Chapter 8
Lessons Learned in Transdisciplinary Graduate Education: Claremont Graduate University's Decade-Long Experiment

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8.1 Introduction

Claremont Graduate University is engaged in a more than decade-long experiment in transdisciplinary graduate education that positively contributes to a growing, global understanding of transdisciplinarity in higher education, its pedagogy, structure and governance.[1] It is a case study in how Claremont Graduate University has envisioned, institutionalised and measured the outcomes of transdisciplinary education at the graduate level. The case study is unique in that the programme is graduate-only and social science and humanities based. Unlike other transdisciplinary developments in Europe and America, Claremont Graduate University's programme is not grounded in engineering or the hard sciences, but rather in the social sciences, health sciences, computational sciences, business and humanities.[2] The main

[1] First and foremost, I want to thank Alana J. Olschwang, Director of the Office of Institutional Effectiveness, without whose work this assessment and report would not have been possible. I also want to thank Jacob Adams, Provost of Claremont Graduate University, for his support for the t-program. I also want to thank the participants of TheALTAS 2016 Transdisciplinary, Transnational, Transcultural International Conference, held at Xi'an Jiaotong Liverpool University, Suzhou, China, May 29-June 2, 2016. In particular, I benefited from comments from Dr. Paul Gibbs, Dr. Basarab Nicolescu, and Con Kenney.

[2] Special appreciation to Dr. Daniel Stokols for his presentations and consultations with our faculty in 2013 on transdisciplinary research and team science. Transdisciplinary approaches in the applied sciences, particularly the health sciences, have been in practice for many years; recently, the emergence of the fields of study and the science of team science provides evidence of the importance of collaborative team work across scientific specialisations. See National Research Council. (2015) *Enhancing the Effectiveness of Team Science.* Committee on the Science of Team Science, N.J. Cooke & M.L. Hilton, Editors. Board on Behavioral, Cognitive, and Sensory Sciences, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academies Press.

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positive findings of the transdisciplinary programme are that: (1) it provides the opportunity for faculty and doctoral students to experiment with methods, ideas and applications that are not provided within their departmental courses and curricula; (2) it fosters the creation of new courses, some which, such as the 'Big Data' course and 'Digital Humanities', have become part of Claremont Graduate University's core curriculum; (3) it fosters dissertation topics through courses and dissertation grants that are transdisciplinary in nature; (4) it fosters transdisciplinary faculty research projects through small grants; (5) it fosters transdisciplinary student projects through small grants; (6) it creates an ongoing transdisciplinary intellectual dialogue on campus through courses, grants, workshops and conferences. The main negative findings of the transdisciplinary programme are: (1) course evaluations that reveal that not all transdisciplinary courses ('t-courses') are successful; (2) faculty leadership that maintains support across the disciplines and university is difficult to sustain; (3) institutional support at the board and executive levels is inconsistent; (4) a vision for the next steps in leadership, academic programming and administrative management is not fully defined.[3]

I begin with a brief history in order to set the groundwork and explain why transdisciplinarity has found fertile ground in Claremont Graduate University's traditions and programme strengths. I provide some examples of how Claremont Graduate University is fostering transdisciplinary teaching and research and what the results are showing us. I then argue that the emergence of transdisciplinarity provides a promising solution to what is a particularly acute *problem of knowledge* facing us in the twenty-first century. Finally, I leave us with some reflections on where educators and leaders in higher education across the globe should be driving transdisciplinary education and research in the future. The upshot of my reflections is that the role of the generalist – or synthesiser – needs to be further explored and capitalised within the framework of the transdisciplinary approach.

