interdisciplinary teacher education programs may have been established in the twentieth century by faculty who have since retired or whose values and visions of interdisciplinarity no longer guide the department or university. While the current incarnation of various interdisciplinary programs may very well differ significantly from their original inception in the late twentieth century (Kliwer, 2001), some so-called interdisciplinary teacher education may never have been interdisciplinary. Moreover, interdisciplinary has recently been excised from some teacher education program titles because the term does not accurately reflect the program, if it ever did. There is no supporting evidence that the changes in the titles or curriculum of interdisciplinary teacher education programs were required for NCATE or other postsecondary program accrediting agency compliance. As interdisciplinary teacher education evolves, and as interdisciplinary studies continues to establish itself as a bona fide field of study and curricular approach, they will no doubt continue facing enormous and often parallel challenges in the Global Age and beyond. While it can be argued convincingly that interdisciplinary studies, like democracy, contains the seeds of its own demise (Kleinberg, 2008), forms of interdisciplinary education are managing to flourish. Interestingly, the state of Washington did not expect its comprehensively interdisciplinary educational institution, The Evergreen State College, to last, so it was architecturally designed to easily transition at some point into a prison facility. As the field of interdisciplinary studies continues to evolve, it is hoped that through this research, interdisciplinary studies will avoid incarceration and burgeon in various forms, particularly at the confluence of interdisciplinary studies and teacher education.

Interdisciplinary Teacher Education Reform

While English professor Elizabeth Spaulding (2002) regards interdisciplinary teaching one of the most popular curriculum reform efforts of the past decade, interdisciplinary teacher education has not yet been integrated widely or effectively into the field of teacher education. Interdisciplinarity can be linked to the contestation, modification, and transformation of education (Klein, 1999, 2002) and is among the competing views for reforming teacher education. While this study finds significant connections between interdisciplinary and teacher education reform, it acknowledges that the nature of those connections is subject to wide interpretation and representation. For example, the Boyer Commission report (1998) proposes interdisciplinary education.
reforms that include requisite first-year interdisciplinary courses and programs to counter the fragmentation of knowledge in academe and to cultivate the communication skills of students. Yet, how is interdisciplinarity integrated into the curriculum? Klein (2005) cautions against any attempt to superficially add interdisciplinarity to the curriculum, to unify the disciplines and disciplinary organizational structures under false pretenses, or to be a kind of *interdisciplinary interloper*. Interdisciplinary teacher education can be understood as a reaction against the inadequacies of traditional subject-oriented teaching and the “present schooling arrangements” (Klein, 2002, p. 198), as well as the disciplinary hierarchical organizational and social structures of the academy. More extreme forms of interdisciplinarity aspire to extricate disciplinary barriers and envision universities with fewer departments, divisions, colleges, and schools. Similarly, Lattuca (2001) asserts that contemporary interdisciplinary scholars are “revolutionary in their ideas and ideals and are eager to interrupt disciplinary discourse and to challenge traditional notions of knowledge and scholarship” (p. 3). Moreover, Klein (2005) finds interdisciplinarity ensconced in the New Academy, since interdisciplinarity is employed to test the limits of all subjects and disciplines as part of the New Academy repertoire of radical change (Klein, 2005, p. 216). Interdisciplinarity can be understood as either reinforcing or subverting the dominant structures of knowledge and power that can shape-shift and obscure the voices of multiple perspectives (Foucault, 1984; Greene, 1995). It can be associated with curricular approaches that can be understood as discipline directed or discipline shattering (Greene, 1978). Yet, as a twenty-first century curricular innovation, interdisciplinary teacher education is not necessarily as subversive as these ideas may suggest. Jacobs (1989a) supports the idea that conceptualizing, developing, and implementing interdisciplinary curriculum should not be viewed as a covert or subversive activity. Interdisciplinary teacher education reform complements and enhances traditional approaches and departments, “often generating new kinds of excitement” (The National Academies, 2005, p. 18). While this study finds interdisciplinary teacher education is a reform that requires structural changes in the current content and processes of preservice teacher training, reforms are more likely to involve practices that are gradual and evolutionary, not necessarily revolutionary.

**Interdisciplinary Teacher Education Curriculum**

This study advances Dewey and Greene’s directive to provide curriculum based on conditions that are likely to incite learners to learn, to change their abilities to interpret, and to act upon the world. Interdisciplinary teacher education curriculum supports developing new ways of thinking and doing consistent with interdisciplinary approaches. It adheres to Klein’s (2002) claim that the benefits of interdisciplinary coursework include requiring students to grapple with uncertainty, work with multiple criteria, and arrive at nuanced interpretations and evaluations, as well as “go beyond logical skills to become critically reflexive about the nature of disciplines and themselves” (p. 16). It involves developing new ways of thinking and doing consistent with interdisciplinary approaches, described in the following passage:

Seek generalizations, relish them, challenge them, and take them as far as you can. Seek particularizations, collect them, explore them, and build local neighborhoods of understanding from them. And let those generalizations and particularizations interact and engage with each other, for only in that manner will our capacities for
engaging in the practical work of teaching and learning flourish. (Shulman, 2002, p. ix)

At the onset, it is important to qualify that not every course in an interdisciplinary teacher education program should necessarily be interdisciplinary and not every course needs to be seamlessly integrated into the curriculum. Interdisciplinarity offers valuable intellectual or cognitive experiences that traditional approaches do not, yet each program must determine the prominence of interdisciplinarity, hopefully leaving space for novelty and the development of personal interests and fulfillment, for example, through elective coursework. In fact, absolute integration is overkill, or could be considered counter-productive to achieving interdisciplinary aims that correspond, for example, to cultivating well-rounded and interesting future educators. While there should be a pervasive and explicit understanding and implementation of interdisciplinarity in the program, interdisciplinary teacher education programs should also provide students with some latitude in choosing electives and coursework that may have more to do with fulfilling personal interests than interdisciplinary goals.

Interdisciplinary teacher education curriculum development includes but is not limited to the following qualities. Interdisciplinary teacher education curriculum is conducive to student-centered and, as often as possible, student-directed learning. Interdisciplinary teacher education curriculum privileges the active engagement of students who make choices in the context of interdisciplinary and emergent curriculum (Jacobs & Borland, 1986). Ideally, interdisciplinary teacher education curriculum is created or initiated by students; nonetheless, it requires the integration of students’ interests, experiences, and knowledge with the topics engaged (Larochelle, Bednarz, and Garrison, 1998). Yet, ideally it is curriculum continually enriched and guided by open-minded and well-prepared faculty. Davis’s (1995) description provides an additional explanation of characteristics of interdisciplinary teacher education curriculum development:

interdisciplinary courses and team teaching become more appropriate means of organizing instruction in a society where information now functions in a qualitatively different manner from the way it did in the past. Having knowledge is different from having information, and gaining knowledge today involves multiple perspectives and complex processes that students learn best in classrooms where interdisciplinary courses are offered and traditional teaching is augmented by other strategies. (p. 39)

Newell (2002) addresses critical and controversial aspects of interdisciplinary curriculum development, such as determining coverage, or what should be taught and how it should be organized. He also addresses appropriately sequencing interdisciplinary courses. Newell (2002) identifies issues educators typically encounter in the process of initiating interdisciplinary courses and addresses four dimensions of interdisciplinary curriculum. Interdisciplinary courses must involve two key concepts: Breadth and completeness. Breadth corresponds to drawing from disciplines with divergent epistemologies, and completeness, the degree to which interdisciplinary integration is achieved. Further, Newell asserts that the curriculum must incorporate cognitive and developmental psychology research. It must also include postmodern perspectives, namely that interdisciplinarity is a text and should be critiqued in ways that illuminate its
relation to the social structure of power. Newell (2002) recommends initiating interdisciplinary pursuit through courses that are narrowly but fully interdisciplinary.

This study finds that in general, interdisciplinary teacher education coursework (e.g., a course, set of courses, or thematic sequence) should be organized around practical projects, themes, problems, questions, issues, and ideas (Klein, 1999, 2002) relating to teacher education. The curriculum may be constructed around various disciplinary traditions and perspectives, but also sets of concerns or goals, that include, for example, arriving at a practical solution or crafting a viable and coherent approach to address a defined problem or issue (Boix Mansilla & Duraising, 2007). This study endorses, in most instances, some configuration of team-teaching by faculty who ideally are effective interdisciplinary educators embodying diverse multicultural perspectives and demonstrate proficiency in more than one disciplinary perspective. Davis (1995) elaborates:

In the ideal interdisciplinary team-taught course, the subject grows out of the idea; it is invented by the faculty who participate in the course, it is more than the sum of the disciplinary parts, and it is presented to the students, as nearly as possibly, as an integrated whole. On the other hand, there is no magic number for how many disciplines to involve – the number depends on the idea for the course – but for those disciplines that are involved, the ideal to be approximated is optimal collaboration for maximal integration. (p. 52)

In general, this study endorses at least a thematic interdisciplinary teacher education sequence, tailored to prospective educators, which provides students with a strong foundation that folds interdisciplinary studies into teacher education. For example, a framework or bare bones course structure could be based on a series of three team-taught courses. The first course would introduce students to interdisciplinary teacher education by providing an overview of its history, essential terms, concepts, and theories as well as the major scholars and classic texts of the field. This course would engage students, for example, in an introductory-level project that integrates interdisciplinary studies and teacher education. This project would be guided by faculty fluent in interdisciplinary integrative techniques and discipline-based insights from one or more fields. The goals of this course include introducing prospective educators to interdisciplinary approaches, as well as to the interdisciplinary discourses that pertain to teacher education. Moreover, curricular goals include expanding knowledge of the field of education through the infusion and subsequent integration of insights gained through interdisciplinary pursuit. Further, since disciplinary and interdisciplinary approaches to research differ, the second course in the thematic sequence could further acclimate students to interdisciplinary work through the development of a more advanced and substantive interdisciplinary teacher education research project of the students’ design. Finally, the third course could bring the project, planned in the second course, to fruition.

Klein (1999) maintains, “Although model syllabi and programs are valuable and should be consulted, interdisciplinary study is creative and constructed rather than imitative and formulaic” (p. 17). Klein (1999) adds, “Any curriculum must make sense locally, so a restrictive, one-size-fits-all curricular approach is untenable for every student at every postsecondary institution,” and adds, “The wisest approach is not a single strategy but a portfolio of strategies” (p. 22). It is assumed that there will be great variety among interdisciplinary teacher education faculty and their teaching strategies, based on individual, small- and large-group discussions and projects, hands-on activities, various
media, as well as a variety of fieldwork and pedagogical activities that involve lifelong learning, learning communities, service learning, experiential learning, study abroad, and various forms of multicultural immersion (Newell, 1994, 2002; Klein, 1990, 1999; Beane, 1995, 1997; Andrew, 2007, Beck & Kosnik, 2006; Brady, 2004; Kroll, 2005; Watson, 2001). In particular, interdisciplinary teacher education teaching strategies should support problem solving and “visible thinking” (Greene, 2005, p. 112), based on teaching and learning through the visual, musical, and performing arts. A goal of teaching strategies is to cultivate engagement that evidences interdisciplinary products and processes, “a repertoire of examples of new models, insights, or solutions that could not have been arrived at through a single discipline” (Boix Mansilla & Duraising, 2007, p. 227).

Interdisciplinary teacher education strategies that support “learning holistically, critically, and reflectively” (Klein, 1999, p. 12) utilize many of the same curricular and pedagogical innovations (Newell, 2001a) found in current teacher education programs. There are multiple examples of how the curriculum would be organized around a problem, topic, theme, or issue. For example, sets or series of courses could be clustered around the topic or integrative approach, such as feminism or cultural studies (Klein, 1999). Interdisciplinary courses could be linked to their disciplinary counterparts through guest speaker presentations, seminars, or learning communities. Team teaching and educational technology could be utilized. Study-abroad, residential living-learning, and service learning opportunities could be used (Newell, 2001a). A variety of assessments could be employed (Boix Mansilla, 2004a, 2006; Boix Manilla & Dawes, 2004). The goal of these strategies is to support learning “at the productive intersections of interdisciplinarity and integrative approaches” (Klein, 1999, p. 18) in teacher education contexts.

In sum, interdisciplinary teacher education curriculum should center on providing more relevant and less fragmented learning experiences that foster reflective and prospective work to meet short- and long-term educational aims, like integrating teacher education coursework and cultivating educators as lifelong learners. The curriculum should include multiple service-learning components, so that the students could compare and contrast, as well as evaluate and reflect upon, valuable, real-world experiences. These experiences would, for example, provide the opportunity to see theory in action but also to facilitate the transformation of their knowledge and understanding through praxis. The curriculum should be continually enriched by ongoing faculty development and professional development research in interdisciplinary teacher education.

Curricular Designs of Various Levels of Integration

Klein’s (2002) classification of four interdisciplinary curricular designs is a valuable resource for understanding what disciplinary integration is and conceptualizing the degree to which interdisciplinary teacher education should engage disciplinary integration. The degree of integration is the major distinction between these models, described as follows.

First, the least interdisciplinary curricular design corresponds to what Klein (2002) refers to as parallel, correlated, or sequenced designs. In these courses, the content does not change but its sequencing does. The same or compatible topics coincide or overlap in two different courses, so students may study global warming in the same
This model is related to what Jacobs (1989a) describes as a curricular design that evidences the \textit{polarity problem}, a curriculum design flaw that imposes a disciplinary-interdisciplinary false binary. Consequently, Jacobs finds, the course lacks clarity and provokes disciplinary turf issues among participants.

This model is critiqued on the basis that it sequences but does not align content, and regards integration at best as a secondary or tertiary aim, a curricular enhancement in the service of teaching the disciplines, not a major curricular goal. For example, students may study the Civil War in history while reading \textit{Uncle Tom's Cabin} in English and studying Currier and Ives prints in art. In another example, an education major may participate in a cohort, fulfill a required field or service learning experience, or take in a term separate courses in teacher education and special education that deal with the same issues, yet they are taught in relative isolation. Integration is at best hit or miss, as there is little or no communication between professors, just as there is little or no student or faculty accountability for integrating the knowledge and experience.

