

Handbook of Research on

# Transdisciplinary Knowledge Generation

Wang

Handbook of Research on Transdisciplinary Knowledge Generation



IGI Global  
DISSEMINATOR OF KNOWLEDGE

Victor X. Wang

IGI Global  
DISSEMINATOR OF KNOWLEDGE

## Editorial Advisory Board

Michelle Caron, *Southern New Hampshire University, USA*

Linda Ellington, *Southern New Hampshire University, USA*

Eileen O'Donnell, *Dublin Institute of Technology, Ireland*

Judith Parker, *Teachers College, Columbia University, USA*

Kymn Rutigliano, *SUNY Empire State College, USA*

David Starr-Glass, *University of New York in Prague, Czech Republic & SUNY Empire State College – Prague, Czech Republic*

Gabriele Strohschen, *DePaul University, USA*

Karen Swanson, *Mercer University, USA*

Rosaria Torrisi, *Griffith University, Australia*

## Preface

Knowledge is traditionally compartmentalized into disciplines – a neat idea for categorization of knowledge but not without issue. Debate about discipline borders and the nature of disciplines has ensued for as long as disciplines have existed. Consequently, disciplines today are the result of substantial evolution (Osborne, 2015). That the term “disciplinarity” has had a host of prefixes—inter, intra, cross, anti, etc.—evidences the problematic nature of knowledge production and the idea of disciplines (Osborne, 2015).

Configuring knowledge into disciplines is useful for giving structure to knowledge, but it also oversimplifies our understanding of knowledge production. Importantly, organizing knowledge into disciplines induces a degree of fragmentation, which constrains the usefulness of knowledge. This is especially true in the application of knowledge to solve complex problems, and the present society is characterized by increasing levels of complexity. The past half a century set the stage for unprecedented rapid growth in knowledge and technical advancement. The cost of progress though, is greater complexity. Complexity can be thought of in terms of large, open systems characterized by nonlinear connectivity and interactivity, unpredictability, instability and disequilibrium producing a state of perpetual change (Rzevski, 2015). Largely driven by technological development, complexity is now a defining feature of the twenty-first century, and likely a defining feature of the future. Climate change, sustainability, unstable globalized economies, ethics in bio-technological development, and social disturbances to name just a few of the highly complex, ill-defined problems the human race is facing.

Complexity is disruptive. Established systems and processes become less effective or completely ineffective (Rzevski, 2015). The complex problems emanating from complex systems require new approaches and new methods of knowledge production. Against this context, it is unsurprising that the last few decades have seen acceleration in the debate around how human knowledge is to be organized.

There has also been significant investment in developing our understanding of knowledge production. Problems now are many orders of magnitude more complex than many of those in the past. Established ways of knowing are disrupted, and the knowledge economy is in full swing. Amid the debate, one emerging view is that attempting to address such problems requires the transcendence of disciplinary boundaries, and a model of knowledge production that is truly collective and empowering for lay persons and researchers alike - in other words, transdisciplinarity (Bernstein, 2015).

The term “transdisciplinarity” was first used, almost offhandedly, by Piaget in 1970 (Bernstein, 2015). Piaget (1972) points us towards a system, or more accurately, a melded view of knowledge in which there is not only reciprocal relationships among disciplines, but the boundaries of the disciplines are deeply permeable, with one discipline flowing into another (Piaget, 1972). At around the same time Jantsch (1972), Mahan (1970), Kockelmans (1979) and others discussed transdisciplinarity. As the conversation

## **Preface**

around transdisciplinarity continued, two schools of thought emerged, spawned largely by the writings of Gehlert (2013) and Gibbons, Limoges, Nowotny, Schwartzman, Scott, and Trow (1994; Bernstein, 2015). Gehlert (2013) school of thought was about transdisciplinarity from an ethical and philosophical viewpoint. In contrast, Gibbons et al. (1994) place emphasis on real solutions for “real world” problems (Bernstein, 2015).

Though transdisciplinarity as a concept had been around for some time, strong interest in transdisciplinarity really emerged around two decades later, in the 1990’s. Interestingly, this is about the same time at which the digital revolution and the disruption it brought began in earnest. In the emerging digital globalized world with its rising complexity, the luxury of transdisciplinarity starts to be seen as necessity. Nowadays, as Bernstein (2015) notes, “Transdisciplinarity ... is characterized by its focus on “wicked problems” that need creative solutions, its reliance on stakeholder involvement, and engaged, socially responsible science. In simultaneously studying multiple levels of, and angles on, reality, transdisciplinary work provides an intriguing potential to invigorate scholarly and scientific inquiry both in and outside the academy” (Bernstein, 2015, p. 1). Transdisciplinarity is much more than simply working together with others from different disciplines, it is much more than the sharing of minds. Rather embracing transdisciplinarity is about challenging our acceptance of disciplines as units of organization for knowledge in theory, research and practice (Bernstein, 2015) – it is about a “new way of thinking and engaging in inquiry” (Muntuori, 2008, p. ix).

The discourses of transcendence, and problem solving, are aligned with transdisciplinarity (Klein, 2004). A third discourse, transgression also permeates transdisciplinarity. Positioned within the discourse of transgression, and emerging at a time when human rights accountability was a dominant social theme, transdisciplinarity is seen to yield ‘socially robust knowledge” (Klein, 2004). From the perspective of disciplines, the dominant forms of knowledge establish ways of knowing (genres, protocols, canons etc.) that “marginalize “other ways of knowing. Transdisciplinarity combats marginalization and is conducive to more equitable knowledge production (Fam, Palmer, & Riedy, 2016).