8.2 A Brief History: The Transdisciplinary Transformation at Claremont Graduate University and Lessons Learned

To set the stage for understanding the transdisciplinary transformation underway at Claremont Graduate University, we begin in the early 2000s, when George Kozmetsky, a former trustee at Claremont Graduate University, sat with our then-president, Steadman Upham. Dr. Kosmetsky's goal was to persuade him of the

[3] In the Educational Effectiveness Review from the Western Association of Schools and Colleges site visit to Claremont Graduate University in March 2014, the review team declared that Transdisciplinary Studies is a 'key element of the Claremont Graduate University brand' and 'has the potential to serve as a powerful intellectual engine for key aspects of the university's mission.' However, the team also observed 'the success of the programme is contingent upon the active involvement of a critical mass of faculty' as well as 'the energy and practical and administrative skills required for everyday operations.' The team's recommendations for Transdisciplinary Studies at Claremont Graduate University were for the university to build on the current momentum by enhancing leadership, faculty engagement, and programmatic capacity.

importance of transdisciplinary education in a time of hyper-specialisation in research and teaching, particularly at the graduate level.[4] Stead, an archaeologist by training, knew that the specialisation of knowledge brought with it the increased responsibility to synthesise and ask questions that more often than not take us beyond our specific domain of knowledge and training.

As President Upham stated it:

> A 'university of ideas' is founded on the unyielding premise that academic progress and advancement are only possible if teaching and research are organized around the unrestrained pursuit of ideas, wherever they may lead. (*The Flame*, Winter 2003)

Behind President Upham's comments is that with specialisation comes increasing complexity, and with globalisation comes increasing pressure to solve complex problems. If transdisciplinarity is the approach best suited to deal with these developments, then where better to have the necessary debates than at a graduate research university? Or, at a university that is steeped in the Blaisdell[5] tradition of having conversations that matter? Transdisciplinary thinkers such as the late Peter F. Drucker, the father of management theory, Michael Scriven, the father of evaluation science, and Mihaly Csikszentmihalyi, the father of flow and positive psychology, were attracted to Claremont Graduate University for a reason. The campus invites such giants to test their ideas in an intellectually open and collaborative environment.

In spring 2003, the faculty at Claremont Graduate University unanimously voted to institute a four-unit course requirement for all doctoral students. In his convocation speech to the university, President Upham made that case for a required core course for all doctoral students:

> to add a small counterbalance to the overwhelming specialisation of the disciplines. The curriculum of the core course would reveal for doctoral students the interconnectedness of different bodies of knowledge, the unity of the disciplines, and the importance of thinking holistically when approaching complex, multidimensional problems. This kind of core course will foster collaborations among faculty and students while helping each new doctoral student position his or her specialized knowledge on a broader intellectual map.[6]

The new requirement meant that students from every discipline were required to enrol in a transdisciplinary course that would be constituted of students from across disciplines in a course designed around a complex problem or issue. The problem of social justice and poverty was the inaugural theme of the programme. Courses were team-taught and took multiple forms. We learned that, while a course requirement helped to institutionalise transdisciplinarity at Claremont Graduate University, the courses were unwieldy and did not foster the integrative component that we strived for. In truth, faculty steeped in their disciplines were less likely to display the values

[4] It was the vision and gift of George and Ronya Kozmetsky and its reception by President Upham and Claremont Graduate University that led to establishing the George and Ronya Kozmetsky Transdisciplinary Program at Claremont Graduate University in 2004.

[5] James Blaisdell, 3rd president of Pomona College.

[6] Steadman Uphman, 'In Celebration of Claremont Graduate University and Our Unfinished Business.' Speech given at Claremont Graduate University's Convocation, September 2, 2003. (http://Claremont Graduate University.edu/include/2003_Convocation_9-2-03.pdf)

of transdisciplinarity – open-mindedness, thinking outside of and beyond their discipline – than the students taking the class. By 2008, we added a collaborative project around a common question or problem to the design of T-courses. We learned that the structure of a collaborative project was a great pedagogical advance, but needed further faculty development on how to create effective collaborative projects. The fine-tuning of the collaborative component and how to instil a discipline of 'team science' is ongoing. We have also learned that there are two kinds of T-courses: those focused on methods that reach across disciplines such as interpretation, evaluation and data mining, analysis and simulation; and those that are focused on real-world problems such as environmental justice, poverty and inter-cultural and religious dialogue.

