2024 STRATEGIC LEADERS GLOBAL SUMMIT ON GRADUATE EDUCATION

Transdisciplinary & Transnational Research to Solve Global Grand Challenges

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INTRODUCTION: GLOBAL GRAND CHALLENGES AS CATALYSTS FOR SYSTEMS CHANGE IN GRADUATE EDUCATION

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The Council of Graduate Schools is pleased to co-host the Sixteenth Annual Strategic Leaders Summit on Graduate Education with Consejo Mexicano de Estudios de Posgrado A.C. (COMEPO) at the University of Guadalajara. This event would not be possible without the support of Erick Sanchez Flores, the president of COMEPO, and Marcela Torres Hernandez, the vice president of COMEPO and the Director of Research and Graduate Studies at the University of Guadalajara. It has been a pleasure to collaborate with COMEPO on the Global Summit and to see the shared opportunities between Mexican and American graduate education. I would also like to thank our sponsor for this year's event, Educational Testing Service (ETS), for their continued commitment to graduate education in a global context. A special thanks to Chrystal Molnar for recognizing the value of the Global Summit and supporting this convening.

Global grand challenges require bold solutions. The globalization of the 20th century facilitated first by quicker travel and eventually by digital technologies, connected diverse nations and peoples into a single global network of communication, trade, and ideas. While globalization allowed for improved communication and collaboration across national borders, it also laid bare the common challenges that affect humanity: food insecurity, social and economic inequality, misinformation and misunderstanding between and within societies, and hate-motivated violence. Furthermore, the rise of these technologies created and accelerated many of these issues, most notably climate change, making them seem more intractable.

While these global challenges were mentioned during last year's Global Summit on internationalization, their scale and urgency requires a deeper exploration into ways to ameliorate and solve them. These problems test the entire system of graduate education and research. The bounds of disciplinary study limit the ability to look at large scale problems holistically and lead to partial or uneven solutions. The blinders of nationalism cause similar myopias. This event will explore transnational and transdisciplinary research as a way to more completely understand and address the grand challenges of our times. It will examine new research partnerships as well as the administrative innovations that make such collaborations possible. It will examine how researchers are beginning to address global challenges and where there is more to be done. Finally, we will come together during the final session to draft a set of best practices and an action agenda to synthesize the papers presented and translate our diverse national perspectives into guidance that is applicable to many disciplines and national contexts. The remainder of this paper will focus on work being done in the United States to expand transdisciplinary and transnational research as well as initiatives CGS has undertaken in this arena.

The Challenge of Transdisciplinarity

Transdisciplinary collaborations are difficult. While interdisciplinary and multidisciplinary approaches to research support partnerships within disciplinary frameworks, transdisciplinary research aims to move beyond disciplines to create holistic solutions to difficult problems. An emphasis on disciplinary skills and competencies throughout undergraduate, graduate, and, in some cases, postdoctoral training fosters comfort and belief in certain types of inquiry over others. Creating equal partnerships that value the knowledge and skills of all participants is also a challenge, particularly in collaborations where funding or prestige are unequal (as is often the case with partnerships between STEM fields and the humanities).[1] The scale and urgency of grand challenges, however, can provide added momentum and funding to overcome disciplinary biases and institutional inertia to foster creative transdisciplinary research collaborations.

Global grand challenges represent an opportunity for administrators and researchers to experiment with transdisciplinary approaches. Historically, crises have compelled scholars to reach across disciplinary boundaries and work with scholars in other fields. While the Manhattan Project is the most famous example of transdisciplinary collaboration during World War II, the conflict inspired a constellation of new transdisciplinary partnerships and even the creation of transdisciplinary fields. Area studies, a transdisciplinary approach that brought together researchers in diverse disciplines to study a geographic area, grew out of a wartime need for deeper understanding of America's wartime enemies and allies, so too did partnerships with industry that challenged existing disciplinary norms in favor of transdisciplinary approaches.[2]

Currently, a similar paradigm shift is occurring with generative artificial intelligence. The rise of AI challenges nearly all aspects of graduate education and research. At the same time, however, universities, as repositories of knowledge and expertise, are some of the institutions best equipped to understand and harness AI. The National Science Foundation (NSF) has recognized the special role of universities by designating and investing in seven National Artificial Intelligence Research Institutes.[3] These institutes are transdisciplinary by design and are organized around understanding the challenges presented by AI and how to use it to positively impact American

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[1] *Cyrille Rigolot, "Transdisciplinarity as a Discipline and a Way of Being: Complementarities and Creative Tensions" Humanities and Social Sciences Communications 7, No. 100 (2020): https://doi.org/10.1057/s41599-020-00598-5.*

[2] *Mark Solovey, Shaky Foundations: The Politics-Patronage-Social Science Nexus in Cold War America (New Brunswick: Rutgers University Press, 2013).*

[3] *The seven National Artificial Intelligence Research Institutes are the NSF Institute for Trustworthy AI in Law & Society at the University of Maryland, the AI Institute for Agent-based Cyber Threat Intelligence and Operation at the University of California, Santa Barbara, the AI Institute for Climate-Land Interactions, Mitigation, Adaptation, Tradeoffs, and Economy at the University of Minnesota, the AI Institute for Artificial and Natural Intelligence at Columbia University, the AI Institute for Society Decision Making at Carnegie Mellon University, the AI Institute for Inclusive Intelligent Technologies for Education at the University of Illinois at Urbana-Champaign, and the AI Institute for Exceptional Education at the University at Buffalo. More information can be found on the NSF website at: NSF announces 7 new National Artificial Intelligence Research Institutes | NSF - National Science Foundation.*

society. They are an example of a problem-based approach to research that moves beyond disciplinary foci toward holistic approaches to solving grand problems. Furthermore, they demonstrate the overlap between grand challenges as the institutes will explore the ways AI can help solve complex issues like climate change, cybersecurity, and improving health outcomes.

While solving grand challenges presents an important lever for transdisciplinary collaboration, graduate student and employer demand are also important factors. The recent CGS project on postbaccalaureate certificates and microcredentials found that emerging credentials were a site of innovation for universities looking to offer more opportunities for transdisciplinary collaboration to students.[1] In the National Name Exchange (NNE), a CGS managed and NSF support program to connect students with opportunities in graduate education, student interest in interdisciplinary study led to the create of new identifiable interdisciplinary fields of interest including not only the broad fields of interdisciplinary and multi-disciplinary studies, but also the transdisciplinary field of peace and conflict studies.

Transnational Solutions to Global Problems

Transnational collaborations to solve global grand challenges are a necessary complement to transdisciplinary innovation. Just as the knowledge and skills needed to solve global grand challenges do not belong to a single discipline, neither do they belong to a single nation. This is easier said than done, however. Recent years have seen an upsurge in nationalism worldwide, which has been both expressed in and intensified by recent wars in Ukraine and Gaza. These headwinds make it all the more important that transnational collaborations take place, since they serve as important people-to-people diplomacy between nations, as well as avenues to solve global challenges.

Global challenges require new transnational frameworks and ways of thinking in order to address issues on a supra-national scale. Transoceanic collaborations are one framework that may help transcend national boundaries. In this vein, 32 nations launched a Partnership for Atlantic Cooperation in 2023 to tackle a range of global grand challenges affecting nations bordering the Atlantic Ocean, including climate change, economic inequality, and disseminating new technologies more equally between nations. While the Partnership for Atlantic Cooperation only obliquely engages university research at this time, it is an important bulwark to nationalism because it calls for an open Atlantic and greater collaboration between Atlantic nations on areas of regional and global importance.[2]

At CGS, we have undertaken several programs to facilitate transnational collaboration in recent years. First and foremost, of these is the Global Summit itself. This is the sixteenth Global Summit convening, and the Summit has long been an opportunity for CGS to engage with international graduate leaders, learn from delegates about innovations in graduate education being undertaken across the globe, and share what CGS and its member institutions are doing that may be applicable in diverse national and regional contexts. Beyond the Summit, in 2020 CGS started convening a Committee on the Global South to

[1] *Matthew Linton, Enyu Zhou, Jeffrey Allum, and Madeline Rowe, Microcredentials and the Master's Degree: Understanding the National Landscape to Support Learners and the Workforce (Washington: Council of Graduate Schools, 2024). DOI: 10.17605/OSF.IO/F6U2K*

[2] *Bruce Jones and Daniel S. Hamilton, "The Promise of a Free and Open Atlantic" Brookings Commentary (September 20, 2023): The promise of a free and open Atlantic | Brookings.*

better understand the challenges facing graduate programs in the Global South and to begin establishing relationships with institutions in Africa, Latin America, and Southeast Asia. We are happy to note that these relationships are continuing to grow and there are institutions joining us today in Mexico that were part of that effort. Finally, CGS member institutions continue to drive innovation in graduate education through transdisciplinary and transnational efforts. At Washington University in St. Louis, for example, the humanities doctoral students were grouped into transdisciplinary cohorts to explore issues of public concern. The goal of this transdisciplinary program is both to make graduate students more active in their communities and to help them develop skills of collaboration and communication that will help them in a variety of careers.[1]

Overview of Panels

During this year's Summit, we will explore the ways that transdisciplinary and transnational research can be used to solve global grand challenges. This topic encompasses not only the deployment of research, but also how transdisciplinary and transnational collaboration is supported and promoted. As in previous years, this year's Summit has been organized into six thematic panels and a final concluding session during which we will collectively develop a series of principles and action agenda. Panel topics this year include global, regional, and national contexts for transnational and transdisciplinary research; creating new and innovative models of graduate education; the role of transdisciplinarity in erasing boundaries between disciplines; using transdisciplinary knowledge to solve global grand challenges; and exploring how emerging fields of study can challenge boundaries between scholars.

Final Session and Next Steps

During the closing session of the Summit, we will work together to create a set of principles and action agenda to assist our efforts to transform our conference discussions into policies and actions. These principles and action agenda will reflect our diverse national and institutional contexts, as well as share themes that unite all of us. CGS will publish the proceedings of the Summit, including your paper and a final document of key findings, on the CGS website. We will also share this information with our member universities and with the broader graduate education community in the United States. We hope that you will do the same with your networks.

I look forward to our conversations on this vital topic and the insights this esteemed group of graduate leaders will share with us over the next two days. The Global Summit itself is a site of transnational collaboration and I hope our discussions over the next few days are testament to the value of these partnerships in solving pressing global issues.

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[1] *More information about this program can be found in an Inside Higher Ed profile published in 2023: https://www.insidehighered.com/opinion/career-advice/2023/11/30/introducing-transdisciplinary-cohort-model-grad-students-opinion.*

I.

LOCAL, NATIONAL, AND REGIONAL PERSPECTIVES ON TRANSDISCIPLINARY AND TRANSNATIONAL RESEARCH

TOWARDS COMPREHENSIVE AND MULTI-, INTER- AND TRANSDISCIPLINARY LOCAL SOLUTIONS TO GLOBAL GRAND CHALLENGES: THE MODEL AND STRATEGIES OF THE UNIVERSITY OF GUADALAJARA

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The University of Guadalajara is the second largest Higher Education Institution in Mexico, composed of a University Network with 19 campuses (University Centers) covering the fourteen Regional areas of the State of Jalisco, with six located in Guadalajara Metropolitan Area (AMG). The University Centers within the state territory are multidisciplinary, and those in the state capital metro area were designed with a multisisciplinary approach. Nevertheless, in the last three years, there has been a transition process in the traditional disciplinary University Centers to develop the substantive activities of a multi, inter, and transdisciplinarity nature, driven by the General Administration and through the Agreement proposed in 2022 by the President of the University, Dr. Ricardo Villanueva Lomelí.

The University Centers have been catalyzers of regional development, fulfilling the social responsibility of public higher education that refers to the formation of talent, considered a primary element for regional and national competitiveness, and is considered a crucial indicator to measure the development of countries and regions (Huang et al., 2023). A diverse and robust supply of postgraduate programs with context-based elements also has a regional spread, representing 21% of the total postgraduate enrollment of the scholar year 2023-2024. Moreover, more than half of the University of Guadalajara student community comprises youth from the five lower-income percentile households. The regionalization model of the University of Guadalajara is responding to the demand for social justice, equal opportunities, and talent development, representing an essential element of social mobility in the State for three decades from now.

Additionally, with the recent implementation in 2024 of the non-payment of tuition program in postgraduate studies that aims to retain talent and ensure that the payment of tuition does not hinder continuing with their academic careers of advanced studies and research training, the University educational model and academic programs have contributed to reducing educational and economic inequality, one of the major challenges towards 2030 and beyond, as stated by UNESCO in 2019.

Nevertheless, the University of Guadalajara in 2024 has started a long-term pathway, based on diverse strategies, to advance in consolidating an innovation ecosystem in Jalisco, focusing on regional, economic, and social vocation. The economy of Jalisco presents activities from all economic sectors, and the Jalisco innovation ecosystem, due to the participation of companies and digital enterprises, is considered the most dynamic in the

country. Since 12 years ago, the state Secretariat of Innovation, Science, and Technology has been the leading actor in the construction of the ecosystem, generating financing and relationship support programs focused on creating triple-helix innovation projects with an emphasis on science and digital technology. Companies, governments, universities, and R+D institutions working together on particular projects, achieved by public policy continuity, now present the necessary conditions to move towards an innovation ecosystem model with potential impacts on economic growth and social development.

We conceive the Ecosystem Innovations as the definition of Vasconcelos et al. [2018] configured as a co-creation [a form of collaborative innovation since ideas are shared and significantly improved] or the joint creation of value, composed of interconnected and interdependent networked actors. This approach implies that the ecosystem consolidation is based not on the number of patents achieved but on the quantity and quality of communication and interactions among the innovation network members.

Recently, models of ecosystems driven by the Universities have highlighted crucial elements for successful participation, as in the research of Tolstykh et al. [2021], which mentioned the ability to identify the needs of the University in the intersectoral ecosystem as an integrator of knowledge, as well as the goals, objectives and functions of the University from the point of view of the effectiveness of development strategies both for the individual actors of the ecosystem, as well as the framework of interaction between industries. Some other factors stated by Guerrero [2022] are the importance of relational talent, the density of researchers, entrepreneurs, and facilitating institutions, among others [Guerrero, 2022].

Regarding the density of researchers element, the University of Guadalajara has more than 2,100 researchers recognized by the National System of Researchers of the , being the public University with the highest number of scholars with this recognition, only below the National University of Mexico [UNAM]. Since 2015, there has been an increase in experiences in the development of research that has obtained intellectual property, some brought to market or that are in experimental phases for that purpose, offering solutions for relevant problems in health, biotechnology, and sustainable solutions.

However, to date, some other vital elements still need to be present in a structured and continuous way to achieve the established objective of contributing to the consolidation and growth of a regional innovation ecosystem in the State of Jalisco. Therefore, next, we present the strategies and actions that have or are to begin.

1- Networking strategies for the generation of long-term collaborative relationships.

1.1—UDG Synergy Network. Its objective is to enhance communication and relations with sectors outside the University.

1. **Informal Networking Events.** During September, we organized the first activity for this purpose. It was organizing a dinner to which we invited business people. We choose three types of companies: First, those with

whom research has developed solutions for particular problems; Second, those with whom we are in conversations to define the technology to develop. Third, entrepreneurs with whom we would like to collaborate to offer solutions based on science and technology. During the dinner, entrepreneurs, researchers, and heads of laboratories, institutes, and research centers in areas related to the activities of the invited companies had the opportunity to meet and share the research services that the University can offer, as well as the needs of companies. The results were encouraging, as there was a significant response from the business sector. All participants shared the importance of generating these spaces and their interest in attending upcoming events.We aim to construct long term relationships, based in trust, with the business sector.

2. **..Study of Prospective local challenge**s and interaction with local leaders in Jalisco regions. Its first purpose is to identify, from the regional leaders' view, the relevant issues with a 15-year perspective at the regional level and the need to train specialized profiles that contribute to the proposal and development of solutions. Based on the results, elements will allow evaluation of the social pertinence of the postgraduate programs offered in the regions and the relevancy of opening new programs. This study started at the beginning of October, and a pilot test of the methodology will be carried out in 3 state regions this year.

1.2—**Ciencia en RED UDG (UDG Network Science).** Interdisciplinarity and Transdisciplinarity approaches among scholars of the University Network. Its objective is to create meeting spaces between researchers of the University Network, promoting dialogues from a perspective of proposing comprehensive solutions to relevant problems instead of dialogue from the disciplinary perspective. It is an effort to promote the initiation, development, or consolidation of multi-, inter-, or transdisciplinary research.

1. **Research communities.** This activity is about to be developed. Groups of researchers will gather around a great challenge to be solved in the State or its regions. A laboratory, center, or institute will be the leader, with the participation of others, defining research agendas for the proposal of solutions. Some proposed research communities are: Cities, food security, Artificial Intelligence, Education, One Health, Inequity, Inequality and Poverty, Violence and Peace culture, and Solutions for sustainability.

   a. The approach focuses on the problem and addresses the disciplinary contribution needed for problem-solving.

   b. Collaboratively and collectively identify the frontier of knowledge in the different scientific approaches that will help to evaluate the scientific pertinence of the graduate programs curricula and research protocols.

2. **Meeting of Laboratories, Research Centers, and Institutes.** In the third week of September 2024, we organized the First Meeting of Laboratories, Institutes, and Entrepreneurship Centers of the University of Guadalajara. Its objective was to present to the University Network

community the installed capacity for research they have and present the research and research services they develop. The intention is to encourage and generate spaces for the collaboration of multi, inter, or transdisciplinary research, using the academic strengths and laboratory equipment, software, and machinery existing at the University.

3. Design of an online double digital campus to facilitate intra-collaboration among the University Network community and collaboration with external actors through the visualization in real-time of researchers' profiles, laboratory services, and research in the process.

1.3—**Flexibilization of Postgraduate Programs.** All the following strategies are in the stage of analysis and proposal construction.

1. Generate analysis and reform of normative documents governing the constitution of curricula for undergraduate and postgraduate programs. The main aim is to consolidate curricula for different levels of higher education programs. In this way, revalidation and more organic transitions from undergraduate to graduate education could be allowed, resulting in time savings for students when concluding their programs.

2. Analyze the viability of creating professionalizing doctoral programs based on research and incidence, with a solid and close linkage with industry.

3. Generate online platforms with an "engage at scale" focus for graduate programs.

2- Strategies for integration and dissemination of knowledge

2.1—**Foro Ciencia UDG.** In 2024, we will hold the third edition of this Forum, whose objective is to disseminate the contributions of knowledge, science, and technology generation of our scientific community, as well as a meeting point with the main actors in the development of science and technology in the State and the country. This year, we will have the presence of Dr. Morten Peter Meldal from the University of Copenhagen, a Nobel Prize Laureate in the chemistry of the year 2022, for his contributions to "click chemistry."

2.2—**Ciencia UDG Kids.** Its purpose is to promote scientific vocations from an early age and the dissemination of inventions by our researchers in simple language and in a playful way. A platform was generated with characters aimed at children, each representing a scientist in different areas of knowledge (Social, Behavioral, Engineering, Natural sciences, and the traditional and ancestral knowledge of native peoples).

Conclusion

To face the grand challenges at the local and regional level in the State of Jalisco, comprehensive, inter, and transdisciplinary solutions can be enriched from the most active and decisive participation of the Universities, and in a notable way by the University of Guadalajara due to its reach and influence at the regional level. The strategies designed and initiated in 2024 by the University of Guadalajara contribute to the following elements, identified as crucial factors to generate a significant impact on the success of organizational design for the consolidation of innovation ecosystems:

Relational talent, number of researchers, entrepreneurs, and facilitating institutions, [Guerrero, 2022], infrastructure [Appioa et al., 2019], and exploration and diffusion of success stories [Giffordun et al., 2021].

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TRANSNATIONAL RESEARCH: A EUROPEAN NORMALITY

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Transnational research and research funding in Europe

Research has always been of top priority on the agenda of the European Union [EU]. In one of the EU's core treaties, we find the following statement: "The Union shall have the objective of strengthening its scientific and technological bases by achieving a European research area in which researchers, scientific knowledge and technology circulate freely, and encouraging it to become more competitive, including in its industry, while promoting all the research activities deemed necessary by virtue of other Chapters of the Treaties." The concept of a "European Research Area" [ERA], formally introduced in 2000, is aiming at increasing the competitiveness of European research institutions by bringing them together. Consequently, the DNA of European research funding, organized in Framework Programs and comprising various different funding formats, is collaboration across borders, i.e. transnational research.

The volume of the Framework Programs has continuously increased – from 3.8 bn € in FP-1 [1984–1987] to 95.5 bn € in FP-9 [2021–2027]. While most of research staff funding means positions for doctoral candidates at the end of the day, there are also formats particularly addressing doctoral training. A prominent example are the Doctoral Networks, a funding line within the Marie Sklodowska-Curie Actions [MSCA]: "The objective of Doctoral Networks is to implement doctoral programmes by partnerships of organisations from different sectors across Europe and beyond to train highly skilled doctoral candidates, stimulate their creativity, enhance their innovation capacities and boost their employability in the long-term".

Beyond these activities of the European Commission, there are also bi- or multilateral collaborations of national funding agencies. Those can happen either in a more formalized way. The DACH [D/Germany | A/Austria | CH/Switzerland] agreements of the German Research Foundation [DFG] and its Austrian and Swiss counterparts, e.g., simplify the reviewing of respective cross-border proposals [roughly speaking, one agency is in the lead and organizes the reviewing, and the other agencies just accept the outcome and, if applicable, provide the funding for "their" applicants]. Or it can happen in an ad-hoc way. For example, there was a German-French-Japanese program on Software for Exascale Computing a few years ago, where DFG and partner agencies from France and Japan agreed on a joint venture.

A further key component of transnational university collaboration across Europe are university alliances. Examples are LERU [League of European Research Universities; 24 members] or CESAER [Universities of Science & Technology; 58 partners].

In addition to ERA, the European Commission has established the "European

Education Area" (EEA), hoping to improve education and training as well as collaboration on education topics across Europe. One of the European Commission's most prestigious calls within the EEA for proposals to establish ambitious European university alliances over the next few years is the "European Universities Initiative" that aims to make the European university landscape even stronger in the fierce competition with the USA and Asia.

The TUM perspective

Technical University of Munich (TUM) is among the leading universities in Germany and Europe. TUM is very active and successful in obtaining European funding – be it via the Framework Programs depicted above, via the European Institute of Innovation and Technology (EIT), or, in the form of individual grants, via the European Research Council (ERC).