Freed from the constraints of adhering to the norms of any particular discipline, transdisciplinarity produces knowledge by drawing on many sources of knowledge and parts of society – a heterogeneous instead of a homogenous approach (Montuori, 2011). Within transdisciplinarity, the disciplinary boundaries become unimportant and largely dissolve, as do the boundaries between the academic/expert and the layperson (Nowotny, Scott, & Gibbons, 2001). Knowledge construction from the frame of transdisciplinarity is less about who is the expert and the ‘rules’ of the discipline and more about the problem to be solved, who is involved and the context within which it is embedded. Transdisciplinarity provides fertile ground for participatory approaches wherein all voices [are] heard (Fischer, 2011); participants are equally valued and empowered to participate actively in problem solving and research is more likely to be socially relevant (Binder, 2014).

In its ideal, transdisciplinarity facilitates open systems of knowledge production, paving the way for richer ecologies of creative thought (Fischer, 2011). Creative thought is of course pivotal to the solving of highly complex problems. Creativity and innovation, along with participatory methodologies are what is required to tackle the truly difficult and highly complex problems such as climate change and sustainability. To illustrate, it is apparent in literature that sustainability and transdisciplinarity cohabit the same spaces and have a close relationship.

*Research for sustainable development has to be issue orientated and reflect the diversity, complexity and dynamics of the processes involved as well as their variability between specific problem situations...*

*knowledge of people involved and their needs and interests at stake have to be taken into account. (Haddorn, Bradley, Pohl, Rist, & Weismann, 2006, p. 119)*

Highly complex problems such as sustainability necessitate building a culture of ‘democratic’ participation. This is necessary where problems may be so large that individuals or even large teams are unable to solve, or problems that are ill-defined or poorly understood requiring a pooling of minds (Fischer, 2011). Further exemplifying the application of transdisciplinarity to complex problems, are works such as that by Gehlert (2013). In discussing the health disparities (heart disease, diabetes, cancer and HIV) experienced by the “most vulnerable residents” of United States, Gehlert (2013) positions transdisciplinarity as not only a realistic aim for inquiry but also a “necessary one” (p. 1). Gehlert (2013) points out that thus far the United States Government has failed to address the disparities, mostly not through lack of effort but through inadequate approach to inquiry. Gehlert (2013) states:

*Executing successful disparities research depends on the ability to visualize the multiple influences on health and health disparities and understand the complex ways in which they interact with one another to produce worse outcomes for some groups than others. This can be done neither by a single investigator nor by a single discipline. (p. 2)*

Gehlert (2013) argues that the impediment to progress is the lack of transdisciplinary research and goes on to articulate some of the issues and approaches, which foster the required approach. Like Gehlert, others hold the view that through a culture of participation, transdisciplinarity “democratizes design and innovation, shifting power toward users” to develop real-time, socially relevant systems of use (Fischer, 2011, p. 44).

For the time being transdisciplinarity is, as Piaget (1972, as cited in Klein, 2004, p. 1) observed, is “still a dream”. If transdisciplinarity’s potential is to be truly realized (and not remain rhetoric), then new methods, practices and paradigms are required. Transdisciplinarity, for all its potential advantages, is problematic. It requires not merely a shift towards more collaborative methods, but rather a transformation of thought and practice. It is literally a ‘new way of thinking’ which must be achieved. The way researchers have proceeded in the past may no longer be the best way or yield the greatest benefit. A major challenge is therefore to achieve a transformation of practices and methods. There is a need for new theoretical, conceptual and practice orientated approaches (Blassnigg & Punt, 2013). Transdisciplinarity requires evolution of thought and a great deal of reflection on the methods, processes and approaches of transdisciplinarity. There is a need for “methodological frameworks to forge innovative approaches to research collaboration that is inquiry-driven and seeks to identify new topics and concerns” (Blassnigg & Punt, 2013, p. 3). From this perspective, transdisciplinarity is something more than a problem driven approach for unifying disparate disciplines of knowledge. The inquiry itself drives methods and tools and precipitates previously unidentified areas of concerns (Blassnigg & Punt, 2013).

Transdisciplinarity is therefore not only a way by which to address complex or ill-defined problems, but also a way of identifying new problems that in the past have not been recognized or that are being newly generated by the evolving system (Blassnigg & Punt, 2013). The obvious challenge of transdisciplinarity is moving beyond established institutional frameworks. Rather than being merely established repositories of knowledge, universities must reformulate themselves as enablers of participatory approaches.

Transdisciplinarity challenges the established structure of knowledge and to some extent shakes the very foundations of university bureaucracy. Despite the generally positive support for transdisciplinar-

## **Preface**

ity, it is mostly relegated to the domain of rhetoric. To illustrate, consider that while transdisciplinary reviewers of grant and other funding applications value approaches. The assessment of grant applications still relies heavily on the word of ‘experts’ (Blassnigg & Punt, 2013). Consider also that promotion and career tracks are based largely on performance standards as dictated by professional organizations. The processes remain rooted in the marginalization of knowledge outside the academy. From the pragmatic perspective, the challenge is devising tools and methods, which will enable the synthesis of knowledge in the manner of transdisciplinarity. A move towards ‘pragmatic transdisciplinarity’ is seen in literature and is reflective of the need to establish more strongly a practical dimension.

At the practical individual level, engaging in transdisciplinarity requires teams to negotiate shared conceptual frameworks and ways of knowing (Gehlert, 2013). Hence one of the challenges faced by individuals engaging in transdisciplinarity is establishing communication and trust. Working beyond disciplines, team members must establish a shared lexicon (Gehlert, 2013). Functioning within a transdisciplinarity setting may not come naturally but rather requires training and education alongside institutional support (Gehlert, 2013). Gehlert (2013) articulates a need for transdisciplinarity in higher education: “The transdisciplinary approach will be an indispensable complement to the disciplinary approach” (p. 17). Bringing Transdisciplinarity into education is an important step in building a culture of transdisciplinarity. Interestingly, transdisciplinarity in the manner presented by Gehlert (2013) is more complementary rather than contradictory to the traditional disciplinary view. The argument for imbuing education with transdisciplinarity is pointed:

