Chapter 3
Improving Learning and Performance in Diverse Contexts: The Role and Importance of Theoretical Diversity

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The department of Instructional Systems Technology (IST) at Indiana University evolved from an Audio-Visual Education program that offered Master's and doctoral degrees by 1946. This academic program grew out of a campus service program where courses were taught by Audio-Visual Center staff with academic qualifications. Increased support by the federal government for education in science and technology led to adoption of the name Educational Media in 1959; this name change reflected the term favored by the US government.

The Educational Media division at Indiana University adopted a *systems view* of education in 1969 and changed its name to IST (Molenda 2010). By 1972, the IST curriculum was organized around several emphasis areas: message design, instructional design/development, evaluation and integration, systems design and management, and diffusion/adoption—all elements in a *systems view* of education. These themes persist in the research-and-theory emphasis areas of IST today and converge in the research and teaching enterprise of improving learning and performance. Currently, IST's emphasis is manifest in our collective efforts towards advancing the field through theoretical diversity: "We improve human learning and performance in diverse contexts."

Theoretical diversity is highly valued in advancing an applied field such as instructional technology. The goal of applied research is the discovery of new relationships in the knowledge within the domain to which the research is applied, whereas the goal of basic research purports the discovery of knowledge and the production of new knowledge (Torraco 2004). An important role for theory development

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in applied research, therefore, is to bridge gaps in knowledge that exist along the research continuum from basic to applied (Lynham 2002). For an applied field to grow and gain recognition, advancing science (i.e., theory and research) and technology (i.e., process and conceptual tools, design, and evaluation) is crucial (Merrill and Wilson 2007). Good theory is practical because it advances knowledge in a field, guides research toward crucial questions, and enlightens the profession through evidence-based practices (Van de Ven 1989).

To improve learning and performance in diverse contexts, we must adhere to sound research practices. Our continued effort towards pushing and collapsing boundaries through theoretical diversity has fostered innovation in IST since its inception. In this chapter, we describe some of the diverse theories that underlie current research in IST at Indiana University. Included are Reigeluth's theory of instruction, Frick's theory of totally integrated education (TIE), Boling's design research, Brush, Ottenbreit-Leftwich, and Glazewski's collaborative research on problem-based learning in teacher education, Bonk's extreme learning, Haynes' discussion of social cognitive theory (SCT) and developmental networks (DN) in mentoring and appreciative inquiry (AI) in change interventions, and Cho's use of citation network analysis in the field.

3.1 An Information-Age Theory of Instruction[1] (Charles Reigeluth)

Reigeluth has described the Information-Age paradigm of education as being based principally on active learning, intrinsic motivation, customization, attainment-based student progress, collaborative learning, and self-directed learning (Reigeluth 1994; Reigeluth and Garfinkle 1994). His research group at Indiana University is pursuing the belief that the Information-Age paradigm of education will utilize the synthesis of two lines of instructional theory: project-based instruction (defined broadly to include problem-based and inquiry-based instruction) and more traditional instructional theory based on constructivism, cognitivism, and behaviorism.

3.2 A Theory of Project-Based Instruction

There is much validated guidance for the design of the "project space," including universal and situational principles for the project space (see e.g., Barrows 1986; Barrows and Tamblyn 1980; Duffy and Raymer 2010; Savery 2009). They include guidance for selection of a good problem or project, formation of groups, facilitation

[1] Parts of this section are taken from Reigeluth (2012).

of higher learning by a tutor, use of authentic assessment, and use of thorough debriefing activities. Computer-based simulations are often highly effective for creating and supporting the project environment, and seem likely to predominate by 2020. STAR LEGACY (Schwartz et al. 1999) is a good early example of a computer-based simulation for the project space.