The TUM Graduate School (TUM-GS) was founded in 2009 as the general hub for doctoral education university-wide, across all scientific domains. Since 2014, TUM-GS membership of our new doctoral candidates has been mandatory, such that we do have an almost 100% coverage now. Currently, there are more than 10,000 doctoral candidates enrolled, coming from more than 110 different countries (China, Austria, Italy, India, and Iran being the top 5 in numbers). Overall, 31% of our doctoral candidates represent another nationality than German. The TUM-GS model of doctoral education comprises five layers: individual research (the core) | subject-specific training | transferable skills training | international research phase | career support. This shows the crucial role international experiences play in our system.

Alliances – EuroTech. With respect to European university alliances, TUM is a member of EuroTech. EuroTech is an alliance of six universities of science and technology: DTU (Lyngby, Denmark), EPFL (Lausanne, Switzerland), TU/e (Eindhoven, Netherlands), IPP (Paris, France, the former l'X), Technion (Haifa, Israel), and TUM. Formally established in 2011 by, then, four partners, EuroTech is a strategic partnership to build a strong, sustainable, sovereign, and resilient Europe. The partners joined forces to accelerate their research in high-tech focus areas and advocate for change through dedicated partners and a strong presence in Brussels. Within EuroTech, the Graduate Deans' Group is a very active component, meeting once a year to foster exchange among the different doctoral systems and structures, to increase research collaboration and mobility of doctoral candidates within the Alliance by aligning IP regulations & legal requirements, joint doctoral qualification, and mobility schemes, and to discuss recent developments in graduate education and align university positions.

Within EuroTech, a couple of signature joint qualification and mobility schemes have been established: (1) an (extended) Joint Supervision Program (two or more partners involved | at least six months at partner institution(s) | tuition fee waiver and full access to research and support infrastructures | access to and recognition of qualification elements taken by the candidates during research placements by their home institution | joint examination committee | degree awarded by home institution only, plus additional certificate); (2) a joint course database with full visibility and access; (3) joint PhD summer/winter schools (initiative of doctoral candidates | one host institution, organizers from several partners | training and networking designed by candidates for candidates); (4) a EuroTech postdoc initiative

(postdocs spending time at two partner universities at least | co-funded by the EU and the partners).

EuroTeQ—The Engineering University. Within EU's "European Universities Initiative", the EuroTech group with additional partners (HEC Paris, IESE Business School Barcelona, Tallinn University of Technology, and Czech Technical University Prague) developed the concept of an engineering university of the future, where also 45 partners from industry and society are involved. Within EuroTeQ, which is now one among 64 such "European Universities" projects, several signature measures have been implemented, and two of them shall be mentioned here: (1) Micro-credentials (take advantage of additional, interdisciplinary, short learning opportunities in a flexible way, provided by teachers from all partner institutions for students from all partner institutions); (2) EuroTeQ Collider (the heart of the joint initiative | students, trainees in technology-related professional fields, and stakeholders from society and industry come together to develop concrete approaches to solving current problems | takes place in the form of project weeks, running at all partner universities at the same time | the various projects developed will be presented in a public EuroTeQaThon event).

Strategic Partnerships—TUM-ICL. Another instrument for intensive transnational collaboration are bi-lateral strategic partnerships. Here, one of TUM's strategic partners is Imperial College London (ICL), and one joint activity with ICL is the Joint Academy of Doctoral Studies (JADS): one cohort of about 5 collaborative research projects (at least one doctoral candidate on each side) per year | new research theme every year to foster research collaboration across multiple strategic research collaboration fields | joint qualification elements (coursework, training) besides joint academic supervision of the research project; regular funding for doctoral candidates (research staff position and/or scholarship) for 3-4 years provided for participating research groups, in addition to mobility funds for research stays at the partner institution. A second example is the Global Fellows Program, a well-proven interdisciplinary program designed by ICL and organized with different university partners around the globe, here with TUM and NTU Singapore. The 5-day transferable skills training program for 40-50 participants focuses on the development of collaborative interdisciplinary competencies and intercultural awareness required to establish new or continue successful collaborations. Participants will engage in intercultural and interdisciplinary discussions under a changing annual theme and will develop creative innovations to address global challenges under the respective theme (2023: Data for Sustainability; 2024: Data-driven Innovations for Zero-pollution Mobility).

Conclusion

The European research landscape has been built on the idea of transnational collaboration, designed to complement the existing national research activities and funding schemes. Since doctoral projects are at the heart of research at universities, the formats available offer a lot of opportunities in the context of doctoral research and education, both at the institutional and at the individual level.

LOCAL, REGIONAL, AND NATIONAL PERSPECTIVES ON TRANSDISCIPLINARY AND TRANSNATIONAL RESEARCH: EXAMPLES AT TULANE UNIVERSITY

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Background on Tulane University

Tulane is a private research-intensive university located in New Orleans, LA, USA. The location of the university highly impacts research ideas, programs, and activities. As one a leading research university in the region, Tulane has significant research opportunities at the local, regional, national and international geographic areas. We were founded as The Medical College of Louisiana in 1834 to train New Orleans doctors in the fight against yellow fever and cholera, Tulane has a long history at the forefront of groundbreaking research. We use a motto, "Of New Orleans, For the World" to convey the university's sentiments. Tulane has a rich legacy, and yet its story is still being written. Ours is a passionate, tight-knit community where our differences make us stronger, and our culture inspires us to celebrate life. Tulanians lead with confidence, humility — and spirit.

History of Graduate Education at Tulane.

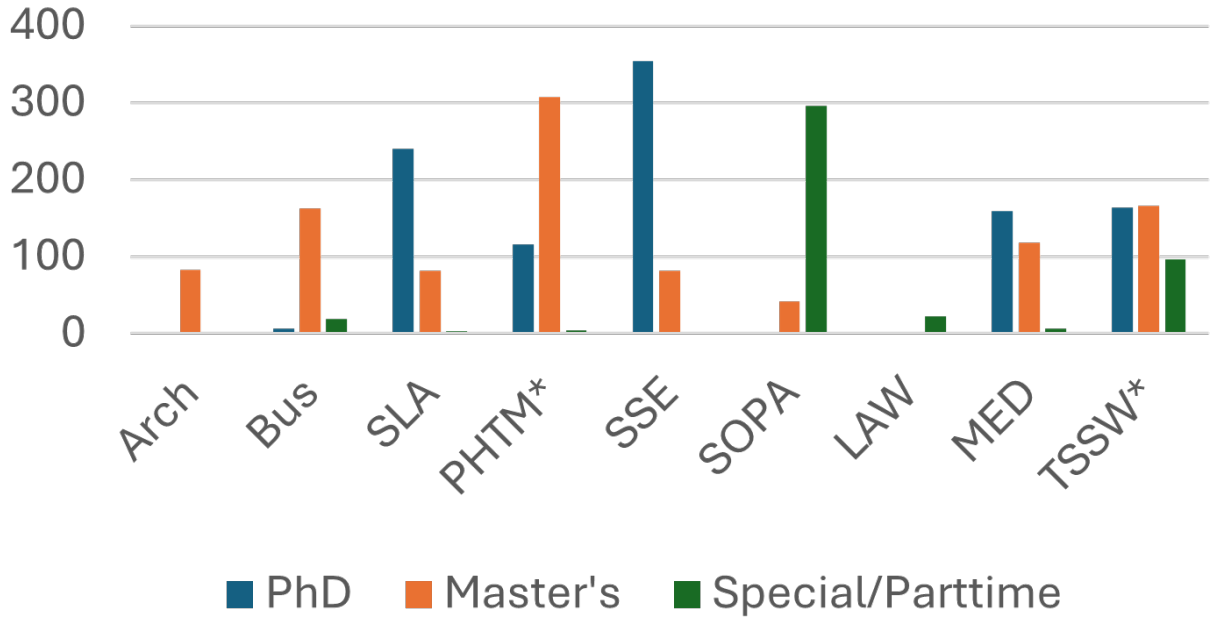
Graduate education has always been an important component of Tulane's core identity. In fact, the university was founded as a public institution named the Medical College of Louisiana in 1834. One of the founding purposes of the university was to serve the expanding region of New Orleans and Gulf Region. At its founding, the New Orleans' region had a surge in yellow fever beginning in 1817. The Medical College of Louisiana brought together top scientists to address these challenges. In 1847, the Law School was opened, which made the university a "comprehensive" institution and it was renamed as the University of Louisiana. Tulane became a private university in 1884 when the public University of Louisiana was reorganized and named in honor of benefactor Paul Tulane. This reorganization allowed undergraduate male students to be admitted. This reorganization allowed undergraduate male students to be admitted. Females were first admitted in 1886 when H. Sophie Newcomb College for Women was established as a part of Tulane University. The following year a graduate division was established in 1885 to oversee a growing number of graduate programs. A formal graduate school was established in 1925.

Graduate education continued throughout the years with a vibrant graduate school. All of this changed in the aftermath of Hurricane Katrina. Gibbons [2019] explains, "Hurricane Katrina was the costliest storm in U.S. history, and its effects are still felt today in New Orleans and costal Louisiana." Tulane was forced to close its campus for the first time in the history of the

university. Students went to colleges and universities all over the United States. During the Fall of 2005, Tulane's Board of Administrators met with former President Scott Cowen and a group of higher educational leaders to decide how Tulane would come back and retain its stature as a major Research 1 institution. Scott Cowen (2007) explains, "In December 2005, we undertook the largest restructuring of an American university in over one hundred years. The objectives were to save the institution financially and to better position it for an academic recovery in the future. Both objectives had to be met, but the financial restructuring was absolutely essential because of our projected losses. The university was projected to lose on an ongoing basis, $75 million per year. The revenue base went down, and there was no way to close the gap. The only option was to reduce the costs (p. 9)." As a result of the university's restructuring, the Graduate School was closed in 2006. With the renewal plan of the university in 2006, all graduate program administration returned to the respective academic schools. The deans of these schools now administer graduate programs.

It took 2 years before the Office of Graduate and Postdoctoral Studies (OGPS) opened to serve the functions of the former Graduate School. The purpose of OGPS is to serve and support all masters, doctoral, and postdoctoral scholars in the School of Liberal Arts, School of Science and Engineering, School of Medicine' Biomedical Sciences as well as Ph.D. students in the School of Public Health and Tropical Medicine and the A.B. Freeman School of Business. OGPS advances graduate education and enhances graduate training programmatic oversight, policy development, and the implementation of career and academic workshops. OGPS is housed under the Office of Academic Affairs and Provost and is overseen by the Associate Provost for Graduate Studies and Research. The office includes three fulltime staff members (e.g., Assistant Director, Sr. Academic and Career Advisor, & Administrative Program Coordinator.

Current Graduate Education at Tulane



During the 2023-2024 academic year, graduate students (e.g., PhD & masters) comprised 24.22% of the university's total population. Professional students (e.g., MD & JD) comprised 10.60% of the total student population. As indicated in Table 1, out of the 9 schools that offer graduate education at Tulane, the largest percentage of PhD students are in the School of Science and Engineering (SSE).[1]

Over the last 5 years, the total enrollment in SSE has consistently been in the n = 500 range. Specifically, the total SSE enrollment in n = 498 in 2019, n = 520 in 2020, n = 481 in 2021, n = 479 in 2022, n = 478 in 2023 (see the graph on the preceding page).

The programs included in this proposal have strong and growing numbers of PhD students. Earth and Environmental Sciences (EES) enrollments are consistent (e.g., n = 25 in 2019, n = 30 in 2020, n= 32 in 2021, n = 29 in 2022, & n = 24 in 2023. The cohort of students in Physics is n = 37 in 2019, n = 30 in 2020, n = 25 in 2021, n = 19 in 2022 and n = 20 in 2023. The PhD cohort in Materials Physics & Engineering is steadily growing from n = 3 in 2019, n = 9 in 2020, n = 14 in 2021, n = 15 in 2022, and n = 14 in 2023.

Local Research Initiatives

Research impacting the local geographic area are exemplified in several schools. The most prominent initiatives are interdisciplinary and operate across units. For example, The Violence Prevention Institute is an equity-focused research, training, and advocacy hub that supports communities in addressing systemic, structural, and interpersonal violence. While housed in the Tulane University's School of Public Health and Tropical Medicine, the Violence Prevention Institute is an interdisciplinary endeavor bringing together other social scientists, physicians, nurses, health care workers, mental health professionals, educators, and any community member interested in violence prevention. Similarly, the School of Social Work uses a statement, "Do Work That Matters!" The school offers degree programs that incorporate equitable approaches to learning, evidence-based practices, and contemporary research topics that provide you with a solid foundation to improve the lives of individuals and families in your community and beyond. The School of Liberal Arts embraces their dual identity as a research intensive unit with a liberal arts touch. Best-selling author and School of Liberal Arts Professor, Walter Isaacson states, "The next advances of the world will come from people who are able to link beauty to engineering, humanity to technology and poetry to processors." This interdisciplinary theme is highlighted in university-wide institutes such as The Brain Institute. Research at the Tulane Brain Institute is centered around research themes built on identified strengths that are advanced by transdisciplinary teams made up of Brain Institute faculty, postdocs, and students from across the University. Themes are supported through investment in infrastructure and programmatic initiatives with the goal of developing physical and intellectual clusters of research excellence (e.g., memory & cognition, neurodegenerative disease, neural injury, and repair, hormone-brain interactions, and body-brain health).

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[1] *Arch – Architecture, Bus – Business, SLA – School of Liberal Arts, PHTM – Public Health and Tropical Medicine (PhD & DrPH), SSE – School of Science and Engineering, SOPA – School of Professional Advancement, Law – Law School, MED – School of Medicine, TSSW – School of Social Work (DSW)*

National Primate Research Center

The Tulane National Primate Research Center (TNPRC) improves human and animal health through basic and applied biomedical research. As one of the seven National Primate Research Centers in the U.S. that if primarily funded by the National Institute of Health, the TNPRC is committed to discovering causes, preventions, treatments, and cures that allow people around the world to live longer, healthier lives. Primary research interests include developing vaccines, treatments, and diagnostic tools for infectious diseases such as AIDS, COVID-19, Lyme disease, tuberculosis, and emerging infectious diseases. Research at the Tulane National Primate Research Center focuses on understanding infectious and chronic diseases that require the use of the nonhuman primate model. Over the past 60 years, the primate center research has grown to meet the research needs for our nation's most pressing human health problems. It has become a premier infectious disease research facility with an economic impact estimated at $70.1 million each year.

Roger Thayer Stone Center for Latin American Studies

The Stone Center coordinates the research and teaching activities of over 70 core faculty and 35 affiliated faculty and adjuncts in schools and departments across several Tulane campuses. Except for the professional schools, this is the largest number of faculty associated with any department or program of the university. The Center comprises a diverse group of scholars representing many disciplines and points of view drawn together by our common interest in Latin America. The Center's principal purpose is to promote, sustain, and encourage research and teaching of Latin American Studies primarily at Tulane University. The Center upholds a very broad definition of Latin America including geographic locations, disciplines, political and ideological perspectives. The Center fosters a community of scholars representing a broad spectrum of ideas, interests, disciplines. The Center has done much to encourage an interdisciplinary approach to Latin American Studies, and provides a model of a true interdisciplinarian spirit. The Center is an integral part of the International Latin American Studies community. The Center educates the university community about the multicultural and multi-faceted importance of Latin America and makes this importance felt in the community at large. The Center initiates or encourages new projects involving Latin America. The Center coordinates the training of students in Latin American Studies.

The presentation will highlight recent themes that distinguish Tulane as international institution with a local touch. For example, more recently, the U.S. President, Joe Biden and First Lady, Jill Biden visited Tulane to announced nearly $23 million for Tulane to develop revolutionary cancer "moonshot project." The goal is to create a machine-learning-assisted imaging system capable of identifying even the tiniest remnant of cancer during surgery. The project is one of eight included in a $150 million funding effort to develop novel technologies that will allow surgeons to remove cancerous tumors with higher accuracy. If successful, these technologies will revolutionize surgeries, dramatically reducing rates of repeat procedures. Tulane's portion of the Biden Cancer Moonshot project is funded with an award of up to $22.9 million from the Advanced Research Projects Agency for Health, also known as ARPA-H, a federal funding agency established by the Biden Administration

in 2022 to rapidly advance high-potential, high-impact biomedical research. Another significant project is associated with Psychology professor, Stacy Overstreet. As a School Psychologist, she oversees a project called “Safe Schools NOLA,” which is a trauma-informed approach in schools that reflects a national movement to create educational environments that are responsive to the needs of trauma-exposed youth through the implementation of effective practices and systems-change strategies. The goal of the National Institute of Justice-funded Safe Schools NOLA project is to determine whether a multicomponent implementation strategy including professional development in trauma-informed care, on-site consultation in the use of trauma-informed strategies, and technical assistance for system-wide adoption of trauma-informed approaches improves school safety by aligning staff attitudes, beliefs, and behaviors with a trauma-informed approach.

GRADUATE RESEARCH AS A RESPONSE TO THE CHALLENGES OF THE STRATEGIC NATIONAL PROGRAMS IN MEXICO

Erick Sánchez Flores

President, Consejo Mexicano de Estudios de Posgrado A.C. [COMEPO] [Mexico]

Graduate education, focused on research, can provide elements to address the major challenges we face as a society. The major social, economic and environmental problems that afflict the world today have a complex and multidimensional character that requires transdisciplinary approaches to find innovative solution to generate a true social impact. Social innovation, which implies new institutional arrangements and new forms of resource mobilization to produce responses to problems, generates social impact through its implementation and leads to long-term changes in the well-being of society, through the creation, dissemination, use and appropriation of the products generated by scientific and technological activities. Thus, research that produces innovations represents an initial push to generate social impacts. Graduate research allows for innovative approaches to these problems and has the potential to trigger solutions to improve the social reality of their contexts.

The transformation of social realities towards more just forms, as well as the systematic efforts to end poverty, inequalities, adaptation and mitigation of the effects of climate change, the productive reconversion towards sustainable technologies, and the universal access to safe living conditions for vulnerable populations, are some of the main challenges that require comprehensive attention. Educational institutions and particularly their graduate programs play a leading role by being co-participants in the creation of these transformations towards more just, sustainable, inclusive and equitable social realities. Graduate programs are therefore active agents of social innovation by proposing changes in public policies that seek the benefit of society based on the results produced by research.

To promote the development of research for the solution of major social challenges from the graduate studies, the Mexican Council of Graduate Studies [COMEPO] undertook the task of identifying and awarding the best theses that address complex problems of global impact through the Strategic National Programs [PRONACES]. Thus, in 2023, it launched a call for graduates from educational institutions and Research Centers in the country to submit their theses to the "COMEPO Award for graduate theses for innovation and social impact in Mexico." This award seeks to recognize theses that present innovative solution to address national and regional problems and challenges, with the potential to generate social impact. In addition to recognizing these works, the award seeks to make the winning research visible disseminating its findings and bringing its results closer to social actors interested in solving the target problems.

The first edition of the COMEPO Award focused on the second of the PRONACES, which represents a challenge of vital importance at the

international, regional, national and local levels: Water. Due to the complex interrelations of the factors that intervene in the socio-natural cycle of water, its management today faces various problems such as the environmental deterioration of the basins, pollution and poor comprehensive water-environmental management. Guaranteeing the human right to water is a major challenge that requires a transdisciplinary perspective to offer innovative solutions. In this edition, the problem of water was addressed from the perspectives of 15 doctoral theses and 17 master's theses, which were evaluated by two national scientific committees, one specialized in the topic of water and the other specialized in innovation in social impact. The winning theses proposed solutions to the problems of water quality and contamination, integrated management of water resources, territorial planning in hydrological basins, equitable access to water, and community participation in improving water management and sanitation.

In the second edition, the award focused on the PRONACE Energy and climate change, in response to the urgent need to act from all areas to address the serious environmental crisis related to climate, which threatens the viability of society and is largely derived from the excessive use of fossil fuels. The effects of this crisis are particularly damaging for vulnerable populations since their design and adoption schemes for sustainable energy technologies and adaptation schemes are generally insufficient or ineffective. In this context, one of the central premises of this PRONACE is to promote scientific approaches that build energy schemes that recognize the biophysical limits of the country and develop alternatives appropriate to the diversity of biocultural contexts, to achieve a sustainable and equitable energy system in Mexico. Ten doctoral theses and 16 master's theses were submitted to this call, addressing the topics of sustainable energy as a link between mitigation and adaptation to climate change, fair energy transition, governance for the energy transition, social strategies for the installation of clean energy, and linkages between energy, climate change and gender equity.

With this exercise, COMEPO has planted an initiative that seeks to contribute through the dissemination and recognition of graduate research contributions to the solution of major social transdisciplinary challenges.

DUAL DEGREES, DUAL BENEFITS: THE IMPACT OF FRANCE-QUÉBEC COTUTELLES ON INTERNATIONAL GRADUATE STUDIES

Philippe-Edwin Bélanger

President, Canadian Association of Graduate Schools [CAGS] [Canada]

Cotutelles play a key role in promoting international academic cooperation, especially between the Canadian province of Québec and universities in France and Belgium. These agreements not only support collaborative research efforts but also facilitate the global exchange of knowledge. By allowing PhD students to be supervised jointly by institutions in different countries, cotutelles strengthen academic ties and contribute to a more diverse educational experience.

INRS: A model for international cooperation

The *Institut national de la recherche scientifique* [INRS] stands apart from traditional universities due to its focus on applied and fundamental research at the graduate level. This emphasis aligns with Québec's goals for economic, social, and cultural development, and promotes the transfer of knowledge across various sectors.

A notable feature of INRS is its multidisciplinary approach, with research organized through specialized centers rather than traditional academic departments. This structure fosters collaboration across different fields of study, helping INRS build strong relationships with international partners. Additionally, INRS is dedicated solely to graduate-level education, which allows the institution to focus on producing advanced expertise in targeted research areas. This unique approach enhances its attractiveness for academic collaborations, as international institutions seek out INRS for its focused research programs and advanced infrastructure.

Strengthening Cooperation: France, Québec, and Belgium

The partnership between Québec and France dates back to the 1960s, formalized by the creation of the Commission permanente de coopération franco-québécoise in 1965. More recently, this cooperation has been extended to include Belgium, with a framework for academic collaboration established in 2018. This collaboration has led to many academic exchanges, particularly at the graduate level. Cotutelle agreements have been a central feature of this partnership, with hundreds of joint PhD programs now in place. These agreements provide students the opportunity to be supervised by faculty at both Quebec and French universities, thereby enriching the research environment for each partner.

The addition of dual-degree master's programs has further strengthened these relationships. Unlike cotutelles, which are often initiated by individual students, dual-degree programs are formalized agreements between institutions. They provide students with the chance to earn degrees from both their home institution and a partner university, enhancing their academic and

professional credentials.