All the various tensions—economic, cultural, spiritual—are inevitably perpetuated and deepened by a system of education founded on the values of another century, and by a rapidly accelerating imbalance between contemporary social structures and the changes which are currently taking place in the contemporary world. More or less embryonic wars between economies, cultures, and civilizations never stop leading, here and there, to actual wars. In fact, our entire individual and social life is structured by education. Education is at the center of our becoming. The future is shaped by the education which is delivered in the present, here and now. (Gehlert, 2013, p. 20)

Gehlert’s (2013) perspective puts a slightly different lens on transdisciplinarity and the institutional challenge of its adoption. Transdisciplinarity is not a discipline in itself and researchers working in the transdisciplinary space are not “transdisciplinary experts” says Gehlert (2013, p. 25), so there is no necessity to create new departments and or new chairs. It is better to promote a ‘spirit of transdisciplinarity’ through workshops and communities of practice where the transdisciplinary attitude can be nurtured and infused throughout the institution so that a tolerance, or even appreciation, of transdisciplinarity can evolve.

For anyone considering moving outside of the disciplinary boundaries they are likely to be confronted with institutional, individual, epistemological, or methodological challenges (Darbellay, 2015). Though often promoted, transdisciplinarity is not always recognized as a “form of research in its own right” (Darbellay, 2015, p. 163). As Foucault (1971, as cited in Darbellay, 2015) states a discipline is “defined by groups of objects, methods, their corpus of propositions considered to be true, the interplay of rules and definitions, of techniques and tools” (p. 32). With this conceptualization of a discipline, the discipline provides structure and rigor, and controls the research process. For some, moving beyond the boundaries of the discipline is contradictory to the established view of scientific research and is even suggestive of sacrificing the rigor and needed structure of research thereby challenging legitimacy. As Darbellay (2015) astutely observes academics working on or outside the boundaries of disciplines are taking a risk. They have the profile of a ‘transdisciplinary hacker...who would like to change academe

from within without causing its collapse” (p. 172). These ‘transdisciplinary hackers’ should be supported (Darbellay, 2015). Their willingness to take the risk of venturing into largely uncharted ‘waters’ to help investigate the potential of transdisciplinarity needs to be valued.

Thus far we have highlighted the facets of transdisciplinarity as complex, disruptive, transformative, unifying, challenging, legitimizing and empowering. Racialized, gendered and classed, the need to promote a more just society is a pressing but also a very complex issue. This is just one ‘wicked’ problem facing humanity in which transdisciplinarity seems an appropriate approach to inquiry. Engaged in searching for ways to solve complex problems and situations, practitioners and researchers rely on a base of the scientific method popularized by John Dewey (1916), and on the three kinds of knowledge (instrumental, practical and emancipatory) advanced by Jurgen Habermas (1971). Anchored on these existing methods, researchers and practitioners commonly need to forge bridges across multiple disciplines in order to solve complex problems and situations. ‘Transdisciplinary theory’, the idea of working across disciplines is not new. Our profession has always advocated multidisciplinary and rhetorically interdisciplinary approaches as ways to solve problems that occur from generation to generation. However, the profile of transdisciplinary theory is now raised to new heights. Knowledge creation is identified as being of the utmost importance to a surviving and thriving human society in the 21<sup>st</sup> century and beyond (the new edition of Bloom’s 1956 as cited in Krathwohl, 2002) taxonomy identifies knowledge creation at the highest level), and we are turning to the epistemology of transdisciplinarity in order to generate the needed knowledge to solve complex problems and move towards a more positive, socially robust future for all.

The traditional methods of viewing the world through the scientific method or instrumental knowledge do not adequately serve the needs of theory, research and practice within an increasingly complex world. Through transdisciplinary theory, research and practice, academics focus on a new form of learning and problem solving involving cooperation among different parts of society to meet the complex challenges of society. No longer can academics afford to work within the imagined boundaries of disciplines and ignore the power of mutual learning, and the insights which may arise from the interaction of knowledge of all participants. Practical knowledge or the dialogue between academia and other parts of society create new interactions and new results, offering a new vision of nature and reality. Intricate societal problems are interwoven and the future requires co-creation of knowledge in the manner of transdisciplinarity (Binder, 2014). Transdisciplinarity may be considered a Utopian idea, but it is a new way of thinking that challenges established institutional, individual and methodological norms. Transdisciplinarity is an attitude, a state of mind. Exploring, understanding and building a culture of transdisciplinarity requires ongoing discussion alongside more pragmatic exploration by ‘taking the risk’ of venturing forth.

## OBJECTIVE OF THE BOOK

*Handbook of Research on Transdisciplinary Knowledge Generation* will feature full length articles (7,000 to 10,000 words) authored by leading experts offering an in-depth description of concepts related to transdisciplinarity in theory, research and practice in this changing society. The multiple volume book will serve as the comprehensive and best resources for teaching, learning, research and application across disciplines. Offering a diversity of thought on transdisciplinarity, the book will serve as foundations for scholars and practitioners to generate knowledge from across the disciplines. The book will be a milestone handbook of research, attracting intellectual attention from around the globe. Every researcher’s horizon will be widened by using this book as a reference source.

## Preface

## TARGET AUDIENCE

The book will be appropriate for university libraries, dissertation libraries and national libraries from around the globe. Individual departments and colleges may also need to catalog this book.

*Victor X. Wang*  
*Liberty University, USA*

*Geraldine Torrisi-Steele*  
*Griffith University, Australia*

## REFERENCES

Bernstein, J. (2015). Transdisciplinarity: A review of its origins, development, and current issues. *Journal of Research Practice*, 11(1), 1–20.

Binder, C. R. (2014). Transdisciplinarity: Co-creation of knowledge for the future. *RCC Perspectives*, 1, 31–34.