The second form of interdisciplinary course design is referred to by Klein (2002) as a \textit{multidisciplinary design}. These courses typically focus on a coordinated topic, theme, or “potpourri problem” (p. 11; see also Jacobs, 1989b). Yet, Klein (2002) points out, “A theme is not an automatic guarantee of integration” (p. 12) and finds these interdisciplinary courses “fall short of more integrated design” (p. 11). Klein (2002) explains

Class schedules are reconfigured so that students can explore similar themes, topics, issues, or problems simultaneously…[yet, students] are usually left to uncover connections by themselves, the content and procedures remain intact, and the dynamic of team teaching is often missing…This model is common: It is easy, inexpensive, and does not disrupt the status quo. (p. 10)

This curricular design is critiqued on the basis that such courses tend to be deficient in content focus, scope, and sequence as they “lack focus, direction, conceptual clarity, … clear goals and objectives. Basic skills also tend to be neglected, the teaching of subjects may be superficial, and students do not necessarily perceive connections, even if their teachers do” (Klein, 2002, p. 11). These courses employ a kind of unbridled buffet approach to interdisciplinary studies. While students may gain a breadth of knowledge, they do not explicitly analyze or synthesize disciplinary perspectives. In short, these courses “fall short of more integrated design” (Klein, 2002, p. 11).

Third, \textit{integrated designs}, also referred to as curriculum integration, unified studies, or fusion models (Klein, 2002), involve restructuring the curriculum so that subjects and disciplines are focused or blended and “become tools for studying themes such as culture, identity, ethnicity and regionalism…[or moving] beyond multidisciplinary juxtaposition of separate disciplines to include core interdisciplinary seminars” (p. 11).

Finally, the most comprehensive level of interdisciplinarity has no corresponding name but correlates with Beane’s (1997) curriculum integration and transdisciplinary models, likened to a kaleidescope, in that “Varied and shifting images produce a new complexity of design” (Fogarty, 1991 as cited in Klein, 2002, p. 11). Klein (2002) explains that this level of interdisciplinarity is student-centered, allowing students to choose topics and work collaboratively, through which students become “partners” in
learning and enacting democratic education. This level of integration is the benchmark for conceptualizing interdisciplinary teacher education.
CHAPTER FOUR: INTERDISCIPLINARY TEACHER EDUCATION MODEL

Introduction

This chapter provides a normative a priori definitional and conceptual model of interdisciplinary teacher education, which re-complicates (Greene, 2001) the conceptualization of postsecondary teacher education as it addresses major theoretical issues that emerge from the synthesis of teacher education and interdisciplinary studies. At the onset, this model acknowledges the dilemma of framing a construct that rejects any one-size-fits-all approach, the same paradox Dewey found in his own work: How does one re-complicate teacher education through one approach or theory (Eisner, 2002)? The proposed model does not endorse reductionist concepts of what interdisciplinary teacher education is or should be. It does not intend to suggest that any standardized, monolithic, or unitary programs of or approaches to teacher education are possible or desirable as it advocates the need for highly contextualized approaches, “with a distinctly ‘local’ nature” (Klein, 1990, p. 54), for interdisciplinary teaching and learning (Klein, 2002; Jacobs, 1989a), supporting Klein’s (2002) conclusion, “The most important lesson to emerge… is that there is no ‘best’ way of doing things” (p. 202). This model identifies thirteen principles of interdisciplinary teacher education, linking the conceptualization of interdisciplinary teacher education to teacher professionalization, creating a guiding interdisciplinary vision, expanding global consciousness and wide-awakeness, and the democratic dimensions of interdisciplinary teacher education. Further, this study supports critically and socially relevant forms of education, as well as learning communities, student-centered education, and novice and non-specialist interdisciplinary inquiry. It explores the concept of cognitive disequilibrium proffered by John Dewey, and supports the need for developing interdisciplinary research questions and questioning skills in interdisciplinary teacher education programs. Further, interdisciplinary research and curriculum integration in teacher education addresses perspectives on disciplinary adequacy, as well as critique, respect and tolerance for epistemological diversity, and the integration of forms of integrative learning, including reflective thinking and lifelong learning. Concepts such as modeling good teaching practice, experiential learning, and learning by doing are explored, as are alternative academic structures and resources to support interdisciplinary teacher education programs. Finally, this chapter addresses the limitations of this study and proposes directions for future research.

Principles of Interdisciplinary Teacher Education

Teacher Professionalization: Education and Certification

The professionalization of the teaching profession is tantamount, and it is associated more with educating than training, based on Dewey (1921, 1963) and Eisner (2002). Dewey (1921) sharply demarcates being “trained like an animal rather than educated like a human being” (p. 13), critiques methods of teaching that neglect the development of the mind, and insists the only viable approaches to improving learning must focus on “the conditions which exact, promote, and test thinking” (Dewey, 1921, p. 153; see also Dewey, 1933). Eisner (2002) distinguishes between teaching and instruction, and finds the complexities of teaching are misconceived and undervalued when the differences between education and training are neglected. Eisner (2002) associates teaching with that which is flexible, emergent, expressive, and artistic, whereas
instruction corresponds to the kind of rote, technological, or mechanical processes that could be aptly described in an instructional manual, or with forms of education that stress standardization, efficiency, and routine, as well as “skills obtained apart from thinking” (Dewey, 1921, p. 152). Educating cultivates what Eisner (2002) refers to as “fluid intelligence” which finds parallel in Dewey’s (1963) “flexible purposing,” the ingenuity to shift goals, thoughts, and actions to problem solve, as well as modify or adjust the environment (Eisner, 2002, p. 163). Eisner (2002) claims “What diminishes human rationality is the thwarting of flexible human intelligence by prescriptions that shackle the educational imagination” (p. 165). Educating stands in contrast to training and interdisciplinary teacher education strives to teach, not merely train future educators. The form of education advances by this study corresponds to an education “beyond function, beyond the subordination of persons to external ends…beyond mere performance to action” (Greene, 1988, p. 133).

This does not in any way serve to advance alternative teacher certification programs that, for example, provide teacher certification for people with bachelor’s degrees in non-education fields. Interdisciplinary teacher education strives to enhance the academic integrity of the teacher education program by preparing teachers as well-educated, transformative leaders through an integrated curriculum that provides a solid theoretical and practical grounding in the field of teacher education. Eisner (2002) endorses taking “alternative routes” that embrace the possibilities of education, just as interdisciplinarians advocate “alternative” interdisciplinary approaches to teaching, learning, and researching, yet those alternatives clearly have no connection with alternative teacher certification.

Cochran-Smith (2006) points out “there are no clear, compelling, and empirically strong conclusions” (p. 91) that prove alternative certification programs, including Troops to Teachers and Teach for America, improve P-12 education. Interestingly, alternative teacher certification finds support at present among influential individuals and groups, including the U.S. Department of Education, conservative foundations endorsing deregulation of teacher education and other market-based reforms, and the American Board for the Certification of Teacher Excellence (Cochran-Smith, 2006, p. 91). Cochran-Smith (2006) maintains that alternative certification denigrates the professionalization of teacher education as it imposes false binaries onto teacher education in two significant ways. First, she attacks the claim that alternative certification dichotomizes college graduates and educational school graduates, hinging on the notion that college graduates possess subject matter knowledge and verbal ability, whereas teacher education graduates are deficient in both areas. Second, she rejects the presumption that education courses are superfluous but discipline-based content-area courses are not. Eisner (2002) reminds us that to endorse benchmarks that attempt to deskill the profession, to “teacherproof [and] develop methods that do not require the use of the teacher’s judgment, is to demean teachers and to expect them to function as automatons rather than professionals who have a stake in what they are doing in classrooms” (p. 41). Cochran-Smith (2006) maintains alternative teacher certification represents an enduring and deep disagreement in public perception about the purposes of schooling, the value of teaching, and the academic preparation of teachers. These are among the reasons why interdisciplinary teacher education does not endorse or intentionally align with alternative teacher certification programs. The more clearly we
can articulate the sorts of people we wish our P-12 educators to be, the more effectively we will be in declaring why professional teacher education is essential.

Guiding Interdisciplinary Vision

It is foundational in conceptualizing interdisciplinary teacher education to create what The National Academies (2005) refer to as an interdisciplinary vision: A guiding construct, mission statement, or set of aims, goals, or principles. The National Academies (2005) acknowledge the importance of having an interdisciplinary vision. Newell (1983b) refers to interdisciplinary advocates as educational visionaries as he proffers a vision of interdisciplinary studies. An interdisciplinary vision can be linked to Greene’s (1988) “vision of education that brings together the need for wide-awakeness with the hunger for community, the desire to know with the wish to understand, the desire to feel with the passion to see” (p. 23). Yet, what form can be given to this abstraction, a vision of what could be (Greene, 1988)? Ronald Jones, Professor of the Experience Design Group (edg) in Department of Interdisciplinary Studies, at the Konstfack University College of Arts, Crafts, and Design, in Stockholm, Sweden, provides an arts program description that exemplifies an interdisciplinary vision:

…at edg we additionally investigate new relevance for hybrid studio practices; that’s why edg is comprised of students, researchers and faculty who work across disciplines, typically in advanced hybrid constellations of research and practice. We are devoted to interdisciplinary and transdisciplinary practice-led research – from art and design to the experience economy; from history to science; philosophy to technology. Our work, while often speculative, remains practically engaged socially, culturally and ethically. We educate artists, designers and crafts-persons who can perceive relevance – often furthest from their own discipline – and convert it into new forms of knowledge…edg graduates are the creators and producers of tomorrow’s – as yet unanticipated – experiences. (http://varutstallning08.konstfack.se/interdisciplinary-studies/ronald-jones.html)

Interdisciplinary teacher education is guided by an evolving interdisciplinary vision, international in scope and inspired by Hannah Arendt’s words, that education is the point “at which we decide whether we love the world enough to assume responsibility for it” (Greene, 2001, p. 75). It cultivates teachers with professional leadership judgments whose prime responsibilities are to students, colleagues, and the wider world, with whom teachers interact “dialogically and critically, in a passionate concern for learning” (Davidson, 2004, p. 301). It guides efforts to establish new forms and levels of discourse and knowledge integration within the field of teacher education (Klein, 1990). It maintains as the rule rather than the exception the complexity and variation (rather than uniformity) of the disciplines, disciplinary programs, and integrative approaches, as it legitimizes highly localized, contextualized traditions, experiences, and values within the field of teacher education. Based on Greene’s constructivist understandings, it strives for an ethical basis for valuing cooperative, discipline-based education (Greene, 1995). This vision guides reform efforts in teacher education that demonstrate how teacher education can be revisioned and reimagined through interdisciplinarity to meet the needs of individuals in the Global Age.

Expanding Global Consciousness and “Wide-Awakeness”
Interdisciplinary teacher education guided by the interplay of two parallel constructs — global consciousness as conceptualized by Boix Mansilla & Gardner (2007) and wide-awakeness as presented by Maxine Greene -- that seek to expand consciousness through education. Global consciousness and wide-awakeness view consciousness as a social construct, and parallel on additional points. To begin, Greene (2001) maintains how inextricably entwined are consciousness, living, and learning, as evidenced in the following passage:

When consciousness is opened to the appearances and to the sounds of things, when children are encouraged not simply to perform correctly, to demonstrate sets of skills or competencies, but to perceive and name dimensions of their lived worlds, they are far more likely to pose the questions in which authentic learning begins. I believe that if they can come to realize that there is always something – a color, a sound, a shape, an event, a moment of clarity – just beyond where they are, they are likely to exert the effort, to master the discipline that will enable them to reach beyond. That, to me, is what learning should be. That is moving toward possibility. (Greene, 2001, p. 62)

This study embraces existential-phenomenologist Greene’s (1973) concept of consciousness based on the following points. Consciousness is the essential concept for phenomenologists concerned “with things themselves and with the ways things and events, in their structures and relations, present themselves to consciousness” (p. 261). Consciousness is a part of the world, not separate from it, impelling us “toward the world not away from it” (Greene, 1973, author’s italics, p. 131). Consciousness is always of something; for example, a sound or idea enters our consciousness and we are compelled to make sense of it as it is presented to us (Greene, 1973). Our consciousness is our context in the world; it corresponds to our biographical situations, standpoints, perceptions, and histories. Consciousness emerges from making sense and being wide-awake. It requires reflection upon our selves as conscious beings as it opens possibilities, moving “everyday reality to other spheres and other structures of meaning” (Greene, 1973, p. 133). It requires speculation and risk (Greene, 1988). Greene (1973) asserts human beings need to be conscious of our consciousness, our presence in the world (1973, p. 92), and to elevate our lives through conscious endeavors. In particular, teachers are obligated to become more fully conscious and, in turn, to raise student consciousness. Greene (1973) states that educators are obligated to provide learning opportunities through which students cultivate their own consciousness-raising perceptions and interpretations of the world (p. 35, 56). Greene (1988) finds the aim of education is to help individuals to reach their full potential and it requires “a consciousness of the normative as well as the possible” (p. xi), referring to what should and could be “in an always open world” (p. xi).

Global Consciousness

Veronica Boix Mansilla (2007 class observation) expands on the global significance of interdisciplinarity when she speaks of a reshaping agenda for interdisciplinary understanding, moving from teaching globalization to developing global consciousness. Global consciousness, a normative construct defined by Boix Mansilla & Gardner (2007) as “The capacity and the inclination to place our self and the people, objects, and situations with which we come into contact within the broader matrix of our
contemporary world” (p. 58). Boix Mansilla & Gardner (2007) identify a critical need for students and teachers to be globally aware, sensitive, and responsible citizens of the twenty-first century.

Boix Mansilla & Gardner (2007) explain that global consciousness corresponds in students to “a disposition to place their immediate experience in the broader matrix of developments that shape life worldwide, to construct their identities as members of world societies, and at least in some instances, to orient their actions accordingly” (p. 56). Boix Mansilla and Gardner (2007) find global consciousness manifest in cognitive-affective capacities that give meaning and cohesion to lived experience. These faculties correspond to *global sensitivity*, or the awareness of local experience as a manifestation of the forces of globalization, *global understanding*, or the capacity to be open-minded and aware of current global events, and *global self-representation*, or the perceptions involving oneself as a global actor and member of the human race, engaging responsible actions and commitments. Boix Mansilla & Gardner (2007) state whether we peer at global consciousness through the normative lens of education or we examine it empirically as a developing psychological capacity, the most important function of global consciousness for today’s individuals is to give coherence to otherwise fragmented experience…Global consciousness situates us – not without tension – in unifying narratives and explanations that help us to make sense of daily developments on the planet. In doing so, global consciousness expands our human self beyond the limits of our here and now, revealing new aspects of our identity in connection to others and to the planet. (p. 63)

Boix Mansilla (2007) explains that cultivating global consciousness through interdisciplinary teaching and learning engages students in contemporary debates and topics that require the critical investigation of the forces of globalization and its impact on the natural environment. Boix Mansilla and Gardner (2007) explain that students are at the center of learning through a kind of feedback loop connecting them, directly and indirectly on deeply and personally meaningful levels, to these forces, leading ultimately to the development of a “global consciousness” (p. x). Boix Mansilla and Gardner (2007) find that educators must assume their critical responsibility to understand and explain the forces of globalization to students, and that the purpose of teaching is, in the final analysis, linked to nurturing global consciousness.