For a high-tech vision of the project space, imagine a small team of students working on an authentic project in a computer-based simulation. Soon they encounter a learning gap (knowledge, skills, understandings, values, attitudes, dispositions, etc.) that they need to fill to proceed with the project. Imagine that the students can "freeze" time and have a virtual mentor in the form of an avatar appear and provide customized tutoring, based on traditional (nonproject-based) instructional theory, to foster the needed learning individually for each student. Then, as soon as the students have mastered the necessary learning (just-in-time), they unfreeze time in the project space and continue working on the project.

3.3 Traditional Instructional Theory

Selection of instructional strategies in the instructional space is primarily based on the type of learning (the ends of instruction) involved (see Unit 3 in Reigeluth and Carr-Chellman 2009). For *memorization*, drill and practice are most effective (Salisbury 1990), including chunking, repetition, prompting, and mnemonics. For *application* (skills), tutorials with generality, examples, practice, and immediate feedback are most effective (Merrill 1983; Romiszowski 2009). For *conceptual understanding*, connecting new concepts to existing concepts in a student's cognitive structures requires the use of such methods as analogies, context (advance organizers), comparison and contrast, analysis of parts and kinds, and various other techniques based on the dimensions of understanding required (Reigeluth 1983). For *theoretical understanding*, causal relationships are best learned through exploring causes (explanation), effects (prediction), and solutions (problem solving); and natural processes are best learned through description of the sequence of events in the natural process (Reigeluth and Schwartz 1989).

These sorts of instructional strategies have been well researched for their effectiveness, efficiency, and appeal. And they are often best implemented through computer-based tutorials, simulations, and games in the "instructional overlay." Each student continues to practice until she or he reaches the standard of mastery for the learning. Upon reaching the standard, the student returns to the project space where time is unfrozen, to apply what has been learned to the project and continue working on it until the next learning gap is encountered, and this learning–doing cycle is repeated.

Reigeluth's research team is currently working on the design of a new kind of Learning Management System, called a Personalized Integrated Educational System, that offers tools for record keeping, planning, instruction, and assessment for student learning (Reigeluth et al. 2008).

3.4 TIE Theory (Theodore Frick)

When we learn something new, we are able to connect it to what we already know. The desired outcome of successful learning attempts is to form appropriate mental schemata. Such mental structures allow us to act intelligently as we go through life and carry out complex tasks (cf. Kandel 1989, 2001; Squire and Kandel 1999; van Merriënboer and Kirschner 2007).

Frick's recently developed theory of TIE predicts that mental structures formed by learners are expected to be stronger when *knowing-that-one*, *knowing-how*, and *knowing-that* are integrated with learner *emotions* and *intentions*. Such whole, completely connected mental structures are expected to be less vulnerable to forgetting.

Socrates identified "will" or "intent" as a part of mind, as distinguished from the intellect and emotion (cf., *The Republic of Plato* (Cornford 1945)). Greenspan and Benderly (1997) have noted that since the ancient Greek philosophers, the rational or cognitive aspect of mind has often been viewed as developing separately from emotion. They argue that this view has blinded us to the role of emotion in how we organize what we have learned: "In fact, emotions, not cognitive stimulation, serve as the mind's primary architect" (p. 1). They identify the importance of emotion during human experience: "… each sensation … also gives rise to an affect or emotion … . It is this *dual coding* of experience that is the key to understanding how emotions organize intellectual capacities … " (p. 18). In a similar vein, Goleman (2011) articulates this idea from the framework of 'emotional intelligence' (see Fig. 3.1).

Given the importance of emotion and intention in learning, it is discouraging that the majority of US high school students are bored every day in school. Yazzie-Mintz (2007) summarizes results from a survey of 81,499 students in 110 high schools across 26 US states. Approximately two out of three students said that they were bored in class every day. When asked why they were bored, the top reasons were that learning materials were uninteresting, irrelevant, and not challenging enough.

If emotion is the architect of mental structures, as mounting evidence appears to support (cf., Greenspan and Shanker 2004), then it follows that many students are likely to be developing ill-formed mental schema for the subject matter they are expected to learn—mental structures which are weakened or disconnected from existing mental structures due to feelings of meaninglessness, irrelevance, boredom, and even disdain with respect to the content of their education.