Opportunities and Challenges

Although cotutelles and dual-degree programs offer significant benefits, they can be difficult to establish due to differences in academic regulations and administrative procedures between institutions. Setting up these programs requires careful coordination to ensure that students meet the requirements of both universities. However, despite the challenges, these programs create valuable opportunities for student mobility and transnational collaboration.

For institutions, cotutelles and dual-degree programs offer an opportunity to enhance their international reputation and build academic networks. By participating in these programs, universities can attract top-tier students and researchers from around the world, contributing to a dynamic and collaborative academic environment. Collaborative projects supported by cotutelles and dual degrees also encourage the development of new research areas and can lead to increased funding opportunities for international research.

Conclusion

In conclusion, the longstanding partnerships between the Canadian province of Québec, France, and Belgium have facilitated the development of cotutelle PhD programs and dual-degree master's programs. These academic collaborations support student mobility, foster cross-border research, and contribute to the global exchange of knowledge. Although setting up such programs can be complex, the significant opportunities they create for both students and institutions make these efforts worthwhile. By promoting international cooperation, cotutelles and dual degrees help build stronger academic networks and enrich the educational experience for students in Québec and beyond.

TOWARD TRANSDISCIPLINARY/TRANSNATIONAL GRADUATE EDUCATION – A MULTI-LEVEL PERSPECTIVE FROM CHINA

Wei Yang

President, Association of Chinese Graduate Education [China]

Introduction and Basic Data for Graduate Education in China

In China, one nation-wide goal is to build world-class universities. The so-called “C9” was founded in 2008, at a conference hosted by Zhejiang University. All 9 universities are currently ranked within the top 100 in the world. The mission is largely driven by the surge of graduate education, concerning both the increase on quantity and quality. The data indicate that the number of awarded degrees correlates with the scholarly output in China, as shown in Fig. 1 [1]. The current enrollment of graduate students exceeds 4 million, in contrast with only 300,000 in the year 2000. The quality of graduate education is improved by two factors, one lies in a closer linkage with the economic/societal development in China, attributed to the transdisciplinary education out of the ivory tower, while the other is the network formed by transnational education. The latter can be summarized by a circulation model: capable and mission-inspired students first receive domestic, and then oversea education. The oversea graduate students are branched by a sensible partition. Some of them return to the homeland, and many of the returnees are employed by the domestic universities. They cultivate new graduates, and send some of them oversea again. For those remain in oversea and reach the status of university faculties, they receive the home country graduates and continue the cycle. The number of Chinese

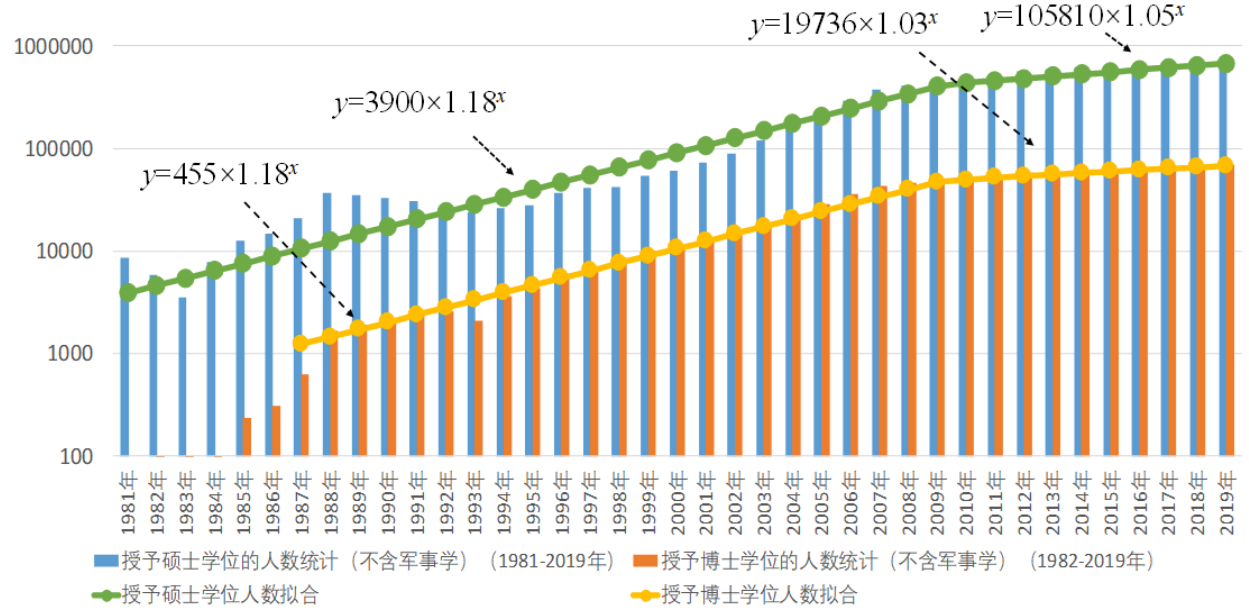

Fig. 1. Degrees awarded from the mainland of China.

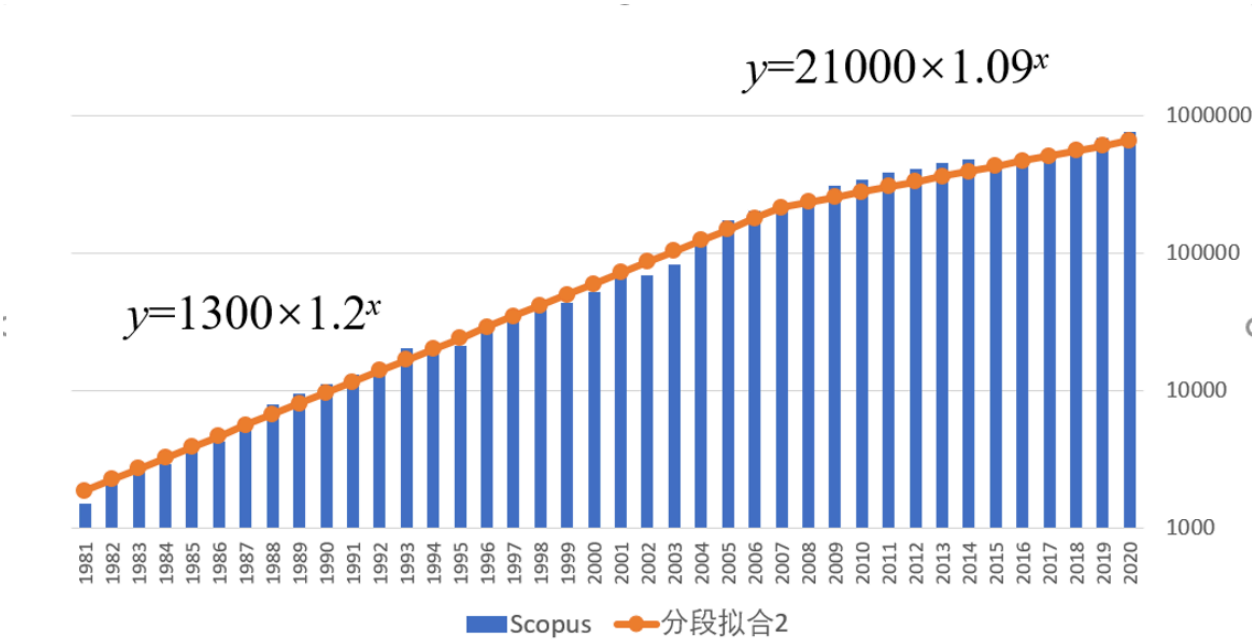

Fig. 2. Scholar output from the mainland of China.

studying abroad is at the level of 800,000.

Transdisciplinary/Transnational Education for My family

I would like to exemplify this approach from a multi-level perspective, from my family as the individual level, from my research group as the group level, from Zhejiang University and Tsinghua University as the university level, and finally show some policy development and statistics from the nation level of China. Most of my family members received transdisciplinary/transnational education, and benefitted from those experiences. My father, K.-H. Yang received BS in Zhejiang University, and received PhD from University of Wisconsin at Madison in chemical engineering and later on studied in Moscow for 3 years in petroleum refinery. I studied metal forming [1973-76] at NWPU, and solid mechanics [1978-81] at Tsinghua University for MS, and engineering [1981-1984] at Brown University for PhD. At the different stages of my carrier, I visited and worked in many nations/regions and received 5 honorary doctor degrees, namely Doctor of Engineering at Hong Kong Polytechnic University, 2011; Doctor of Science at Brown University, 2012; Doctor of Law at the University of Bristol, 2013; Doctor of Engineering at Aristotle University of Thessaloniki, 2017; and Doctor of Engineering at Northwest University, 2017. Those experience greatly helped the carriers of my father and myself. My only son Yue Yang received BS from Zhejiang University [2000-04] at thermal energy, MS [2004-07], from CAS at fluid mechanics, and PhD from Caltech [2007-2010] at aeronautics. He also did postdoc at Connell University at combustion, and return to China and work as a faculty member at Peking University for turbulence research since 2013. Through 10 years carrier development, he becomes a full professor and head of School of Mechanics & Engineering Science. All my family realize the

importance of transdisciplinary/transnational education/research.

Transdisciplinary/Transnational Education for My Research Group

I now describe the practice of transdisciplinary/transnational education/ research in my research group, called Yang Group. Through 40 years of my education carrier, I supervised 45 PhD/MS students. Among them, 15 remain in China, without long-time oversea experience. 30 went abroad, with 13 of them returned to China after oversea experience and 17 stayed there. Within those 17, 10 became university faculties. The 28 former students who currently in China, 19 became university faculties, and the other 9 work in industry/finance sector. The 19 university faculties are educating more graduate students, and the academic family tree continues.

For transdisciplinary research, I founded the Center for X-Mechanics at Zhejiang University since 2018. The aim of X-Mechanics is devoted to transdisciplinary research related to mechanics [2]. Especially we focus on four aspects: crossing media, crossing scales, crossing compliance, and crossing cyber/physical spaces.

Transdisciplinary/Transnational Education at University Level

Zhejiang University is a major comprehensive university in China. It is research intensive, the number of graduate students (41000+) exceeds that of undergraduates (26000). I served as the university president from 2006 to 2013, and is a professor and chair of the University Steering Committee since 2013. Zhejiang university puts large emphasis on transdisciplinary research. The Institute of Fundamental and Transdisciplinary Research is established and is headed by the current University President. We construct large research facilities for basic science [3]. The world largest Centrifugal Hyper-gravity & Interdisciplinary Experiment Facility (CHIEF) will soon be completed in my university.

We next take the example of Tsinghua university where I worked for 28 years as a faculty member. Related to a newly established transdisciplinary program Artificial Intelligence, Tsinghua university recently established the School of AI with 50 PIs. The school is complimented by three correlating research institutes to strengthen the research, policy-making and industry applications of AI.

The transnational graduate education has been actively pursued by leading Chinese universities. In collaboration with MIT, Zhejiang university engaged in a joint program to form a new university, Singapore University of Technology and Design (SUTD). Zhejiang university hosted several meetings for international university alliance, such as Association of Pacific Rim Universities (APRU), and I myself served as the Chair of APRU in 2009-2010. Transnational education pilot programs have been carried out through the collaboration with academies, such as TWAS and the Royal Society of London.

Transdisciplinary/Transnational Graduate Education in China

Transdisciplinary education and research came into a fast lane in the past few years. To incubate transdisciplinary research, NSFC launched a new division (the 9th division) of transdisciplinary researches with 4 thrusts. To better harvest the achievement of transdisciplinary research, special measures are taken for the evaluation of transdisciplinary research, such as the grand panel

for national awards, special quotas in the elections of academicians. For sustained development at firmly formed areas of transdisciplinary research, the Ministry of Education set up a new transdisciplinary domain with 6 new programs. They are Integrated Circuits, National Security, Design, Remote Sensing, AI, and Area Studies. The top 34 universities in China now have the autonomy to set their own transdisciplinary programs which can offer graduate degrees.

Open science facilitates the transdisciplinary/transnational graduate education. Two UN STI Forum Side Events were launch in 2022 and 2024, with Wei Yang being the moderator. We proposed an Open Science Readiness

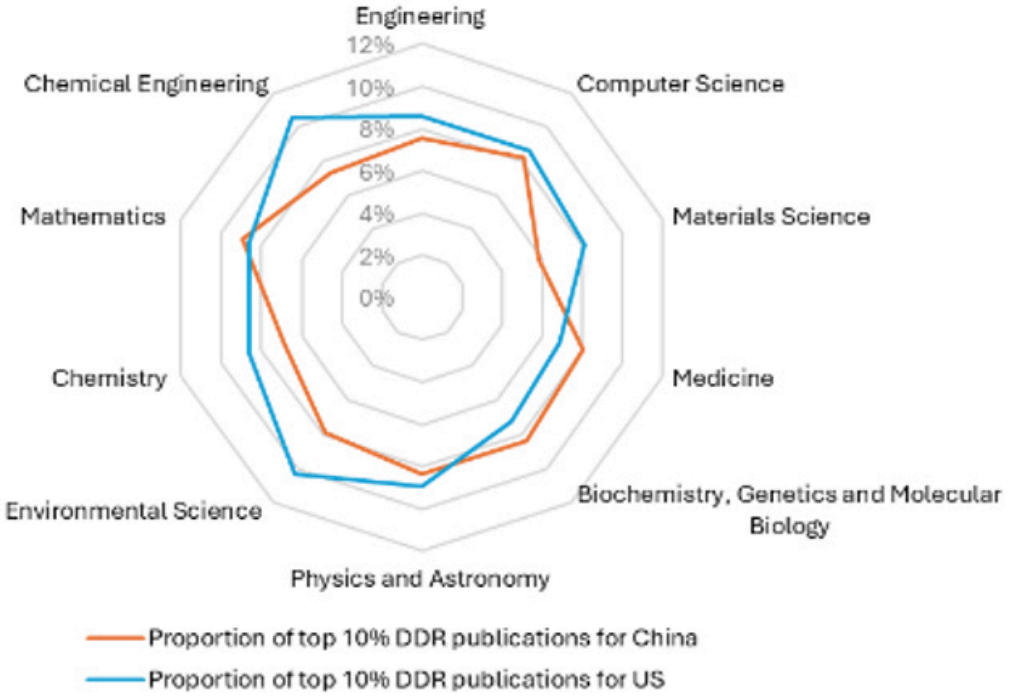

Fig. 3. Disciplinary diversity of references by subject for China and US.

Index (OSRI) to quantify the advancement of open science in different countries/regions, where transdisciplinary/transnational research forms a key factor for OSRI.

The graph above exhibits the disciplinary diversities from China and US, it clearly indicates that the disciplinary diversity from China is lower than that from US, by both reference and author counts. The graph on the next page

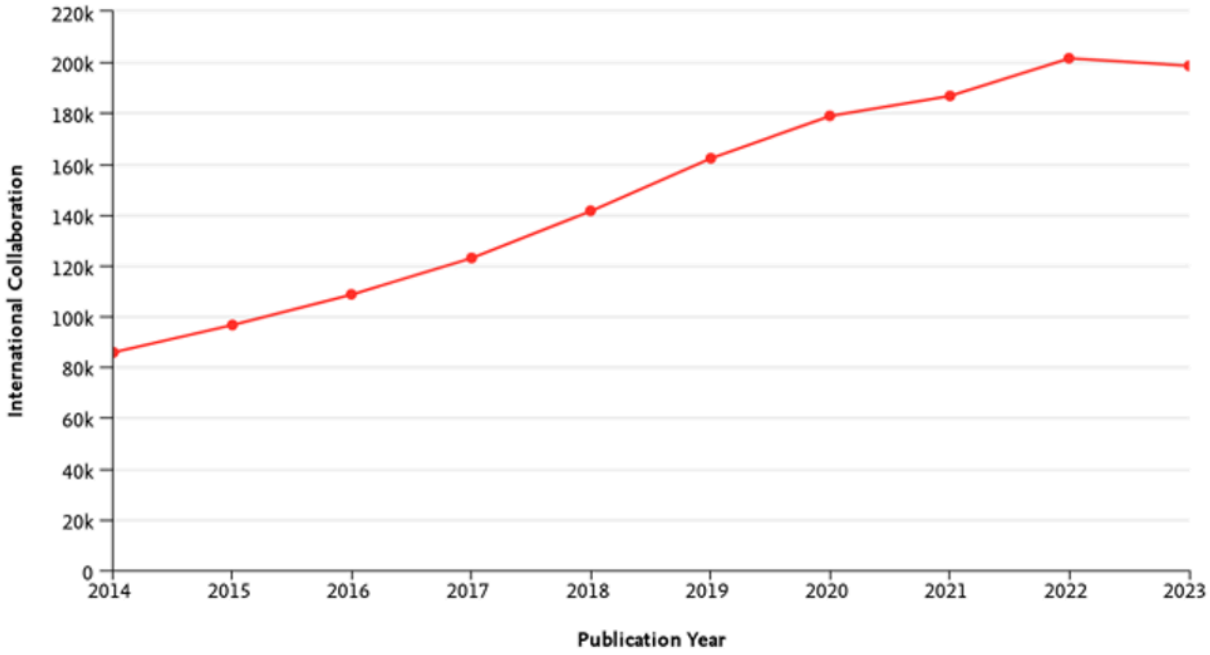

Fig. 4. Research articles from China with international collaboration.

exhibits the research articles from China with international collaboration, it indicates a rapid rising from 2014 to 2020, where 50% from Sino-US collaboration. However, the data started to descend (from percentage to overall number) since 2021.

Conclusions

The essential role of transdisciplinary/transnational graduate education for cultivating talents and leaders in China is examined from a multiple level assessment, with examples given in individual, group, university and national levels. China still needs to increase disciplinary diversities and international collaboration. Open science may facilitate these goals.

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II.

CREATING NEW AND INNOVATIVE MODELS OF GRADUATE EDUCATION

NEW ADMINISTRATIVE MODELS TO SUPPORT TRANSDISCIPLINARY AND TRANSNATIONAL RESEARCH AT CONCORDIA UNIVERSITY

Effrosyni Diamantoudi

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There has been an increasing interest in the creation of interdisciplinary programs in all levels (from Microprograms all the way to PhDs), where their course components span over a few areas typically hosted (taught) by faculty members that belong to different departments. Similarly, supervision is assumed by faculty members belonging to different departments. Challenges around the creation governance and administration of interdisciplinary programs prevent their development, despite the popular demand by students and the labor market. Common current governance structures often require a single or at best a dominant discipline. Resources are typically attributed to units structured around disciplines, making their allocation tricky when collaborations across disciplines are proposed. A discipline neutral zone (such as the school of graduate studies) can offer a home and support to interdisciplinary programs.

Concordia's School of Graduate Studies hosts two such programs, the Individualized PhD program and the newly developed Microprogram on Sustainability. The former gives students the opportunity to design their own research goals in areas not covered by existing graduate programs and explore topics outside the normal boundaries of research and creation. The latter, described in more detail below, is co-taught by 10 faculty members from 4 Faculties. This microprogram forms the first among a group (constellation) of microprograms around sustainability that can be stacked together to comprise a Certificate (15 credits), Diploma (30 credits), Masters (45 credits).

Microprogram: Perspectives on Sustainability (8 credits)

The 8-credit graduate microprogram advances students' knowledge and understanding of sustainability through an interdisciplinary lens. Students examine major issues from a theoretical standpoint, deepen their knowledge through readings, reflection pieces and online discussions, and apply key concepts in the development of their case studies.

Learning outcomes:

By the end of the microprogram, students will be able to:

1. Identify, understand, and critically discuss key issues in sustainability drawing upon the strengths, methodologies, and approaches of multiple disciplines.
2. Demonstrate a practical understanding of sustainability by applying theoretical principles, evaluating complex scenarios, and developing innovative solutions to address the challenges posed by the case study.
3. Communicate findings, analyses, and recommendations clearly and persuasively to a diverse audience with varying levels of disciplinary knowledge.
4. Work effectively in a collaborative setting and develop strategies to estab-

lish networks that will advance their professional goals.

Issues and questions to be covered during the course: sustainable cities (how to accelerate action towards sustainable and zero-emission cities; how to design and implement emission reduction strategies), climate change governance (how do organizations integrate climate change into their risk management and governance) and biodiversity erosion (what is the status of biodiversity in Quebec and Canada; what are the commitments made under the COP15 agreement). Potential avenues for case studies include investigating local biodiversity through citizen science apps.

The program is divided into a lecture component and a practical component. The lecture component extends for one week. Each day focuses on a particular sustainability issue and one or more faculty members address this issue from their various disciplinary perspectives. A course coordinator is responsible for recruiting potential students, helping design the interdisciplinary course, manage the course delivery, and ensure continuity and coherence from lecture to lecture. The course coordinator is the main point person for all student support.

The practical component extends for seven weeks. Every week, students complete readings assigned by the coordinator and teaching faculty members, submit short reflection assignments, and participate in online discussions with their peers facilitated by the coordinator. They also advance their case studies, which will be completed in small working groups. The case study work requires individual work as well as weekly meetings and collaboration with the working group. The primary objective of the practical component is for students to develop a deeper understanding of a sustainability issue relevant to their research or work. The online discussions and case studies foreground collaboration, interdisciplinarity and networking. Throughout the practical component, students can seek mentorship and expertise from the teaching faculty members and rely on the course coordinator as the main contact person for support.

The program concludes with a one-day in-person event in which students present their case studies to their peers and all teaching faculty members, participate in a debriefing session facilitated by the course coordinator and take part in a final networking event.

COLLABORATIVE OPPORTUNITIES FOR ENHANCING GRADUATE PROFESSIONAL DEVELOPMENT AND EXPANDING INTERNATIONAL MARKET REACH

Shawn N. Fraser

Dean, Faculty of Graduate Studies, Athabasca University [Canada]

Brock Olive

Director, PowerEd, Athabasca University [Canada]

Overview

Athabasca University [AU] has been an open and distance university since 1973 and has delivered fully online programs for 30 years. The mission of AU, Canada's Open University, is to expand access and student success through the removal of traditional barriers to higher education for students around the world. As an open and online university, we have over 4500 graduate students enrolled in certificate, diploma, Masters and Doctoral programs studying across the globe. This model removes geographic barriers and creates unique opportunities for global partnerships.

In the past few years, AU's Faculty of Graduate Studies [FGS] has been collaborating with AU's non-credit unit, PowerED, to provide more opportunities for graduate students and lifelong learners, globally. Collaborating across these units enhances nimble credit and non-credit program development and flexible, customized learning opportunities for students. This paper focuses on how we are developing an international partnership in Nigeria through a unique collaboration between FGS and PowerED.