8.3 Assessment of the Transdisciplinary Programme and Next Steps

An internal formal review process was conducted in 2012–2013 by the Office of Institutional Effectiveness.[7] The study included a statement of the programme mission, description of the programme; evaluation of the curriculum and scholarship, and report on external relations. The self-study followed the WASC site visit and review that uncovered the strengths and challenges of the programme in its initial phase (2005–2012). To complement these findings, the internal self-study assumed a future focus. Stakeholders identified what the second phase of the programme could and should include. Students and faculty participated in interviews, focus groups and surveys. The self-study included an analysis of the course and award data from the first phase (course evaluations, enrolment trends, student learning outcomes and awarding patterns).

8.3.1 Findings

The findings from both the data and stakeholders clustered around themes, including:

8.3.2 Define Transdisciplinarity

Develop a clear definition of transdisciplinarity for the programme, including the meaning of transdisciplinarity within each course, and for scholarly and research work.[8]

[7] Elements included here are taken from a report by Alana J. Olschwang, Director of the Office of Institutional Effectiveness, who deserves special recognition for her thorough work for this study.

[8] An advisory committee post-review was convened and, rather than define transdisciplinary as 'an

8.3.3 Develop Clear Pedagogy and Application

Integrate theories across disciplines and consider new research methods (how to define problems, apply new methodology, conduct successful group project work, communicate across disciplines and engage in experiential application); facilitate group projects and discussion for a deeper dive into material across disciplines applying high levels of rigour. Course alterations to meet the needs of Masters students should be included. Students provided positive comments in course evaluations about faculty and class discussions. Additional time in class for synthesising and debating viewpoints was recommended.

8.3.4 Expand Transdisciplinary Programme Scope

Expand the scope to connect faculty and students across campus who share research interests. The programme should provide support for networking and development, and faculty mentorship. Increasing the knowledge of what faculty and students are doing across campus will also enable the programme to provide guidance for dual-degree students. In addition to formal coursework, students and faculty recommended workshops, seminars and connection to subject matter experts within and across Claremont Graduate University programmes and discussion groups. Students and faculty would also like to learn from experts from other institutions. Making time and space to spotlight examples of good transdisciplinary work will provide recognition as well as exemplars for future students and faculty. The transdisciplinary programme was initially charged with and should move toward also identifying funding sources and research support.

8.3.5 Enhance Claremont Graduate University Support of Transdisciplinarity

Strengthen the structure around transdisciplinary including budget, research support and incentives; promotion and tenure policies; develop a culture of risk taking to try new approaches; and resources to bring to Claremont Graduate University the transdisciplinary scholarship that has developed nationally and internationally. A common comment from faculty was the lack of time to engage in transdisciplinary

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approach to knowledge, research, and problem solving that takes the core ideas, methods, concepts, and history of at least three disciplines and uses them to study a broad range of problems that no one discipline alone can address', the working definition is now 'an approach to problem-centered research and teaching that draws upon the ideas and methods of multiple disciplines and extends our knowledge beyond any single discipline-specific domain to create new, integrative, and transformative solutions.'

scholarship. A common comment from students was that the transdisciplinary programme attracted them to Claremont Graduate University, however, the programme felt separate from other things that were going on at Claremont Graduate University.

8.3.6 Advance Assessment and Link to Employment

Strengthen connections between the transdisciplinary courses, student learning outcomes and student career trajectories. Student learning outcomes should be explicitly aligned with strategic goals and reflect what is distinctive in a graduate culture. Systematic assessment with director and leadership oversight will enable the programme to use data for decision making and continuous programme improvement. As the award programme increased in popularity, the faculty faced a challenge in selecting the most qualified applicants. Building relationships with transdisciplinary experts and organisations outside of Claremont Graduate University can strengthen the programme. There are numerous regional transdisciplinary programmes that Claremont Graduate University can learn from. Students and faculty do not have a shared understanding of the job market for future faculty members who have a transdisciplinary orientation or the job market outside of academia.

In conclusion, the impact of the t-courses is just beginning to crystallise. We have seen a positive impact in the number of external grants by multidisciplinary teams, as well as students and faculty interested in themes, problems and methods explored in t-courses.