Blassnigg, M., & Punt, M. (2013). *Transdisciplinarity: Challenges, Approaches and Opportunities at the Cusp of History*. Plymouth, UK: Transtechnology Research. Retrieved from [http://www.trans-techresearch.net/wp-content/uploads/2015/05/TTReader2012\\_001\\_Punt-Blassnigg.pdf](http://www.trans-techresearch.net/wp-content/uploads/2015/05/TTReader2012_001_Punt-Blassnigg.pdf)

Bloom, B. S. (1956). *Taxonomy of educational objectives, handbook 1: Cognitive domain* (2nd ed.). Boston, MA: Addison-Wesley Longman.

Darbellay, F. (2015). Rethinking inter- and transdisciplinarity: Undisciplined knowledge and the emergence of a new thought style. *Futures*, 65, 163–174. doi:10.1016/j.futures.2014.10.009

Dewey, J. (1916). *Education and democracy*. New York, NY: Macmillan.

Fam, D., Palmer, J., & Riedy, C. (2016). *Transdisciplinary research, practice for sustainability outcomes* (1st ed.). New York, NY: Routledge. doi:10.4324/9781315652184

Fischer, G. (2011). Understanding, fostering, and supporting cultures of participation. *Interaction*, 18(3), 42–53. doi:10.1145/1962438.1962450

Gehlert, S. (2013). Shaping education and training to advance transdisciplinary health research. In B. Nicolescu & A. Ertas (Eds.), *Transdisciplinary theory & practice* (pp. 1–16). Fayetteville, NC: Atlas Publishing.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The new production of knowledge: The dynamics of science and research in contemporary societies*. London, UK: Sage.

Habermas, J. (1971). *Knowledge and human interests*. Boston, MA: Beacon Press.

Hadorn, G., Bradley, D., Pohl, C., Rist, S., & Weismann, U. (2006). Implications of transdisciplinarity for sustainability research. *Ecological Economics*, 60(1), 119–128. doi:10.1016/j.ecolecon.2005.12.002



Jantsch, E. (1972). Towards interdisciplinarity and transdisciplinarity in education and innovation. In Centre for Educational Research and Innovation (Ed.), *Interdisciplinarity: Problems of teaching and research in universities* (pp. 97-121). Paris, France: Organisation for Economic Co-operation and Development.

Klein, J. (2004). Discourses of transdisciplinarity: Looking back to the future. *Futures*, 63, 68–74. Retrieved from [http://lepo.it.da.ut.ee/~cect/teoreetilised%20seminarid\\_2009%20s%C3%BCgis/3\\_seminar\\_IDENTITEET\\_24.11.2009/Prospects\\_of\\_transdisciplinarity\\_2004.pdf](http://lepo.it.da.ut.ee/~cect/teoreetilised%20seminarid_2009%20s%C3%BCgis/3_seminar_IDENTITEET_24.11.2009/Prospects_of_transdisciplinarity_2004.pdf)

Kockelmans, J. J. (1979). Why interdisciplinarity? In J. J. Kockelmans (Ed.), *Interdisciplinarity and higher education* (pp. 123–160). University Park, PA: Pennsylvania State University Press.

Krathwohl, D. R. (2002). A revision of Bloom’s taxonomy: An overview. *Theory into Practice*, 41(4), 212–218. doi:10.120715430421tip4104\_2

Mahan, J. L., Jr. (1970). *Toward transdisciplinary inquiry in the humane sciences* (Doctoral dissertation). United States International University. UMI No. 702145. Retrieved from ProQuest Dissertations & Theses Global.

Montuori, A. (2011). Complexity and Transdisciplinarity: Reflection on theory and practice. *World Futures: The Journal of Global Education*, 69(4-6), 200–230. doi:10.1080/02604027.2013.803349

Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science: Knowledge and the public in an age of uncertainty*. Cambridge, UK: Polity Press.

Osborne, P. (2015). Problematizing disciplinarity, transdisciplinary problematics. *Theory, Culture & Society. Special Issue Transdisciplinary Problematics*, 32(5-6), 3–35. PMID:26456992

Piaget, J. (1972). The epistemology of interdisciplinary relationships. In *Centre for Educational Research and Innovation (Ed.), Interdisciplinarity: Problems of teaching and research in universities* (pp. 127–139). Paris, France: Organization for Economic Co-operation and Development.

Rzevski, G. (2015). Complexity as the defining feature of the 21st century. *International Journal of Design & Nature and Ecodynamics*, 10(3), 191–198. doi:10.2495/DNE-V10-N3-191-198

# Detailed Table of Contents

**Preface**..... xxii

**Acknowledgment**..... xxix

## **Chapter 1**

Report of an Interdisciplinary Course in Product Design Education..... 1

*Giovanni Jesue Contreras Garcia, University of Sussex, UK*

*Kin Wai Michael Siu, The Hong Kong Polytechnic University, Hong Kong*

Interdisciplinarity refers to the process of addressing a topic or problem from the angle of different disciplines or sciences, not just one. Typically, those who promote interdisciplinarity argue that the complexity of modern societies demands an interdisciplinary approach to problem-solving. This claim has gained traction in the field of Product Design in recent years, with some scholars and commentators arguing that technological, social, and economic changes have made the process to develop new products more collaborative. At the same time, however, there is a sense that universities focus on training specialists, and that there is a need for new pedagogies. Interdisciplinarity, however, can be understood—and implemented—in different ways. Should students be trained in a wide range of subjects? Or so that they can function in an interdisciplinary team? Different views can result in substantially different educational experiences and sets of skills. This chapter outlines some aspects of the process to facilitate interdisciplinarity in a course involving product design and engineering students.