PowerED

PowerED is a division focused on delivering high-quality, non-credit professional development [PD] courses through an accessible and flexible online platform. It offers a wide range of courses designed to equip individuals with practical skills and knowledge for career advancement, continuously updating its offerings to align with industry standards.

Faculty of Graduate Studies

The Faculty of Graduate Studies supports and enhances the graduate student experience by providing oversight and guidance for graduate programs. It fosters academic excellence and professional success through policy development, program implementation, and interdisciplinary collaboration, ensuring graduate students gain valuable skills and knowledge for their careers.

The Faculty of Graduate Studies and PowerED collaborate in two main ways, enhancing graduate PD offerings and expanding market reach, particularly in

international markets.

Graduate Professional Development Expansion

1. **Course Availability:**

PowerED extends its non-credit PD courses to AU graduate learners at no cost via its online platform, providing a wide range of high-quality courses that complement academic studies.

2. **New Program Development:**

FGS and PowerED jointly develop new PD programming tailored to the needs of graduate students and professionals seeking ongoing development. This ensures relevance and practicality for diverse audiences.

3. **Quality Assurance:**

A regular feedback cycle from graduate students and professionals to align course content with current industry standards and academic requirements, ensuring continuous improvement.

4. **Comprehensive Offerings:**

The collaboration aims to create a dynamic and comprehensive suite of PD courses supporting lifelong learning and career advancement, enhancing the overall educational experience for AU graduate learners.

International Market Development

1. **Market Research:**

FGS and PowerED conduct market research to understand the needs and preferences of international markets, such as Nigeria, identifying key sectors and industries for PD courses.

2. **Course Localization:**

Course content is localized to reflect the cultural and economic contexts of target markets, incorporating relevant case studies and scenarios to enhance applicability.

3. **Partnerships:**

They establish partnerships with educational institutions, professional associations, and industry bodies in target markets to enhance credibility and reach.

Strategic Outcomes

1. **Enhanced Career Readiness:**

Graduate students gain practical skills improving employability, enhancing career readiness through high-quality PD courses.

2. **Increased Enrollment:**

Targeted efforts increase enrollment from both domestic and international markets, expanding PowerED and FGS's reach and impact.

3. **Leadership in Professional Development:**

The collaboration positions PowerED and FGS as leading providers of innovative and accessible professional development in both local and

international markets.

International Market Development, an example from Nigeria

PowerED and FGS are collaborating to expand into international markets such as Nigeria focused around the collaborative model described above, which aims to provide high-quality PD courses that equip graduate students and professionals with practical skills to enhance their career prospects. The initiative involves developing new PD courses tailored to the specific needs of these markets, incorporating feedback to ensure relevance and applicability, and localizing course content to reflect Nigeria's educational, cultural, and economic context, including relevant case studies and scenarios.

To effectively expand into Nigeria, we are working with our local partners to understand the specific needs and preferences of Nigerian professionals and students, identifying key sectors and industries that would benefit from PD courses. Working with partners in Nigerian educational institutions, professional associations, and industry bodies will enhance credibility and reach. A key strategy includes developing targeted marketing campaigns leveraging FGS's academic expertise and networks and PowerED's marketing expertise.

The implementation plan involves four phases: planning and development, course development and pilot testing, launch and marketing, and evaluation and expansion. The official launch will include marketing campaigns targeting both graduate students and the Nigerian market, with continuous monitoring of enrollment and engagement metrics. Success will be evaluated based on feedback and performance metrics, with courses and strategies refined for further expansion into select international markets.

Expected outcomes include increased enrollment from both domestic and international markets, and the establishment of PowerED and FGS as leading providers of online professional development in emerging markets like Nigeria. This strategic collaboration focuses on course relevance, cultural adaptability, and strategic partnerships to achieve significant local and international impact.

Graduate Professional Development Expansion

PowerED extends the availability of its non-credit professional development (PD) courses to AU graduate learners at no cost through its online learning platform. This initiative aims to enhance the educational experience and professional readiness of graduate students by providing them with access to a wide range of high-quality PD courses. PowerED's robust online platform allows AU graduate learners to conveniently enroll in and complete these courses, gaining and demonstrating valuable skills and knowledge that complement their academic studies.

In collaboration with FGS, PowerED also focuses on developing new PD programming that is relevant to graduate learners and other groups seeking ongoing professional development. This collaborative effort ensures that the courses are relevant, practical, and tailored to meet the diverse needs of both student and professional audiences. The joint development process involves

gathering feedback from both groups, ensuring that the content is aligned with current industry standards and academic requirements.

Together, PowerED and FGS are committed to creating a comprehensive suite of PD courses that support lifelong learning and career advancement. By making these courses available at no cost to AU graduate learners, they are investing in the future success of their students while also attracting a broader audience of professionals looking to enhance their skills and knowledge. This strategic collaboration not only benefits individual learners but also strengthens the overall educational offerings of AU, positioning it as a leader in innovative and accessible professional development while creating and maintaining connections between university and industry.

MAKING INTERDISCIPLINARY (GRADUATE) PROGRAMS WORK

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The term interdisciplinary lacks a stable consensus definition. Indeed, it is often used in different ways by different stakeholders, and its meaning varies by time and place (Downey, et al. 2017). This is precisely why, in my view, the literature on the benefits of interdisciplinary research and training is inconclusive (Frickel, et al 2017).

While the literature may be inconclusive, there are glimpses throughout it suggesting that the blending and blurring of disciplines, the transformation of perspective that comes from surprising integration, can be associated with innovative research and education (see Klein 1991). Based on my own research, teaching, and administrative experience, I've been an advocate for interdisciplinary training and research for many years. In my varied administrative roles, I've sought to develop and institutionalize interdisciplinary initiatives.

We know that disciplines are called such for a reason. They discipline members, reinforcing the norms of fields and, along with these, methods and orientations (Foucault 1975). Efforts to build interdisciplinary initiatives often must push against deeply institutionalized disciplines in very practical ways.

I've seen two major organizational barriers to successful interdisciplinary programs. Most essentially, they frequently have no or few budgeted tenure line faculty. This was true at Wisconsin-Madison's Holtz Center for Science and Technology Studies (which I directed) and the Wisconsin's Nelson Institute for Environmental Studies. At Boston University, where I am now the Associate Provost for Graduate Affairs and Professor of Sociology, this is true of almost all interdisciplinary programs, including the Graduate Program on Neuroscience, the American and New England Studies Program, and the Gender Women and Sexuality Studies Program.

Fundamentally, this means two things. First, there will inevitably be constraints on the knowledge that is produced. Faculty members seeking tenure or promotion in discipline-base departments need to satisfy disciplinary colleagues that their scholarship is worthy, and this will be easier to accomplish if they adhere clearly to disciplinary norms, methods, and orientations and, indeed, if they publish in discipline-oriented journals. Relatedly, faculty seeking to hire interdisciplinary-oriented faculty into discipline-oriented departments will likely face colleagues who do not believe these applicants meet disciplinary standards.

Second, the primary teaching obligation for faculty who do not have budgeted appointments in interdisciplinary programs is to their home departments. For the interdisciplinary programs with which these faculty may be affiliated, it means that course offerings cannot be stable, since there is a reasonable likelihood that faculty cannot guarantee to teaching the program's core interdisciplinary courses. If their discipline-based department requires

their teaching at the last minute, the faculty member is likely obligated to the department. This is especially likely to be the case, if the faculty is not tenured and has limited capacity to push to serve their interdisciplinary program as a priority. Of course, all of this makes it difficult to establish a stable curriculum with courses students can expect to be offered on a regular cycle. This in turn can reduce student demand for these interdisciplinary programs.

With many years of work with and in interdisciplinary programs in the two universities where I've had leadership roles, I had an opportunity in 2019 to help craft a new interdisciplinary program. I was asked by BU's president to co-chair a committee of faculty charged with exploring the future of data science at BU. We immediately confronted a turf challenge. Most committee members were from departments that arguably did some data science, but they recognized that a university budget is largely zero sum and if a data science program was developed with a significant budget and its own faculty, they would lose faculty and money.

My co-chair and I worked some (highly contingent) diplomatic magic. We brought the president to a committee meeting discuss why he believed a new approach to data science was important and the president and the provost brought together the deans of the various schools that might be affected to argue for the virtues of a novel approach to organizing an interdisciplinary program. After some significant tussling, the committee issued a report that proposed some 100% tenure lines and some split appointments with joint tenure. Our committee proposed a cross program advisory board and independent degree programs that would have cross-listed courses (to ensure the disciplinary departments with data science-related courses would not be too badly hurt).

In terms of program establishment, the story of data science at BU had a happy ending. The President and Provost committed to developing an independent interdisciplinary program (not a school or college) called the Faculty for Computing and Data Sciences and the organization of the new Faculty ended up following many of the lines the committee ended up recommending. The Faculty offers an undergraduate major, a PhD program, and a master's program. All have stable and integrated course offerings.

That said, its early development has not been challenge free. Struggles continue on the allocation of resources between the interdisciplinary Faculty and discipline-based departments and to what extent department-based faculty have the freedom to participate in the Faculty's programs.

Briefly, my experience and my knowledge of the literature points to several conclusions:

- We need more research on the value and benefits of interdisciplinary research and programs. This research will depend upon a clear and operationalizable definition of interdisciplinarity.

- Establishing stable and successful interdisciplinary programs in discipline-based universities is challenging. Budgets and tenure lines are at the core of success, but relative success does not mean there will not be bumps throughout.

REDEFINING THE RESEARCH MODEL AT UNIVERSIDAD LA SALLE BAJIO FOR SOCIAL IMPACT

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In Mexico, scientific research has faced several challenges; less than 0.5% of the GDP was invested in science and technology in the last ten years, and the number of researchers per million of inhabitants is 358, versus leading countries that have over five thousand researchers per million of inhabitants. These facts, coupled with the policy changes within the most important entities that supply research funds (namely, CONAHCYT, but also in several state organizations), derive in a challenging environment for scientific research in our country.

On the other hand, even though academic research has been traditionally measured with the number of articles or other publications released within academic journals, or patents and other registered output, today the focus is on how research can improve people's lives. This means that what was usually understood as "spreading knowledge" should go further than the academia, and somehow, now it has to translate into real actions that benefit somebody and have a tangible impact.

For some universities, basic science is a priority, and they have the means and personnel to work on that lane; however, for universities such as La Salle Bajío, that have at their core and as a motto the improvement of life conditions within their communities, there has been a clamor to define and focus on what kind of research, and with what topics, should be fostered. The model where we evaluate and praise researchers on the number of articles they issue each year, has derived for us in a situation where researchers work for a paper and the "points" derived from that, not for a solution to a research problem.

Therefore, following the suggested guidelines of the "Brothers of the Cristhian Schools" and our District, we have decided to return to a model where the focus of our research lies on the solution of problems within the frame of the Sustainable Development Goals (SDG); if a problem is solved, then we will have something to communicate in articles, books or other venues. Publishing will be the result of research solutions, not the objective of the research in itself.

The fact that accreditation organisms and Federal and State entities in Mexico, like CONAHCYT or IDEA Guanajuato, are insisting on evidence of how research results benefit communities to award funds to research projects, clearly tells us that our path should evolve thusly. In general, they are asking for evidence on how research is taught and fostered in our institutions, what kind of problems are we focusing on, how involved our faculty and students (not only full-time researchers) are in our research activities, how we benefit the communities where our campuses are, and how we promote this knowledge and all research results not only amongst peers, but also with

all actors involved (society, government, enterprises). As a result, it was imperative to evaluate both our research lines and programs and our organizational research structure.

Lasalian research should emphasize collaboration between science, technology and innovation entities; it fosters an ecological, academic and associative attitude, solving problems that allow communities to improve their life quality and develop scientific vocations amongst our students and faculty. Since 2004, Universidad la Salle Bajío has supported a Research department that has evolved throughout the years and completed almost 500 research projects with internal and external funding; our goal is to increase our competitiveness and bonds with society, enterprises and government.

To achieve this, we have developed a new Research Ecosystem. Instead of assigning full-time researchers to a specific Faculty based on their disciplinary approach, we have assigned all of them to the Research and Doctoral Studies Department, prioritizing multi, inter and transdisciplinary collaboration. A two-tier problem-solving structure was established, allowing full-time researchers to concentrate on what we call core research problems, and an increased participation of faculty and students in disciplinary research was enabled through Research Committees in each Faculty.

As a result, research with combined teams for specific core problem-solving within the frame of social responsibility and the SDG, will be strengthened and better equipped. On the other hand, all Faculties will have at their disposal all 30 full-time researchers to support their disciplinary research efforts and contribute to the development of new research talents.

As a complement, our research lines were also reviewed; we decided to establish three transversal institutional research lines, with six programs each, that allow our researchers to work in multi, inter and transdisciplinary teams and focus on specific problems that must be addressed in the realms of "Quality of Life", "Technological and Digital Transformation" and "Educational and Institutional Improvement".

Faculties were also instructed to align their disciplinary research lines to the institutional ones, and to focus their research within their own scope on relevant issues that could be addressed through their disciplines. Doctoral students will be able to collaborate at both levels, thus facilitating their insertion in the scientific production of the University.

Under this dynamic, the disciplinary projects in the Faculties will be accompanied by their respective Research Committees and funded internally, while the projects that address core problems in the institutional lines will seek to attract external resources from grants and diverse entities; we are confident that this new structure will strengthen strategic alliances in research networks.

The creation of the Transfer, Innovation and Entrepreneurship Council will advise on the activities of our new Technology and Knowledge Transfer Office (OTTC), while the Research Council will provide general guidelines for the work of the Ecosystem and will accompany the development of the Research Plan. Finally, we have added a new publishing entity, Editorial Universum Nostrum, which allows us to complement the existing magazines and publish our own books for further dissemination of knowledge.

III.

THE ROLE OF TRANSDISCIPLINARITY IN ERASING BOUNDARIES BETWEEN REALMS OF KNOWLEDGE

TRANSDISCIPLINARY APPROACHES IN GRADUATE EDUCATION: STRATEGIC COLLABORATION, COMMUNICATION, AND INTEGRATION FOR THE MODERN ERA

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Addressing the complex and challenging problems we face in today's world requires that scholars, leaders, educators, and professionals from all walks of life have the capacity to see beyond the often-arbitrary disciplinary lines we have drawn to define academic disciplines, bodies of knowledge or organizational units in our institutions. In the two decades prior to the turn of this century, the focus of many college and university students shifted from seeing educational pursuits for self-discovery to following in the career pathways that fed their financial enrichment. The change in focus paralleled the educational reforms that saw evaluation of educational institutions shift from cost per student to outcome measurement by way of assessment. These shifts resulted in the decline in the enrollment in many humanities and social sciences disciplines and the growth of the sciences, technology and mathematics related disciplines. Further implications of these shifts include the narrowing of the disciplines and in many cases, the overspecialization in disciplinary fields (Horn, et.al. 2024; Radakovic, 2023). While no one wants to return to the days when universities consisted of four or fewer academic disciplines, the two major economic downturns, in the late 1990s and again in the early 2000s, resulted in academic departments needing to collaborate and integrate, particularly in the social sciences. In this paper, we will examine how transdisciplinarity connects realms of knowledge often siloed within disciplines by focusing on the strategic employment of cluster hires, the expansion of collaborative research teams, and developing proposals for new graduate degree programs.

Resolving grand challenges and wicked problems requires the collective ingenuity from a broad range of disciplines and knowledge branches. Over the years scholars have engaged in multidisciplinary research and have drawn on several disciplines in parallel to explore areas under study. While other researchers and educators have crossed disciplinary boundaries, they often remain in their separate disciplinary domains. And then again, new disciplines have developed from interdisciplinary research which synthesizes approaches from different disciplines into a new field. With transdisciplinarity we see the integration that transcends disciplinary boundaries, often bridging the humanities, social science, and the sciences. The distinction between transdisciplinary, interdisciplinary, and multidisciplinary approaches is ambiguous (Horn et.al, 2024); keeping the ultimate goal in mind, we aim to provide customized solutions that can increase the use and integration of a range of knowledge fields to address an array of challenges facing society today. Seeking a common definition of transdisciplinarity led us to understand that a characteristic of transdisciplinarity is the impetus to "think laterally, imaginatively, and creatively not only about solutions to problems but to the

combination of factors that need to be considered" (Bernstein, 2015, p. 12).

The Need for Transdisciplinarity

Transdisciplinarity in today's world is mainly concerned about "wicked" or difficult problems to resolve. As Horn, Visser, et. Al (2024) assert, "Transdisciplinarity requires adopting a different attitude towards research, knowledge, and collaboration" (p.10). The process challenges the conventions of traditional disciplinary boundaries. In transcending these boundaries, researchers, faculty, staff and students need to focus on unity of knowledge, and the endeavors need to include multidisciplinary and interdisciplinary academic research. The benefits of transdisciplinary approaches are that we are collectively working in a transformative manner to fulfill our mission as a public university. We are working on real-world problems to develop solutions or design an intervention. The broader contexts of societal problems are exposed and new insights are gained across the discipline. As mentioned previously, students' interest in degree programs has shifted to programs that include knowledge formation from a broader disciplinary base and greater potential for career advancement. In line with the efforts to better serve students' needs and to expand both multidisciplinary and interdisciplinary synergies, the university administration is formalizing the partnership with a local community college on a joint educational center; the goal is to plant the seed for transdisciplinary work across segments of the educational spectrum. To support these and other major student success initiatives, the leadership sought a way to attract and retain a more robust and engaged faculty to teach a broader base for the curriculum. As Radakovic (2023) points out, interdisciplinary approaches "are considered insufficient, lacking both integrated scientific understanding and the potential to transcend disciplinary boundaries" (p. 205). The academic leadership has a commitment to breaking down disciplinary barriers, and over the years, the university has seen success in other critical areas through the use of cluster hiring. While the purpose of cluster hiring is normally to expand the diversity of the faculty; an unanticipated outcome is a faculty group focused on specific, often complex, societally relevant problems and a group of faculty members who are dedicated to developing solutions for the betterment of society. The goals and mission of student success are also related to fostering a transdisciplinary culture. With the institution of the cluster hires, the university has experienced an expansion of faculty engaged in transdisciplinary research.

In the United States, as the value proposition for higher education, particularly graduate education ensues, students are demonstrating their unwillingness to explore areas or disciplines that do not show a direct line to a career or potential employment. However, the academy risks capturing the interests of segments of the population if a field is too narrow or limited. Thus, it is important to engage faculty in fostering and leading transdisciplinary initiatives, research, service, and teaching. Academic centers and institutes are one way to advance collaborative teaching and learning environments. The Center for African Peace and Conflict Resolution serves this purpose at the university. The center provides conflict resolution and reconciliation services for agencies, governments, institutions, businesses, civil society and community organizations and other groups through training, education, research, and intervention. It serves as a case study of problems solved through transdisciplinary methods. The center, with faculty from

across the disciplines, develops curricular materials and provides training on mediation, negotiation, arbitration, and other conflict resolution services. The faculty and students work in a transformative manner solving real-world problems for governmental and nongovernmental organizations, business and community groups, public and private agencies, educational institutions and allied professional associations in the United States and Africa. At its core, transdisciplinarity focuses on the inherent complexity of reality that is seen when one examines a problem or phenomenon from multiple angles and dimensions with a view toward "discovering hidden connections between different disciplines" [Madni, 2018, p. 3].

The university supports the faculty in the endeavor of transdisciplinary research; much of this change has been in disciplines with strong interdisciplinary or multidisciplinary traditions, such as communications, education, environmental science, gerontology and social work. The faculty in these disciplines are beginning to design of transdisciplinary curricula and integrate transdisciplinary approaches into curricula. There is an informal dimension to the growth of interdisciplinarity and the connection to their desire to address real-world problems in a meaningful way. Conversations and collaboration have been begun on the development of a transdisciplinary graduate degree program. Using the integrative studies graduate program model, the faculty seek to develop a transdisciplinary program. In the integrative studies program, students access expertise from two to three areas and integrate courses into a degree that meets the needs of an emerging career field. Graduates of the integrative studies degree can pave numerous paths with a focus in integrative theories, methods, and thinking. With the transdisciplinary model, the goal is to provide a core set of courses focused on transdisciplinary thought and practice; 3-4 electives courses and a culminating experience to address real-world problems. The program is in its initial development stage, but the plan is to leverage the gains from the cluster hires and the faculty engaged in academic centers and institutes engaged in the development and teaching of the degree programs. The career outlook is expansive across the spectrum with the goal to prepare graduates to be an innovative scholar, leader, manager or entrepreneur.

Conclusion

In examining how transdisciplinarity connects realms of knowledge, we learned the strategic employment of cluster hires, the expansion of collaborative research teams, can lead to the development of proposals for new graduate degree programs. We also know from the literature that transdisciplinarity leads to "better preparing university students for addressing complex societal issues" [Horn, Visser, et. al, 2024, p. 11]. However, we also recognize the disciplinary boundaries remain a major organizational and knowledge basis for universities. Societal changes are coming quickly at the academy as faculty, staff and administrators grapple with the whirlwind pace of innovation, while balancing the demands of the intellectual humans who need time and space to manage the changes and realities of the new academy – reduced tenure lines, increasing pressures to manage enrollments, and declining revenues and resources to support the academic enterprise [Ballard, 2022; Madni, 2018; Radakovic 2023]. And yet, persist we must. "Despite these challenges, the promise and opportunities for new knowledge and understanding" awaits us [Ballard, 2022, p. 16]. The shift

from the source of knowledge to the inquirer requires being open to being an ongoing learner, and recognizing that new insights and opinions of value may come from those outside or new to the academy. The cluster hires and academic research centers have helped to establish a culture of collaboration which ever-soslowly is making its way to building curriculum for graduate degree programs that extend beyond interdisciplinary and are heading into transdisciplinary. The interpersonal dimensions are an important element in the process of developing a culture which erases boundaries between realms of knowledge. We must harness our humanity and embrace the ambiguity of change as we lead our universities with a lens for cultivating spaces to engage in transdisciplinary endeavors and foster faculty, staff, and student engagement in transdisciplinary research and work with our community and industry partners to address the wicked or challenging problems ahead of us.