The t-programme has also sponsored conferences, reading groups, small student and faculty grants, dissertation awards, and initiatives to foster transdisciplinarity on campus and beyond. Claremont Graduate University Alumna Emi Makino, of the Drucker Graduate School of Management, in her essay 'Connecting the Transdisciplinary Funding Dots', summarises the effect of each of these T-sponsored activities. (6/22/2012). She writes of receiving a $1500 T-grant that led to the funding of a larger research grant, which in turn led to and was supported with a t-dissertation grant.

In the past 2 years, with my co-director, Tom Horan, we launched two transdisciplinary initiatives. The first is called 'Big Data, Better World?' and the second, 'Innovation and Creativity.' As George Kozmetsky noted, it is important to use initiatives to spark solutions:

> [C]reative management involves abilities to take a problem or crisis and develop its issues, generate alternative solutions, and select feasible initiatives from among the alternatives. Furthermore, creative and innovative management includes the ability to use initiatives as a first step to solutions.[9]

[9] George Kozmetsky, Creative and innovative management: A new academic frontier in *Creative and Innovative Management: Essays in Honors of George Kozmetsky.* A. Chanres and W. W. Cooper, (eds) (Cambridge, MA: Ballinger Publishing Company, 1984), p. 4.

In November 2014, 'Big Data, Better World' was the theme of a transdisciplinary conference, the keynote speaker of which was Jack Dangermond, founder of ESRI.[10] It was also the theme for a new course developed by professors from our information systems and technology programme and our Drucker School of Management. This course focuses on teaching students from across the university to use Big Data tools and technologies effectively across various disciplines and settings, in particular, the social sciences, humanities, information systems, policy and healthcare. Examples of student projects pursued in the course include ones where[11]:

- The student team 'scraped' data from publicly available film databases, in order to answer the following question: Can we use TV show attributes (such as genre, producer/director and time slot) to predict which shows are likely to get cancelled?
- The student team used publically available health data to build a clinical trials 'dashboard.' Using a sophisticated visualisation tool, they created a tool to help users answer 'queries' about clinical trials: Which companies have the most ongoing trials and in which region of the country? What kinds of ailments are getting the most attention, organisationally and financially? What are the companies that are focused on specific, less well-funded ailments? In order to create a seamless user experience, the team had to create a process to download, clean and stream the data into the dashboard on the 'back end'. Their hard work resulted in a remarkably easy-to-use interface that promises to unearth and visualise important information about clinical trials.
- The student team used information made available by the US Department of Education in order to assess the value of an undergraduate degree. They focused specifically on degrees from the University of California (UC) and California State University (CSU) systems, the two largest in the state and two of the largest in the nation. While still preliminary, the team's results suggest that CSU degrees provided greater lifetime earnings, due mainly to the lower cost of tuition.

The Big Data theme also supported the development of a new course in Digital Humanities. Three student dissertation projects have emerged from the initial course offering:

- The first is Alyssa Krueger's *Reviving Irish* project that studies how a literary movement championed by James Joyce and W.B. Yeats helped to revive a dead language, namely Old Irish. Using story maps and other digital tools, she is conducting a thorough analysis of texts and the frequency and use of Old Irish terms.

[10] ESRI is a software company located in Redlands, California. It uses ArcGIS, a location platform to connect people with maps, data, and apps through geographic information systems (GIS). See ESRI http://www.esri.com/

[11] Thanks to Dr. Hovig Tchalian, Assistant Professor of Practice and Director, Drucker Advisory Services, Drucker School of Management, Claremont Graduate University, who provided the details.

- The second is Francesca Gacho, whose project is using GIS technology to track the movement and locations of characters, places of employment and residences of characters in Gissing's novel.
- Finally, Julianna Kirschner is using 'Twitter scraping tools' to understand the usage of the 'Je suis Charlie' ('I am Charlie') hashtag, or #JeSuisCharlie. The goal is to trace the usage of this phrase to see if it is functioning like the phrase that appeared during the World War II in France, namely, 'We are all German Jews'. The generalisation that Julianna is testing is that humans in times of crisis employ the connection of each individual to the common goal, thus fostering unity.