**Wide-Awakeness**

Greene finds it is critical for human beings to break with complacency and what Greene refers to in the majority of her writings as *the crust of convention*, to live in wide-awakeness, which corresponds to arousing an attitude toward or awareness of being a part of all that is happening in the here and now (Greene, 2001). Through interdisciplinary inquiry -- involving sociology, history, philosophy, literature, and the arts -- Greene explores wide-awakeness to advance social justice (http://www.maxinegreene.org/foundation.html). Greene’s (1995) conceptualization, derived from Maurice Merleau-Ponty, describes *wide-awakeness* as a consciousness, the “ability to take a fresh look at the taken for granted” (p. 100) and an “awareness of what it is to be in the world” (p. 35). Wide-awakeness corresponds to an informed and heightened awareness of the sights and sounds of culture, equated with being “personally
present and alive” (Greene, 2001, p. 98) or “vividly present” (p. 15) in our own lived contexts. “The wide-awake person is at least free to confer significance upon his or her situation, to identify the alternatives that exist,” Greene (1978) writes, adding “The capacity to assess a situation…to perceive openings, is essential if there is to be moral action” (p. 156). Greene (1973) finds that as our perspectives diversify, we find ourselves living in a progressively more meaningful world, involving “a breaking through, a free play” (Greene, 2001, p. 58-9) but also an “education in perceiving, noticing, attention, paying heed” (Greene, 2001, p. 59), described as follows:

The more his perceptiveness, the more his willingness to attend and prehend, the more the beholder will find his repertoire of feelings expanding, his emotional palette becoming enriched. He may find that his vision of his life space is sharpened because of his experiences in looking at painting…The teacher who is drawn in this direction may well find continuities between his teaching effort and his effort to see more…He may be gaining opportunities to enable those he teaches to see as well, truly to see, not through his eyes but through their own. (Greene, 1973, p. 293-4)

Greene (1995) asserts that teachers and students ought to “seek more shocks of awareness as time goes on, more explorations, more adventures into meaning, more active and uneasy participation in the human community’s unending quest” (p. 151). Wide-awakeness is the perpetual “enlargement of experience” (Greene, 2001, p. 28). Greene (2001) adds, “I have said there is always more – more awakening to the world on the part of those willing to act, to come alive, to choose” (p. 42). Greene (1995) links wide awareness with a “demystified” understanding of the world, stating “the intensification of perception can go as far as to distort things so that the unspeakable is spoken, the otherwise invisible becomes visible, and the unbearable explodes” (Marcuse, 1977, p. 45 as cited in Greene 1995, p. 101). Greene (2001) writes that the aim of educators is to help students “become more wide awake, more aware” (p. 26) and asserts “It remains important to work for wide-awakening, to help our students focus their attention, to provoke them to greater perceptual acuity” (Greene, 2001, p. 62). In fact, knowledge informed by wide-awakeness “cannot be self-disclosed and cannot miseducate” (Greene, 1995, p. 101). Wide-awakeness is equally important for teachers and students; it is both a gift and a demand, a “promise to change” (Sartre, 1949, p. 62). Yet, Greene (1973) acknowledges the risk of being wide-awake; individuals may be suddenly overwhelmed by “the sights and sounds of a culture in crisis” (p. 183) or a “deep disquietude” (p. 183), realizing that each of us are responsible for our own moral choices, that every one of us is quite on our own and “dreadfully free” (p. 183). Yet, shocks of awareness can jar us out of complacency and ultimately into a transformed and transformative state of praxis (Sartre, 1963). Greene (1995) finds “disruption has to do with consciousness” (p. 109), and finds that educators must provoke students to break the crust of convention through “shocks of awareness” (1995, p. 115), and “breaks with that has been established in our own lives; we have to keep arousing ourselves to begin again” (p. 109). In sum, interdisciplinary teacher education ought to be guided by Greene’s concept of wide-awakeness, which encourages educators to develop their knowledge and experience, to value multiple perspectives embodied in communities of learners, and to realize “how much remains to be discovered by those who can notice what there is to be noticed” (Greene, 2001, p. 20) as we hone our abilities to transform the world.
Democratic Dimensions of Interdisciplinary Teacher Education

Interdisciplinary teacher education is preparation for participating in democratic citizenship, lifelong learning, and social transformation. Democracy is a precondition of interdisciplinary teacher education, according to Newell (2002), who holds that democracy is central to the vision of interdisciplinary studies. To reach their full potential, interdisciplinary courses require of “full participation and equal voice” (p. 125) of the participants and the disciplines they employ. Interdisciplinary teacher education corresponds to an epistemological shift from purely transmissive pedagogical models to a pedagogy that is interrogative, interdisciplinary, international, and linked to a larger dialogue devoted to developing a more democratic society (Lattuca, 2002; Giroux, 1992; Beane, 1997). Further, democratic threads run through interdisciplinary teacher education in that its curricular approaches diffuse the centrality of disciplines, make knowledge accessible to all (King and Brownell, 1966, as cited in Pinar 2004, p. 170), encourage the development of new knowledge and understandings, validate multiple perspectives, and support curricular domains that foster free inquiry and public exchange. Interdisciplinary teacher education cultivates democratic spaces that are inclusive, learner-centered, collaborative, and cooperative in the exchange of ideas that lead to the growth of future teachers (Larrivee, 2009). It challenges, questions, and evaluates social borders and structures of power to critique how they enhance and negate democratic ideals, such as liberty, equity, and justice (Giroux, 1992). It requires the integration of insights from the disciplines and multiple vantage points, as well as theoretical and practical knowledge, which represent acts of democratic engagement. It is equated with what Beane (1997) describes as a progressive approach, centering on social improvement and integration as well as the common good, and supporting “personal integration and creative individuality… as aspects of a democratic society rather than ends in themselves” (p. 3). Interdisciplinary teacher education embraces the shared concern and “the liberation of greater diversity of personal capacity” (Dewey, 1916/1921, p. 101-2) that typify democracy and democratic education. It promotes educating all students and doing so through interdisciplinary approaches as a form of fulfilling the democratic promise of education (Dimitriadis & Carlson, 2003). It privileges educating students to think for themselves (Klein, 2005a) as self-determined individuals actively participating in learning communities (Greene, 1998) in “a democracy dedicated to life and decency” (Greene, 1988, p. xii). It cultivates the individual voice in a public space (Greene, 1995) and finds that to reach its interdisciplinary potential, every member and discipline represented by an interdisciplinary team “needs full potential and equal voice” (Newell, 2002, p. 125). While interdisciplinary teacher education supports the engagement of differences in values and ideology manifest, for example, in the disciplines, public education, politics, and other forms of cultural expression, it does not necessarily strive for discipline-based agreement or consensus but for integrating knowledge and experience that will serve teachers in global contexts with a greater capacity to dialogue with rather than for others.

Critically and Socioculturally Relevant Education

Interdisciplinary teacher education embraces critical forms of interdisciplinarity (Klein, 2005a) with two major aims in mind. First, interdisciplinary teacher education critiques in particular the theoretical and political dimensions of various texts. Second,
Poet Muriel Rukeyser (2005) writes, “I am in the world to change the world” (p. 460), and this idea guides critical forms of interdisciplinary teacher education, which endeavor to cultivate students with critical consciousness, understanding themselves as responsible agents of social change and praxis (Greene, 1988). Critical forms of interdisciplinary teacher education not only apply disciplinary insights to teaching and learning issues, but regard as necessary “their critique through interdisciplinary conversation about matters of common interest” (Davidson, 2004, p. 303). Greene acknowledges a paradox of such critique. While students are unique persons with their own biographical standpoints, they are also a function of culture, enmeshed in a culture from which they cannot entirely disconnect or stand apart (Greene, 1973, p. 8). Greene (1988) writes of “embodied social intelligence” (p. 43), for we cannot assume the role of absolute spectator or completely disentangle ourselves from reified social experience or our own culturally infused understandings. Yet, critique, argument, and debate — like observation and experiment — must test, challenge, and even refute theories. These forms of critique must be employed in interdisciplinary teacher education contexts. Interdisciplinary teacher education finds support in Greene (1988), who asserts the need for critical forms of education in a “resistant world” (p. 77), adding, “A properly educated individual [is] one able to judge and to care and to see through the artifices of convention” (p. 80). Greene (1995) states, “education today must be conceived as a mode of opening the world to critical judgments by the young and to their imaginative projections and, in time, to their transformative actions” (p. 56), thereby underscoring the need for critical forms of interdisciplinary teacher education.

Through an interdisciplinary pre-culture (Klein, 2005a), students critique “the epistemological and ideological assumptions undergirding disciplines and cultures and...the notion of universal forms of truth and knowledge without erasing commonalities” (Klein, 2005, p. 215). For example, critical discussions generally maintain that interdisciplinary knowledge should be challenged just as expert and handed down knowledge are meant to be refuted. Preservice interdisciplinary teacher education supports not only “critical dialogue between the disciplines on complex topics that are beyond the resources of individual disciplines alone” (Davies & Devlin, 2007, p. 4) but also deeper understandings of the disciplines as agents of cultural dominion and power (Foucault, 1977, 1984). Typically, critical forms of interdisciplinary teacher education accept Foucault’s (1972) claim that “every educational system is a political means of maintaining or of modifying the appropriation of discourse, with the knowledge and powers it carries with it” (p. 227). Critical forms of interdisciplinary teacher education, then, recognize that social power does what it must to survive and that the domination by the few denies opportunities for the many (Greene, 1988). It encounters and even counters power (Foucault, 1977). In this way, critique can be understood as a form of resistance, without which there is no progress, for, as Magee (1999) states, criticism more than anything brings about growth and improvement. Further, critical forms of interdisciplinary teacher education correlate with Martin Heidegger’s term un conceal, referring to “disassembling, presenting something as other than it is…. To ‘un conceal’ is to create clearings, spaces in the midst of things where decisions can be made. It is to break through the masked and the falsified, to reach toward what is also half-hidden or concealed” (Greene, 1988, p. 58). Further, critical forms find support in Kleinberg’s (2008) assertion that through such curricular approaches,
the goal is to destabilize authority and authoritative pronouncements – not to fall into relativism but, rather, to keep the ideas at play so as to create a space for dynamic discussion. In doing so, one necessarily cedes the authority inherent in the disciplines and embarks on new and often untried domains. (p. 10)

Critical forms of interdisciplinary teacher education cultivate critical understandings of the sociocultural dimensions of the disciplines and their respective disciplinary insights and require what Vadeboncoeur (1997) refers to as pedagogical approaches that “highlight the significance of critical analysis and structured reflection” (p. 33). Vadeboncouer (1997) finds that structured analysis and critical reflection help students understand the sociohistorical context in which students learn and the sociohistorical forces that shape students’ lives. Vadeboncouer (1997) continues:

Critical analysis consciously engages students in constructive and deconstructive inquiry about academic discourses and personal experiences, and the way in which they are linked through the construction of meaning. Preservice teachers develop working theories about practical situations based on academic content and then test them with experiences in service learning, practicums, or in student teaching. (p. 33)

Interdisciplinary teacher education finds critical consciousness is necessary (Greene, 1978) to foster intellectual independence, moral commitments to that which Greene (1988) refers to as “the worthwhile” (p. 119), and praxis (Greene, 1988). Echoing Dewey, Greene (1988) finds educators should be concerned with social issues and the need for critical social inquiry. Yet, Greene equates students who embrace more critical forms of interdisciplinary teacher education with Ellison’s (1952) *Invisible Man*. As such they can no longer be “absorbed in what is taken to be ‘normal’ or real… cannot fully ‘belong’…[with a vision that] remains that of the critical stranger, who always sees more (and differently) than the one habituated to the everyday world” (Greene, 1988, p. 99).

The purpose of this sort of *wide-awakeness* or critical consciousness is “to defamiliarize things, to make them strange” (Greene, 1988, p. 122), which, among other things, enables individuals to name and resist cultural reproduction and the impediments to our “shared becoming” (p. 133). In addition, critical consciousness cultivates *praxis*, which can be understood as a normative project in that it corresponds to putting values and ideas into action (Denzin and Lincoln, 2003a), opening the potentiality for transformation of the common world (Greene, 1988). Quoting Sartre and Freire, Greene (1988) explains that praxis is *transformative*, a synthesis of theory and practice that creates a revolutionized understanding and way of being in the world. Greene (1988) adds that it is critical “to find a way of developing a praxis of educational consequence that opens the spaces necessary for the remaking of a democratic community” (p. 126).

Similarly, progressive educator Deb Meier (1992) supports critical forms of education that allow students and teachers to initiate their own *liberation*. Interdisciplinary teacher education aspires to *liberate* students, regarded as critical, conscious, and free thinkers enmeshed in the social milieu. While Meier’s (1992) concept of liberation supports forms of critical interdisciplinary teacher education, it does not correspond to liberation in the traditional liberal arts understanding of the term, which, according to Russell (2006), can be traced from Plato’s theory of recollection, through the educational philosophy of Rousseau, Kant, and Pestalozzi, and Piagetian human development theory and resting on the perennial conflict between “the inner nature and
the outer illusory, corrupt, or repressive social world” (Russell, 2006, p. 174). Liberation is associated with freeing educators to make choices, as well as construct, deconstruct, and reconstruct various texts and “contingent categories that have been continually reified through their educational biography” (Desautels, Garrison, and Fleury, 1998, p. 268).

While interdisciplinary teacher education can play an integral role in helping students to overcome the pervasive sense of powerlessness, as well as “the taken-for-granted and the routine” (Greene, 1995, p. 36) in our world, it supports and empowers students in the critical examination of texts and the “principled pursuit of a fairer social world” (Greene, 1997, p. xxxvi). Bullough (2006) asserts the “New forms of beholding, of interpreting the world, not only create new data but also alter practice by changing researchers’ understandings of themselves” (p. 9). As Greene (1988) asserts, “It is, actually, in the process of effecting transformations that the human self is create and re-created” (p. 21).