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TRANS-DISCIPLINARY AND INTER-DISCIPLINARY RESEARCH: A CASE FOR PARADIGM SHIFT AT MICHAEL OKPARA UNIVERSITY OF AGRICULTURE, UMUDIKE, NIGERIA

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1.0 Introduction

On 10th April, 2023, I had the opportunity to attend the quarterly Summit of the Committee of Provosts and Deans of Postgraduate Colleges and Schools(CPDPGCS) in Nigerian Universities at Makurdi, Nigeria. The summit was well attended by over 100 Universities in Nigeria running Postgraduate programmes. Of course the Committee consists of Provosts/Deans of Postgraduate Schools for Public, State and Private Universities. The only criteria to be a member is that participating Provost/Dean must have come from a University whose Postgraduate programmes are recognised by the National Universities Commission, NUC. By the way, the NUC is a regulatory body instituted by the Federal Government of Nigeria to monitor and regulate University Education in Nigeria. NUC, therefore is like a watchdog as far as maintaining standard and monitoring compliance are concerned. By law, it can order for the closure or interim suspension of programmes if minimum academic standard is not adhered to. NUC conducts accreditation exercise every five(5) years across the various Universities in Nigeria for both undergraduate and postgraduate programmes.

In our quarterly summit of April 2023,, the Committee looked at the best ways to enhance the quality of research works in our various universities with emphasis on Ph.D. It is a sad commentary to note that most of our Ph.D works are not funded. Some do not have direct impact towards addressing the needs of the society. No wonder most of the dissertations ended up on the bookshelf. Apart from funding, the Committee noted that some of the research topics are not multidisciplinary in outlook; thereby narrowing the dissertation's contributions to national development or solving any of the Sustainable Development Goals(SDGs) cardinal objectives.

It is therefore based on this background that I consider this year's CGS Summit very apt and relevant to the overall improvement of research in my home University.

2.0 Definition of Basic Concepts

Before we proceed further, it is important we define some of the basic concepts associated with this write-up for clarity and ease of comprehension.

2.1 ....**Multi-disciplinarity**

Multi-disciplinarity draws on knowledge from different disciplines but stays within their boundaries. Multi-disciplinary research refers to additive research method in which each researcher remains within his/her discipline and applies its concepts and methods without necessarily sharing a common objective with other researchers.

2.2 ....**Inter-disciplinarity**

Inter-disciplinary researches are those in which concerted action and integration are accepted by researchers in different disciplines as a means to realize a shared objective that usually is a common subject of study. As observed by Choi, inter-disciplinarity analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent entity.

2.3 ....**Trans-disciplinarity**

Trans-disciplinarity incorporates a combination of concepts and knowledge not only used by academics and researchers but also other actors in civic society, private sector, public administrators and the community. Trans-disciplinary research moves beyond the bridging of divides within academia to engaging directly with the production and use of knowledge outside of the academy. It enhances the cross-fertilisation of knowledge and experiences from diverse groups of people leading to achieving innovative goals, enriched understanding and a synergy of new methods. Figure 1 illustrates these three methods to innovation according to Mcphee.

Figure 1: Multi-Disciplinary, Inter-Disciplinary and Trans-Disciplinary approaches to Innovation.

3.0 Michael Okpara University of Agriculture, Umudike Perspective

In September, 2020 when I assumed office as the Dean of Postgraduate School, I met a system that encourages single authorship. As I stated before, most of the researchers done in my university are mostly not funded. Emphasis is usually placed on "publish or you perish"—a situation where academic staff are assessed for promotion based on the strength of their academic publications. By our University's condition of service, single authorship carries more points than multiple authorships. This imposes a lot of burden on academic staff who must go solo, without recourse to quality in order to earn more points in his/her publications. The danger of such practice is that quality is usually sacrificed with the attendant consequences of relegating multi-disciplinary research to the background.

At present, the University has put in place a situation where all our Postgraduate students must publish their works together with their Supervisors. These made our theses and dissertations to be visible online and not domiciled at the bookshelf-which hitherto has been the practice.

Based on the Committee of Provosts/Deans Summit in Makurdi, Nigeria where emphasis was on encouraging Ph.D research topics to be based on the SDGs cardinal mandates, my University has adopted a situation where a Ph.D candidate can be supervised by two or more supervisors from different disciplines. This in our view will encourage multi-disciplinary approach to research as well as improve the quality of our Ph.D works. The University in turn will enjoy excellent global ranking arising from sound visibility of staff publications.The Directorate of University Research and Advancement, DURA has through her call for grant application reiterated the need for Principal Investigators[PIs] to involve Co-researchers from other disciplines-thereby encouraging multi-disciplinary research. Similarly, the National Research Fund, NRF which is the highest Grant Giver in the country; instituted by the Federal Government of Nigeria has gone a step further to encourage inter-disciplinary research. This type of research is often linked with applied research that starts with a real-world phenomenon and uses different disciplinary ideas and methods not just as guideposts, but rather as tools. In order to ensure a successful outcome, most Principal Investigators now generate grant proposals that are SMART with emphasis on Inter-disciplinarity. As a beneficiary of the grant in 2021, I can attest to the fact that my strongest points in the proposal was the careful selection of co-researchers from the academia and the industry.

4.0 The Way Forward

It is obvious that we are living in a rapidly changing, hyper-connected world and are facing increasingly global, complex and dynamic situations such as global warming, health management issues, security threats and energy crises. When confronted with such intractable and complex issues, it is necessary to shift from mono-disciplinary to interdisciplinary and trans-disciplinary concepts and methods. In order to be efficient and effective, this shift should be founded on a clarification of definitions, goals and methods. Trans-disciplinarity as an innovation concept is still unknown in my University. And not common in most Nigerian Universities. Emphasis has been on Mono-disciplinary and inter-disciplinary. However, complex problems require trans-disciplinary approach which is action-oriented, future –focused, participatory, holistic and systemic. With growing calls from advanced Institutions for inter- and Trans-disciplinarity research to be adopted, there is need for cautious optimism towards its efficacy in increasing critical capabilities in solving real-world problems. Therefore, such research approaches need to be embraced in a critically reflective manner.

5.0 Recommendations

Going forward, the following recommendations are necessary if inter- and trans-disciplinarity research is to be embraced at Michael Okpara University of Agriculture, Umudike alongside existing multi-disciplinary research efforts:

[i] The University Management through the assistance of the Federal Government of Nigeria should increase the funding for research.

(ii) There is need to review the promotion criteria of academic staff with respect to sole-authorship/Mono-disciplinary research.

(iii)....There is need to create adequate awareness on what these concepts entail in order to understand the challenges inherent in these methods of research.

(iv)....The University Management should support young lecturers to embrace inter and trans-disciplinary research

(v) .....Grant Givers such as DURA and NRF should encourage proposal submissions from more than one discipline.

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THE ROLE OF INTER/TRANS/MULTI-DISCIPLINARITY IN ERASING BOUNDARIES BETWEEN REALMS OF KNOWLEDGE

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The Evolving Landscape of Research and Knowledge Creation: How Inter, Trans, and Multidisciplinarity are Transforming Graduate Education

In the rapidly evolving landscape of global challenges, inter-disciplinarity and trans/multi-disciplinarity have emerged as indispensable pillars of academic training and research. As we confront the multifaceted crises that define our era—ranging from socio-economic disparities and political instability to environmental degradation—the limitations of discipline-specific approaches have become increasingly evident. The intricate and interwoven nature of these challenges necessitates innovative solutions that transcend the boundaries of any single academic discipline. It is imperative that we harness the intellectual capital from a broad spectrum of disciplines while also engaging stakeholders from various sectors of society.

Indeed, the global problems we face today are not merely complex but also inherently multidimensional, defying local or national solutions and demanding a holistic approach that integrates diverse perspectives. Scholars must collaborate not only with their academic peers but also with representatives from industry, civil society organizations, governmental bodies, and the general public. This collaborative approach ensures that the solutions we develop are both contextually relevant and globally applicable.

In the realm of graduate education, the urgency of moving beyond the traditional, discipline-based training model has never been more pronounced. The future leaders and innovators emerging from today's universities must be equipped with the ability to think across disciplinary lines and to synthesize knowledge from various fields. Whether they are delving into the intricacies of robotics, navigating the complexities of big data, unraveling the nuances of legal theory, or engaging with the profound questions of philosophy, graduate students must be afforded the opportunity to cultivate a multidisciplinary skill set. This approach not only enhances their capacity to address the grand challenges of our time but also prepares them to become agents of change in an increasingly interconnected and interdependent world.

In order to position graduate programs as engines of social change through transdisciplinary and interdisciplinary approaches, the following strategies could be considered:

1. Inspiring and Supporting Program Innovation:

- **Cross-Disciplinary/Multi-Disciplinary Programs:** As we grapple with an interesting mix of opportunities and challenges, championing innovation in curriculum and program development in order to meet the needs of the

new generation of graduate students, including life-long learners, becomes a necessity. An emerging consensus highlights the need for grad schools to bring different (unlikely players) together to develop programs that cuts the traditional disciplinary and faculty boundaries. While the activity-based budget model might make such a task incredibly complex, the grad school can be a catalyst to advance the University's academic mission by inspiring and supporting innovation and new ways of thinking in program innovation.

- **Collaborative Specialization:** Collaborative specializations, as multi/trans/disciplinary framework of learning, provide an opportunity for grad students to become what is called the T-shaped learners. At the heart of it is a deep appreciation for learning the different disciplinary perspectives that can help them succeed in today's complex world of work.

- **Cross-Disciplinary Courses:** Design programs that require students to take courses outside their primary discipline, integrating knowledge from fields like economics, sociology, environmental science, and technology. This approach helps students gain a broader perspective on global challenges.

- **Collaborative Research Projects:** Encourage research that crosses traditional disciplinary boundaries, enabling students to work on projects that tackle complex, real-world problems from multiple angles. Such projects could involve partnerships with industry, non-profits, and government agencies. The PhD-Community Initiative program could serve as a model for such initiatives.

2. Civic Engagement Platforms:

- **Community/Industry Partnerships:** Create partnerships with various sectors, including government, private industry, non-profits, civil society groups, and community organizations. These collaborations can provide students with the opportunity to apply their interdisciplinary training to real-world problems, fostering innovative solutions. In the Canadian context, Mitacs is an organization funding these types of partnerships exclusively.

- **Public Engagement Initiatives:** Develop programs that require students to engage with the public or specific communities. This can include workshops, public talks, or community-based research projects that bring together academic knowledge and local expertise to address pressing issues.

3. Trans-Inter-Multi-disciplinary Research Centers:

- **Creation of Multi-Disciplinary Research Hubs:** Establish research centers within universities dedicated to addressing global challenges through interdisciplinary methods. These hubs, such as the Beaty Water Research Institute or Ingenuity Labs at Queen's, serve as incubators for innovative ideas and solutions, drawing on the expertise of faculty and students from multiple disciplines.

- **Collaborative Inter/trans/multi-disciplinary Grant Opportunities:** Offer funding specifically for interdisciplinary research, encouraging students to pursue projects that bring together different fields of study to solve global challenges.

4. Comprehensive Global Engagement:

- Global Citizenship: I see comprehensive global engagement as an ambitious project which contributes to building a new framework of learning and research designed to champion the interconnectedness between the local, the national, and the global. Implicit in this new framework is the thirst for developing cross-border research and teaching collaborations that aim to unlock the power of mutually beneficial partnerships. An important aspect of the global engagement effort is geared toward creating meaningful opportunities for graduate students to become global citizens. For example, the Dean's Travel Grant funds research exchanges for doctoral students at Queen's University. Encourage graduate students to participate in global initiatives, including internships, dual/joint degree programs that expose them to different cultural and disciplinary perspectives on global issues from trans/multi/inter-disciplinary perspectives.

- Local Impact Projects: Develop programs that focus on local issues with global relevance, allowing students to apply their interdisciplinary knowledge to influence change within their own communities.

5. Mentorship and Networking:

- **Interdisciplinary Mentorship Programs:** Pair students with mentors from different disciplines and sectors to guide them in developing holistic approaches to problem-solving. Queen's Innovation Center Summer Initiative [QICSI] and the Dunnin-Dashpande Changemakers Program offer mentorship and funding support to students who are interested in creative-problem solving opportunities to address pressing issues facing our communities today.

- **Alumni Networks:** Build networks of alumni who have successfully applied interdisciplinary approaches in their careers, offering current students access to these networks for advice, collaboration, and inspiration. The Queen's Connects network facilitated by Career Services, allows students and alumni to build these connections across disciplines.

TRANSVERSAL PATHWAYS FOR PROFESSIONAL IDENTITY FORMATION IN GRADUATE PROGRAMS

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Tecnológico de Monterrey was founded in 1943 as a private, non-profit, independent institution with no political and religious affiliations. The current vision statement is "Leadership, innovation, and entrepreneurship for human flourish". The Graduate Direction Office was created in 2021 to guarantee interdisciplinary and transdisciplinary graduate programs throughout the six graduate schools to share ethical values and social responsibility to address creative solutions to new problems. Graduate programs through teaching and research contribute to the global and local needs and projects that society requires (Castilla & Camacho, 2012)

Coupling academic and institutional interdisciplinary challenges with students' aspirations for their professional identity is a challenge. While the institution expects to prepare students to address the emerging needs of humanity, candidates start a graduate program as a process for better employment.

Professional identity refers to the ability to enhance, calibrate, and reconfigure personal beliefs, competencies, and expectations to positively impact academic or occupational settings in the present and the future. Even though professional identity changes its scope and maturity over time, each transition has four cyclic dynamic phases that modify learning and training pathways (Olivares et al.,2020).

Professional Identity Formation (PIF) is the journey that evolves from who you are to who you want to become. Graduate degrees are generally stratified in research-based or course-based (taught). Research programs are master's degrees and PhDs that include research training and inter/transdisciplinary generation of knowledge through strategic relationships with the social, public, and productive ecosystems, to promote scientific talent that positively influences society and the world. There are a thousand students registered in this category at Tecnologico de Monterrey.

Course-based programs are master's degrees for students who seek to broaden, upskill, or reskill their professional capacities based on learning disciplinary or interdisciplinary trending content that enhances their professional development and contributes to transforming the world from their setting. There are six thousand students registered in this category at Tecnologico de Monterrey.

Considering differences among programs and their purposes, they were contrasted with students' interests and expectations for their future selves. The present study was a mixed sequential methodology approach with two phases. The qualitative phase consisted of interviewing 8 graduate program directors for questionnaire design. Subsequently, 1,535 surveys were administered to professional and research students from 25 graduate programs.

The answers to the question What would you like to achieve in the future? were stratified into four possible identities:

- Professional growth: Students in this category selected answers that seek personal growth (Improve position within the company or salary level).
- Entrepreneur: Students in this group seek to innovate through the creation or innovation of their own companies.
- Scientist: Generating knowledge, Deepening certain lines of research.
- Transformative leader: Students with this profile seek to impact their setting (Transform my environment, leave a legacy).

The most important discovery was that only 40% of the students registered in the professional programs wanted professional growth as their first choice. Only 25% of the students registered in a research program declared they wanted to become scientists. Students aspire to plural professional identities that do not distinguish gender or type of program.

Past barriers to achieving interdisciplinary projects and desired professional identity include academic periods and program design. The new programs include four elective Transversal Educational Pathways where students from the 6 graduate schools collaborate on projects aligned with their aspirations.

- Leadership that transcends: This educational track includes initiatives that benefit the vulnerable or unprivileged communities. The coursework promotes significant and positive transformation of individuals and society, with projects such as zero hunger, quality health and well-being, peace, justice and solid institutions, reduction of inequality, end of poverty, etc.
- Professional development: This program encourages students to carry out a process of self-knowledge and self-direction to define their purposes and impact as agents of change in the present and the future. The content includes CV writing, professional social media, and interview training.
- Entrepreneurship: This elective pathway aims to align entrepreneurship ideas to strengthen a culture that promotes, triggers, and celebrates the entrepreneurial spirit in the academic community, thus accompanying the process of business creation and development to accelerate the ecosystem of innovative entrepreneurship and investment in the area of influence of each student.
- Grants and funding: This track aims to provide the student researcher with skills to search, select, and evaluate funding opportunities for research, including how to make a project proposal, and how to manage external funds and grants.

The proposed educational model with Transversal Pathways at Tecnologico de Monterrey promotes the customization for professional identity formation regardless of discipline, gender, or any other stereotype that restrains the future possible self.

Entering new experiences or professional roles requires training the person's internal potential in some of its possible future selves (Ibarra, 1999). Each of these dimensions is reconfigured cyclically, generating tension between the transition of stages or the generation of a new trajectory that allows deepening or expanding professional roles throughout life.

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COUNTRY AND REGION STUDIES: AN INTERDISCIPLINARY AND CROSS-CULTURAL PERSPECTIVE

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The unprecedented changes in the 21st century are intertwined with multiple global challenges, including poverty, extremism, climate change, the rise of new technologies, and serious conflicts in various countries and regions. Despite these challenges, globalization presents numerous opportunities, with new technologies generating new wealth. In the upcoming future, global challenges should be addressed globally, and global opportunities should be shared by all countries. Addressing global challenges and sharing opportunities worldwide necessitates a deeper and better understanding of each other, which is fundamental to forming concerted efforts. Academia is always in the frontier of fostering mutual-understanding and cultural exchanges. Country and region studies, as an interdisciplinary field that investigates specific foreign countries or regions, shall shoulder the responsibility of enhancing one nation's understanding of another and facilitating cultural exchanges.

Chinese modernization champions the beauty and diversity of world civilizations. Under such cross-cultural philosophy, building a community of a shared future for mankind has become a core tenet of Chinese modernization. In support of this cause, China accredited country and region studies as a first-tier discipline in September 2022. This discipline encompasses six second-tier framework disciplines: theories and methodology, comprehensive studies on specific countries and regions; specific issues in country and region studies; comparative studies; China-foreign cultural exchanges and mutual learning; global and regional governance.

The objectives of this disciplinary advancement are clear and substantial: to solidify the disciplinary identity of country and region studies with innovative theories and concepts, to efficiently build a system of talent cultivation in this new interdisciplinary field, to provide academic and intellectual problem-driven solutions to the national and global challenges, and to promote cross-cultural exchanges and mutual learning among civilizations. Attaching such importance to country and region studies, academic communities in China expect to understand and to be understood by other countries and their people.

By the year 2024, hundreds of centers specializing in country and region studies are expected to operate in 186 colleges and universities throughout China. Leading universities have begun to offer graduate programs under this new disciplinary framework, with top institutions like Peking University and Beijing Foreign Studies University offering doctoral programs. Approximately 30 universities are providing master's programs in this field.

Beijing Foreign Studies University [BFSU] lives by its motto, "to learn with an open mind; to serve a great cause," and promotes cross-cultural

understanding with interdisciplinary education. For 83 years, country and region studies, alongside foreign language studies, have been the foundation of BFSU's contribution to international exchanges. To further advance in this field, BFSU established the Academy of Country and Area Studies (CASA), which strives to identify the academic identity of country and area studies. CASA also explores studies on various countries, regions, and international organizations. In this process, BFSU has created academic platforms like the Global Index Series and the Global Index Network, coordinates country and area studies centers, and annually hosts international conferences that attract hundreds of renowned experts and scholars worldwide, jointly promoting the development of the country and area studies discipline.

The international academic network is a vital component of the country and region studies at BFSU, providing multidisciplinary knowledge and multicultural understanding. Concurrent with the accreditation of country and region studies as a first-tier discipline in 2022, the Consortium of Country and Area Studies (CCAS) was inaugurated at BFSU. Comprising scholars from over 180 countries working in more than 100 languages and adhering to principles of "Diversity in Perspectives, Inclusiveness in Coverage, Originality in Research, and Depth in Understanding," the consortium is dedicated to advancing interdisciplinary research related to country and area studies. It addresses emerging realities, issues, and challenges at national, regional, and global levels. Supported by CCAS, BFSU has published a series of journals, textbooks, and other academic works.

The emergence of country and area studies as a discipline presents an opportunity to bridge global civilizations and enhance international understanding. From this perspective, the significance and mission of this discipline are to replace a world of conflicts with a community with a shared future for mankind and preventing cultural clashes through cultural exchanges.

IV.

USING TRANSDISCIPLINARY KNOWLEDGE TO SOLVE GLOBAL GRAND CHALLENGES

MAKING GENERAL COMPETENCES WORK FOR STUDENTS

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Key messages

- Academic teachers should and can do better
- Graduate admission from looking at to looking for …. Learning incomes

My work over the past years has been focusing on two key messages:

1. Graduate admission can improve by articulating "learning incomes" and by changing from "looking at" to "looking for" in the vetting of applicants.

2. Academic teachers – also in graduate school – should do better and can do better in improving students' transversal skills.

I have worked on these issues of transversal skills in the MastermindEurope[1] project and in LOUIS[2] as one of components of the Aurora Competence Framework developed in Aurora, a network of societally committed research universities[3].

The development of better tools for transversal skills in higher education have also been the focus of other initiatives like Tuning[4], CALOHEE[5], and Megaskills[6]; they also play a role in a recent initiative to look back at the Lisbon Recognition Convention of 1997, of which the USA is a signatory member.

In Mastermind Europe, we analysed the admission to graduate schools and came up with the following observations:

- In the USA [and other Anglo-American countries]:
  - It is implicitly clear that other factors than subject specific competence also are important;
  - There is a tendency to follow practices in the most highly esteemed graduate schools, even if their programme is very different;
  - Schools are often much more explicit about what they are looking at [transcripts, institutional competitiveness, motivation letters, reference letters] than what they are looking for [the things students have to be good enough at; the knowledge, skills and/or understanding students should have at the start of the programme];

[1] MastermindEurope.eu
[2] https://aurora-universities.eu/louis/
[3] https://aurora-universities.eu/
[4] https://www.unideusto.org/tuning/
[5] https://www.calohee.eu/
[6] https://www.megaskills.eu/

- Predictive value of the indicators used (marginal GPA or GAT difference, letter) is frighteningly low;
- Schools tend to opt not for a policy of "Of those qualified, the best fit", but "Of those qualified, the best"; they do this implicitly and in spite of demonstrated poor or absent predictive value of the indicators used to rank applicants.

- In post-Bologna Europe:
- the paradigm for admission to Master's programmes is still in many places: "we admit our own Bachelor's in the same topic and other if their Bachelor's programme is similar enough";
- If and when Europeans step away from that paradigm, they tend to look to Anglo-American examples for guidance.

In LOUIS: Learning Outcomes in University for Impact in Society, we adapted the VALUE[1] approach developed by the AAC&U to the context and needs of European research intensive universities. European university teachers broadly acknowledge that the development of general or transversal skills is among the most important and lasting contributions of university education to graduates' lifetime competencies – but feel ill-trained and poorly equipped to help students in this respect. "It is a key role of university of education, but not my forte".

The adaptation was not in the 16 competences, 85 dimensions or 340 progressive performance descriptors. It was more in:

- Using the tool first and foremost for the articulation of learning outcomes rather than for assessing students' progress;
- Using the tool in subject-focused courses – from pharmacology through linguistics to environmental law – rather than in liberal arts and general education contexts.