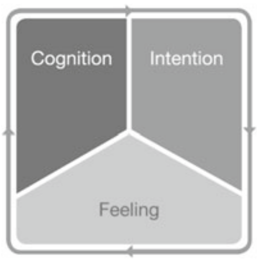

Fig. 3.1 Schema for integration of thinking, willing, and feeling. (Graphic by Colin Gray)

Ideally, students should instead be developing mental structures that are strengthened through real purpose in life and positive emotion. If so, then those positive feelings and the relevant purpose of learning activities will facilitate organization of mental structures that constitute long-term memory. Metaphorically speaking, once we have a solidly built house on a good foundation, then it is easier to add or remodel a room. We build on what is already there in terms of the existing structure.

To focus only on student cognitive development at the expense of emotion will result in weaker or disconnected mental schemata. Such schemata will lack wholeness and hence would be poorly integrated into existing mental structures, much like an uninvited guest at a party who stands in the corner of the room and does not interact with other invited guests.

TIE theory builds on seminal work of John Dewey, Charles Sanders Peirce, Elizabeth Steiner, George Maccia, Stanley Greenspan, Kenneth Thompson, Myrna Estep, David Merrill, and Jeroen van Merriënboer. Implications from TIE theory include a strategy for reconceptualization of curriculum that is based on authentic learning tasks selected from existing culture. These tasks are predicted to help students integrate nine kinds of knowing with emotions and intentions: recognitive, acquaintive, appreciative, imitative, adaptive, creative, instantial, relational, and criterial (cf. Maccia 1988; Frick 1997).

For further explanation see: http://educology.indiana.edu/Frick/TIEtheory.pdf.

3.5 Design Knowledge and Design Pedagogy (Elizabeth Boling)

Design (the entire enterprise, under which making strategy decisions is subsumed) uses and creates generalized knowledge in the scientific sense. Generalized knowledge in design falls into two categories: first, knowledge about people, materials, and phenomenon that provide potentially fruitful avenues of design action and that warn designers off directions not likely to be productive (Krippendorf 2006); and second, knowledge about how design is carried out, what designers do, how they think, and other aspects of designing itself (Cross 2007). The first category includes what are called in the instructional design (ID) field "prescriptive theories" (Reigeluth and Carr-Chellman 2009), or principles (Silber 2007). These are necessary for effective design of instruction, whether employed explicitly or absorbed and used implicitly by designers, but they are not sufficient to instantiate individual designs, the "ultimate particular" which designs must become in order to exist as more than ideas (Stolterman 2008), and the extent to which any but the most broad of these can be generalized is arguable (Lawson 2005). This category also includes bodies of knowledge drawn upon across fields of design, including ID, psychology, sociology, physiology, and others that describe human characteristics, abilities, limitations, and universally or locally shared behaviors. The most pervasive form of the second category in this field is process knowledge expressed as models of designing (Smith and Boling 2009), whereas in other fields of design extensive empirical studies of designers in the act of designing are carried out using rigorous methods amenable to the production of generalized findings (see for example: Cross and Christiaans 1997; Goldschmidt 1991; Lawson 2004) and treat the issue of research on design as a serious area of study (Margolin 2010).

Research on designing shows that at least two other forms of knowledge are required to move beyond the choice of an instructional strategy and effect an instantiation of that strategy (Nelson and Stolterman 2003; Rowe 1987; Vincenti 1990). Precedent, the experienced record of designs and design moves, is a dispersed form of knowledge that is not complete until it is used (Boling 2010; Lawson 2004). Design judgment, the ability to recognize and discriminate patterns and properties, and to assess their appropriateness, in a specialized area of action, is a form of knowledge recreated anew in each individual who develops it and not amenable to explicit transfer from one individual to another (Nelson and Stolterman 2003). Developing expertise in designing requires prolonged and varied exposure to precedent (Lawson and Dorst 2009), reflection in action (Schön 1983), and individual development of the human instrument (Boling and Smith 2010; Boling 2008).