## **Chapter 2**

Transdisciplinarity: The Dynamic Future of Exemplary Leadership ..... 18

*Nancy Kymn Rutigliano Harvin, SUNY Empire State College, USA*

*Barbara Ann Avena, SUNY Empire State College, USA*

*Joshua Gichuhi Mbugua, Mount Kenya University, Kenya*

*Alexandria S. Frye, Texas State University, USA*

Transdisciplinarity is the union among, between, and across all disciplines. Its aim is to promote a unity of knowledge and imagination that can be harnessed to solve problems in innovative and constructive ways. Transdisciplinarity fuels leadership as it is a powerful tool easily wielded to generate results through expanding available options; promoting reflexivity and inclusivity; cultivating new languages, vocabularies, and methods of communicating ideas; constructing state-of-the-art systems; and developing unconventional, composite knowledge bases. Through transdisciplinarity, problems that have long plagued individuals, organizations, and societies can be solved. Through transdisciplinarity, knowledge across disciplines is integrated and transformed into wisdom. Through transdisciplinarity, leaders can engage in the very important work of nurturing the minds, hearts, and spirits of those they lead and serve.

### **Chapter 3**

Higher Education Transcendence Through Transdisciplinarity ..... 30

*Linda Ellington, Southern New Hampshire University, USA*

*Kimberly L. Blanchette, Southern New Hampshire University, USA*

The future of higher educational institutions is in need of innovators, creative thinkers, problem solvers, and people who can envision transcending across disciplines into a transdisciplinary environment that by its nature requires institutions of learning to identify the challenges that affect humanity and investigate and implement solutions throughout the life of those challenges, working continuously to iteratively improve upon yesterday's solutions. Allowing the coexistence of old and new, being able to deal with change and disorder while explaining persistence and order requires practices that connect contextually things, people, and events that are distant and only partially congruent. Transdisciplinarity as a construct or framework can guide institutions of higher learning to break from outdated models and structures to form new ways of being that are fluid, heuristic, and holistic. Transperformative education can serve as a model to operationalize transdisciplinarity at the curricula, instructional, operational, and strategic level.

### **Chapter 4**

Practice Perspectives on Learning Analytics in Higher Education..... 45

*Geraldine Torrisi-Steele, Griffith University, Australia*

*Victor X. Wang, Liberty University, USA*

*Joy Galaige, Griffith University, Australia*

Learning analytics have taken higher education by the proverbial "storm." Universities primarily employ learning analytics at the level of metrics to satisfy institutional requirements but are also investing significant effort in technical development. In the domain of teaching, learning analytics are making an appearance but are much less developed than in institutional or technical domains. On the basis of the potential of learning analytics to inform teaching practice and thus improve learning experiences, course instructors are now encouraged to use learning analytics at classroom level. Early forages are giving mixed results, and some confusion reigns among teaching staff in relation to the usability/value of learning analytics. The fundamental premise of the present chapter is that if potential of learning analytics to improve learning experiences is to be realized, then learning analytics must shift further into the practice domain, and this requires the projection of learning theory onto learning analytics.

### **Chapter 5**

JIT Inventory Management Strategy..... 57

*Alan Smith, Robert Morris University, USA*

Implementing a just-in-time (JIT) inventory management strategy seems to be the latest hot topic in the business world, particularly in manufacturing industries. In today's competitive supply chain environment, more and more companies are either adopting JIT methodology or at least beginning to research and understand how JIT would affect their business. But what exactly is JIT? Many companies may be already putting into practice some of the concepts of JIT – such as looking at always improving or trying to reduce waste in terms of product or labor steps. Some companies may be fully ready to embrace a JIT operating process; yet, perhaps JIT is not the best choice for their business. The goal of this chapter is to develop a better understanding of JIT, from this history behind its inception to the various risks and benefits that relate to adopting JIT from an interdisciplinary/strategic approach to a transdisciplinary viewpoint. Those strategies, which include the basic methods of minimum stock, economic order quantity (EOQ), and Safety stock methods, are explored and explained in this chapter.

## Chapter 6

A Short Review on Fuzzy System of Linear Equations Applications ..... 75

*Hale Gonca Kocken, Yildiz Technical University, Turkey*

*Inci Albayrak, Yildiz Technical University, Turkey*

Fuzzy system of linear equations (FSLE) plays a major role in various areas such as operational research, physics, statistics, economics, engineering, and social sciences since the parameters of FSLE are not always exactly known and stable in real-life problems. This effect may follow the lack of exact information, changeable economic conditions, etc. Although there exist many review papers on the solution methods for FSLE, they are not based on the applications. This chapter has attempted to provide a short review on real-life applications of FSLE. In addition, for the common application areas, the fundamental models and the solution methods are presented considering the most cited and leading papers in the literature.

## Chapter 7

Moving Toward a Third Generation of Medical Education: Integrating Transformational Learning

Principles in Health Professions Education ..... 88

*Wendy M. Green, Cleveland State University, USA*

The number of health professions education programs continues to increase across the United States and globally, but unequal access to healthcare remains a pressing issue. Health professions education has shifted from a first-generation approach, centered on didactic teaching, to a second-generation approach, centered on problem-based learning. In a Lancet paper, Frenk and colleagues argued for the incorporation of a transformative paradigm within health professions education facilitating the move towards the third generation of health professions education. Drawing on Mezirow and Freire, they argued for the incorporation of a transformative paradigm to improve health professions education by better aligning medical education and population needs. This chapter examines how a transformative approach to health professions education could be implemented and where it would be most effective. It also looks at how a transformative paradigm within health professions education could provide an additional lens to understand health disparities, structural inequity, and diversity.

## Chapter 8

Perceptions of Service-Learning in the Sunshine State ..... 102

*Jarrad D. Plante, University of Central Florida, USA*

*Lauren I. Murray, University of Central Florida, USA*

*Melody A. Bowdon, University of Central Florida, USA*

*Amanda M. Wolcott, University of Central Florida, USA*

College students enroll in service-learning coursework for many reasons. For some, the opportunity to enhance classroom-based learning by engaging in hands-on activities benefiting the community serve as an important motivator. As the nation's only campus-based civic engagement association, Campus Compact promotes community and public service that forges partnerships, provides training and resources for faculty seeking community-based learning (service-learning) into their curriculum while developing students' citizenship skills. Florida Campus Compact is comprised of over 50 college and university presidents committed to engaging students in active citizenship via participation in public and community service. In this chapter, researchers surveyed 437 students enrolled in service-learning courses from nine (9) participating Florida Campus Compact institutions. The purpose of the project was to examine how service-learning and student volunteer opportunities are shaping educational experiences from

transdisciplinary backgrounds for students and impacting the communities around them. Participation in the project provided a complete assessment of students' connections to their communities, political activism, and career employability. The results will shape service-learning practices at those participating campuses across the state of Florida.