The key strengths of the VALUE rubrics and the LOUIS adaptation – particularly in comparison to similar frameworks of qualifications – are:

- Their deconstruction of broad competences into more intuitively understandable dimensions or subcompetences, and
- Their articulation of decreasing levels of errors and increasing levels of sophistication in the same (sub-)competence, rather than adding new skills at higher levels, which are always assumed to be mastered either not-at-all or fully.

In LOUIS, we have developed a infrastructure and ecosystem to gradually increase the use in the Aurora universities, with:

- Local LOUIS teams in most of the Aurora universities, with both academic champions and educational and professional development staff;

[1] https://www.aacu.org/initiatives-2/value

- Language versions of the LOUIS-adapted VALUE rubrics, currently in English, German, Italian and Iceland, with Czech on the way;
- Training courses and training course materials for academics and professional development staff;
- Sample descriptions of LOUIS-adapted courses, reflecting a group of between 50 and 100 academic teachers using the tool in one form or the other.

In one Aurora university: the University of Innsbruck, LOUIS has been incorporated in the institutional regulations for course programme design and accreditation.

LOUIS was developed with an open eye on related initiatives:

- Tuning: an EU-supported initiative (ERASMUS+) and set of projects to bring together academics from various countries/system in one discipline, leading to converging conversations on 'the essence of education in our field" at the various levels.
- CALOHEE (measuring and Comparing Achievements of Learning Outcomes in Higher Education in Europe): an EU-funded project (ERASMUS+) to eventually test Bachelor's and Master's students' performance in Europe, currently covering five subject areas: Civil Engineering, Nursing, History, Physics, and Education.
- MegaSkills: an EU-funded project (Horizon 2022) with the aim to bridge the gap between education and the labour market through the research and design of an innovative and affordable game-based methodology for training and evaluating soft skills.

Finally, the work on MasterMind Europa and LOUIS is embedded in the informal initiative for a publication on the Lisbon Recognition Convention (1997) and future paths to further international recognition of HE qualifications.

ADDRESSING PRESSING GLOBAL ISSUES WITH TRANSDISCIPLINARY KNOWLEDGE

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Higher education institutions (HEIs) are working within national and international contexts to respond to and address pressing concerns and emergencies. In South Africa, these crises include socio-economic challenges and environmental disasters, all of which have significantly impacted and shaped research agendas. For instance, the ongoing energy crisis and load shedding have not only affected daily operations but have also driven research into sustainable energy solutions (Swilling, 2020). In addition, the COVID-19 pandemic highlighted the need for robust public health research and the development of responsive healthcare systems (Nkengasong & Mankoula, 2020).

The HEIs in South Africa have been mindful of developments in Africa and globally which influence the course of their work. The African continent faces unique challenges, such as the need for economic development, political stability and climate resilience. To meet their mandates and address the pressing problems confronting education in general, and higher education in particular, a philosophy of multi- and transdisciplinary research is necessary. The multifaceted and interconnected nature of pressing global issues requires an integrated approach that builds upon transdisciplinary knowledge. This contributes to a better understanding of the problems and affords productive solutions as HEIs aim to produce socially just, ethically responsible and non-politicised planetary knowledge.

South African universities are increasingly partnering with global institutions to enhance the impact of their research. The collaboration between the University of Cape Town and the University of Bristol on the Future Water Institute is an example of how international partnerships can drive innovation in addressing water-related challenges (Johnston, 2022). The Stellenbosch Institute for Advanced Study (STIAS) promotes transdisciplinary research to address complex societal challenges, integrating insights from diverse fields such as economics, environmental science and sociology (STIAS, 2023). To tackle challenges related to health, inequality and climate change, the University of the Witwatersrand collaborates with the African Research Universities Alliance (Fongwa et al., 2022). Similarly, a partnership between the University of Johannesburg and four African universities, namely the universities of Zimbabwe, the Western Cape and Botswana, the Namibia University of Science and one European university, Vrije University Amsterdam, will work towards realising Goal 13 of the Sustainable Development Goals (SDGs) '*Climate Action: Take urgent action to combat climate change and its impacts*'. Named '*TESIECS – Towards Enhancing Sustainable and Innovative Environmental Change Solutions*' the Intra-Africa Mobility Scheme will facilitate long-term and short-term student and staff capacity enhancement and train cohorts of postgraduate students to be environmental thought leaders and sustainability champions (TESIECS, 2024).

“Transdisciplinarity” challenges scholars to study other disciplines and foster cooperative projects (Bernstein, 2015). By fostering collaboration across disciplines, transdisciplinary knowledge creates holistic solutions that are sustainable in ways that cannot be developed by a single discipline. In South Africa, fostering such partnerships is critical for addressing the country's unique socio-economic and environmental challenges. To enhance a philosophy of multi- and transdisciplinary research in local and global partnerships, some partners play the role of boundary brokers to challenge disciplinary boundaries and facilitate conversations in boundary crossing between disciplines (Wenger, 1998). Boundary brokers are essential in South Africa's context where the integration of Indigenous knowledge systems with modern scientific research can lead to more holistic and sustainable solutions. National organisations, such as the South African National Biodiversity Institute works closely with universities, government agencies and local communities to promote biodiversity conservation through transdisciplinary research that integrates ecological, economic and social dimensions (Daly & Ranwashe, 2023). These partnerships are pivotal in facilitating the exchange of knowledge and resources, strengthening the capacity to tackle complex problems.

To support these initiatives, institutional policies must also align with the principles of transdisciplinarity. This includes providing funding for cross-disciplinary research, incentivising faculty collaborations and recognising the value of interdisciplinary work in tenure and promotion processes. These HEIs are going beyond symbolic infusion of transdisciplinary knowledge through reframed university policies. New policies are emphasising the integration of diverse academic disciplines to foster innovative problem-solving approaches. To make meaningful transformation in HEIs and effectively address pressing national, continental and international issues, these institutions are envisioning themselves as interdependent entities (Maringe & Chiramba, 2023). This has been a paradigm shift from traditional siloed approaches to a more interconnected and collaborative framework. Interdependence among HEIs fostered through global networks and partnerships can facilitate the sharing of resources, expertise and best practice. In addition, embedding transdisciplinary education into curricula can equip students with the skills needed to navigate and address multifaceted problems. This could involve creating interdisciplinary programmes and courses that encourage students to think beyond the boundaries of their primary field of study. For instance, in our University of Johannesburg, different departments have been instrumental in bridging the gaps between natural and social sciences. They promote collaborative research efforts that address pressing health care issues through various public campaigns that include Cervical Cancer Awareness collaborating with a Peer Education Programme for university students (University of Johannesburg, 2023). Nationally, the National Research Foundation (NRF) collaborates with international bodies to fund and support transdisciplinary research projects, enhancing the country's research capacity, fostering global partnerships and recognising the importance of such approaches in addressing national priorities (NRF, 2024).

As HEIs have advanced the co-production of transdisciplinary knowledge within and among their institutions, they are also looking outward and fostering close engagements with movement activists (Mitlin et al., 2019). Engaging with movement activists not only enriches the research process but

also ensures that the knowledge produced is relevant and applicable to real-world challenges. It fosters a bottom-up approach to problem-solving, where lived experiences and insights of affected communities are integrated into academic research, leading to more effective and inclusive solutions. For example, the partnership between the University of Cape Town and the Shack Dwellers International network has been pivotal in co-producing knowledge that addresses urban housing issues, advocating the rights of informal settlement residents [Tshabalala, 2020].

In conclusion, South African HEIs must continue to advance transdisciplinary research while actively engaging with local and global partners, including movement activists. While the incorporation of transdisciplinary knowledge in university policies is a significant step forward, the real transformation lies in HEIs adopting an interdependent mindset. This approach will enhance their capacity to address the complex and interconnected challenges of the 21st century, producing knowledge that is both socially just and globally relevant.

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MULTIDISCIPLINARY AND TRANSDISCIPLINARY RESEARCH AT IPICYT: INTEGRATING DISCIPLINES AND SECTORS FOR ADDRESSING COMPLEX PROBLEMS

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The Instituto Potosino de Investigación Científica y Tecnológica [IPICYT] is a public research institute located in San Luis Potosí, México. The institute was established to provide the region with an alternative space for the cultivation of natural and exact sciences, as well as for developing technologies applied to solving local and regional problems. Among its strategic objectives, the Institute considers the generation and transfer of knowledge as well as the training of excellent human resources in frontier knowledge fields. The institute addresses research lines and grants postgraduate degrees in five areas: Molecular Biology, Advanced Materials, Control and Dynamic Systems, Environmental Sciences, and Applied Geosciences. It actively promotes collaboration among various scientific disciplines and incorporates knowledge from non-academic stakeholders to address complex problems. The needs of society, as well as the opportunities and limitations of the environment, were considered in the selection of these knowledge areas. Scientific dissemination and outreach are also considered important activities at the institution.

Since its foundation, IPICYT has been established as a multidisciplinary institute, and recently, a transdisciplinary approach has been incorporated to solve global problems. This transdisciplinary approach integrates knowledge from outside the academic environment, including contributions from local communities, industries, and governmental organizations. This approach aims to develop practical and applicable solutions to real-world problems by combining scientific knowledge with insights from other sectors. Here I report two examples of ongoing projects at IPICYT that are addressing pressing global issues using multidisciplinary and transdisciplinary knowledge.

A safety framework to monitor and improve the indoor air quality of public spaces.

San Luis Potosí City is the capital and largest city of the Mexican state of San Luis Potosí [SLP] that has an estimated population of 1.2 million in its metropolitan area including the neighboring Soledad de Graciano Sánchez and other municipalities, making the San Luis Potosí Metropolitan Area [SLPMA]. SLPMA is a major industrial region with a prolific manufacturing industry due to its strategic location for trade. It is well known that the air pollutants present in the SLPMA includes polycyclic aromatic hydrocarbons and volatile organic compounds, metals, and metalloids, and large amounts of PM2.5 and PM10. However, SLPMA indoor public spaces have not been characterized, and there is a lack of regulations to monitor and improve indoor air quality [IAQ] through adequate air ventilation and filtration in buildings. The objective of this project was to develop a framework to monitor, document, characterize, and improve IAQ in public spaces of the SLPMA. The initial target was IAQ characterization and intervention on a stratified statistical sample of public-

school spaces across the SLPMA, to reduce transmission of COVID-19 and other airborne infections. The team developing this project is experienced in determining indoor and outdoor air quality. They have developed a mobile crowdsourcing / crowdsensing platform to support data collection with the help of citizens, miniaturized monitors for measuring individual exposure, and calibration protocols for PM10, PM2.5, PM4, PM1, and VOC sensors. Recently, the team also developed a crowdsensing platform and performed a pilot study to determine indoor CO2 levels in IPICYT, including a monitoring system of CO2, PM10, and PM2.5, and a calibration protocol for each in-house constructed sensor. With the data collected in public schools, a team of public health researchers and students will conduct a workshop at each school space with a medium to high-risk index of adverse health effects. The workshop will enable to develop citizen-based solutions to intervene in the IAQ of the affected school spaces. Interaction between community members and scientists will enable resource-constrained interventions using resource-allocation techniques. Furthermore, as the overall objectives of the project are to link sensor readings to key health objectives (such as infection rates), they can use these indices to influence resource-constrained interventions for schools.

A graduate-level education strategy for solving complex socio-environmental problems: The extramural laboratory (LEMUR).

To address the current environmental crisis, it is necessary to transform our societies towards sustainability. Higher education systems play an important role in this effort, both in the training of professionals and for their potential impact on society. LEMUR is an institutional course transversal to the five graduate programs at IPICYT (Molecular Biology, Environmental Sciences, Control and Dynamic Systems, Applied Geosciences, and Nanosciences and Materials), established in 2020 as a space for interdisciplinary collaboration to apply knowledge outside the classroom and aimed at social welfare. As a group, they selected the presence of water hyacinth in the San José Dam (SJD, San Luis Potosí) as a socio-environmental problem and since then they have been working on this case study for seven semesters. During this process, LEMUR has focused on understanding the causes of the hyacinth in the SJD and advancing towards a participatory methodology, managing to maintain an interdisciplinary team within IPICYT and a transdisciplinary team with the incorporation of members from the academic, governmental, and social sectors. They have identified key issues to address and advanced in the co-design of strategies aimed at implementing impactful actions to solve the problem. This transdisciplinary route as an educational strategy at the graduate level could foster a new approach to learning and understanding.

In summary, IPICYT promotes both transdisciplinary and multidisciplinary research, facilitating collaboration across various disciplines and involving multiple stakeholders to generate innovative and practical solutions to complex problems.

MODULES POLYTECHNIQUES: ESTABLISHING TRANSDISCIPLINARITY IN HIGHER EDUCATION AT UNIVERSITE POLYTECHNIQUE HAUTS-DE-FRANCE

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Introduction

Transdisciplinarity in higher education and research in France is a concept often discussed but rarely implemented. Despite institutional advocacy for this approach, genuine understanding and agreement, and concrete initiatives remain scarce. More generally, the integration interdisciplinary research and education is frequently obstructed by rigid academic structures and entrenched disciplinary cultures, exacerbated by the French CNU (National Council of Universities) sections that fragment disciplines and hinder interdisciplinary collaboration (Maheu, 2015; Champy, 2016).

In 2019, Université Polytechnique Hauts-de-France (UPHF) launched Modules Polytechniques (hereinafter 'MP'), a promising initiative aimed at integrating interdisciplinarity into the curriculum with the goal of fostering the emergence of transdisciplinarity. This note presents the genesis of the MP, highlights the challenges in their widespread implementation, and underscores their added value, particularly in fostering research connections and generating significant impact.

Interdisciplinarity at UPHF

UPHF's views the concepts of multidisciplinarity and transdisciplinarity through the lens of practice integration and methodological approach. Multidisciplinarity is seen as maintaining distinct separation between disciplines, where each field remains within its own boundaries. In contrast, transdisciplinarity aims to fuse these disciplines together, creating new knowledge that transcends traditional academic limits. Methodologically, multidisciplinarity juxtaposes different disciplinary methods side by side without merging them, whereas transdisciplinarity involves the integration and synthesis of these methods to develop comprehensive, innovative solutions (Huutoniemi, K., 2010 : Klein, J. T., 2010).

The Genesis of Polytechnical Modules

The genesis of the Polytechnical Modules at UPHF stems from a desire to enhance interdisciplinary collaboration and prepare students to solve complex problems. Launched in 2019, these modules emerged from a collaborative effort involving educators, researchers, and experts from various fields. The development process was structured through a detailed specification document and encompassed rigorous design phases, testing, and the implementation of digital tools to facilitate learning.

These innovative modules offer students a multidisciplinary learning experience, fostering cross-pollination among hard sciences, arts, humanities,

and design. Each module addresses a common topic through various disciplinary perspectives, promoting an interconnected understanding of the issues studied. Emphasis is placed on contemporary issues such as eco-responsibility, ethics, and innovative environments, among other topics.

Targeting both undergraduate and master's students, the Polytechnical Modules provide a progressive training framework over several semesters. Continuous and terminal evaluations within each module allow students to validate their skills through digital badges. These modules are designed not only to enrich students' academic paths but also to prepare them for professional challenges by exposing them to authentic, practical situations.

Challenges of Polytechnical Modules

The implementation of Polytechnical Modules (MP) at UPHF presents several significant challenges. First, the organizational complexity of coordinating multiple departments and disciplines necessitates meticulous management of schedules and educational resources to ensure coherence. Additionally, evaluation and competency tracking pose difficulties; developing criteria suitable for interdisciplinary approaches requires innovative assessment methods and platforms. Communication with students has been a critical issue, as many have expressed negative feedback, questioning the relevance of the course to their programs. Furthermore, the perceived difficulty level of these modules adds to the students' reluctance. Ensuring the adoption of MPs by students, teachers, and administrators requires extensive sensitization and training in cross-disciplinary methods. Another hurdle is motivating students to enroll and actively engage in these compulsory modules, which are sometimes perceived as being imposed on faculties across the university. These challenges highlight the need for a structured framework to support the effective implementation and acceptance of Polytechnical Modules within the educational curriculum.

Success Stories of Polytechnical Modules

The implementation of Polytechnical Modules (MP) at UPHF has led to success stories, demonstrating their potential to foster educational and research collaborations and drive innovation.

First, Professor Maxence Bigerelle, a materials scientist, and Professor Ludovic Nys, a fine arts researcher, exemplifies the potential of Polytechnical Modules (MP) at UPHF to advance transdisciplinary education and research. Together, they co-constructed several MP courses, merging material science and fine arts. Their partnership not only enriched the educational experience but also led to significant research outputs, including securing a PhD grant on which a doctoral student is currently enrolled. This collaboration has yielded multiple publications, such as "Digital Cultural Heritage Preservation in Art Painting: A Surface Roughness Approach to the Brush Strokes" (Mironova et al, 2020) and "Fractal and Statistical Characterization of Brushstroke on Paintings" (Bigerelle et al, 2023). These works demonstrate the fruitful intersection of their fields, leveraging statistical and fractal analysis to enhance the understanding of art preservation techniques. The integration of these disciplines through MP courses has fostered a creative and innovative academic environment, encouraging further interdisciplinary research and setting a precedent for future educational and research endeavors. Their

success underscores the importance of financial incentives and institutional support to sustain and expand such interdisciplinary initiatives, promoting a space and a culture of collaboration and innovation within the university.

Another notable example is Professor Claire Barat from the archaeology department, who has developed the Polytechnical Modules "Archaeo-Physics" in collaboration with researchers in Physical Measurements focusing on ceramics and terracotta, and "Archaeo-Materials" in partnership with Mechanical Engineering researchers specializing in coins and flint. These modules have allowed Professor Barat the freedom to be creative, placing her at the heart of her often-overlooked profession. The ripple effect of her work has led to internal events focused on MPs, providing opportunities for interdisciplinary creators to meet and share ideas. These encounters have the potential to evolve into collaborative research ventures, highlighting the need for financial incentives that support cross-laboratory research. While internal lab research funding exists for interdisciplinary endeavour, there is a pressing need for transversal financial incentives to encourage broader collaborations across the university. Recognizing and showcasing the achievements of those who have successfully integrated teaching and advanced research through MPs can serve as an inspiration and model for others.

Conclusion

The implementation and success of Polytechnical Modules at UPHF illustrate the immense potential of multidisciplinary education as a spring board for transdisciplinary research. By fostering a collaborative and innovative environment, these modules serve as a model for future educational advancements. Continuous support and incentives for interdisciplinary initiatives are crucial to sustaining and expanding this innovative approach.

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BEYOND SILICON VALLEY: TRANSFORMING UNIVERSITIES INTO R&D CENTERS – CASE STUDY OF PIDAT-UDG

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Introduction: The Potential of Universities as Innovation Drivers.

The conference explores how universities can extend their role beyond teaching to become catalysts for innovation through quadruple helix projects. It discusses the model of High Technology Research and Development Parks (PIDAT), proposing educational infrastructure as a platform for multi-sectoral participation in regional development. This transformation is viewed as a replicable and scalable methodological strategy that could significantly impact regional development in Latin America and globally. First Part: Evolution from Triple to Quadruple Helix Model. The triple helix model, integrating academia, industry, and government, has proven fundamental in fostering innovation. By incorporating civil society as a fourth pillar, the quadruple helix model broadens inclusion in development processes. However, the influence of each sector varies, and the conference suggests it is not always equitable. Three scenarios are discussed:

- **Industry as the driver:** Tends to favor innovations that are profitable in the short term, often at the expense of broader social benefits.
- **Government as the driver:** Its projects are often constrained by preestablished political agendas, which can compromise the adaptability and sustainability of innovations.
- **Civil society as the driver:** Although it promotes equitable solutions, it faces challenges such as organizational complexity and a lack of resources, which can delay or limit its impact.

Academia could serve as a neutral articulator, leveraging its knowledge base and ethical framework to balance the interests of all actors. Second Part: Lessons from Silicon Valley. Silicon Valley provides a historical model of how collaboration between academia and industry can create robust innovation ecosystems. The development of the Stanford Industrial Park in 1951 and the founding of companies like HewlettPackard and Varian Associates illustrate how proximity to academic resources and a vibrant community can accelerate technological innovation. The "luck" mentioned in this context refers to the convergence of academic preparation and economic opportunities, facilitated by a collaborative and strategically constructed environment.

Third Part: The Brain Drain in Mexico and the PIDAT-UDG Response.

Despite Jalisco being called the "Mexican Silicon Valley," it faces significant limitations in terms of investment in science and technology, which reduces opportunities to retain local talent. This challenge highlights the importance

of strengthening educational infrastructure to provide a promising future for students in their own country. Creating an environment that nurtures and retains talent is crucial for transforming the educational and economic landscape of Mexico.

Fourth Part: PIDAT Model at the University of Guadalajara.

The PIDAT at the University of Guadalajara is presented as an innovative model that integrates concepts of multidisciplinarity, hybrid learning, dual education, and micro-credentials. This model seeks to adapt academic training to the changing needs of today's society and economy, providing training that goes beyond traditional methods and fits the demands of the market and regional vocations. The goal is to form human capital that is not only globally competitive but also contributes to regional development.

Final reflections: Re-thinking Educational Infrastructure.

The University of Guadalajara is at a key moment to redefine its role as an innovation epicenter, adapting lessons from Silicon Valley to the Mexican context. The focus is on creating an ecosystem that fosters innovation and leverages local potential to positively impact society and the economy, thereby offering new opportunities and hopes for the future of talent in Mexico.

V.

SOLVING GRAND CHALLENGES II: SUPPORTING INTERNATIONAL STUDENT MOBILITY

SUPPORTING INTERNATIONAL STUDENT MOBILITY AND CARING FOR DISPLACED STUDENTS

Roger Marcelin Faye

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Introduction

In the framework of globalization, the mobility of people, knowledge, know-how and information has become a characteristic of the internationalization of higher education. Therefore, they are covering a series of processes which favor the development of training and university research, given that they constitute a capital gain in the personal life and professional future of students. They also open up path for extremely rich and fruitful scientific collaboration; as well they participate in the creation of a « university community » that is multicultural, tolerant, humanist and open to the world.

The ambition to disseminate a strong « international culture », at all levels of the university, in all sectors, for all staff, whether students, teachers, teacher-researchers or administrative staff, prompt us to:

- Place student mobility at the heart of training and skills acquisition
- Promote interculturality within student life;
- Initiate a real language policy.

Many lessons have been learned from the COVID-19 pandemic, especially in relation to the repercussions on education, training and the resulting digital transformation.

In fact, this digital transition had led to another approach to mobility in the higher education system.