Learning Communities: Bringing People Together Around Ideas

“The world in which the person creates and works through a future project cannot but be a social world,” Greene (1988) writes, “and the nature of the project cannot but be affected by shared meanings and interpretations of existing social realities” (p. 70). Learning is never a completely solo endeavor, nor should it be. Interdisciplinary teacher education recognizes

The greatest gift a formal education can bestow is to develop in us a conception of the world that is not merely an enlargement of our own views and attitudes and interests and assumptions; and in the nature of the case we are not able to do this without help from others who are free of our limitations. But from this, alas, it follows that the self-educated can never be more than half-educated, a regrettable but inescapable fact. (Magee, 1999, p. 23)

We live and learn in a social milieu and participate in dialogical communities that correspond to what Dewey (1927) describes as an “articulate public” (p. 184). Through learning communities, students share and form viewpoints, engaging in “Certain modes of ordering or structuring…the disciplines” (Greene, 1998, p. xxxix). While we have different vantage points, circumstances, and understandings, we form common ground (Arendt, 1959) and actively participate in constructing Dewey’s (1927) a democratic “Great Community” (p. 143). Students should be educated and active participants in democratic social life, and should develop social habits and dispositions that enable them to actively participate in the “free and enriching communion” (Dewey, 1927, p. 189) and “conjoint[ed] communicated experience” (Dewey, 1916/1921, p. 87; see also Dewey, 1927, p. 153). Further, Greene (1988) finds learning communities

enable persons to hear and to see what they would not ordinarily hear and see… offer visions of consonance and dissonance that are unfamiliar and indeed abnormal…disclose the incomplete profiles of the world…[and] defamiliarize experience: To begin with the overly familiar and transfigure it into something different enough to make those who are awakened hear and see. (p. 129)

“Making more and more connections in their own experience, reflecting on their share lives, taking heed of the consequences of the actions they performed, they would become aware of more and more alternatives, more and more experiential possibilities” (Greene, 1988, p. 42-3). “By giving voice to personal perspectives, listening to others’ stories,
seeking agreement, enlarging on it, and trying to expand the referent of what is shared” (Greene, 1995, p. 68), we cultivate “respect for the capability of others, as well as a willingness to expose ignorance and learn from others” (Newell, 2006, p. 137).

Jurgen Habermas’ concept of communicative democracy is described by Greene (1998) as a process that begins by forming communities of individuals who, of their own free will, discuss issues that are significant to them. Participants bring their vantage points and lived situations to bear on discussions, requiring persuasive speech acts and justifications as well as careful listening, through which participants become more reflective and convinced of legitimate claims as they make commitments to arrive at an outcome of the group’s design. Yet, the coherence of a community of learners may be found in its refusal to allow differences to remain incoherent and inarticulate. Similarly, Klein (2005b) writes of the unique demands of interdisciplinary collaboration, notably that it requires “communicative action” (p. 42), epistemological reflexivity, and “the willingness of individuals to subordinate their individual interests to a common objective” (p. 40). Klein’s (2005b) views on interdisciplinary collaboration are compatible with Habermas’ communicative democracy, particularly in that such collaborative work resists overspecialization and hierarchical decision-making so that no single perspective is privileged. Greene (1998) writes, “By listening to others and trying to understand their experience and claims, persons or groups gain broader knowledge of the social relations in which they are embedded and of the implications of their proposals…[and] often transforms the motives, opinions, and preferences of the participants” (Habermas, 1979, quoted in Greene, 1998, p. xxxvii-xxxviii). Learning communities remind us that all ways of seeing are selective and emphasize a perspective at the exclusion of others, thereby potentially limiting individual fields of vision (Lattuca, 2001). Interdisciplinary teacher education reinforces knowledge formation as a constructivist project, and participates in advancing what Greene (1988) regards as the profound struggle of the educational undertaking, to attend to the multiple perspectives of individuals often submerged by the so-called true and real (p. xi).

Collaborations build the individuals who comprise the community, for as Greene (1988) states, “the person – that center of choice – develops in his/her fullness to the degree he/she is a member of a live community” (author’s italics, p. 43). Individual minds develop through shared experience, as well as mediated and communicated language (Greene, 1973, p. 75). The growth (Dewey, 1916/1921) of individuals requires “ways of being dialogical in relation to the texts we read together; reflecting, opening, to one another upon the text of our lived lives” (Greene, 1995, p. 116). Greene (1995) elaborates,

as I work in a dialogical relation with students, I want…them to make their perspectives available so that both I and they can see from many vantage points, make sense from different sides. I want us to work together to unconceal what is hidden, to contextualize what happens to us, to mediate the dialectic that keeps us on edge, that may be keeping us alive. (p. 115)

Learning communities, according to Clifford Geertz (1983) are sites in which “thought is spectacularly multiple as product and wondrously singular as process” (p. 215). Similarly, Greene (1988) writes of the “need to be continually empowered… to create our identities within a plurality…something we can never do meaningfully alone” (p. 51). While Greene (1995) acknowledges that concern “for language, dialogue, conversation,
narrative, story, and quest connects with our quest for self-creation among individuals in worlds of potentially shared experience” (p. 108), mutual learning in a highly collaborative process aimed at building student *ownership* of knowledge. The social agency of individual members of dialogical learning communities reminding us “of what it means to be alive among others” (Greene, 1988, p. xii). Greene (1995) finds that, “engaged in speech and action from their many vantage points, they may be able to identify a better state of things – and go on to transform. Sometimes, I believe it is our only hope” (p. 59).

**Narrative**

In the context of forming democratic learning communities, the significance of narrative is underscored. Greene (2001) insists on the need to “allow young people to tell their stories, to draw them, to dance them, to shape some of the stuff of their lives” (p. 62). Moreover, Greene (2001) finds the individual stories that students contribute and engage are an invaluable source of knowledge that is attainable only within the context of the group. For example, in the context of analyzing a text, as students share the stories of their own lived lives, this engagement encourages the community of learners to reflect on their own assumptions and narratives and to examine the threats and opportunities that historically and currently inform and situate their lives (LeCompte, 1993; Neal & Weaver, 2001). These processes serve to legitimize multiple perspectives as they challenge and affirm the knowledge and experience of every member of the community (Greene, 1998, 2001; Davidson, 2004). Moreover, the ethos of communication and contestation amid collaboration helps individuals to be open to criticism, to ensure alternatives, and to scrutinize any claims to the sole truth.

Similarly, interdisciplinary teacher education learning communities disclose as much about the group’s social dynamics of knowledge construction as the disciplinary knowledge and theories more explicitly engaged. Vygotsky and Dewey find that learning communities “attempt to teach students yet another discipline, albeit a relatively new one” (Russell, 2006, p. 175), the sociology of knowledge, which focuses on the relationship of knowledge formation in the historical and social context of groups. It centers on the social dimensions of knowledge transmission, which can be understood in terms of *habitus* (Bourdieu, 1990; Bourdieu & Passeron, 1977; Scahill, 1993), the flexible, transposable, and generative system of socially constituted (pre)dispositions implicitly and explicitly held by a community. Bourdieu (1990) explains that “Habitus is a socialized subjectivity” (p. 90), corresponding to group adaptations to sociohistorical necessity, as well as commonsense and often highly contextualized understandings, which seems self-evident to the community in which they reside. Further, the sociology of knowledge explores group dynamics in terms of what the social transmission of knowledge reveals and conceals. For example, it acknowledges aspects of Bourdieu’s (1983) *cultural capital*, Apple’s (1993) conceptualization of *official knowledge*, Foucault’s *absent presence* (Carlson, 2006b, p. 97), and Eisner’s (2002) *null curriculum*. These concepts address aspects of the deeply structured yet shape-shifting manifestations of social power, which does what it must to survive. The sociology of knowledge is part of the irrefutable but unacknowledged social structures of power, perceptible in the curriculum and group dynamics that privilege some disciplinary understandings and participants over others.
Student-Centered Education

In keeping with Greene’s constructivist theory, interdisciplinary teacher education recognizes that the self is not ready-made or pre-existent; it is in perpetual formation (Greene, 1988; Dewey 1921). Students are singular human beings (Greene 1988, p. 18), whose inner or individual life cannot be separated or distanced from outer or social realities. Students are recognized in holistic terms and understood as active knowers, continually adjusting to and reshaping the environment (Greene, 1973). As Lampert (1997) explains, “Students have had different experiences and have very different ways of making sense of those experiences, and therefore bring a wide range interpretive frameworks to the lessons they are learning in school” (p. 97). Greene (1973) writes, “The method of responding is always individual; the end in view (attained through continuing reconstructions of experience) is to socialize, to enlarge, to initiate the person into the larger world – into wider and more encompassing meanings, always subject to change (p. 169).

Novice and Non-Specialist Interdisciplinary Inquiry

Constructivism holds that we can know a discipline but never completely, so in a constructivist mode, this study finds interdisciplinary work should not be left just to so-called experts just as it does not require disciplinary expertise (Boix Mansilla, 2004; Taber, 2006). In the book Scholarship Reconsidered (1990), curricular theorist Ernest Boyer (1990) explains that the scholarship of integration is defined as “making connections across disciplines, placing the specialties in larger context, illuminating data in a revealing way, often educating nonspecialists, too” (Boyer, 1990, p. 18). Davies and Devlin (2007) acknowledge that disciplinary expertise is required in some interdisciplinary pursuits, and point out that expertise among undergraduates and mature scholars differs considerably. While students are not expected to have a thorough disciplinary grounding to engage in interdisciplinary work (Boix Mansilla, 2004), it requires students to become “‘experts’ at making connections” (Klein, 2002, p. 14).

Newell (2002) recommends introducing students to interdisciplinary thinking through work that is “narrowly but fully interdisciplinary, rather than… broad but partially interdisciplinary” (p. 125). Newell (1998) concurs that disciplinary expertise is not necessarily a prerequisite of interdisciplinary work but offers an insightful perspective on the importance of helping students to get a feel for interdisciplinary work and to think as disciplinary experts do. He endorses forms of interdisciplinary education, particularly interdisciplinary research, which involve students in operationalizing discipline-specific theory and practice, as well as formulating practical disciplinary insights from traditional disciplinary theories, questions, and forms of inquiry. Newell (1998) finds an interdisciplinary vantage point, which usually entails viewing a discipline from outside in instead of the inside out, serves interdisciplinarians well in that interdisciplinarians are less likely to harbor disciplinary biases as they become “conscious of their difference, foreignness, or otherness” (p. 545) in the process of employing a discipline “that does not really belong to them” (p. 545). Interdisciplinary teacher education asserts that novices, non-specialists, students, and can make invaluable contributions to forms of interdisciplinary knowledge and experience (Clark, 2002). Interdisciplinarity teacher education increase democratic educational opportunities for
all, based on teachers and students who are non-specialists yet capable of gaining novel understandings, contributing significantly to research and scholarship, and providing critical evaluations and disciplinary insights in multiple, meaningful ways.

*Deweyan Cognitive Disequilibrium*

The centrality of the processes of inner growth, or what Dewey refers to as the *growth of the mind* (1921), is integrally tied to interdisciplinary approaches that include dialogue, reflection and self-reflection. These activities can, for example, disclose and challenge the perspectives and biases of individuals, to help future teachers to better address the learning needs of students and to create significant patterns of understanding that are attainable only through interdisciplinary knowledge and experience. Compared to traditional undergraduate coursework, interdisciplinary teacher education will likely involve a greater frequency of what Dewey (1921) refers to as *disequilibrium*, due primarily to the complex nature of interdisciplinary integration. Disequilibrium figures prominently in Dewey’s theory of education. While disequilibrium is not necessarily a goal or requirement of interdisciplinary teacher education, it is a concept that merits analysis in the context of conceptualizing teacher education because it will likely be encountered and should be nurtured with greatest care.

Disequilibrium is discussed in the developmental theory of Gestalt psychologists, Sigmund Freud, Jean Piaget, and Erik Erikson, and generally corresponds to the negotiation between individuals and their surroundings. Disequilibrium is a complement to equilibrium, in that disequilibrium is a temporary state of cognitive imbalance or instability experienced as individuals cognitively progress “from one level of understanding about the world or themselves to a more complex level of understanding” (Mortola, 2001, p. 46). Further, Mortola (2001) contends, “anyone who wishes to learn must risk a voyage from the familiar to the strange and ‘no learning can avoid the voyage’” (p. 46). Dewey (1934) describes disequilibrium as follows,

At every moment, the living creature is exposed to dangers from its surroundings, and at every moment, it must draw upon something in its surroundings to satisfy its need. The career and destiny of a living being are bound up with its interchanges with its environment, not externally but in the most intimate way. (p. 13)

Dewey endorses learning situations that can “be made problematic for the child and there resolved through inquiry” (Eisner, 2002, p. 13) and explains that disequilibrium can be initiated by “certain tensions and adjustments” (Dewey, 1921, p. 347) that precede actions individuals put forth to modify their environment or move “from a more uncertain, divided, hesitating state to a more overt, determinate, or complete state” (Dewey, 1921, p. 347). Based on the idea that out of conflict comes the potential for growth, Dewey finds in each transition equilibrium is restored and learning is enriched, stating “the recovery is never a mere return to a prior state, for it is enriched by the state of disparity and resistance through which it has successfully passed” (p. 14). Dewey critiques traditional education for not paying enough attention to the active engagement of these sorts of discordant experiences that are necessary for the growth of the mind (Eisner, 2002).
Constructivism embraces this concept of disequilibrium, and finds individuals need to experience cognitive conflict and struggle to reconcile alternative perspectives (Agne & Clarke, 2002; Fosnot, 1996, 2005). Agne & Clarke (2002) state in the life of the mind, recollected images, sounds, smells, and sensations become actors, memories. If new impressions resemble older memories, we assimilate them, strengthening the ideas we use to organize mental clutter. If new impressions conflict with prior knowledge, we experience disequilibrium. We are forced to question. Questions force us to reconcile new information with prior knowledge. The answers we develop to resolve conflicts change the entire structure of what we know…expectation and actuality are mutually self-correcting in the process we call learning” (p. 97-98).

Interdisciplinary teacher education cannot avoid engaging difficult and complex issues and questions, and educators should anticipate that the complex questions that will likely be asked in the context of interdisciplinary teacher education are conducive to occasions in which students experience the cognitive disjuncture of disequilibrium. “The value of the tension arising from intense conversations across differing worldviews or patterns of sense-making about some puzzle or problem that is recognized in some way as shared” (Bullough, 2006, p. 3) is integral to interdisciplinary teacher education. Yet, if disequilibrium is an aim, it comes with tremendous responsibility and requires the skillful crafting of learning opportunities and coaching of students. Experiences of disequilibrium can be moments in which the most meaningful learning transpires, yet they can come at great physical and psychological risks if not monitored and handled appropriately, and recognizes that significant role human emotions play in signaling our falling in and out of states of disequilibrium. To illustrate, students required to solve an unfamiliar, complex mathematical equation may experience disequilibrium. If the students feel challenged, which this model holds is educationally productive, they are experiencing disequilibrium. Yet, if the problem is beyond their grasp and they feel profoundly frustrated, this is also an experience of disequilibrium but is counterproductive. Further, in a group discussion, students confronting the stereotypes they harbor may feel so threatened that they temporarily or permanently disengage from the group (e.g., become silent, lash out at the learning community, or drop the course). Dewey (1934) recognizes that disequilibrium is not necessarily a helpful or productive state. Student growth is achievable and desirable through disequilibrium. Disequilibrium fosters opportunities for students to have a stake in their own learning and engage in deconstructing their understandings and perspectives, which might otherwise go unchallenged or unacknowledged. Similarly, interdisciplinary teacher education requires intense philosophical and introspective work that is not required in typical disciplinary courses. Some educators, particularly in multicultural courses, regard disequilibrium as an aim -- that the more confrontational and distressing a discussion, the better it is -- whereas other teachers prefer to avoid complex subjects and controversial topics. While those approaches may work for their respective teachers, interdisciplinary teacher education recognizes the educative potential of experiences of disequilibrium, regarding it as a means to an end. Introspection and inner growth should be explicit aims carefully cultivated in interdisciplinary teacher education programs.