## **Chapter 9**

Transdisciplinarity Practice in Higher Education ..... 115

*Bernice Bain, Southern New Hampshire University, USA*

*Keely Griffith, Southern New Hampshire University, USA*

*Jennifer Varney, Southern New Hampshire University, USA*

This chapter communicates a learning configuration based on a literature review of transdisciplinary practices across higher education institutions. The knowledge of transdisciplinary practice will be expanded through the review of scholarly work by those in higher education and industry. The practices should be applied across disciplines. In order to achieve transdisciplinarity in higher education, co-dependent collaboration of curriculum frameworks, learner, and education strategies must exist. Industry leaders, such as Amazon, Google, and Purdue Global, are solving complex problems and making innovative changes that require experience and exposure across knowledge areas including technology, teaming, and problem solving. This means higher education institutions no longer have the convenience to view academics through independent curriculum and faculty lenses. While collaborative approaches have been used in the past, a transdisciplinary approach should now include industry perspective, evolving learner needs, and education strategies.

## **Chapter 10**

Beyond Digital Tools: A Transdisciplinary Approach to Healthcare ..... 132

*Khadijeh (Roya) Rouzbehani, University of Victoria, Canada*

As the North American healthcare system moves to online value-based care, the importance of engaging patients and families continues to intensify. However, simply engaging patients and families to improve their subjective satisfaction will not be enough for providers who want to maximize value. True optimization entails developing deep and long-term relationships with patients through understanding their needs. This chapter discusses the result of a research conducted in Canada. Questionnaires were given, and the collected data were analyzed using SPSS 20.0 statistical. The findings indicate that IT healthcare is rapidly growing. However, despite a significant number of initiatives in Canada related to online health information, lack of interoperability remains one of the major challenges in implementing successful health IT systems at this time.

## **Chapter 11**

Women Professors' Ways of Working in Academia ..... 143

*Rachel L. Wlodarsky, Cleveland State University, USA*

*Catherine A. Hansman, Cleveland State University, USA*

Faculty members face many challenges, among them maintaining a healthy work-life balance, and although this need is not gendered (i.e., males who have sole custody of their child[ren], gay couples with children), in this chapter, the authors have chosen to focus on the challenges women faculty members in higher education face, particularly balancing their work and personal lives. In the examination of research studies and literature, the authors sought to address their research questions, which concerned which women's

development theories might frame and explain women professors' academic identity, the recognition of unique pressures faced by women faculty members in their quest for tenure and promotion, and how these issues impact faculty members who are striving to balance personal and professional lives. Several recommendations for institutions of higher education are discussed, among them employing an ethic of care to design and implement supportive mentoring and other programs for women faculty members.

## **Chapter 12**

A Short Review on Supplier Selection Problem Methods Under Uncertainty ..... 157

*Beyza Ahlatcioglu Ozkok, Yildiz Technical University, Turkey*

*Neslihan Fidan Kececi, Istanbul University, Turkey*

In today's globally competitive environment, firms give great attention for selecting right suppliers in the context of their supply chain management. Choosing right suppliers helps to reduce the purchasing costs and improve the quality of final products and services. Supplier selection problem is one of the multi-criteria decision-making problems which includes both qualitative and quantitative factors like unit cost, delivery on time, service quality, etc. Handling imprecise information is one of the most important problems for modeling supplier selection problem. In order to overcome this problem, many scientific researchers have been published during the years, and many mathematical theories have been used to handle uncertainties in supplier selection problem such as fuzzy set theory, stochastic theory, rough set theory, and some hybrid techniques, etc. This chapter aims to provide short review on SSP methods under uncertainty. The sources used for the study consist of scientific refereed journals and books and are selected with respect to their citation rate and the ability of presenting the contained technique well. Also, the publications in languages other than English and non-refereed professional ones are not included.

## **Chapter 13**

Lean Principles and Optimizing Flow: Interdisciplinary Case Studies of Best Business Practices ... 169

*Alan Smith, Robert Morris University, USA*

This chapter aims to provide an elementary background on lean methodologies from its beginnings at Toyota through current applications of lean processes at local companies. Via case studies, a greater understanding of the advantages of lean systems will be attempted along with a discussion of the future of lean practices. Notable improvements to the lean philosophy, such as successful implementation of six-sigma techniques, are addressed through interdisciplinary case studies of successful best business practices. Therefore, we need a cluster of metrics, certainly more than just cost. If we cannot adequately measure customer satisfaction and utility, we need to have more subjective ways to measure it in order to understand its complexities. Unfortunately, it is unlikely that there is a one-size-fits-all solution, as many managers are more prone to try something that has worked elsewhere in times of crisis, but has limited applications to other dissimilar problems.

## **Chapter 14**

Demystifying Unlearning and Innovation in Higher Education Institutions ..... 185

*Isabel Martins, University of KwaZulu-Natal, South Africa*

*Ana Martins, University of KwaZulu-Natal, South Africa*

*Orlando P. Pereira, Universidade do Minho, Portugal*

This chapter analyzes human and emotional capitals as the main source for organizational change, innovation, and learning. Individuals and teams thus have the aptitude to revitalize their learning

ability. The purpose of this chapter is to explore the relationship between intentional unlearning and forgetting. Dynamic capabilities and knowledge management emphasize that organizational innovation depends on knowledge considered to be the vital resource. The old dominant logic must be unlearned for organizations to embrace innovation and creativity. Organizational learning models are critiqued and the capacity for unlearning in organizational learning processes is highlighted. Unlearning typologies and related barriers of organizational forgetting are critiqued. Furthermore, unlearning leads to innovation as re-learning is based on initiative and experimentation between individuals in a blameless culture. The organizational learning social constructivist perspective is adopted in a dynamic capability theoretical framework. Furthermore, the notion of transdisciplinarity embraces a new age mindset which refutes the old dominant logic.