3.6 Using Technology to Support Problem-Based Learning in Teacher Education (Thomas Brush, Anne Ottenbreit-Leftwich and Krista Glazewski)

Problem-based learning (PBL) represents a widely recommended best practice in which effective technology integration can make a tangible difference. PBL provides learners with authentic ill-structured problems without a clear solution path. Using this student-centered approach, the teacher guides students through the problem-solving process (Barrows 2002). Several meta-analyses have shown PBL to be more effective than traditional instruction in increased student achievement and engagement (Ravitz 2009; Strobel and van Barneveld 2009; Walker and Leary 2009). Strobel and van Barneveld (2009) found that "PBL was superior when it comes to long-term retention, skill development and satisfaction of students and teachers, while traditional approaches were more effective for short-term retention as measured by standardized board exams" (p. 44).

New technology tools have the capacity to make the implementation of PBL in both university and K-12 classrooms much more effective. Collaboration is a large component of PBL, and many "Web 2.0" technology tools have recently been leveraged to facilitate collaboration among learners. For example, wikis can facilitate PBL implementation and practice by providing an environment in which instructors and students can collaborative, discuss, and reflect. In addition, students can take full advantage of linking to research, images, and videos to support their solutions. One vocational teacher education course used wikis to facilitate PBL; preservice teachers were provided a case and used a template wiki page that included guidance for each section that needed to be addressed (e.g., design considerations, recommendations, record of meetings, references) (Robertson 2008). Other teacher education programs have used online resources such as electronic resources, threaded discussion, PBL scenarios, videoconferencing, and distance tutorial support to facilitate PBL (Wheeler et al. 2005).

Based on the demonstrated effectiveness of PBL, more K-12 school models are implementing technology-enhanced PBL to target twenty-first century skills. For example, the "New Tech High" model currently in place in high schools across the country uses technology-enhanced PBL as a foundation. Some teacher education programs have attempted to address the need for teachers prepared to meet the instructional needs of these new school models by incorporating more PBL into their courses. A study of one program that introduced technology integration in a PBL environment found that preservice teachers' intentions to use technology for PBL increased (Park and Ertmer 2008). In another study, 96 preservice teachers collaborated on PBL lessons that integrated technology (So and Kim 2009). Results indicated that the preservice teachers demonstrated increased knowledge of PBL theory and practice.

Unfortunately, many teacher education programs still approach preservice classrooms with conventional practices (Feiman-Nemser 2008; Kiggins and Cambourne 2007), and few preservice teachers have clear conceptions of designing and implementing technology-enhanced PBL instruction (So and Kim 2009). However, more teacher education programs are beginning to recognize the potential for PBL and the need for support in order to integrate PBL (Murray-Harvey and Slee 2000; Edwards and Hammer 2006). In order for PBL to be successfully adopted by preservice teachers, teacher education faculties need to be comfortable with technology-enhanced PBL (Vannatta and Beyerbach 2001). Our current research efforts are focused on both identifying and developing web-based tools and resources that teacher educators and preservice teachers at institutions across the nation can utilize to develop effective PBL curricula. This happens in tandem with fostering opportunities for teacher educators to collaborate with experts in the integration of Web 2.0 tools and PBL strategies to use these resources and implement curriculum reform in their own teacher education programs. To learn more about our work, please visit http://education.indiana.edu/pbltech.

3.7 Extreme Learning (Curtis Bonk)

For the past two decades, Curt Bonk has been exploring online and blended learning as well as emerging technology tools for learning and collaboration. Recently, this research has involved aspects of the Web 2.0 and participatory e-learning such as blogging in China and Korea (Kang et al. in press), the creation and use of shared online video such as found in YouTube (Bonk, in press), TeacherTube, Academic Earth, and dozens of other places, and wikis in education. His wiki research has stretched from national surveys of elementary teacher use of wikis to the creation of cross-institutional wikibooks in higher education (Bonk et al. 2009) to the endorsement and use of wikis in corporate training environments (Lee and Bonk 2010) to the challenges, frustrations, and opportunities of wikibooks in the world community (Lin et al., in press). As detailed below, this research has both widened and narrowed during the past couple of years.