Developing Interdisciplinary Research Questions and Questioning Skills
Questions are at the axis of interdisciplinarity — which begins with questions that are too large or complex to be adequately addressed by one discipline — and interdisciplinary teacher education. In the context of interdisciplinary teacher education, it is vital not only to craft solid interdisciplinary research questions but also to cultivate questioning skills that will be utilized by individuals as present students, future teachers, and lifelong learners. While Greene (1988) paints in broad strokes, linking questioning to consciousness, which “involves the capacity to pose questions to the world” (p. 20-1), Seabury (2002) underscores the importance of asking good questions specifically in relation to studying the disciplines and promoting integration through interdisciplinary work. This study finds support in O’Reilley’s (1993) statement, We have a lot to tell our students, but I believe our primary job should be to bring them to asking, by whatever means we can devise, the questions that will elicit what they need to know. Students do not really listen well to the answers to questions they have not learned to ask. (p. 34) Further, Myers & Haynes (2002) acknowledge that while students may not be comfortable or familiar with generating questions of their own, they need to develop their own questions and questioning skills, adding, “Discussing what constitutes a good question is time well spent” (p. 186). Based on a theoretical framework provided by Greene, key dimensions of questioning will be examined in the context of interdisciplinary teacher education. This section considers that the disciplines are defined in part by the overarching questions they ask, and that is how they are discerned by students. Constructing effective questions and engaging students in their own questions are central aspects of conceptualizing interdisciplinary teacher education programs.

Greene (2001) provides a theoretical framework, supporting questions that “feed into the ceaseless quest for meaning… give rise to wonder” (p. 170), and “aid our efforts to respond” (p. 18). Individuals pose their own questions in light of what they have done and experienced as well as what they want to know (Greene, 2001). Questions multiply in private and public spheres, aiding our efforts to weigh our experiences against one another and respond effectively to other human beings (Greene, 1988). Further, Greene (2001) recognizes “when people come together with their unanswered questions and their sense of mystery, the diversity of perspectives about what is shared makes possible a unique dialogue” (Greene, 2001, p. 196). Further, questions “keep sounding and resounding; unanswered” (Greene, 2001, p. 170; see also Lattuca, 2001), or lead to more questions than answers, yet “questions must multiply and not be covered over by the answers” (Greene, 2001, p. 194). Greene finds that questions may disclose more than we thought possible or reveal answers we are not entirely prepared to receive (Greene & Miller, 1997), provoking a state of cognitive disequilibrium. Yet, “it is surely those who can pose their own questions, pose them in person, who are the ones ready to learn how to learn” (Greene, 2001, p. 22; see also Greene, 1988, p. 14).

Each discipline and field of study can be understood as being structured around sets of overarching questions (and their corresponding answers). As students cull disciplinary insights, they develop an understanding of the quintessential questions of the disciplines employed. Interdisciplinary pursuit encourages students to interrogate discipline-based answers and responses. For example, through engaging disciplinary insights with interdisciplinary processes, students learn, not surprisingly, that while not every psychologist will see eye to eye, the overarching questions posed within the
discipline of psychology differ from those of most other disciplines. In general, one
discipline asks and answers questions that another discipline can or cannot. Further, one
discipline may provide an answer that another does not, or may provide an answer that is
challenged, rejected, or attacked on different grounds from various disciplinary
perspectives. Interestingly, interdisciplinary teacher education examines disciplinary
questions that may not be engaged even through traditional disciplinary courses, for how
commonly do postsecondary courses essentially and explicitly engage something as basic
as the overarching questions of a particular disciplinary field? Many disciplinary courses
overlook or take for granted the value of engaging foundational questions, expecting
students to get it on their own (Davis, 1995). The interrogative quality of
interdisciplinarity (Klein, 2002) can disclose knowledge that is paradoxically and more
substantially disciplinary than what is transmitted through traditional disciplinary
courses. The point is that by centering on discipline-based questions, students root out
disciplinary perspectives and insights, which leads not only to integrating disciplinary
insights but also to looking at and grasping a particular problem or topic in valuable ways
that could not have been achieved otherwise. Further, as Myers and Haynes (2002) point
out, “The questions raised in such fields as organic chemistry, botany, and physics may
rest comfortably within those disciplines during a classroom discussion in pure research,
but all questions become interdisciplinary when applied to the human condition” (Myers

Myers and Haynes (2002) examine various aspects of constructing questions in
relation to productive interdisciplinary work (Myers and Haynes, 2002). For example,
questions that are open-ended, unanswerable, or too complex — for example, in light of
time and resource constraints — may not be an appropriate to spearhead interdisciplinary
projects. The authors explore different types of questions, including speculative
statements (e.g. “what would happen if...?”), analytical questions that challenge
assumptions, comparative questions that address similarities and differences, and
synthetic questions expressing hypothetical relationships between variables. Myers and
Haynes (2002) also endorse certain prompting questions to provoke deeper thinking,
including “Who might find this question particularly important? How do these compare?
Which disciplines could provide insights into the topic?” (p. 188).

Interdisciplinary teacher education provides a context for students to engage their
own questions. Dewey (1921) points out, rather than engage in “suggestive questioning”
(p. 57), which corresponds to the pedagogical technique of drawing a specific factoid or
predictable answer (e.g., corresponding to the knowledge level of Bloom’s taxonomy)
from students, interdisciplinary teacher education should “supply a context of experience
in which problems naturally suggest themselves” (Dewey, 1921). Further, Vadeboncouer
(1997) justifies the need for teachers to cultivate students who actively question, stating,
If the teacher does not problematize and question existing knowledge and social
structures, and it does not occur to the child to do so, it is quite possible that
cultural assumptions and beliefs, as taken for granted ‘truths,’ will be appropriated
by the child unchallenged. (p. 28)

There are many unasked questions future educators should examine through
interdisciplinary approaches (Wear, 1999). Students need dialogical spaces to inquire and
discover in ways that emphasize the processes of asking and not necessarily or
conclusively answering questions. Myers & Haynes (2002) find students generally need
guidance in these processes. Crafting and asking appropriate kinds of questions is essential to clarify concepts and press student thinking, as student ideas and beliefs are “surfaced, reflected upon, critiqued, discarded, or elaborated and refined in our curricula” (Lattuca, 2001, p. 356).

Interdisciplinary Research and Curriculum Integration in Teacher Education

Interdisciplinary teacher education supports a rich language of integration, collaboration, synthesis, and interdependence (Newell, 2006), and its integrative dimensions are considered its greatest contribution to teacher education (Repko, 2008). Synthesizing students’ knowledge constructions with discipline-based knowledge, integrating disciplinary insights, forging common ground, and arriving at an interdisciplinary solution, perspective, or understanding can be understood as facets of the integrative process. The following section examines some of the multiple dimensions and contexts of interdisciplinary integration. These topics include disciplinary adequacy, critique, epistemological diversity, forms of integrative learning, and glocalization. The relationship between integration and reflection and integration and lifelong learning are also examined.

Just as discipline-based work typically centers on disciplinary mastery and expertise, interdisciplinarity focuses on developing and building upon disciplinary adequacy (Klein, 1996; Repko, 2008). Disciplinary adequacy corresponds to having enough proficiency in a discipline to determine which of its insights are most relevant in relation to the interdisciplinary problem or question (Klein, 1996; Repko, 2008). It involves deciding, for example, which disciplines to utilize, as well as how much and what kind of knowledge is required before students can draw from and integrate disciplinary insights (Repko, 2008). Further, while students need to develop enough competence in a discipline to glean disciplinary insights from it, they are also expected to venture into new interdisciplinary territory and demonstrate that interdisciplinary work can be built sufficiently upon a general rather than a so-called expert model (Boix Mansilla, 2004; Taber, 2006). Disciplinary adequacy and competency empowers so-called novices and non-specialists, who develop sufficient understandings of the disciplines to employ appropriate disciplinary insights to a problem or question.

While interdisciplinary teacher education requires the integration of disciplinary insights, its integrative process is largely structured around critique. Dewey (1934) believed that education should entail critiquing and learning from culture. Integrative critique should include the interrogation of discipline-based “methods, theories, or perspectives compare and perhaps even how they complement one another” (Lattuca, 2001, p. 30-1) and lead students to rationally and persuasively advocate, maintain, challenge, dismantle, or reject disciplinary insights (Lattuca, 2001). Critical approaches analyze the disciplinary epistemological assumptions employed in an interdisciplinary project. Further, integration has its limits, which do not necessarily escape critique. Although we aspire to construct comprehensive understandings of complex topics through interdisciplinary integration (Klein 1990, p. 249), Newell (2006) points out that due to the nature of complexity, integration does not necessarily lead to a solution to a complex problem. The interdisciplinary integrative processes are conceptually linked to critique, which typically centers on interrogating the constituents of disciplinary knowledge and expertise.
Interdisciplinary teacher education aims to cultivate a tolerance and respect for epistemological diversity, understood as a precondition that can be addressed but never resolved. It provides creative latitude and encourages students to question and overcome the limits of the reductionist, positivist, determinist, and objectivist assumptions of Western science, imprinted over the centuries onto Western consciousness. Integration corresponds to a knowledge construction gleaned from the synthesis of individual patterns of experience infused with interdisciplinary insights. We need to cultivate students who can effectively integrate actively constructed knowledge and experience within the structures of formal coursework. It is imperative to design and facilitate teacher education programs that provide opportunities for curriculum integration (Beane, 1997), for example, through inter- and intra-course integration, or integration that occurs within and among general education and survey courses, as well as courses that are more specialized, including independent study courses (Beane, 1997). Moreover, interdisciplinary teacher education should cultivate “a collegiate setting with an ethos of communication and contestation that ensures that no proposal stands without alternatives or arrogates to itself the claim of possessing the sole truth” (The Challenge of Connecting Learning, 1991, p. 12).

Interdisciplinary teacher education curricular integration requires students to step out of their comfort zones to develop practical teacher education skills and competencies by experiencing the world instead of memorizing its characteristics through various “forms of integrative learning” (Newell, 2001a, p. 196). Learning in- and outside the traditional classroom is integrated, for example, through community service, service learning, immersion, and study-abroad programs, as well as “Formal ‘fieldwork’ programs, on-site experience, mentoring arrangements in real work situations, involvement in undergraduate workshops and conferences, and similar mechanisms” (Davies & Devlin, 2007, p. 7). These educational innovations support interdisciplinary work (Newell, 2001a, 2001b), as well as pedagogical “strategies that share a common concern for learning from diverse perspectives” (Newell, 2001a, p. 197). Newell (2001a) distinguishes between interdisciplinarity as a curricular approach that draws insights only from academic disciplines, and integrative learning, which draws from “additional sources of alternative perspective” (p. 197). The integrative approach is the locus of common ground between and among integrative pedagogies as well as curricular strategies (Newell, 2001a). Further, Newell (2001a) finds that integrative curricular and pedagogical strategies complement and balance more traditional disciplinary approaches. Newell (2002) explains that through sets of interrelated curricular and pedagogical strategies, “Students taking interdisciplinary courses…are even more motivated if they see interdisciplinary studies as a way to integrate their undergraduate education and connect disciplinary courses to the real world” (p. 2). Moreover, Newell (2002) tells us that when integrative thinking is reinforced outside of the classroom, through community interactions, “there is a synergistic effect on learning that can be quite powerful” (Newell, 2002, p. 130) through which the interdisciplinary sum can be greater than its parts (Newell, 2001a).

Localization, or globally-infused local responses and understandings of one’s relatedness to others in local and global contexts (Anderson et al., 2008) participates in the collective generativity and integration of a learning experience, in which local practices and judgments are informed by broader contexts in regional, national, and
global levels (Klein, 1990, 2002). It can be understood as a reaction to global influences through which the global is transformed in local contexts, a hybrid cultural expression that privileges distinctly local qualities of interdisciplinary work. Geertz (1983) speaks to this point from a slightly different angle, recommending work that reflects “a feeling for immediacies” (p. 167). Yet, Geertz is referring in part to preparing or practicing on a local level, then applying that knowledge to wider contexts. As Geertz (1983) explains it, to avoid being overwhelmed by the enormity of the abstractions global issues can represent, we must first glean knowledge and experience from work in situation-specific local communities. Yet, this study maintains there must be a constant interplay between understanding in global and local contexts, so that one does not necessarily precede the other. Relatedly, Repko (2008) finds “the creative development of the concept of interdisciplinary understanding on the local level has important implications for service learning, internship experiences, and student projects” (p. 323).

Integration and Reflection

Reflection is an integral practice in constructivist (Kroll, 2005) and integrative forms of learning (Greene, 1973; Newell, 2002; Fosnot & Perry, 2005; Myers & Haynes, 2002). Reflective thinking is regarded as not only a necessary constituent and driving force of learning in interdisciplinary teacher education but also a tool of inquiry and discovery that can help individuals achieve praxis (Greene, 1988). Dewey’s (1916/1921) understanding of reflection as a disciplined way of thinking is integrally linked to the “reconstruction and reorganization of experience which adds to the meaning of experience, and which increases ability to direct the course of subsequent experience” (p. 76). Greene (1988) finds reflectiveness is important as it corresponds to the capacity to interpret lived situations (p. 22). Klein (2002) advocates interdisciplinary teacher education that “emphasizes active involvement, exploration, and higher-level thinking skills of reflection. Students are engaged in the actual doing of a subject or discipline. They also grapple with the cognitive conflict that occurs when working with alternative perspectives.” (author’s italics, Klein, 2002, p. 14). Reflection, according to Dewey (1921), requires reason and a disciplined way of thinking and is integrally tied to “Reflecting, deliberating, weighing alternatives” (Greene, 1973, p. 129). Beck and Koznik (2006) write about the importance of time for “personal reflection, discussion of implications, and expression of alternative views” (p. 10). Through reflection we realize our own ideas. We analyze, test, and develop those of others, but do not accept them in a preset form. Reflective thinking and writing can illuminate otherwise hidden assumptions and understandings, leading to more useful research and deeper understanding (Myers & Haynes, 2002; Boix Mansilla, 2007; Seabury, 2002). Journal writing is a recommended strategy to promote interdisciplinary reflection (Fosnot & Perry, 2005; Wear, 1999). Fosnot and Perry (2005) recommend time for reflection “through journal writing, representation in multisymbolic form, and/or discussing connections across experiences or strategies” (p. 34). Further, Newell (2002) acknowledges the benefits of interdisciplinary courses that explore the confluence of self-reflective thinking and the interdisciplinary process. Similarly, Greene (1978) finds self-reflectiveness should be encouraged, and supports the idea that “teacher educators and their students be stimulated to think about their own thinking and to reflect upon their own reflecting” (p. 61). Reflection is cultivated as a desirable personal and professional habit, in part because
before we can reflect upon ourselves as teachers, we must engage introspection and self-critique and consider ourselves as learners (Meek, 1991).