**Chapter 15**

Social Constructivism as a Theoretical Foundation of Cross-Cultural Mentoring for Foreign-Born Faculty..... 201

*Pi-Chi Han, National Kaohsiung Normal University, Taiwan*

Globalization results in the diffusion of people across geographical boundaries. Over the past twenty years, the number of foreign-born faculty has continued to increase in American universities.. Foreign-born faculty represent a significant labor force in the global academic settings; they bring in diversity, new perspectives, and innovative skills wherever they teach. Research asserts that foreign-born faculty encounter huge cultural change that make their lives tremendously difficult in the host country. Furthermore, studies also suggest that cross-cultural mentoring may serve as a solution to help foreign-born faculty adapt to the host countries.. However, there has been a lack of theoretical justification to conceptualize cross-cultural mentoring. This chapter proposes the theory of social constructivism as the theoretical foundation and suggests an action-reflection practice to help the theory building inquiry and conceptualize cross-cultural mentorship for foreign-born faculty.

**Chapter 16**

Bricolage: Excursions Into Transdisciplinary Territory ..... 216

*David Starr-Glass, SUNY Empire State College – Prague, Czech Republic*

Disciplinary work is conducted within a socially constructed framework of assumptions, processes, methodologies, and discovery that are particular to, and embedded in, a specific discipline. Disciplinary paradigms define the discipline and provide it with a cohesive integrity, but they also operate as barriers for those outside the disciplinary community. For collaborative explorations and research—whether in the form of interdisciplinary, multidisciplinary, or transdisciplinary work—it is necessary for those involved to first recognize and appreciate these paradigmatic boundaries before negotiating them. The approach of the bricoleur is different. Bricoleurs make do with fragments of previous knowledge, analogous encounters, and different disciplinary experience and use them to gain new insights into the problem at hand—insights that may be partial but which are also both pragmatic and functional. This chapter considers the nature of bricolage and the approach of bricoleurs in conducting explorations of transdisciplinary territory.

**Chapter 17**

Online Group Work Is Possible, Just Not Easy..... 231

*Pat Gibson, Texas State University, USA*

While many authors specializing in online education stress the use of group work as an essential tool for the online instructor, students almost unanimously complain. As students resist it, they often have good reasons. While it can be a means to insure good learning outcomes, online group work should not be universally recommended. For the instructor using it effectively is not easy. However, with a good design and effective facilitation, it can be successful. To use it successfully, it must be necessary for the content of the class, provide work areas for the groups, and be monitored by the instructor. Well designed and facilitated group work may help to reduce student aversion to this essential learning tool.

## **Chapter 18**

From Macro to Micro: Transdisciplinary Statewide Networks Drive Innovations in Cancer Care.... 242

*Nancy Johnson, Georgia Cancer Control Consortium, USA*

*Nancy Paris, Georgia Cancer Control Consortium, USA*

*Nidsa Baker, Georgia Cancer Control Consortium, USA*

*Kelly Durden, Georgia Cancer Control Consortium, USA*

*Chris Parker, Georgia Cancer Control Consortium, USA*

*Angie Patterson, Georgia Cancer Control Consortium, USA*

Transdisciplinarity characterizes the collaborative statewide networks organized around the disease continuum of cancer care in Georgia, United States. By exploring the driving forces at the macro level of policy formation and state cancer control efforts, the transdisciplinary team approach translates to the meso level where statewide workgroups organize to develop implementation initiatives designed to influence improvements in cancer control. Georgia's statewide cancer control efforts apply three cross-cutting priorities of quality, care coordination and palliative care/survivorship in association with the top five site specific priorities. The influence of transdisciplinarity is demonstrated through the Georgia Colorectal Cancer Roundtable (GCCRT) initiatives impacting colorectal cancer screenings at the micro level where practitioner and patient interactions occur. A medical home achieves improvements in colorectal cancer screening after participating in the GCCRT annual meeting.

## **Chapter 19**

This Seed Will Bear No Fruit: Older People's Perception About Old People's Home in Selected Local Government Areas in Osun State of South-Western Nigeria..... 262

*Friday A. Eboiyehi, Obafemi Awolowo University, Nigeria*

The continuous increase in the number of older people and the gradual erosion of the extended family system which used to cater to them are alarming. While older people in much of the developed countries have embraced old people's homes as an alternative, the same cannot be said of older people in Nigeria who still believed that it is the duty of the family to accommodate them. The chapter examined the perception of older people about living in old people's home in some selected local government areas in Osun State, Nigeria. The study showed that their perception about living in old people's home was poor as many of them still held on to the belief that it was the responsibility of their family members to house them as it was done in the olden days. Although a few of the interviewees (particularly those who are exposed to what is obtained in the Western world and those with some level of education) had accepted the idea, many preferred to live with their family rather than being dumped in "an isolated environment," where they would not have access to their family members. Pragmatic policy options aimed at addressing this emerging social problem were highlighted.



## **Chapter 20**

Education: Instrument for Socio-Economic and Humanizing Development..... 284

*Orlando Pereira, University of Minho, Portugal*

*Daniel Gonçalves Novo Gomes, University of Minho, Portugal*

*Ana Martins, University of KwaZulu-Natal, South Africa*

*Isabel Martins, University of KwaZulu-Natal, South Africa*

This chapter discusses the role of education in “humanizing the economy” and emphasizes its contribution to the development of a new socio-economic model that helps to overcome the irregularities present in contemporary society. It proposes the implementation of school practices aimed at the completeness of the individual and in favor of social balance. It also emphasizes the importance of the humanizing process in the attainment of values such as, justice, freedom, solidarity and cooperation, which are structuring values of social cohesion. The primary data focused on the Secondary Education in the Districts of Braga and Viana do Castelo, in the northwest of Portugal. Interviews were conducted with school principals as main actors in the research. In spite of the limitations of the work, the results show that, in Portugal, education is still focused on individualism. It is also noted that assimilation of social aspects and humanization is weak, which inhibits placing the individual at the center of economic concerns and produces negative externalities on economic and social performance including wellbeing.