Using his recent book, *The World Is Open: How Web Technology Is Revolutionizing Education* (Bonk 2009b), as a base, his research camp is now focused on aspects of open education (Iiyoshi and Kumar 2008). In particular, they have coined a new term, "extreme learning," to represent their main focus. Akin to nontraditional or informal learning, extreme learning entails how people learn or teach with technology in unusual ways. It encompasses any technology-based learning not traditionally included in schools, universities, or corporate and military training centers. Think "not school." Extreme types of learning occur in or from planes, trains, boats, mountain tops, islands, icebergs, space stations, parks, monuments, war zones, religious missions, retreats, vacation resorts, submarines, camps, research stations (e.g., Antarctica), outdoor classrooms, grocery stores, museums, zoos, conferences, institutes, and summits, cafes, bookstores, nursing homes, hospital beds, shopping malls, virtual worlds, online communities or groups, webinars, webcam experiences, text messaging, mobile devices, virtual schools, open educational resources and open courseware, open universities, free universities or courses, etc. As such a list illustrates, humans not only learn in classrooms, we learn far beyond them such as on a ship at sea, in the air, and when in remote lands (Bonk 2009a). Each place, tool, and resource listed above offers countless people new hope for an education; often information rich, free, and on-demand.

As noted in Bonk's *World is Open* book, anyone can now learn anything from anyone else at any time. The above listing of environments for such learning is just a starting point. Bonk's research team is chronicling a wide array of extreme learning Web resources from which to learn. As the list has grown to over 200 such online resources, programs, and initiatives, four subteams have developed; namely (1) virtual education, (2) online language education, (3) adventure learning and environment education (Doering 2006; Doering and Veletsianos 2008), and (4) social change and global education. These four subteams are currently conducting an evaluation of these 200+ Websites using an eight-part coding scheme. This scheme includes the following criteria: (1) Content richness; (2) Functionality of technology; (3) Extent of technology integration; (4) Novelty of technology (Coolness Factor #1); (5) Uniqueness of environment/learning (Coolness factor #2); (6) Potential for learning; (7) Potential for life changing; and (8) Scalability of audience.

As part of these efforts, the Extreme Team is attempting to record "empowerment moments" wherein people's lives, and, in effect, their identities, were changed due to their use of Web-based technology. The team intends to document human development and growth as it pertains to life-changing moments involving learning technology. The world is open for learning and it is time to collect human interest stories that prove it and that can serve an inspiration for others.

3.8 Social Cognitive Theory, Developmental Networks, and Appreciative Inquiry (Ray Haynes)

Social cognitive theory (SCT) and developmental networks (DN) can be used to understand and structure mentoring in work organizations. The appreciative inquiry (AI) perspective can be useful in structuring and evaluating change interventions. There are numerous definitions of mentoring however, a central defining feature of organizational mentoring is that it is an interpersonal developmental relationship embedded in the career context (Higgins and Kram 2007). SCT is an extension of social learning theory (SLT) and it suggests that human functioning (behavior) including performance (required behavior) is not driven by internal forces or external stimuli. Rather, it is shaped by triadic reciprocality that involves: (a) personal factors, (b) external environmental factors, and (c) overt behavior (cf., Bandura 1986). SCT is considered a core theory in mentoring research because it takes a cognitive–constructivist approach to the mentoring dimension of career development. Cognition is concerned with thought processes and constructivists view people as proactive shapers of the environment rather than mere responders to it (Lent and Brown 1996). Triadic reciprocality drives individual functioning; thus, it plays a central role in determining individual, group, and ultimately organization performance. The individual factors in the triad operate interactively as determinants of each other; reciprocal determinism (Bandura 1986).