Integration and Lifelong Learning

Another dimension of integration, the union of past, present, and future learning, privileges an understanding of educators as lifelong learners. Klein (2002, 1995) predicts that understanding the confluence of adult and interdisciplinary learning will be increasingly important in preparing preservice teachers as well as the continuing professional development of teacher education faculty throughout their careers. Curriculum should cultivate synthesizing new knowledge into prior knowledge and experience (Schindler, 2002), and recognize education as a continual process engaged throughout one’s lifetime, reflected in the motto of Kean College of New Jersey: *Who dares to teach must never cease to learn.* As Dewey (1921) states, education should not cease when one leaves school...the purpose of school education is to insure the continuance of education by organizing the powers that insure growth. The inclination to learn from life itself and to make the conditions of life such that all will learn in the process of living is the finest product of schooling. (p. 60)

Yet, interdisciplinarity, as a means to an end, serves a practical purpose beyond career preparation and ongoing professional development (Schindler, 2002). If we embrace the Deweyan claim that growth is education and education is growth, then it is possible to conceive of ourselves as lifelong learners whose growth does not begin or end with a diploma or professional life, but whose education represents perpetual integration, a dialogue of past and present learning inextricably bound to future learning and more fully human *being* (Greene, 1995; see also Palmer, 1998).

*Learning by Doing: Interdisciplinary Teacher Education Students*

Most prospective educators teach as they have been taught, so it is critical to realize that if we wish for preservice educators and their future students to become interdisciplinarians and engage in the distinctive energy and benefits of interdisciplinary work, then we must provide interdisciplinary teacher education curriculum (Augsburg, 2005, Repko, 2008; Russell, 2006; Spaulding, 2002). Educators must develop habits (Dewey, 1916/1921) that support flexible and open-minded approaches to constructing curriculum and learning experiences and provide students with practical and concrete examples of how interdisciplinary work is done in the field of education (Loughran & Russell, 1997; Andrew, 2007). Hinde (2005) asserts

the efficacy of an interdisciplinary approach to curriculum is that when skilled, knowledgeable teachers employ integrated methods, student achievement is equal to, or better than, that of students who are taught in the traditional separate-subject approach...for integration to be effective, teachers must have adequate knowledge about the content areas they are integrating, and they must have adequate knowledge in integrative techniques. (p. 107)

What is experienced in the social milieu of the interdisciplinary teacher education program, as well as through experiential and hands-on learning, exerts a substantial influence directly on future educators but also through them upon their future students (Russell, 2006; Kroll, 2005; Lampert, 1997). Teaching is significantly influenced by and
contingent upon, but not restricted by, what teachers have been exposed to through their formal education (Richardson, 1997; Vandeboncouer, 1997; Loughran & Russell, 1997).

The understanding of imitation proffered by Vygotsky (1962; see also Moll, 1990; Dimitriadis & Kamberelis, 2006) is that when individuals internalize a thought or idea and make it their own, they have engaged in a form of imitation. Vygotsky (1962) equates imitation with a complex process of development that engages the conscious activity of reshaping meaning and cultivating new facilities for shaping and adapting to novel situations. Vygotsky (1962) finds imitation typically involves adults or more knowledgeable people guiding novices in a process through which the novices internalize a past formulation (Russell, 2006), for example, disciplinary terminology or approaches, that can then be applied or adapted to a future action or novel situation. Similarly, cognitive psychologist Bruner (1977) states, “There is a vast amount of skilled activity required of a ‘teacher’ to get a learner to discover on his own” (p. xiv) and finds learning depends upon “participation in a dialogue carefully stabilized by the adult partner” (p. xiv). Further, in a Deweyan mode, it is the teacher’s role to facilitate the development of insights and to create situations for learning; Dewey (1921) rejects the traditional role of the teacher as merely a vehicle for transmitting information. It is critical that future educators learn firsthand how to do interdisciplinary work so they can in turn teach it, through word and deed, to their students (Richardson, 1997).

**Alternative Academic Structures and Resources**

Debates about the place and resources for interdisciplinarity in academe (Klein, 1996) disclose the fact that the structures of disciplines are so deeply entrenched in academe “that it is unusual to find an argument for interdisciplinarity that does not acknowledge that sociopolitical reality” (Klein, 1990, p. 78). The National Academies (2005) assert, “The nature of the structure in which interdisciplinary research takes place – which may be in actual or virtual space – can help or hinder its progress” (p. 171). The National Academies (2005) conclude that academic institutions should “develop new and strengthen existing policies and practices that lower or remove barriers” (p. 5) to interdisciplinarity. Further, The National Academies (2005) find that postsecondary institutions could do with recommendations on issues relating to interdisciplinary “hiring, promotion, and resource allocation” (p. 3), as well as “how to better stimulate and support interdisciplinary research” (p. x). Yet, Lattuca (2001) finds in general interdisciplinary research has occurred despite, not because of, academic structures. Similarly, Rhoten (2004) claims that while there is external support and faculty motivation to perform interdisciplinary work, the kinds of systematic, organizational, and strategic management measures required to cultivate it are lacking (see also Harris & Holley, 2008). For example, the traditional structures of most colleges and universities are comprised of academic departments with a single disciplinary orientation (Lattuca, 2001, p. 44), traditional departmental hierarchies, and institutional reward and tenure systems that serve as disincenitives to interdisciplinary work (Klein, 1990; Lattuca, 2001; Sa, 2007). Moreover, Davis (1995) notes, “the more diverse the disciplines represented in a course, the more difficult it becomes to answer the structural question[s, such as]...Who approves it, who staffs it, who pays for it, and under what conditions?” (p. 138). Obviously, the answers and solutions will vary from institution to institution, but Davis (1995) concludes, “The more distant the collaborating parties are, the higher the
level of the organizational structure needed to bring them together” (p. 139). Similarly, Wong (1996) asserts the need to connect the disciplines and develop academic “structures and incentives to encourage and reward continuous conversations at the intersections of the varied specialties” (p. 63). Yet, Sa (2007) claims, “The university structure is by and large self-replicating, and without concerted action, barriers to interdisciplinarity are likely to persist” (p. 19).

Interdisciplinary teacher education will likely engage structural change of the university, perhaps on multiple levels, and must acknowledge the interdisciplinary paradox (Klein, 1990), reflected in Comprone’s (2001) claim that despite the “contradiction of departments and interdisciplinary teaching and learning, faculty and administrators can intentionally craft effective learning communities within a departmentally organized college” (p. 116). Davis (1995) recommends that interdisciplinary programs heed the successes of disciplinary courses, which acknowledge “organizational structures within and outside the institution are important, as are the mechanisms for training and sustaining faculty” (p. 149). Yet, interdisciplinary teacher education may require a range of new structures, as well as alternative resources and support, to accommodate interdisciplinary teacher education courses and programs (Newell, 1983, Humphreys, 2002). Compared to conventional courses and programs, interdisciplinary teacher education may require different administrative, social, and psychological support. It may require alternative planning, release time, class enrollment, salary, teaching load, and tenure criteria, as well as additional resources and seed money for equipment, laboratories, technology, travel, and visiting professors and researchers to enrich the level of teaching and learning. While many of these fiscal and logistical issues affect disciplinary programs and faculty as well, they are compounded for interdisciplinarians, based on their relation to the rest of higher education (Trow, 1984), “the politics of disciplinary advantage” (Rogers, Booth, & Eveline, 2003), and disciplinary imperialism (Sayer, 1999; Anderson et al., 2008). It may require nothing short of a cultural shift to reorganize academic institutional and cognitive structures conducive to interdisciplinary teacher education (Lattuca, 2001). Yet, Davis (1995) argues that institutions committed to the values of interdisciplinary education will not be discouraged by its structural and budgetary challenges, and will find ways to provide adequate structures and resources that include crediting and rewarding interdisciplinary faculty.

Newell’s (1983) model or vision for implementing interdisciplinary postsecondary curriculum proposes “a radical restructuring of the curriculum within existing institutions of higher education” (p. 252) based in a separate interdisciplinary department. It also endorses the “team-development of courses, centrality of interdisciplinary studies to the educational missions of the institution, an ambience of innovation, and a clear conception of the definition and nature of interdisciplinary studies” (Newell, 1983, p. 249). Newell (1983) maintains the need for full-time faculty committed to and supportive of interdisciplinary work, as well as tenure and promotion systems that provide faculty not only with adequate release time for lesson planning and preparation, as well as professional development, with rewards in the form of salary, promotion, and tenure.

Klein & Newell (1996, 1997) and Klein (1999) provide a general guide for developing interdisciplinary programs that takes into account multiple conceptual and organizational variables that can factor into instituting interdisciplinary change. The
nature of the institution, including its size, mission, and financial base, weighs in, as does the academic culture. The perceived educational needs of students, the nature of the academic and local communities, the prior experience with curricular innovation, and the interactions between the faculty and administration may disclose implicit and explicit aspects of the institutional culture. In addition, the nature and scope of change should be carefully considered. For example, would changes in a course or set of courses, in programs, or in the entire academic institution be involved? Similarly, what exactly would need to be changed? Does the requisite change call for a radical university-wide transformation, the addition of a new thematic sequence, or university partnerships and service learning assessments? Finally, human resources need to be considered, for example, in terms of hiring consultants, permanent faculty, and administrative support staff.

Sa (2007) outlines three general, interconnected interdisciplinary trends, often associated with strategic planning, in higher education. First, offering financial and administrative support designed to stimulate and support interdisciplinary teaching, learning, and research. One example would be programs that facilitate interdisciplinarity by providing infrastructure, administrative support, and seed monies to collaborative interdisciplinary research teams. Second, advancing interdisciplinary research by directing institutional resources and initiatives in “high-profile, resource-intensive fields” (p. 20). For example, the University of Cincinnati currently extends an interdisciplinary funding initiative to its faculty. The program is competitive and designed to support interdisciplinary courses and research projects that will enhance its reputation as a cutting-edge academic and research institution. It is a competitive fund for faculty who design and implement interdisciplinary teaching, learning, and research opportunities at the university. Finally, one trend involves the establishment of organizational arrangements that essentially guarantee interdisciplinary work will be supported. These structural arrangements can include, for example, building new interdisciplinary facilities, laboratories, programs, and courses, as well as hiring new faculty specifically to teach interdisciplinary courses and conduct interdisciplinary research. While these trends are typically associated with investments designed to improve the university as a whole, this model finds they could be utilized in the strategic planning of interdisciplinary teacher education.

While interdisciplinarity is often a major selling point of colleges and universities in the United States, interdisciplinary programs require in many instances monumental structural and organizational changes. Some critics argue that such changes may be a reward for bowing and scraping to political pressures and market forces that support the creation of vacuous, corporate-style niche academic program markets (Kleinberg, 2008) or impose downsizing and other cost-cutting measures at the expense of advancing knowledge production (Davis, 2007). Harris and Holley (2008) assert that interdisciplinary institutions need nontraditional physical, social, and normative organizational structures that are conducive to interdisciplinary exchange and integration, and maintain that the emergence of and push for interdisciplinary knowledge challenges the academy to consider deeply its physical, social, and normative structures. Harris and Holley (2008) state, “An interdisciplinary community is fostered through the shared characteristics of faculty and students as well as a shared physical and social space” (p. 35). It is vitally important for the academy to create and support well-defined institutional
strategies and physical spaces, as well as an organizational culture conducive to interdisciplinary work. Harris and Holley conclude that such academic support is essential for innovative interdisciplinary work, through which “chance encounters, flexible laboratories, community commitment, university leadership, and a supportive culture can merge to address the complex social problems that extend beyond the scope of any single discipline” (p. 42). Yet, Davis (2007) argues, the notion of hard facts on the one hand and the idea of social construction on the other cannot seamlessly merge into each other. Naïve calls for interdisciplinarity might assume that they could. A more sophisticated interdisciplinarity might mean coming up with new disciplines altogether. It might even mean that the traditional divide between the two cultures of science and the humanities might have to break down. Knowledge might look very different from what we know, from what our ossified departmental and professional structures look like now. But how many universities are willing to transform the blueprints of their internal structure? If we don't radically restructure how we approach knowledge, "interdisciplinarity" will remain just a buzzword for administrators and a code word for amateurs to teach whatever they want. (p. B9)

Sa (2007) asserts, “Factual examples of successful programs based upon careful assessment are needed before practitioners and policy advocates can endorse [interdisciplinary] managerial and organizational innovations” (p. 26). Gauging the return on investments in interdisciplinary programs can be a problematic task, yet Sa (2007) concludes “Given the scale of the resources at stake, universities can only benefit from scrutinizing what results from the inputs allocated to interdisciplinary research” (p. 26). For interdisciplinary teacher education to work, agreement and balance “must be secured among the forces that animate it” (Eisner, 2002, p. 377). As Eisner (2002) states:

As a living organism, the parts exist in a transactional state, and changes must in one part be compatible with the rest of the structure or the changes must be so potent as to change the rest of the organizational structure. If the structure of the school as a whole is resistant to change, as is true of many schools, then it is likely that the change agent will itself be changed rather than the school. (p. 377)

Addressing the Limitations of the Study and Directions for Future Research

The following section examines the limitations of this study and the potential directions for future research. The limitations cited at the beginning of this study included focusing on a review of literature written in English and published between 1997 and 2008 in the United States. The only significant limitation of those factors was that several key resources predated 1997, so it was not possible to limit research to works published in the past ten years. It was necessary to expand the research scope and employ classic texts in the field of interdisciplinary studies that predate 1997. Further, this study was limited by the initial focus on the scholarship of one or two interdisciplinarians, so the research was broadened and enriched by the scholarship of multiple interdisciplinarians. Further, research limitations included the research methods, centering on a review of the literature. Future research will hopefully substantiate and extend these research findings through additional case studies and action research methods. The case studies reinforced findings from the review of the literature but did not figure as prominently or increase generalizability or the criteria of trustworthiness, credibility, transferability, and
confirmability to the degree that had been anticipated at the onset of this study. The case studies demonstrated that there was consistency in how terms were employed (Denzin and Lincoln, 2003b, p. 34).