Our second initiative is 'Creativity and Innovation,' launched this year. We have provided seed funding for the development of a jointly taught course on Museums and Heritage with Bath Spa University in England. The students spend 10 days in England working with curators and museum professionals to visit and learn about British heritage; then 10 days in Los Angeles doing the same, visiting sites such as Watts Towers and the Autry museum. The overall goal of the course is to find answers to the question, 'What constitutes cultural understanding?' We are in the planning stages of a conference/workshop on design thinking.

Through all of these activities – student and faculty grants, workshops and conferences, dissertations and course development, we have built a practice and commitment to transdisciplinary approaches to teaching and research. We like to say that transdisciplinarity is in our DNA, it is our intellectual signature. It signifies the recognition that there is a global demand for our graduates to think across disciplines and the growing expectation for flexible thinkers and problem solvers in the global marketplace.

We continue to refine what we mean by transdisciplinarity. The original operational definition was 'an approach to knowledge, research, and problem solving that takes the core ideas, methods, concepts, and history of at least three disciplines and uses them to study a broad range of problems that no one discipline along can address.' Our current operational definition is 'problem-centered research and teaching that draws upon the ideas and methods of multiple disciplines and extends knowledge beyond any single discipline-specific domain to create new, integrative, and transformative solutions.'

Yet, with all of these advances and developments on our campus, the question, 'what is transdisciplinarity' persists. It is often commented that the word alone is unwieldy and certain to fail anyone who tries to say it more than once. Nonetheless, the more than decade-long experiment with the Kozmetsky transdisciplinary programme at Claremont Graduate University has been a great success. The t-course is part of what we do, with an average of 14 courses offered per year. The curriculum, design and pedagogy of t-courses continue to be developed. Our next step is to develop t-practica that are required of our Masters students.

An important next step is to assess how the t-courses and other t-activities tie to student learning outcomes in specific ways and what impact that has had on their career trajectories. This assessment will not only help track the impact of the

t-programme, but also will give us vital information to continually enhance the design and operation of the t-programme in the future.

Undoubtedly, the advancement of knowledge requires specialisation. Specialisation calls researchers to dive deeper and deeper into the subject of their inquiry. It uses terms, concepts and methods that have been developed to answer the increasingly refined questions that we ask. The history of science is rife with examples. The discovery of the living cell in the seventeenth century by Robert Hooke and Anton van Leeuwenhoek was a result of scientists taking advantage of an accumulated body of knowledge in what was called 'natural history,' and the invention of a new tool – the microscope. Independently, both scientists took us beyond what was visible to the naked eye by building on a body of knowledge and using new techniques to scrutinise nature. What biologists know *now* about the nature and function of the cell would delight, as well as befuddle, Hooke and Leeuwenhoek. And questions beyond the study of cells, about how the environment affects cellular function or how to treat diseases of cellular dysfunction, are questions beyond what these thinkers could imagine, let alone tackle. It is without question that specialisation moves the advancement of knowledge.

Yet, with all its benefits, specialisation has a downside. What specialisation did not teach Robert Hooke was how the understanding these biological functions would be connected to the study of the chemical, as well as environmental, psychological and social sciences. The value of cells in the overall ecology of life and human culture was left for not just specialists of many fields, but for their ability to see beyond the boundaries of any one science to connect the dots.

In the words of Henry David Thoreau:

> A man sees only what concerns him… How much more, then, it requires different intentions of the eye and of the mind to attend to different departments of knowledge! How differently the poet and the naturalist look at objects![12]

These words remind us that providing a description of the chemical composition of a cell does not exhaust what is to be known in relation to the cell. The generalist, or the specialist who sees beyond her own specialty, provides an invaluable perspective.

Specialisation, left unchecked, lends itself to the fragmentation of human knowledge. Without the effort to understand across disciplines, we are left seeing the trees without the forest. It may be the trees that make the forest, but the forest and its ecosystem are more than the sum of the parts. It is the indispensable role of the generalist, as knowledge becomes more and more specialised, to bridge the increasing chasm between the details of knowledge and their general significance and connection to other things and domains of knowledge. The special problem for the generalist in the context of the twenty-first century is that it is becoming more and more difficult to keep up – to both be in the world of the specialist, as well as see across multiple disciplines.