Many scholars and thought leaders in the areas of human resource development (HRD), organizational development (OD), and human performance technology (HPT) align in the view that personal factors and the environment interact to create a byproduct that is behavior or performance. This is evident in Lewin's field theory equation B = F (P, E) which asserts that behavior is a function of an interaction between the person and the environment (see, Lewin 1998). Further, Gilbert's notion of worthy performance, at its core, includes the person—environment interaction (cf., Gilbert 1978). SCT acknowledges this interaction but goes further by suggesting that behavior is also a codeterminant of the person environment interaction (Lent et al. 1994). SCT enables a paradigm shift from the stimulus–response view of learning and individual behavior to a cognitive–constructivist view of learning and individual behavior. Further, SCT offers a broad explanatory base for adult learning (Merriam and Caffarella 1999) and HRD subsets such as workplace learning, employee development, and organizational socialization (Gibson 2004).

As a core theory, SCT provides an explanatory base for mentoring. However, recent work in theory building has advanced thinking and research on mentoring in the career context. The construct of developmental networks (DNs) is now a prevailing perspective in mentoring research (Molloy 2005). DNs have come of age due to changes in the contractual nature of work, technological innovation, the impermanence of organizational structure, and workforce diversity (Higgins and Kram 2001). The DN perspective hinges on two core concepts: network diversity and developmental relationship strength. These are core concepts in social network theory and research (Brass 1995, Ibarra 1993 as cited in Higgins and Kram 2001).

DNs consist of a set of people (mentors) whom the protégé describes as actively interested and takes action to advance the protégés career by providing developmental assistance consisting of career and psychosocial support. Molloy (2005) describes (DNs) as concurrent dyadic developmental relationships. Researchers can draw on SCT and the DN perspective to produce research and contribute to theory building germane to mentoring at work (see Haynes and Ghosh 2008; Haynes and Petrosko 2009; Ghosh et al. 2010). The next logical extension of this work is to apply the DN perspective in K-12 and higher education settings.

In addition to SCT and the DN perspective, appreciative inquiry theory (AI) can be used in evaluating performance interventions as well as developing them (see Haynes and Ghosh 2011). AI is a positive approach to effect change in social systems; it can be viewed as a form of action research (Cooperrrider and Srivastva 1987; Marques et al. 2011). One of the core assumptions in AI is the perspective that organizations have positive aspects about them even when they are malfunctioning. The key is to drive change and or evaluate it by focusing first on those positive aspects.

3.9 The Use of Citation Network Analysis for Interdisciplinary Collaboration (Yonjoo Cho)

Previous reviews published in *Educational Technology Research and Development* (*ETR&D*) have revealed the rankings of individual authors and institutions in instructional technology (IT) but have not provided qualitative details on relations and networks of scholars (Anglin and Towers 1992; Gall et al. 2010; Hannafin 1991; Klein 1997; Ku 2009). Citation network analysis is an answer that solves limitations of previous reviews in the field and opens possibilities for interdisciplinary collaboration.

A distinctive feature of citation network analysis is that it has a theoretical framework borrowed from social network analysis (Jo et al. 2009). Social network analysis is a methodology for examining structures among actors, groups, and organizations, with some patterns of interaction or ties between them (Borgatti et al. 2009; Hatala 2006). Analysis of a citation network built among publications allows us to have a better grasp of how a scholarly community has evolved in the field (Fernandez-Alles and Ramos-Rodríguez 2009; Jo et al. 2009). Citation network analysis has been used in IT cognate fields such as HPT (Cho et al. 2011) and HRD (Jo et al. 2009) as well as in IT itself (Cho et al. in press).