The most formidable limitation was posed by the constructivist theory employed. Constructivism as a methodology, but particularly as a theory of learning, could be developed more substantially in future work to do justice to Maxine Greene’s theoretical construct. Constructivism should fit more seamlessly into this research, serving the dual purpose as a lens through which to view the data and as a theoretical basis for this interdisciplinary teacher education model. This study recognizes that interdisciplinarity does not offer a panacea for change or blueprint for success, but contends that the confluence of interdisciplinary studies and teacher education provides the basis for critical educational reform in the Global Age.

Despite their commonalities, it appears that the fields of teacher education and interdisciplinary studies have in general not cultivated their common ground. Based on this study, it is assumed that teacher education and interdisciplinary studies are theoretically related and compatible on multiple levels, yet each seems to eschew the other for reasons that are not explicitly clear. On the one hand, scholars in the field of interdisciplinary studies may harbor some elitist regard for teacher education as a so-called applied profession, or perhaps as a lower tier on the applied profession hierarchy. Based on this research, interdisciplinarians do not necessarily avoid cultivating closer ties with departments outside of the province of the College of Arts and Science. Yet, interdisciplinary work is being actively cultivated in business-related fields applied professions, they may not be guided by the work of interdisciplinary studies any more than the work in teacher education I, so perhaps the applied profession status or associations are necessarily the issue concerning the regard the field of interdisciplinary studies holds for the field of teacher education. On the other hand, based on a review of the literature, this study finds that particularly since 2004, a growing number of teacher educators have published articles that attempt to explain interdisciplinary teaching and curriculum development, yet these rarely if ever site the scholarship of interdisciplinarians and tend erroneously to equate multidisciplinary with interdisciplinary work. Further, the perception among those working in the field of teacher education is that it is not feasible to be interdisciplinary and comply with national accreditation requirements and interdisciplinary approaches, yet The Evergreen State College clearly demonstrates that it is (Smith, 2001). Therefore, this study could be developed in future research that builds bridges between interdisciplinary studies, teacher education, and national postsecondary accrediting agencies as it critically examines the requirements of national teacher education program accreditation and how interdisciplinarity helps or hinders meeting those criteria, as it considers deeply what Marilyn Cochran-Smith and Kim Fries (2005) refer to as “the constructions of teacher education as learning and teacher education as policy” (p. 102).

While much has been written in the Global Age about expanding, dissolving, and reinventing teacher education to prepare future educators with the skills and capacities they will need in the Global Age and beyond (Humphreys, 2002), there is a critical need for future research that pertains to defining the field or expanding our understandings of what should constitute interdisciplinary teacher education. While research could develop in myriad directions, based on this research, there is a pronounced need to cultivate
interdisciplinary teacher education programs as distinct from special education and early childhood education. Based on Carlson (2006a) and Ekman (2005), future research could cultivate the connections between liberal and teacher education. There may soon be a need for a periodical, as well as conference strands or whole conferences, devoted specifically to advancing interdisciplinary teacher education programs and related interests. Further, there is a need to establish an interdisciplinary teacher education library and clearinghouse to house current and archival information, digitized and accessible to all. Research could explore the faculty role in interdisciplinary teaching, based on an interdisciplinary teacher education perspective on faculty development, team teaching, and teaching and learning assessment, as well as faculty recognition, tenure, and promotion (Stowe & Elder, 2002). Research could center on assessment, which could lead to improvements in interdisciplinary teacher education teaching and learning. It could center on developing the concept of metaphor, which figures prominently in education and interdisciplinary studies. It could examine the relationship of interdisciplinary teacher education programs and quality P-12 education. Research could focus on what motivates students to study and learn in interdisciplinary teacher education programs. Research could center on advancing philosophical and political battles that align liberal education and interdisciplinary teacher education (Newell, 1983; Humphreys, 2002, Carlson, 2007; Porter, 2005; Ruscio, 1987, 2005). Further, research could examine the confluence of theory and practice, or cultivating praxis, through interdisciplinary teacher education programs. Further, lifelong learning and student advising in the context of interdisciplinary teacher education could be fruitful research avenues. Future research could center on the internationalization of teacher education based on Cornwall and Stoddard’s (1999) concept of interculturalism, which corresponds to breaking the boundaries between domestic and international diversity and deepening understandings of global issues through the study of the confluence of disciplines and cultures (G. Klein, 2002). Future work will hopefully center on initiating action research (Greenwood & Levin, 2003) that focuses on postsecondary interdisciplinary teacher education programs, based primarily on students’ viewpoints. Engaging longitudinal research featuring cross-cultural analyzes and ethnographic studies (Emerson, Fretz & Shaw, 1995) of interdisciplinary teacher education faculty and students at international universities is a possible future research direction. The goal of future research could focus on mixed-methods (Denzin & Lincoln, 2003a) research of teacher education cohorts before, during, and after their experience in interdisciplinary teacher education program, in part to evaluate and assess to meet strategic planning and program development goals. The dream is not dreamed out; This research will hopefully serve purposes that advance new and more progressive forms of P-12 education that aspire to educate not train our children and prepare them to realize the kind of democracy we can as yet only imagine.
CHAPTER FIVE: CONCLUSION

The conclusion of this study is guided by a question posed by Geertz (1983): “The interesting question is not how all this muddle is going to come magnificently together, but what does all this ferment mean” (p. 34)? This study conceptualizes interdisciplinary teacher education programs and advocates interdisciplinary approaches to teaching and learning as a postsecondary educational reform. This study of interdisciplinary teacher education is itself an interdisciplinary study, forging common ground between the fields of interdisciplinary studies and teacher education and integrating them within a social constructivist methodology and theory of learning. Using Maxine Greene’s constructivist methodological lens, this study provides a review of the literature of recognized scholars in the fields of interdisciplinary studies, social constructivism, and teacher education to conceptualize and produce a model of interdisciplinary teacher education. It is acknowledged that arguments can never prove the truth of their presuppositions or conclusions (Magee, 1999). Yet, this study supports Adler’s (2001) claim “whether a fragmented system of education can in any effective way produce integrated beings is perhaps the most significant question confronting practitioners of …education today” (p. 151). It holds that interdisciplinary teacher education is essential in the Global Age as it challenges teacher education to more fully consider and implement interdisciplinary curricular and pedagogical innovations. The connections between the fields of interdisciplinary studies and teacher education enrich the learning of future educators and their ability to utilize interdisciplinary approaches in their P-12 teaching practice in the Global Age and beyond. Further, what appears important about interdisciplinary teacher education does not correspond to scientific truths about the world but to ethical questions about how we ought to teach.

We are living in the Global Age, which by many measures is an Age of Interdisciplinarity. Interdisciplinarity is burgeoning as its scope and context evolves and expands exponentially and internationally. The unprecedented development of interdisciplinarity in the twenty-first century may be a natural outcome of the knowledge explosion and the Global Age. Newell (2002) maintains, somewhat controversially, that complex phenomena are necessarily preconditions for interdisciplinarity. He adds, “If the world around us were not complex, there would be no need for interdisciplinary studies” (p. 122; see also Newell 2001). Repko (2008) finds interdisciplinarity is required to address the pronounced need for more comprehensive understandings and solutions to complex real-world problems. Pressing global issues, like poverty, environmental sustainability, and terrorism demand the convergence of multiple disciplinary perspectives — from educators, artists, philosophers, scientists, students, and so on — to pool disciplinary insights and arrive at understandings and solutions that exceed the limits of a single discipline or perspective. Bullough (2006) finds that in the Global Age, the major challenge of interdisciplinarity is “to learn, relearn and – perhaps most important – unlearn our worlds, and to form new, more expansive visions” (p. 9). As colleges and universities worldwide face the ongoing challenge of considering what we should teach and to what end (Bruner, 1977), there is a need to raise curricular and pedagogical research questions that stem from an understanding of the world as increasingly interdependent and complex. Further, there is a need for teacher education to become more interdisciplinary. What teacher education should not do is to proceed as if it is not
faced with the challenges of interdisciplinary teaching, learning, and researching in the Global Age.

While interdisciplinarity can be considered the major educational paradigm of the twenty-first century (Kleinberg, 2008), it has yet to substantially impact the field of teacher education. Despite the growing prevalence of interdisciplinary approaches in virtually every discipline and field of study, they are not translating widely or consistently into the field of teacher education. Interdisciplinary approaches are unknown in most teacher education classrooms, and relatively few faculty are educated or courageous enough to teach in an interdisciplinary mode.

The disciplines are integral to interdisciplinary work. Typically, the disciplines are defined by a general set of principles, understandings, and terminologies that evolve and have a history. The disciplines have respective discourses and examine specific issues from distinct discipline-based perspectives. Interdisciplinary education does not seek to undermine traditional disciplines but to engage disciplinary insights in dynamic and novel integrative relationships that lead to expanded knowledge and understanding. In the context of interdisciplinary teacher education, the goal is not to essentialize the disciplines or tap their essence, but to employ disciplinary insights gleaned from multiple disciplines to examine a topic, solve a problem, arrive at a solution, and so on. Cornwell & Stoddard (2001) state, “Disciplines are like separate cultures and the work of interdisciplinary inquiry parallels the work of intercultural knowledge” (p. 162), yet interdisciplinary inquiry is invaluable to engage and critique, not just parallel, intercultural knowledge.

Interdisciplinarity, Klein (2002) maintains, is not necessarily a new concept but it is a relatively new twentieth century term. According to Newell (2002), interdisciplinary studies has evolved to the point of conceptualizing itself as a field of study based on an established consensus definition provided by Newell and Klein (1996). The field has established its own theoretical foundation, curricular model (Repko, 2008) and professional organization (Association of Integrative Studies), as well as professional publications, undergraduate and graduate degree programs, assessment guidelines, and communities of practitioners. While this study finds there is not necessarily a consensus definition. This study adheres to a hybrid definition of interdisciplinarity, based on three compatible definitions of interdisciplinary studies provided by Klein and Newell (1996), interdisciplinary understanding proffered by Boix Mansilla, Miller, and Gardner (2000), and interdisciplinary research supplied by The National Academies (2005). This study finds that, in general, interdisciplinarity addresses a central problem, issue, or question by integrating disciplinary insights from multiple disciplines and research modalities to arrive at a deeper understanding or solve problems beyond the scope of a single discipline or area of research practice. Interdisciplinarity reveals knowledge could not have otherwise been discerned, known, or experienced otherwise as it opens larger contexts of learning into developing perspectives not necessarily accessible via the study of disciplines and fields of study in isolation. There is an emphasis on bringing information together from various disciplinary orientations, but also collaboration and cooperation among disciplines studying the same issue. Typically students from or representing various disciplines develop their conceptions of a concrete problem or issue. Fields and findings may overlap, but these multiple perspectives are brought together to frame a common, synthesized, and pluralistic solution forged from the establishment of common
ground and content integration. This research supports several claims that express what interdisciplinarity has the potential to achieve. Kleinberg’s (2008) claims “the beauty and utility of interdisciplinary studies reside not in their institutional strength but, rather, in their protean nature and their ability to build bridges and make connections among the disciplines” (p. 10). Further, as interdisciplinarity fosters intellectual independence and critical awareness, it engages “a willingness ‘to learn again to see the world’…[to recognize the] integral relationship between reaching out to learn to learn…[and] the need to play with hypothetical alternatives” (Greene, 1988, p. 124). The outcome of interdisciplinary endeavor is that disciplinary insights “interact multiplicatively as well as additively: The interdisciplinary whole is greater than the sum of its parts” (Newell, 2002, p. 122).

Interdisciplinary teacher education is a normative project that reflect progressivist and social constructivist concerns and aims for education, centering on a new academic ethos, which calls for creating conditions for interdisciplinary engagement and integration and enabling curricular cross-pollination and border-crossing within the presiding curricular designs and academic structures (Ruscio, 1987). It emphasizes Dewey’s concept of the growth of the mind (1916/1921) and Geertz’s (1980) concern for thinking about what our students are thinking, or thinking about thinking, which centers not on teaching students what to think but how to think. Educating future teachers to learn about learning and to learn for themselves, is based on an idea expressed by Carl Rogers in Freedom to Learn; A View of What Education Might Become (1969), “The most socially useful learning in the world is the learning of the process of learning, a continuing openness to experience and incorporation into oneself of the process of change” (p. 3). It cultivates critical understandings and a healthy skepticism towards knowledge constructions, which are never neutral or value-free. Interdisciplinary teacher education envelops the broad category of issues of concern in the field of teacher education. Typically, interdisciplinary teacher education emphasizes the process over the product. Educators develop disciplinary knowledge but also the ability to integrate disciplinary insights and facilitate others in doing so. Interdisciplinary teacher education stresses students making meaningful connections between coursework, present learning, and future teaching. It strives not only to integrate disciplinary insights but also to tap the abilities, proclivities, knowledge, experience, creativity, and imagination of individuals engaged in the interdisciplinary pursuit. Interdisciplinary teacher education engages the curriculum through the integration of disciplinary insights with knowledge and experience co-constructed in highly contextualized intersubjective learning communities. It conceptualizes educators as lifelong learners actively participating in various communities throughout their personal and professional lives. This study supports the development of interdisciplinary teacher education programs within a social constructivist paradigm that emphasizes social activism. It supports programs that are “integrated, inquiry-oriented, and community-based” (Beck and Kosnik, 2006, p. 24), but also global in perspective. There is a need to cultivate the personal and professional growth of critical educators who actively demonstrate commitments to social justice and democratic education, who understand interdisciplinary education and employ its approaches as a reform of traditional teacher education programs, and who – through interdisciplinary curricular approaches -- counter the antidemocratic characteristics of P-12 education, including forms of high-stakes testing, standardization, and tracking.
Interdisciplinary teacher education is one way of cultivating the *articulate public* and democratic community that Dewey advanced through much of his work.

Although a precise language never awaits interdisciplinarity, this study includes a review of the literature that examines the nomenclature and language relationships of interdisciplinary studies, including *multidisciplinarity*, *crossdisciplinarity*, *pluridisciplinarity*, and *transdisciplinarity*, to distinguish these terms from interdisciplinarity. Further, the disciplines are understood as evolving yet foundational bodies of expertise that dominate academic organizational structures and socialize it students and faculty. Conceptualizing interdisciplinarity focuses on integrating disciplinary insights, not the disciplines themselves, and considers ways to classify interdisciplinary approaches, based on instrumental, conceptual, or critical forms, as well as full and partial interdisciplinarity.