## **Chapter 21**

The Relationship Between Nigerian University Students’ Body Literacy Level and Their

Awareness of Embodied Learning ..... 296

*Akpomuje Paul, Obafemi Awolowo University, Nigeria*

Although there is growing global interest in health awareness, and emergence of scales to measure health literacy, there is less effort in empirical research in ascertaining the level of body literacy of different groups of individuals in determining how much information and understanding individuals have about their bodies. The academia may be successful in enhancing cognitive and psychomotor skills of students, but how have these enhanced students’ knowledge to issues concerning their bodies and health such as blood pressure, blood sugar, genotype, body mass index, feeding habit, etc., and the decisions/actions they make/take regarding these, and the implications of these to being embodied learners? This study sampled 120 participants to investigate the body literacy level of postgraduate and undergraduate students of Obafemi Awolowo University, Ile-Ife, Nigeria, their level of awareness to risk, and their challenges of being bodily literate through a self-developed questionnaire which translated into a 21-item body literacy measurement scale.

## **Chapter 22**

Shared Leadership and Team Performance: The Role of Emotions and Trust..... 311

*Ana Martins, University of KwaZulu-Natal, South Africa*

*Isabel Martins, University of KwaZulu-Natal, South Africa*

This chapter contributes to the existing evidence on the constructs of shared leadership, social, and emotional capitals to demonstrate their significant galvanizing effect on team and organizational performance through trust. This study aimed to ascertain how leadership self-efficacy might influence shared leadership team, trust, and performance in this IT Company. Managers with self-reported ratings for the self-efficacy attributes cluster of leadership demonstrate greater probability of improving both perceived and actual employee performance. The emerging results concur with the aforementioned

premise because these appear to emphasize the leadership self-efficacy attributes cluster of problem solving. These results may have a positive impact on the team and organizational performance as a whole.

### **Chapter 23**

Crossing Disciplines to Connect Across Cultures: Transformative Educational Practices With College Students and Educators..... 326

*Christina Van Wingerden, Western Washington University, USA*

*Gloria Burgess, Seattle University, USA*

*Joanne DeMark, Western Washington University, USA*

This chapter shares seven examples of transdisciplinary practices in the areas of assessment, undergraduate and graduate classroom learning, with accomplished industry leaders, and using educational technology (in the form of a learning management site) to create inclusive communities. The application of the Critical Incident Questionnaire for classroom and program assessment amplifies the voices of diverse students coming from different disciplines to dynamically impact class and curriculum design for broader engagement. Classroom and industry leader examples include integration of image, artifact, case study, reflection, documentary, image and metaphor generation, movement, orchestral music, chosen art forms, leadership studies and practices, experiential learning, writing, speaking, and discussing to create deep learning experiences that provoke growth, creativity, and the building of communities. Undergraduate students with jobs in a multi-department unit report that a planned and creative use of a learning management system for an online work orientation program results in their perceptions of belonging and connection to the work unit and each other.

### **Chapter 24**

The Transculturalized Diversity and Inclusion Model: A New Paradigm for Leadership..... 349

*Charlotte L. V. Thoms, National Technical Institute for the Deaf (NTID), USA*

*Sharon L. Burton, Claremont Lincoln University, USA*

While the transculturalized diversity and inclusion (TD&I) model is a contemporaneous strategy for leadership and learning, it is the latest of the existing disability study models. This chapter reviews the development of the TD&I model from the leadership perspective to study arguments, experiences, and to investigate how this information appraises the construction and exercise of transcultural consciousness, expertise, know-how, traditions, determinations, happenstances, objectives, agreement, and learning. This exploration focuses on the implementation of the model and survey results as this transculturalized model is reasoned the appropriate tool to expose how different backgrounds can be utilized in achievement to blend variability, variation, and diversity into unity. Beginning with the initial conceptual frameworks, and the results of the data, this research details the TD&I model and how to implement it in today's environment of activating change and transformation. This information adds to the body of knowledge regarding disability, strategy, diversity, and inclusion for academics, practitioners, and learners.

### **Chapter 25**

Workforce Development and Higher Education Partnerships: Transdisciplinarity in Practice ..... 369

*Sheena Copus Stewart, Auburn University, USA*

*James Witte, Auburn University, USA*

*Maria Martinez Witte, Auburn University, USA*

Workforce development and higher education can benefit from collaborative efforts that incorporate and apply teaching, learning, and research from a variety of environments. This chapter introduces the context of workforce development innovation and the impact on employees. Partnerships, in general, are defined and workforce development and higher education partnerships are examined that have influenced building collaborative relationships. Also included is a review of best practices and future trends related to workforce development and higher education partnerships.

## **Chapter 26**

**Transdisciplinary Approach to Linguistic Diversity: Can We Co-Exist Without “One English”?** .... 383

*Aicha Rahal, University of Gafsa, Tunisia*

In this chapter, the author shows the reality of English. Some light is shed on the features of today’s English. Then, the debate between monolithic standard and pluralist perspective is presented. The linguistic diversity of English is introduced. Based on this diversity, the aim of the study is to summarize the major studies about pedagogy for English as an international language (EIL). In concluding, the transdisciplinary approach is defined, and some ideas are given about how to implement this approach to unify the linguistic diversity of English.

<b>Compilation of References</b> .....	397
<b>About the Contributors</b> .....	460
<b>Index</b> .....	473