[12] Henry David Thoreau (1817–1862), Autumnal tints (1862), in *The Writings of Henry David Thoreau,* vol. 5: 286, Houghton Mifflin (1906).

I want to turn now to explore briefly how to understand this tension between specialisation and integration in epistemological terms.

8.4 The Problem of Knowledge in the Twenty-First Century that Transdisciplinarity Promises to Solve

With my philosopher and historian of science hat on, I suspect that the emergence of transdisciplinarity approaches to knowledge provides a promising solution to what I think is a particularly acute problem of knowledge facing us in the twenty-first century. With the rapidly expanding body of knowledge and its domains, it is becoming increasingly more difficult to see how these domains relate to one another.

In the history of natural philosophy, now called science, it was generally recognised that there is a dual aspect to the method of attaining knowledge: the method of analysis and the method of synthesis. Suarez, Descartes, Newton, Leibniz and others wrote about the method of discovery as a duality of breaking things down into their simples (analysis) and then connecting those simples into wholes (synthesis). The basic insight was that the world is one whole and yet we, as finite knowers cannot see the whole all at once without the parts. Humans have to break things down to begin to understand them, but then the task of putting our knowledge back together again remains. The dual method of analysis and synthesis paved the way for the study of mechanics in deeper and deeper detail, as well as the formulation of the laws of physics and the universal theory of gravity.

As analysis takes us to deeper levels, breaking a phenomenon into smaller and smaller parts, synthesis asks us to build the parts back up into wholes. As the parts get smaller, so do the wholes. Analysis drives scientific inquiry to see the parts, synthesis to reconstruct the wholes. The importance of synthesis can be overshadowed by analysis in scientific inquiry. This is, in part, because synthesis tells us mostly what we already knew before analysis took place and so it does not seem necessary. It is also, in part, because as we dive deeper into the study of a subject, the complexity of those parts and their relations can obscure what holds them all together.

In the twenty-first century, the depth of disciplinary knowledge – the depth of specialisation – lends itself to an acute problem of knowledge. Unlike in the eighteenth century, it is hard to keep up with the specialised domains of knowledge enough to be able to connect the dots to their interconnections. For example, most of the twentieth-century philosophers of mind went about philosophising about the nature of mind without any grounding in science. Fortunately, by the 1980s, many realised that philosophising without grounding in biology, computer science, or neuroscience was making philosophy of mind an esoteric and irrelevant field of study. Yet, as philosophers delve more deeply into these disciplines, the challenge of connecting this back to the philosophical and value questions has become increasingly difficult. Debates about the ‘moral molecule’ and the neuro-chemical basis of

emotions are examples of the reductive approach that can arise when analysis is unchecked by synthesis.

If the natural philosophers of the eighteenth century who gave birth to modern science, as we know it, were correct then we should employ both analytic and synthetic tools in our search after truth. The depth and complexity of knowledge in the twenty-first century is unprecedented and I believe requires an approach that crosses disciplinary boundaries as the problem, concept or issue demands. Increasing specialisation, the very hallmark of our success in science, requires more and more of the generalist or synthesiser to meet the challenge of an integrative understanding of the world and the problems facing us today.

I want to end on a note about the value of transdisciplinary approaches to knowledge for the future. The complexity of what is known and the rapidity of growth of that knowledge will only continue to accelerate. It will become harder and harder for any single individual to stay on the forefront of that knowledge. We must collaborate. We must be open-minded to new ideas and new ways of understanding.

Fundamentally, transdisciplinarity is a new way of thinking and doing. Researchers need to be free to follow a problem across disciplinary boundaries. They should be empowered to draw upon the concepts and methods of other disciplines to create new solutions to industry and societal issues. And they should ask how the creation of knowledge can positively impact our most pressing contemporary problems.

As educators in the twenty-first century, our job is to find ways to honour the norms and methods of specialised disciplines and the advances they afford while opening up pathways to reach beyond these disciplines in ways that stimulate innovative and transformative solutions to the world's thorny problems.