The aims of interdisciplinarity center on developing “deep” understanding, as well as certain interdisciplinary dispositions and skills, which Dewey (1921) refers to as *habits*. Interdisciplinary teacher education fosters desirable intellectual habits of mind, such as open-mindedness and analytic abilities, as well as the ability to question and a willingness to receive answers to the questions asked. Interdisciplinarity is associated with a wide range of desirable character traits, behaviors, skills, and abilities (Klein, 1990, p. 182-3). Klein (2002) finds the skills that apply to P-12 interdisciplinary future and present educators typically include “reflective thinking, critical ethics, problem solving, valuing, self-concepting and self-esteem, and searching for completeness and meaning (Klein, 2002, p. 15). Interdisciplinary teacher education programs should actively recruit future teachers with these proclivities. Further, students should be encouraged to perpetually shift their focus inward and outward, so they understand that individuals are in a social milieu but also that the cognitive development, or growth of the mind, requires the challenges and growth opportunities proffered by the state of disequilibrium. Further, faculty and administration should recognize the demands this sort of *inner* work puts on students, which is not required, for example, of students majoring in most other fields or disciplines.

This study examines a range of interdisciplinary concepts, including boundary work, the *test* of interdisciplinarity, and common ground. Interdisciplinary work is *boundary work*, a concept that corresponds to interdisciplinary endeavor that involves crossing disciplinary borders or working in multiple disciplinary fields simultaneously. In addition, interdisciplinarity is called for if a topic is sufficiently complex; the “test” of interdisciplinarity is whether or not a topic is complex and multifaceted by multiple measures, including student interest. Topics that are complex and require the integration of disciplinary insights from more than one discipline are strong candidates for interdisciplinary study. Further, identifying common ground, or shared ideas and theories, is a requisite step toward integration, or synthesizing interdisciplinary knowledge and experience to meet the goals or preconditions of the interdisciplinary project.

Integration is at the axis of interdisciplinary work and there are multiple dimensions and degrees of integration. This study examines curricular designs with various levels of integration, and argues that prospective teachers should experience interdisciplinary teacher education firsthand. Interdisciplinary teacher education essentially demonstrates to future educators why their teaching and learning should center on integration. Interdisciplinary teacher education involves integration on multiple
levels. Integration occurs within a topic, course, thematic sequence, and program. It can be said that integration engages theory and practice, knowledge and experience, short-term and lifelong learning, and everyday individual and social experience, as well as the curriculum and extracurricular activities, individual and social, personal and professional, and internal and external. Yet, this study finds these facets are so reified, so mutually inclusive and enmeshed within the social matrix (which includes our consciousness) that they cannot be understood exclusively in binary or dialectical relation, or distinguished as entirely separate entities. Integration cultivates students’ ability to think in ways that are integrative and therefore practical. Interdisciplinary integration connects students meaningfully and purposefully to current debates (e.g., imports made by international child labor), and cultivates awareness of and reflection on their responsibilities, for example, as “global citizens,” or in broader community contexts beyond the immediate classroom community. Successful integration in part demonstrates that students have some degree of ownership of the topics studied, as well as the learning process and products they create as the result of their interdisciplinary engagement. Integration can be understood as a social constructivist component of interdisciplinarity, revealing something of the way the world is but also how the world is articulated as it is co-constructed within a perspectival group. Curriculum integration should not be left to chance, to students toiling in an untutored and solitary way to make integrated connections on their own, and it represents one of the most challenging steps in the interdisciplinary process.

In the process of conceptualizing interdisciplinary teacher education, it is critical to understand and anticipate the current, if not constant, tensions and dynamics of the relationship between the disciplines and interdisciplinarity. Klein (1996a) explains that disciplinary borrowing has its pitfalls, and there is a need to establish property rights (Klein, 1996a) amid disciplinary borrowing. Interdisciplinary teacher education recognizes the “shades of confrontation and cooperation” (Arnold, 1986 cited in Klein, 1996a, p. 73), or the relationships of disciplinary engagements and boundary crossings, as well as the struggles for professional and disciplinary control (Klein, 1996a). Interdisciplinary approaches cultivate in future educators a rich confluence of disciplinary and interdisciplinary skills and fluencies, yet “no accounting, disciplinary or otherwise, can ever be finished or complete. There is always more. There is always possibility” (Greene, 1988, p. 128).

Interdisciplinary teacher education programs should center on education not training. Interdisciplinary teacher education is a kind of life-changing platform for social change well beyond the limits and limited expectations of training (Eisner, 2002). It is predicated on teacher education that prepares teachers, who in turn cultivate students, increasingly cognizant of multicultural diversity, to interact effectively and respectfully in the classroom and wider culture. Interdisciplinary teacher education rejects the notion, decades in the making, that teacher education as training or career training. A range of literature, predominantly by scholars of interdisciplinary studies and teacher education, supports interdisciplinary teaching and learning. This study advocates the application of interdisciplinary approaches to teacher education and the development of interdisciplinary teacher education programs.

As a postsecondary reform, interdisciplinary teacher education is not entirely incompatible with traditional forms of teacher education or many existing forms of
interdisciplinary teacher education programs currently offered at postsecondary institutions in the United States. Yet, interdisciplinary teacher education represents a significant curricular and pedagogical shift for most teacher education programs and may require some degree of institutional-wide academic reform.

The current conceptualization and manifestation of interdisciplinary teacher education in the United States is uneven at best. This study finds that at present the term interdisciplinary is applied to teacher education programs that are interdisciplinary, based on the conceptualization advanced in this study, but also to traditional teacher education or special education programs that may be multidisciplinary but are in no discernible way interdisciplinary. Students may come to so-called interdisciplinary teacher education programs expecting interdisciplinarity, only to be offered little or no opportunity for the integration of the curriculum or disciplinary insights, as well as other aspects of interdisciplinary work. Worse yet, students may graduate from these programs with no clear understanding of interdisciplinary approaches to teaching and learning. Major impediments to developing interdisciplinary teacher education programs are linked to the lack of a cohesive language and understanding of interdisciplinarity, and the inexplicable mutual avoidance issues identified between the fields of interdisciplinary studies and teacher education.

Interdisciplinary teacher education curriculum development centers on issues, such as student-directed curriculum integration, and Newell’s theory on the four dimensions of interdisciplinary curriculum. Curricular issues also include practical topics and goals, as well as teaching strategies, notably reflective and self-reflective thinking. Through reflective interdisciplinary teacher education approaches, individuals test the assumptions and proposals of a subject area against questions, claims, and evidence from their own experience. This study finds that interdisciplinary teacher education programs should include at least a thematic sequence specifically in interdisciplinary teacher education.

The model of principles to guide the conceptualization of interdisciplinary teacher education examines teacher professionalization, interdisciplinary vision, and expanding consciousness through interdisciplinary education. Interdisciplinary teacher education nurtures consciousness, understood as a synthesis of Boix Mansilla and Gardner’s conception of global consciousness and Maxine Greene’s representation of wide-awakeness. Interdisciplinary teacher education cultivates preservice educators at once aware of their impact and influence on the world. It helps students to understand themselves in global and local contexts, and to recognize their profound responsibility as social agents for global change.

The democratic, critical, and socioculturally relevant dimensions of education and learning communities are reinforced through interdisciplinary teacher education. Interdisciplinary teacher education engages in critical forms of interdisciplinarity (Klein, 200X) and cultivates a deeper understanding of the complexities of social, cultural, economic, and political issues, which do not necessarily fit neatly into disciplinary compartments. There must be academic space for prospective educators to develop critical perspectives and persuasive arguments. A dialogical setting that encourages collaboration, reformulation, cooperation, and exploration is a testing ground for encountering people with diverse frames of reference, as well as a variety of experiences in and assumptions about the world. Interdisciplinary teacher education privileges
communities of diverse individuals and societies forming “critical and multicultural perspectives intended to interrupt the norms of conventional teacher education” (Cochran-Smith, 2006, p. 212).

Interdisciplinary teacher education is a form of student-centered education that emphasizes education that is at once personally and globally significant, cultivating students as responsible individuals who are free to choose (Greene, 1988) in ways that have consequence in students’ lives as individuals immersed in a range of local and global, as well as personal and professional, contexts. It advances the development of communities of teacher leaders through ongoing interdisciplinary inquiry and lifelong learning. Interdisciplinary teacher education programs have goals that facilitate future teacher in seeing themselves as lifelong learners, or on some level as perpetual students. In the context of lifelong learning, a goal of interdisciplinary teacher education is to create environments that demonstrate teaching and learning as inextricably linked. It is imperative for learners to understand that the connections between teaching and learning represents a powerful force in developing interdisciplinary teacher education curriculum.

Interdisciplinary teacher education supports novice and non-specialist interdisciplinary work on the basis that novel insights and approaches are often provided by individuals from outside a discipline, referring to those with no particular expertise in that or any discipline. Research problematizes the construction of disciplinary prowess as a valid measure of the quality of interdisciplinary pursuits or contributions. Knowledge is enriched by each facet or layer of understanding, including those from the outside looking in and the inside looking out. Interdisciplinary teacher education understands the value of students and non-specialists, unencumbered by disciplinary socialization and inculcation. It is egalitarian in its recognition of the potential contributions and insights of participants with little or no formal disciplinary expertise.

Dewey’s understanding of disequilibrium in the cognitive development of the mind, and provocative questions and questioning, are aspects of interdisciplinary teacher education that. By cultivating questioning skills, students develop in themselves and each other the abilities to identify, articulate, and expand their understandings.

Interdisciplinary teacher education programs require alternative academic structures and resources. While educators need substantive time and support for interdisciplinary curriculum development, this study acknowledges that interdisciplinary teacher education reforms require systemic academic support and structural changes involving, for example, curriculum, budgets, class scheduling, national program accreditation, as well as faculty release time, tenure, promotion, and professional development.

The study limitations and directions for future research are addressed. The limitations of this study could be addressed in future research, which could be developed in multiple directions in the United States and abroad. Of particular interest is developing a cross-cultural ethnographic study of international interdisciplinary teacher education programs.

Interdisciplinary teacher education has multicultural and international dimensions that advance glocalization, the globally-infused local responses and understandings of one’s relatedness to others in local and global contexts (Edwards & Usher, 2000). Apostel, Berger, Briggs & Michaud (1972) assert the problem of how to make approaches to education more interdisciplinary is by its very nature international. The
Global Age increasingly requires educators with a range of fluencies and cognitive skills to teach others as never before, and to adapt to the escalating pace of global changes and of knowledge construction no longer contained by disciplinary or geopolitical borders.

Interdisciplinary teacher education, guided by a constructivist learning theory, finds that knowledge is co-constructed and contingent upon a highly contextualized community of learners that values multiple, relevant perspectives. Furthermore, interdisciplinary teacher education prepares individuals to assume personal and professional responsibility for what transpires within a classroom and the wider culture, settings that are increasingly complex therefore in need of interdisciplinary approaches. Therefore, a synthesis of constructivist and interdisciplinary approaches are recommended to guide and inform interdisciplinary teacher education programs in their conceptual infancy and beyond.

Interdisciplinary teacher education is necessary to cultivate well-educated and well-rounded educators with the kind of strong leadership and interdisciplinary knowledge, skills, and experience needed in the Global Age. Preservice teachers need interdisciplinary teacher education experiences they can utilize as students and, in turn, extend through their future practice to P-12 students and colleagues. In other words, educators need a well-integrated interdisciplinary teacher education for themselves, as well as the skills, knowledge, and experience to be interdisciplinarians in P-12 education for the benefit of their future students and colleagues. Interdisciplinary teacher education programs should be developed to integrate knowledge for the purpose of making meaningful and necessary connections between and among discursive subjects and coursework, and preparing preservice P-12 educators to interact more effectively and sufficiently in the interdisciplinary contexts of practical, real-world interacting and problem solving. While interdisciplinary teacher education programs should integrate interdisciplinary studies theory and practice, the curriculum should focus on engaging topics of practical concern for future teachers. These critical connections involve curriculum that forges deliberate and relevant links, for example, between what is known and what is experienced, theory and practice, curriculum and pedagogy, and formal and service learning, as well as present and lifelong learning. Yet, at present it is largely if not exclusively up to most teacher education students to make meaningful connections and to integrate the various disciplines and topics that are studied in teacher education programs, even most of those which claim to be interdisciplinary.

Developing a symbiotic relation between interdisciplinary and teacher education is necessary to cultivate the kind of educators required in the increasingly internationalized world and to conceptualize schools as social laboratories and democratic microcosms. Cochran-Smith (2006) asserts we “need to make civic education a priority goal and social justice an outcome of teacher preparation” (p. 199). Applying this concept to interdisciplinary teacher education programs translates into developing goals devoted to cultivating in future educators abiding values, dispositions, and commitments linked to social justice, equity, responsibility and transformation, as well as lifelong learning and pluralistic democracy. Therefore, interdisciplinary teacher education and public education potentially share the goal of preparing learners to participate in democratic society “in ways that are critical, culturally responsive, and potentially transformative” (Cochran-Smith, 2006, p. 22). The democratic experiment is not dreamed out.
This study suggests that traditional teacher education inhibits critical inquiry and creativity, as well as our curiosity about the world, when it should be developing those capacities in preservice teachers, namely through interdisciplinary approaches. Current preservice teacher educators risk being products of the type of teacher education we need to replace (Andrew, 2007). Interdisciplinary teacher education upholds that the growth of the mind (Dewey, 1916/1921) requires curriculum that reflects explicit values of critical thinking, creativity, and imagination (Greene, 1988). There is a need for postsecondary interdisciplinary teacher education programs that foster curriculum integration in teacher education and prepare future practicing interdisciplinary teachers. This study strongly supports revisioning and repositioning teacher education, to imagine, as Greene (1988) states, teacher education programs “as if they could be otherwise” (p. 20), specifically as a form of transformative or emancipatory education (Greene, 1988). “It would mean fresh and sometimes startling winds blowing through the classrooms of the nation” (Greene, 1988, p. 126).

This study has broadened and enriched my understanding of the confluence of interdisciplinary and teacher education, as well as “the tensions and continuities between disciplinary and interdisciplinary education, and the common misconceptions that this kind of work reveals” (Boix Mansilla, 2004, p. 8). It seems self-evident that I need to learn how to become an interdisciplinary teacher educator. In the final analysis, I wish to maintain a position that advances interdisciplinary teacher education. I acknowledge that it is one thing to spell out an approach to conceptualizing interdisciplinary teacher education and quite another to establish or teach in an interdisciplinary teacher education program. While wishful thinking may be incompatible with serious thinking, it is hoped that interdisciplinary teacher education can continue “to awaken, to strike sparks” (Greene, 1988, p. 132) in fruitful ways and become a mainstay in the field of teacher education as it has in my own thinking.
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