Forms of students mobility

The most common type of student mobility is the physical one. In reality, statistics deal with this type of mobility and it is the one measured and which is most likely to feature in political and institutional strategies on the internationalization of higher education.

However, toward the Covid-19 pandemic, another form of mobility has emerged: student virtual mobility. With the development of digital technology, this form of mobility could play a peripheral role in the internationalization of higher education, since, seems to me, it embodies a real challenge and offers many opportunities in the context of the scarcity of resources.

Actions to be taken to support mobility

International student mobility is essential for cultural exchange and academic development. What are the means and measures that can improve the

experience of international students and also help them succeed in their studies and support this mobility?

- Financial aid: offer scholarships and financial aid to cover tuition, housing and travel costs.
- Exchange programs: encourage partnerships between universities to facilitate student exchanges and double degrees.
- Psychological support: establish social psychological support services to facilitate adaptation to the new environment and management of stress linked to the travel.
- Housing: provide affordable and secure housing options.
- Cultural integration: organize events and activities to help integrate into the local culture and make friends.
- Administrative assistance: offer administrative support for visa procedures, registration and other necessary formalities.

Furthermore, it should be noted that students choose the country where they will attend their higher education based on the places available in the best universities, their budget and the quality of education in their country of origin compared to the one they may find abroad. Also, a significant determining factor in the choice is related to the policies governing student work in the host country.

Towards an inclusive understanding of student mobility

Student mobility is an important subject in higher education. It allows students to acquire valuable skills and broaden their horizons by going overseas to study or train.

It brings added value if it is well supervised because it can often lead to a type of brain drain.

For being inclusive, student mobility should consider the inequalities and obstacles faced by certain students or under-represented groups, such as those from migrants or displaced persons, with disabilities or with specific financial needs. The idea is to offer adapted support to promote their participation and inclusion in international mobility projects.

Conclusion

The purpose of this reflection was to define, in an inclusive way, the contours of student mobility in the 21st century. It appears that technological progress, in particular the digital transition paired with societal health shocks such as Covid-19 pandemic, are pushing us to try to understand the long-term impacts on student mobility. Therefore, several questions arise: (i) what would be the new priorities for international education? (ii) how long will external factors related to COVID-19 require additional planning and strategy? (iii) will online learning continue, leading to a virtual mobility that could in some way help in the care of displaced students?

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TRANSNATIONAL DOCTORAL STUDY – ACCULTURATION AND CONSIDERATIONS FOR POLICY DEVELOPERS

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Key aspects of transnational study are founded on the aims and perspectives of the researchers who change territories for their graduate. For reporting and funding purposes, these developing researchers are often categorized simply as "International" – but within this, there resides a rich array of intersectionality, ambition, and aspiration. Recognizing this is essential if we are to further align mobility with positive outcomes.

In this short paper, I set out some of the challenges in this space and summarise relevant ongoing activities aimed at evidencing future decision-making in the UK.

Generally, international mobility is recognized as beneficial for researchers and, indeed, the research system. For example, increased impact for scientific publications and multiple affiliations being retained throughout individual's careers [1]. Further, via proxy measures, certain territories (North America and Northern Europe) can be identified as 'cultivators', and Others, who benefit most by attracting (or attracting back) established scholars, as 'recruiters'. Macroscopically, this model is portrayed as "Brain Circulation", rather than "Brain Drain". Interestingly, just such a "circulation model" is noted in Wei Yang's contribution to these proceedings [2]. Within this, the historically strongest systems play the dominant role in training and development – but mobility per se is advantageous to all [1].

This picture is further borne out by global profiling of researcher education, Over 90% of doctoral graduates gain their degree in one of the three main geographical blocks of Asia, Europe and North America [3]. While government-level attitudes to International undergraduate students shift with the political currents, the "brightest and best" badging has (for most) helped to retain relatively stable opportunities for mobility at research degree level.

The extent of transnational doctoral study in the UK is set out in detail in a recent report commissioned by Universities UK [4]. This states that "International postgraduate research (PGR) students are a crucial part of the success of the UK's research and development ecosystem. They provide skills that make PhD programmes a success, they contribute directly to the research base as collaborators and researchers". It also contains some striking data confirming the extent of PGR – and International PGR - across the UK. For the most recent year, the total number of PGR students is 123,525, of which 49,830 - or 40% - are International students. The distribution of these students is heavily skewed to the most research-intensive institutions - half of them are based in just fifteen universities. The report also cites previous research which identifies non-financial advantages associated with the international experiences brought by this large cohort. These include: new

cultural “third-spaces” within the classroom opened up through the intra-cultural teaching of UK students by international PGR students; enhanced development of informal care networks on campus; and the role of international PGR students in mentoring and intercultural community building [4]. This resonates directly with Arianna Sánchez Espinosa’s observations at University of Colima (Mexico), with “the presence of external students … fostering a multicultural environment within our university community, and encouraging dialogue and mutual learning” [5].

The wealth of expectations (and experiences - they are not always the same) of International research students can usefully be characterized by adapting taxonomies of acculturation – thus students might seek (or experience): assimilation, integration, segregation or marginalization. For example, an integrating student might adopt the academic norms of their host research environment, whilst maintaining attributes from their previous educational experience; a segregating student, alternatively, might experience mis-alignment with aspects of the host academic culture challenging (e.g., inappropriate canon of literature, or societal values) but still have a need to develop their levels of intellectual and methodological coherence. As set out in Roger Marclin Faye’s contribution to these proceedings from a Senegalese perspective, inclusive approaches – which are responsive individual student perspectives - are similarly identified as key to achieving effective mobility [6].

This range of potential requirements from transnational student is a real challenge. What implications does it have for provider institutions, policy makers and regulators? Further, how could or should institutions seek to meet the needs of their future graduate students? Can enhanced responsiveness to the multi-faceted needs of mobile researchers also benefit increasingly diverse cohorts of Home students?

Like much in postgraduate research, meeting these challenges will require the contribution from and, likely, targeted upskilling of supervisors or advisors. To this end, the UKCGE is a partner in a $6.2m government-funded project, entitled RSVP, aimed at transforming how research degree supervision is conducted, managed, supported, rewarded and recognised [7]. To inform this, this summer we have run the largest ever survey of UK doctoral supervisors. Supervisors are crucial to effective delivery of research degree programmes – but their perspectives and motivations are rarely considered. This survey has achieved 5174 responses from 141 institutions, just over a 50% increase on the 3435 respondents to our first such survey in 2021. The full report is free to download [8] and organisations interested in using the question set should contact UKCGE directly. The report contains many findings, but noteworthy here is that while 92% of supervisors indicated confidence in their interpersonal skills in supervising doctoral candidates from diverse backgrounds, only 79% were confident that they had the required intercultural skills.

Ultimately, informed by data such as that from the supervisor survey, RSVP will develop a suite of Continuing Professional Development materials and an institutional evaluation tool hosted by UKCGE. The aim is to move away from a one-size-fits-all model for graduate education and supplant it with increasingly responsive and student-focussed approaches. It is a challenge to all of us at this Summit to put in place the policy and people-based

infrastructure needed to achieve this. These will be crucial as increasingly multi-national and multi-disciplinary academic perspectives develop, bringing with them a rich array of exciting research projects and researchers.

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INTERNATIONAL MOBILITY OF GRADUATE STUDENTS AT THE UNIVERSITY OF COLIMA

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In higher education institutions, we assume a significant responsibility to prepare our students to perform at the highest level of disciplinary competence and to lead a broad process of international understanding. This enables us to work together to solve the greatest challenges facing humanity and the planet.

At the University of Colima, internationalization is a transversal process that impacts the core functions of teaching, research, outreach, and institutional governance. It is measured through 23 indicators outlined in our Institutional Development Plan.

Furthermore, we have an Internationalization Policy that states: "At the University of Colima, we prepare our staff and students to engage, work, contribute, and coexist successfully in the knowledge society and multicultural environments."

There are various modalities of student mobility, differing in duration, objectives, and structures:

1. **National and International Academic Mobility:** University of Colima students can spend a semester or a year at a foreign university, and vice versa. This type of mobility allows students to access courses and methodologies different from those at their home institution. It is carried out through a mobility call that is launched twice a year.

2. **Dual Degree Programs:** Students could earn a degree from both the University of Colima and a foreign university. The University of Colima offers a Doctorate in Chemical Sciences in co-tutelle with the University of Padua in Italy and a Doctorate in Social Sciences with Pablo de Olavide University in Spain.

3. **Virtual Academic Exchange:** Notable programs include:

- PIMIVA (Ibero-American Program of Virtual Mobility and Exchange for Postgraduate Studies): This program aims to enrich the academic, professional, and integral training of postgraduate students, allowing them to achieve an international vision and an Ibero-American and global perspective in their university education. It also encourages cooperation and recognition of quality among higher education institutions in the Ibero-American region. It targets 11 higher education institutions in Andorra, Argentina, Colombia, Spain, and Mexico.
- EMOVIES.
- PILA.
- INLAT.

International Collaboration Teaching-Learning Project: One of the most significant advancements in internationalizing our students' profiles was developed during the pandemic. Our faculty's collaborative process with

global peers to offer students international online education, with opportunities to teach and learn in multicultural virtual environments, work in interdisciplinary and international teams, and occasionally bilingual settings, is a benefit of internationalization at home that reaches 100% of students in a group.

For the first time, we can report on the International Dimension in Graduate Studies. Graduate programs also engaged in internationalization activities during 2023, which were measured, similar to undergraduate programs, through the 15 indicators established in the PIDE 2022-2025: learning English or other languages; use of second-language texts as part of the bibliography; extracurricular internationalization activities; diversified mobility; online international collaborative teaching-learning; case studies in different contexts; foreign professors teaching classes; dual degree programs; external students; full-time foreign students; classes taught in a second language; external professors; staff mobility; learning a third language; and virtual academic exchange.

The internationalization activities most frequently implemented by faculties, besides the inclusion of second-language texts in their curricula, were incorporating foreign professors teaching classes in 9 faculties and enrolling full-time foreign students in 7 faculties. We also identified an opportunity to develop dual degree programs and online international collaborative teaching-learning, as these indicators were the least frequently employed. Furthermore, some indicators were not implemented in any graduate program this year, as shown in the following chart.

It is noteworthy that the presence of external students pursuing full degrees at the University of Colima strengthens internationalization at home, fostering a multicultural environment within our university community and encouraging dialogue and mutual learning. In 2023, we registered a total of 24 students, 19 of whom were at the graduate level.

Strategic alliances with international organizations have allowed the University of Colima to strengthen and expand its cooperation ties with institutions abroad. This has created the necessary conditions for the institution to advance in internationalization.

The University of Colima maintained relations and operated with 18 organizations in different geographic areas to promote international education and competence, including University Mobility in Asia and the Pacific (UMAP), the Inter-American Organization for Higher Education (IOHE), the Global Partner Network (COIL), the Columbus Association, the International Association of Universities (IAU), and the ConnectAmericas Network, among others.

Additionally, the University of Colima, through Dr. Christian Jorge Torres Ortiz Zermeño in his capacity as Rector, holds regional leadership roles in two international networks: University Mobility in Asia and the Pacific (UMAP) and the Inter-American Organization for Higher Education (IOHE).

Our institution is highly committed to preparing our students for both local and global environments. To this end, we have a financial support program for postgraduate students engaging in national or international mobility. This program aims to strengthen activities that positively impact our students' education and continue expanding national and international cooperation networks to enhance opportunities for the academic community.

TRANSDISCIPLINARY COLLABORATION AROUND AI AND ADVANCED TECHNOLOGY, IN ALIGNMENT WITH INDUSTRY AND WORKFORCE READINESS

Ken Eisner

Managing Director, Higher Education to Workforce, ETS (USA)

I would like to thank Suzanne Ortega, Matt Linton, and the CGS team for putting on this excellent event. The ideas, discussions, comradery, and openness shared by this group is truly special, and I am grateful to be a part of it. Amidst all of these brilliant academics, I bring an industry and a technology bias – and you may absolutely hold that against me. I will try my best to lean into that external perspective.

For background, I recently joined ETS after about a decade at Amazon and Amazon Web Services, running their global higher education to workforce and educational programs – and specifically founding and running AWS Educate, where we worked with over 4000 primarily higher education institutions and tens of thousands of faculty to provide postsecondary students around the globe with pathways into cloud careers (AI, data sciences, and machine learning; software and web development; and so on).

ETS, while not a higher education institution, is steeped in academic endeavors, the science of measurement, and a robust research practice that integrates with our work. ETS' largest global products are assessments tightly linked with higher education and passage into the workforce: Graduate Record Examination (GRE) which is in my division, Test of English as a Foreign Language (TOEFL), PRAXIS test for teacher certification, our workforce assessment and licensure division PSI, and so on.

ETS is going through an exciting stage of evolution and rebirth, as we focus on the changing nature of assessments. This includes not only the demand for high stakes assessments, but also the changing nature of AI in producing assessments, ensuring that assessments are as AI / fraud proof as possible, promoting equity and not inequity through AI, and creating a much more predictive path between academia and the workforce.

Introduction

The way I think about technology, and thereby the latest advances in AI, is shaped by the following quote.

> Bill Gates: "*We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten. Don't let yourself be lulled into inaction.*"

In alignment with Gates' quote, ten to 15 years back, the hype curve overestimated Knewton which aimed to provide adaptive learning solutions for publishers, Gates Foundation-funded longitudinal data system inBloom, and the University of New Wales eLearning platform Smart Sparrow. $100 million of Gates funding didn't stop inBloom from imploding. Knewton's assets were sold to Wiley for less than $17 million. And Smart Sparrow was acquired by Pearson for $25 million. Hardly impressive.

Several years before that, Carnegie Mellon University came out with the Open Learning Initiative (OLI) headed by Candace Thille, a large-scale applied research project in cognitive and learning science, at the cutting-edge of big data in e-Learning I had the great pleasure to work alongside and learn from Candace while she took a leave of absence from academia to innovate at Amazon, and Candace also sits of ETS' Board of Trustees. OLI has served as one of the connective threads between the beginning of the hype cycle and today.

Today, AI is in a period of hypergrowth, with the flattening of the curve hard to predict. In the adaptive learning space, practical innovation has emerged in different forms than expected, but it is pervasive. Sana Labs leverages non-linear relationship between learning objectives and content to help learning designers create adaptive, mastery-based eLearning for the corporate world. Over 130,000 educators use Dreambox Learning's adaptive reading and math educational products to personalize lessons to over three million young students. Carnegie Mellon University adaptive language learning spin-off Duolingo had a highly successful initial public offering (IPO) in 2021, and their valuation has since doubled to $12.25B amidst a cooling of the educational technology market. Duolingo was actually a spinoff of Carnegie Mellon, with CEO Luis von Ahn and his doctoral student Severin Hacker as its CTO, and it has connections (as well as disconnects) with OLI.

The seeping of generative AI into academia is now occurring at warp speed. In a recent report, OpenAI indicated that its large language model "OpenAI o1 ranks in the 89th percentile on competitive programming questions (Codeforces), places among the top 500 students in the US in a qualifier for the USA Math Olympiad (AIME), and exceeds human PhD-level accuracy on a benchmark of physics, biology, and chemistry problems (GPQA)."

Against this backdrop, Gates' logic provides a mental model for understanding our point along the technology hype to adoption cycle. Embracing AI today, in the years when Gates warned us of underestimating its adoption and its impact, requires embracing a different mindset – one in which everyone is a learner, an innovator, and a creator. The old model of learning involving the consumption of content and lab practice is insufficient when change outpaces content creation and practice requires real-world problem solving.

In this void, transdisciplinary collaborations, in partnership with industry and in the service of better integrating academics into the workforce, can be deployed to help address learning at the speed of AI. Transdisciplinary collaborations that pair individuals schooled in technology disciplines – computer science, machine learning and data science, mechatronics and robotics, and virtual and augmented realities – with individuals solving real-world problems can yield outsized benefits. Instead of isolating technologists in a lab, they can be partnered across the institution and into the community to accelerate their impact.

Models and Benefits

One worthwhile model for this approach was the Data Science for Social Good (DSSG) Fellowship launched by Rayid Ghani at the University of Chicago in 2013. While the summer fellowship effort focused on data scientists, it brought together individuals from non-profits, governments, and corporations

to collaborate on solutions for the common good. A quick Internet search today turns up DSSG programs at Carnegie Mellon University, Stanford University, University of British Columbia, and Vanderbilt University, among others, pointing to the lasting impact of this effort.

Beyond the output of the collaboration, a focused transdisciplinary approach around AI and advanced technologies can unlock the power of peer-to-peer teaching and learning. Pairing an AI-fluent technologist with a non-technologist enables an invaluable and highly relevant knowledge transfer to the non-technologist. Exposure to generative AI, machine learning functionality, and other advanced technologies widens the aperture for non-technologists, creating a basis for technology understanding and supporting an environment where technology-sparked creativity and innovation flourish. The non-technologist gains an appreciation for technology, practical applications, and the powerful capacity to question technological approaches beyond this partnership. Without this understanding, they would eschew technology co-innovation or cede it to the better versed individual, both in academic and commercial settings.

For the technologist, the challenge of supporting the learner through their understanding provides benefits associated with teaching, such as breaking down the approach into comprehensible parts, checking for understanding, and empathy for the learner. For some, peer-to-peer teaching will come naturally; faculty will have to support others along the way. One particularly effective strategy used in the corporate setting is a "check ride," where the learner delivers a technical or semi-technical simulated presentation as a check for understanding and ability to convey that understanding to other technical and non-technical folk.

Another advantage of the transdisciplinary approach is, of course, in applying AI solutions to real problems by putting the impacted constituents in the room. In the corporate world today, with the rush to AI and generative AI, every company seems to be in a rush to develop an AI strategy. Often the creation of an AI strategy is done in the abstract and without a concrete need, problem statement, or prioritized objective. Working transdisciplinary enables other academics, nonprofit, community players, or government to bring the need case for which AI can be used as a lever. This attachment of the need case to the solution places AI in the context of delivering value and approximating or delivering against real-world experience.

Pairing technologists with individuals with competence in written communication, such as those in the liberal arts or business domain, can also lead to worthwhile outcomes. At Amazon, narrative writing and the celebrated six-pager serve as opportunities for both technologists and non-technologists to coherently and substantively present new ideas or initiatives. Without the capability to clearly communicate their ideas in written form, at the technical and business depth that the concept requires, Amazon employees risk being cut off from those opportunities, and the company risks losing that ideation. The skill is so valued that numerous writing courses are taught within the company, and adept writers are often paired with those less skilled or nascent in that activity.

AI's integration across fields also provides students with an opportunity to gain proficiency not only in the AI itself but also in how AI interacts with

other domains such as ethics, law, psychology, and business. These interactions help shape the way we think about AI in both the public and the private sphere, and support important conversations, proactive public policy, and leadership development.

Durable Skills

This transdisciplinary approach also enables us to support the growth and nurturing durable skill sets in our students. At ETS, we are deploying and studying the importance of these durable skills (aka human skills, power skills, 21st century competencies, etc) in the academic and workforce context. ETS experimentation and research is unlocking the relationship between these durable skills and academic performance, community impact, and workforce success. In the case of transdisciplinary approaches around AI, as discussed previously, it appears as if it could support growth around collaboration, communication, dealing with ambiguity, moving at speed, thinking big, and critical and creative thinking.

Conclusion

Transdisciplinary approaches with technology, including the cross-pollination of industry and industry objectives, can unlock significant opportunities for the student and the academic institution. Thoughtful approaches that pair technologists with non-technologists, blend real-world experience, and lean into durable skill sets not only hold the promise of strong research outputs but also the readiness and technology capacity for students to shift seamlessly in-between academia and workforce. With the speed of AI adoption and the rapid iteration of new AI technologies, transdisciplinary collaboration may be the best way for academia to maintain pace with technological change.

TRANSDISCIPLINARY RESEARCH PATHWAYS FOR ADDRESSING GLOBAL GRAND CHALLENGES

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A university can achieve multidisciplinarity through its various schools, departments, and research labs, which cater to distinct fields of study. However, the real challenge is: How can a university aspire to transdisciplinarity? Is it simply a matter of combining different academic pathways or an accumulation of courses and certifications from diverse disciplines? The 2024 Nobel Prize in Physics , awarded to John J. Hopfield and Geoffrey E. Hinton, showcases the power of transdisciplinarity in scientific research. Their groundbreaking work applies principles from physics to revolutionize machine learning through artificial neural networks, systems inspired by the human brain. By merging insights from diverse fields—physics, biology, and computer science—they developed foundational techniques that underlie modern AI applications like image recognition and language processing.

A special charter, adopted by participants of the World Congress of Transdisciplinarity in 1994, states that “Transdisciplinarity does not provide recipes for action. It offers signals to collectively imagine and build.” In the spirit of this charter, our article seeks to inspire an inclusive reflection on how to chart pathways for transdisciplinary research, considering a wide array of diverse parameters and constraints. In this context, unlike more traditional approaches, we do not seek "universal recipes" for solving emerging global grand challenges such as climate change and the Fourth Industrial Revolution. The complexity and specificity of these contemporary issues require tailored responses. We believe that this can be addressed through transdisciplinarity, which emphasizes experimentation, adaptability, and the contextualization of actions.

In the fast-evolving landscape of academia, the emergence of new fields has the potential to significantly reshape how scholars engage with one another. These nascent disciplines often challenge the traditional boundaries that separate academic domains, fostering interdisciplinary collaboration and driving innovation. As we witness the rise of fields such as data analytics, artificial intelligence, healthcare innovation, and sustainability studies, it becomes evident that these areas not only respond to societal needs but also create new opportunities for academic inquiry and professional development. For instance, the integration of human-computer interaction (HCI) emphasizes the importance of user experience across various sectors, reflecting a broader recognition of the need for interdisciplinary training to meet the challenges posed by rapid technological advancements.

Indeed, as academia becomes increasingly interconnected with the socio-economic sphere, it is essential to highlight how these emerging fields can bridge gaps between scholars, encouraging a more integrated and holistic approach to research and education. This integration not only enhances the relevance of academic work but also prepares students for the complexities of modern careers, where collaboration across disciplines is often crucial for

success. Moreover, the rise of digital humanities and cybersecurity illustrates how traditional academic disciplines can evolve and adapt to contemporary challenges, creating new avenues for research that are both innovative and applicable to real-world problems. This is made possible through the inclusion of non-academic stakeholders within transdisciplinary research pathways. Indeed, such an approach actively involves stakeholders outside of academia, including community groups, government agencies, industry, and non-profit organizations. These stakeholders help define the problem, co-create research questions, and participate in the research process, ensuring that the outcomes are practical and applicable.