For example, Cho and colleagues (in press) identified the research trends in IT by analyzing the citation network of 803 articles published in *ETR&D* from 1989 to 2011. On the basis of the citation network analysis, Cho et al. (in press) identified five key themes of IT. The five themes were not totally separate and distinctive but overlapped in many respects compared to those of HPT (Cho et al. 2011) and HRD (Jo et al. 2009) (see Table 3.1).

Table 3.1 Comparison of key themes of IT, HPT, and HRD

Field	IT	HPT	HRD
Key research themes	Instructional design	Performance	Learning and performance
	Learning environments	Instructional design	Theory building
	The role of technology	Performance support	Training transfer
	IT research	Organization/workplace	
	Psychological foundations	Transfer of training	

The results of thematic analysis in Cho et al.'s (in press) study are in contrast with those of HRD discovered by Jo et al.'s (2009) citation network analysis. The themes of HRD appear to be more theoretical and distant from immediate needs of practices than those of IT. In other words, the IT field is a more narrowly focused field than HRD. Instructional design, however, has been recognized as an important intervention for planning processes and practice of HRD and has also played a critical role in decision-making on training strategies and in the instructional nature of the field (Hardré 2003; Korth 1997).

ID was also among the five key themes in the HPT field, indicating that IT and HPT are closely related (Cho et al. 2011). The two fields, however, had different emphases in ID research. The IT field has produced studies on conceptual frameworks (e.g., Jonassen and Rohrer-Murphy 1999), instructional design models (e.g., Jonassen 1997), and designing learning environments (e.g., Hannafin et al. 1997), whereas HPT's studies emphasized instructional designers' practices and activities from the lens of experts and novices (e.g., Rowland 1992). This is presumably due to each field's emphasis on theory or practice and because HPT claims to be a "field of practice" (Foshay et al. 1999, p. 896).

In Cho et al.'s (in press) study, the subfields (five themes) of the *ETR&D* network were less distinctive and, rather, interrelated in direct or indirect ways. One possible reason is that conceptual frameworks in IT research were mostly borrowed from psychology (Weinstein and Shuck 2011). Although the IT field has always claimed its interdisciplinary nature that is influenced by diverse fields such as psychology, communication, and computer science, Cho et al. (in press) did not identify evidence of the field's interdisciplinary efforts for expanding the scope of IT research, except with psychology. As the unit of analysis in IT research becomes larger and it becomes more complex to investigate learning environments in diverse organizational settings, multiple perspectives and innovative approaches to IT research are called for in the field. Theory development efforts as in HRD will help advance the field by providing more explanatory power and insights to existing IT research (Cho and Egan 2009; Cho and Yoon 2010).

The use of citation network analysis has expanded the limited landscape of IT, HPT, and HRD. Identifying whose scholarly works are the most influential and what relationships are the most impactful in the field is definitely a timely intellectual discourse that we need to possess in order to make the scholarly community strong and sustainable, as well as to expand our interdisciplinary efforts to advance the field.

3.10 Conclusion

The foregoing discussions of the theories undergirding current research in IST provide the department's history, its current state, and future directions in improving learning and performance in diverse contexts. Theoretical diversity plays a central role in IST's enterprise of improving learning and performance. The lack of theory makes for great difficulty when attempting to solve problems in applied or practical settings. Kurt Lewin's statement "There is nothing so practical as a good theory." (see, Marrow 1969) underscores the importance of theoretical grounding in design, instruction, learning, and performance. Brevity precludes elaboration of the theoretical range in IST; however, it is necessary to point out that the *systems view* still prevails as an orienting and feedback source. Consequently, as IST at Indiana University produces outputs in the form of teaching students, research, and service it does so cognizant of the inextricable link between theory, research, and application within the context of existing systems. It is an exciting time for IST. We are engaged in the timely and timeless pursuit of improving learning and performance in diverse contexts. What this means for students is that they can find a place within our diverse theoretical range. This theoretical diversity enables faculty and students to work across disciplines to improve design, instruction, learning, and performance. Our interdisciplinary collaboration facilitates theory building, which in turn begets theoretical diversity.

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