As an example of transdisciplinary pathways, we can consider climate change mitigation. Addressing climate change research demands input from climatologists, economists, sociologists, and political scientists. This integrated approach ensures that the multifaceted nature of global issues is adequately addressed, paving the way for more comprehensive and impactful research outcomes. Moreover, interdisciplinary collaboration can lead to innovative methodologies and technologies. For example, the intersection of data science and environmental science can yield advanced predictive models that enhance our understanding of climate patterns and inform policy decisions. Similarly, the collaboration between engineers and social scientists can foster the development of sustainable technologies that are socially acceptable and economically viable.

Future research directions should increasingly focus on addressing the grand challenges of our time, such as climate change, healthcare, and energy. Innovation should be driven by the pursuit of solutions to these complex, global problems, rather than being confined within the boundaries of individual disciplines. This approach emphasizes that the most impactful advances will come from interdisciplinary collaboration and the development of practical solutions that transcend traditional academic silos. By concentrating on problem-solving, rather than adhering strictly to disciplinary frameworks, researchers can foster innovation that addresses the critical needs of society. This will be facilitated by an academic system that adopts educational programs tailored to the context of major global challenges, rather than adhering to standard, discipline-based training. The design of the necessary competencies to achieve such a goal requires the involvement of both academic and non-academic experts, working closely in relation to the specific challenge being addressed. By aligning educational pathways with real-world issues, institutions can better equip students to develop innovative, interdisciplinary solutions that directly respond to the pressing needs of society.

In conclusion, the journey toward effective transdisciplinary research is not merely an academic exercise; it is a vital necessity in addressing the complex global challenges of our time. By embracing the principles outlined in the 1994 charter, we can foster an environment that encourages collective imagination and collaborative action. The integration of diverse fields and the active involvement of non-academic stakeholders enrich the research process, ensuring that solutions are not only innovative but also relevant and applicable to real-world contexts. As we navigate the intricacies of issues like climate change and technological advancement, the commitment to transdisciplinarity will empower scholars, practitioners, and communities alike

to co-create knowledge and drive meaningful change. Ultimately, it is through this inclusive and adaptive approach that we can hope to build a more sustainable and equitable future for all.

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THE PLEDGE FOR INTERDISCIPLINARY STUDIES IN GRADUATE COURSES

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An interdisciplinary field integrates methods, concepts, and theories from multiple disciplines to address complex problems, creating a cohesive framework that transcends the limitations of individual fields. As studies advance, unsolved problems are marginal or too complex to be resolved, making progress in individual domains increasingly challenging. Unlike multidisciplinary approaches, where researchers from different disciplines work on a common problem from their perspectives, interdisciplinary studies address modern research questions that often span multiple fields, requiring broad collaboration for comprehensive answers.

Although this commitment to interdisciplinarity is not new, many factors converge to make it more viable and relevant. Virtual collaboration platforms, data-sharing systems, and advanced communication tools enable seamless collaboration between researchers from different disciplines and locations. Technological advances often emerge at the intersection of disciplines, requiring collaborative efforts. For example, the development of artificial intelligence combines knowledge from computer science, mathematics, neuroscience, and cognitive psychology.

To name a few examples, solutions to social challenges often must be pursued jointly by scientific research, economic considerations, social impact assessments, and ethical frameworks, necessitating collaboration between scientists, economists, sociologists, and ethicists. Addressing diseases like COVID-19 requires knowledge of epidemiology, virology, medical research, public policy, and social sciences. Environmental degradation involves ecology, environmental science, economics, urban planning, and political science to create sustainable solutions.

Encouraging collaboration among graduate students from diverse academic backgrounds is essential for fostering innovation and solving complex problems. Universities and research institutions play a crucial role in promoting this culture of collaboration by providing the necessary funding, shared facilities, and interdisciplinary programs. These institutions create environments where students can interact with colleagues from different disciplines, facilitating the exchange of ideas and methods.

Successful interdisciplinary collaborations highlight the significant benefits of combining different perspectives. These collaborations often lead to advances that are not possible within a single discipline, as they bring together varied knowledge and approaches to solve complex issues. Graduate students gain broader skill sets in these collaborations, improving their ability to think critically and solve problems from multiple angles. This comprehensive understanding of complex issues prepares them for various challenges in their future careers.

Building professional networks in various fields also opens up new career paths and research opportunities for graduate students. These networks provide valuable connections and resources that can support your professional development and facilitate future collaborations. By interacting with peers from diverse disciplines, students can expand their horizons, explore interdisciplinary research areas, and develop innovative solutions to global challenges. Graduate students are well-equipped to contribute meaningfully to their fields and society through these collaborative efforts.

From the university's perspective, promoting interdisciplinary studies involves facing three main challenges. The first challenge is to address communication barriers between disciplines, which are crucial for successful interdisciplinary collaboration. These barriers often result from differences in terminology, methodologies, research cultures, and epistemological approaches. Effective communication is vital to ensuring that all team members understand and appreciate each other's perspectives and methods, essential for productive collaboration.

The second challenge is integrating different methodologies into interdisciplinary studies, merging various research methods and approaches from multiple disciplines to create a unified framework that can address complex problems more comprehensively. The integration process can be complex due to inherent differences in how disciplines conduct research. Yet, it also presents significant opportunities for innovation and a deeper understanding of multifaceted issues. Successfully combining these methodologies requires careful planning and a willingness to adapt and align diverse approaches.

Finally, it is crucial to establish a fair framework for evaluating interdisciplinary work. Traditional disciplinary metrics may need to capture the contributions and impact of interdisciplinary research fully. Therefore, universities must develop criteria that recognise and evaluate interdisciplinary efforts' unique value and outcomes. This includes creating new metrics or adapting existing ones to fairly reflect the contributions of the different disciplines involved in the research. By addressing these challenges, universities can better support and promote interdisciplinary studies, ultimately leading to more effective and impactful research results.

HOW EMERGING FIELDS OF STUDY CAN CHALLENGE BOUNDARIES BETWEEN SCHOLARS: EXPLORING THE CONCEPT OF JOINT AND DUAL DEGREE PROGRAMMES

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Background

Research and graduate education are undergoing transformative shifts as global trends rapidly evolve [1]. Emerging fields in areas such as technological sciences, environmental sciences, social sciences, and physical and mental health sciences are driving innovation by advancing knowledge and generating new insights that address challenges in various sectors including addressing sustainable development goals.

Although graduate training and research in some emerging fields require specialized training and skills, increasingly, progress and impact are driven by innovation through interdisciplinary and transdisciplinary collaborations. This is because issues at the micro, meso and macro levels are often multifaceted, requiring diverse perspectives and expertise to develop effective solutions. Thus, the ability to engage more effectively in interdisciplinary and transdisciplinary initiatives, involving experts from diverse disciplines can lead to innovations in solving complex problems, such as climate change, physical and mental health, and social inequality.

Collaboration across disciplines and institutions especially for researchers and graduate students in the Global South, is therefore critical for understanding challenges comprehensively and driving holistic innovations in addressing them. As experts from different disciplines train, mentor and/or work together, their unique experiences and skills work synergistically toward these comprehensive, sustainable, and innovative approaches to the complex challenges of individuals and their communities [2].

However, research and graduate training within some emerging fields such as artificial intelligence, digital mental health, biotechnology, genomics, and precision medicine in the Global South are often underrepresented, reflecting the need to promote research and innovation. Trans-regional networks have often advanced research and innovation, particularly in fields where access to modern equipment and technology is limited. Thus, the ability to fully engage in cutting-edge research and innovation for institutions requiring such push from well-established ones will help address disparities and foster a more inclusive global scientific landscape that values the unique contributions and needs of researchers and graduate students in the Global South. One potential approach is trans-regional collaborative exchanges in emerging fields for graduate students and faculty/researchers and the development of frameworks for joint/double degree programmes to enhance the educational experience through access to human and technological resources and expertise [3]. This approach can motivate higher education and research institutions to reflect on flexible collaborative and global engagement.

Approach

Joint degree programmes are offered at two (or more) awarding institutions where one can study two different subjects at the same time and then combine them into a single qualification. Graduate students benefit from human resources (tuition and supervision), physical resources (laboratories, ICT infrastructure, library facilities etc.), and socio-cultural experiences from all participating institutions [4,5]. The joint programmes are developed by two or more higher education institutions. They agree on admission and graduation criteria, require students to study at each participating institution, and ensure that examinations taken at partner institutions are fully recognized. Upon meeting graduation requirements, students receive a joint degree issued as a single document. In terms of new paradigms and improved integration of emerging fields into research and training, joint degrees ensure that the curriculum is innovative to tackle complex challenges in the field of study based on the expertise, resources, and perspectives of the institutions involved [3].

Double degree programmes allow students to study for two university degrees simultaneously at two accredited institutions, completing both in less time than it would take to earn the degrees separately. Graduates receive two academic degrees, and the shortened study time is achieved by integrating the curricula. These programmes enable students to either build on existing knowledge with complementary courses from a partner university or broaden their expertise by attending different programmes including ones with limited resources available in one institution [4,5]. The concept of the value of double degrees points to the fact that they are versatile and cater to diverse interests but are particularly relevant for students aiming for careers in organizations that transcend boundaries, including emerging fields of study [6]. This dual approach can equip students and researchers to be innovative and competitively advantageous in their careers. For both joint and double degree programmes, partnering institutions co-own theses/dissertations and other outputs emanating from the study or research [3].

While the emphasis is placed on students and the advantages of joint/double degrees, elements of faculty exchange and development are also key for the successful implementation of joint/double degree programmes since they will be co-tutoring, co-supervising, and/or co-examining. Some faculty-level benefits could include, remuneration, visits to partner institutions, and collaborative research proposal development and outputs.

Conclusion

While fields in research and graduate education are evolving to meet the complex demands of a rapidly changing world, collaborations that encourage knowledge exchange and an equitable global academic environment prepare graduates to address global challenges from holistic perspectives. To help bridge gaps in resources and expertise, joint/double degrees could advance both research and innovation globally. The risk of losing talented researchers and graduate students in emerging fields of study, particularly in resource-limited areas can be alleviated through joint/double degree programmes with resource-advantaged institutions.

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PARTICIPANT LIST

Organizers

Suzanne Ortega became the sixth President of the Council of Graduate Schools on July 1, 2014. Prior to assuming her current position, she served as the University of North Carolina (UNC) Senior Vice President for Academic Affairs (2011-14). Previous appointments include the Executive Vice President and Provost at the University of New Mexico (UNM), Vice Provost and Graduate Dean at the University of Washington (UW), and the University of Missouri (MU). Dr. Ortega's masters and doctoral degrees in sociology were completed at Vanderbilt University.

Ana Marcela Torres Hernández is Coordinadora de Posgrado at the University of Guadalajara (UdeG) and the Vice President of the Mexican Council of Graduate Studies (COMEPO).She holds a PhD in Economic and Administrative Sciences specializing in Public Policy from the University of Guadalajara, where she currently serves as the General Coordinator of Research, Postgraduate, and Outreach at the university. Additionally, she holds the position of President of the Mexican Council of Postgraduate Studies (COMEPO). From 2014 to 2016, she worked as the Director of Evaluation and Monitoring of Social Policy for the State of Jalisco. In 2012, she completed a short research stay at the University of Texas at Austin at the Lyndon B. Johnson School of Public Affairs. She has also served as an editorial coordinator and authored book chapters related to the internationalization of the curriculum and social retribution in postgraduate programs, among others.

Erick Sánchez Flores is a geographer, specialist in remote sensing and in spatial analysis, from the University of Arizona, and professor at the Autonomous University of Ciudad Juarez, Mexico since 1997. His research focuses on the study of land use dynamics in urban areas. He has published 3 books and more than 20 articles in national and international journals. He has presented his work at more than 40 national and international forums; and 13 advised master and PhD. theses. He teaches undergraduate and graduate courses in geography, remote sensing, geographic information systems, and spatial analysis. He is recognized by the Nacional Council of Science and Technology as National Researcher, level 1, is accredited grant evaluator from CONACyT, and program evaluator the Council for the Accreditation of Educational Programs in Humanities. He is the founder of undergraduate and graduate programs at UACJ, where he was Dean of the Institute of Architecture, Design and Art from 2012 to 2018. Since 2019 he is Graduate Studies Coordinator at UACJ and he recently was appointed president of the Mexican Council of Graduate Studies (COMEPO), where he has served in several steering committees and commissions such as the organization of the 3MT National competition in Mexico.

Attendees

Riadh Abdelfattah received an Engineering degree from the Telecommunication Engineering School of Tunis, Tunis, Tunisia, in 1995, the Master Degree (DEA) and the Ph.D. degree in electrical engineering from the "Ecole NationaleIngénieurs de Tunis," Tunis, Tunisia, in 1995 and 2000 respectively, and "le Diplôme de l'HabilitationUniversitaire" from SUP'COM from the University of Carthage in Tunisia, Carthage, Tunisia, in 2008.,Since December 15, 2017, he has been the Vice President with the University of Carthage and a Professor with the Higher School of Communications for engineers (SUP'COM), University of Carthage. He also is currently an Associate Researcher with the Department ITI, IMT-Atlantique, Brest, France. Between 2000 and 2002 he was a Postdoctoral Researcher at the EcoleNationale des Télécommunications, Paris, France, consecutively with the Department TSI and then with the Department of COMELEC. His main research interests include interferometric radar imagining, multiemporal and multiscale image analysis, desertification, flooding and soil salinity mapping from remote sensed data, and SAR-nanosatellite development. Dr. Abdelfattah is a member of the Executive Committee of the IEEE Tunisia Section (2013–2015). He is an elected member at the scientific council of the Agence Universitaire de la Francophonie (2016–2018) and a member of the "Commission Régionale des Experts" of AUF. He was an elected member (2011–2017) with the University Council of Carthage. He is co-chairing the M2GARSS (Mediteranean and MENA Geoscience and Remote Sensing Symposium) symposium to be held in Tunis in March 2020. He is a founding member of the Research Unit in Satellite Imagery and its Applications (2004–2011), and a founding member of the Communication, Signal and Image Laboratory in November 2011 at SUP'COM. He has authored and co-authored more than 70 journal papers, conference papers and book chapters.

From 2002 to 2012, **Philippe-Edwin Bélanger** served at Fonds de recherche du Québec - Nature et technologies, overseeing the organization's scholarship programs and France-Québec partnership. He has been appointed director of graduate studies and student success at Institut national de la recherche scientifique (INRS) in 2012. As director, he is responsible for academic program management, administrative support for graduate students and postdoctoral fellows, the registrar's office, student services and financial support. Trained in political science and public administration, Mr. Bélanger has conducted study on the impact of Québec's family policy. As a member of Conseil supérieur de l'éducation du Québec's commission on university education and research from 2008 to 2011, he contributed to Pour une vision actualisée des formations aux cycles supérieurs, an advisory opinion presented to Québec's Minister of Higher Education highlighting various concerns, and issues associated with graduate studies. A very active member of Québec and Canadian professional associations, Philippe-Edwin Bélanger was president of Association des administratrices et des administrateurs de recherche universitaire du Québec (Québec Association of University Research Administrators) in 2013. During that time, he defended the importance of maintaining public investment in university research. Between 2014 and 2018, he has been president of Association des doyens des études supérieures au Québec (Québec Association of Deans of Graduate Studies). As president, he conducted, in collaboration with Québec Ministry of Higher Education,

Research Funds of Québec, and Francophone Association for the Advancement of Knowledge, the first Québec survey on Ph.D. competencies for the purposes of enhancing programs, improving the professional integration of graduates, and highlighting the contribution of doctoral students to the development of society. He was treasurer of the Canadian Association for Graduate Studies (CAGS) between 2017 and 2019. He is vice president of this association since November 2021. Finally, he has just received the prestigious Career Achievement Award from University of Quebec in recognition of his contribution to the advancement of higher education.

Jonathan Brindle is Head of the International Relations Office at the Université Polytechnique Hauts-de-France in Valenciennes, France. With a background in academia and a passion for leadership, he has worked at various institutions to hone his expertise. Holding positions as a Doctoral Candidate and Postdoctoral Fellow at the Norwegian University of Science and Technology (NTNU), he delved into rigorous research and academic pursuits. Subsequently, his academic journey led me to the University of Ghana's Institute of African Studies, where he served as a Visiting Researcher and Project Leader. This experience allowed him to engage deeply with projects of significant academic and societal impact. As a Research Affiliate at KU Leuven, I furthered my research endeavors, contributing to the vibrant academic community of one of Europe's foremost research universities. Today, as the Head of the International Relations Office at Université Polytechnique Hauts-de-France, he finds purpose in serving as both a leader and a facilitator. His role encompasses supporting the development of international engagement and cooperation, as well as executing strategic plans and associated goals. Efficiency lies at the core of his approach. He establishes robust systems and allocate resources to implement international research and education agendas. Through collaboration with the university community, he cultivates international partnerships, amplifying their impact across the institution. His journey is marked by a dedication to advancing international education and research, leaving a lasting imprint on the academic landscape.

Hans-Joachim Bungartz is the Dean of the TUM School of CIT and TUM Graduate Dean at the Technical University of Munich (TUM) in Germany. His studies of mathematics, informatics and economics at TUM were followed by his doctorate (1992) and post-doctoral teaching qualification (Habilitation, 1998), after which he held a professorship in mathematics in Augsburg and an informatics Chair in Stuttgart before returning to TUM in 2004. He is a member of the board of directors of the Leibniz Supercomputing Centre, a member of the advisory board of several HPC centers and institutions, speaker of the BGCE elite study program and director of the Ferienakademie Sarntal. Professor Bungartz chaired the DFG Commission for IT Infrastructure for seven years, has been Chairman of the Executive Board of the German Research and Education Network from 2011 to 2020 and is a member of the Steering Committee of the Council for Doctoral Education of the European University Association since 2016.

Doug Cleaver has over 25 years of experience as an academic, having taught and assessed at all levels, and led activities ranging from new course developments to REF submissions. Throughout, he has developed a particular expertise in doctoral provision and, in 2011, he became academic lead for

research degrees provision at SHU. He introduced a Doctoral School model in 2014, has overseen innovations such as PGR Learning Contracts, and set up major collaborative programs with industrial, NHS, and academic partners. Doug joined the UKCGE Executive Committee in July 2018 and was elected as Chair in July 2021.

Michael Cunningham serves at the Associate Provost for Graduate Studies and Research in Tulane University's Office of Academic Affairs. Dr. Cunningham holds the academic rank of Professor at Tulane University; and he has a joint faculty appointment in the Department of Psychology and the undergraduate program in Africana Studies. He is a developmental psychologist with a program of research that focuses on racial, ethnic, psychosocial, and socioeconomic processes that affect psychological well-being, adjustment to chronic stressful events, and academic achievement among African American adolescents and their families. He uses mixed methods in his research projects that includes the study of gender- specific patterns of resilience and vulnerability in urban African American participants. Dr. Cunningham has received external funding from several sources including the National Science Foundation (NSF), The National Institutes of Health (NIH), The Mellon Foundation, the Louisiana Board of Regents, and The U.S. Department of Education. He has been recognized for his research from the National Research Council. He has received Tulane's highest teaching award and been designated as a Suzanne and Stephen Weiss Presidential Fellow. He completed his doctoral work at Emory University after completing an undergraduate degree at Morehouse College. Dr. Cunningham also completed a postdoctoral fellowship at the University of Pennsylvania. Along with serving as an Associate Provost at Tulane, his current professional service includes serving as Editor-in-chief for Research in Human Development. He has severed on several journal editorial boards such as a Senior Editor for the American Educational Research Journal, the Journal of Negro Education, and Child Development of which he was an Associate Editor from 2007-2019. He currently serves on executive board of the Council of Graduate Schools as Chair-elect and the Educational Testing Service's Graduate Education Advisory Committee as well as previous service on the boards for organizations associated with graduate education (e.g., Association of Graduate Schools – AAU - AGS, Council of Southern Graduate Schools, & ETS' Graduate Record Exam - GRE) and academic disciplinary societies (e.g., the Society for Research in Child Development's (SRCD) and the Society for Research in Adolescence's (SRA)). His mentoring experiences include being a Senior Mentor for the Robert Wood Johnson's New Connections Program and a Faculty Mentor for the American Psychological Associations Minority Fellow Program's Psychology Summer Institute. Most recently, Dr. Cunningham was as a recipient for the Society for Research on Adolescence's Mentoring Award and he was selected as Tulane University's recipient of the Oliver Fund Award for Excellence in Faculty Mentoring in 2021.

Effrosyni Diamantoudi is dean of graduate studies at Concordia University (Canada), a role she has served in since 2020. She received her doctorate in economics from McGill University and was graduate program director in Concordia's Department of Economics. Prior to becoming dean, she served for nine years as associate dean of recruitment and awards in the school of graduate studies at Concordia. She also serves on the executive committee of

the Northeastern Association of Graduate Schools (NAGS) and is a member of the Board of Directors of the Centre Interuniversitaire de Recherche en Analyse des Organisations (CIRANO).

Ken Eisner is Managing Director of Higher Education to Workforce at ETS. In this role, Eisner will manage all aspects of products aimed at higher education and career readiness, including product ideation, development, marketing, sales and operations. Eisner was previously Global Director of education programs at Amazon Web Services (AWS) and of learning systems at Amazon. While at AWS, Eisner founded and scaled AWS Educate, Amazon's global program to provide students with pathways into cloud jobs. Based on a breakthrough skills taxonomy called the Cloud Competency Framework (CCF), AWS Educate recruited over 1 million students, tens of thousands of educators and more than 3,500 educational institutions and developed countrywide and statewide partnerships to realign curriculum to the CCF. AWS Educate received various awards, including Eisner's recognition as AWS Public Sector's Impact Person of the Year in 2018. Eisner holds a BA from Cornell University and an MPP and MBA with honors from Georgetown University.

Arianna Sanchez Espinosa holds a PhD in Law from the Universidad Michoacana de San Nicolás de Hidalgo, with honors. Master's Degree in Commercial and Business Law from the Universidad Panamericana, with honorable mention; Graduated in Law from the University of Colima, obtaining the "Peña Colorada" award. She currently works as a full-time Research Professor at the Faculty of Law of the University of Colima with distinction of candidate in the National System of Researchers of the National Council of Science and Technology in Mexico, as well as a private legal consultant; She is the co-author of 17 publications in specialized journals and book chapters such as: "The social function of the company and its repercussions in the sphere of human rights.

Roger Marcelin Faye is Vice-rector in charge of Research, Innovation and Partnership of Amadou Mahtar MBOW University-SENEGAL. He prepared his PhD at the CNRS Laboratory for Analysis and Architecture of Systems (LAAS) of Toulouse in France and received PhD degree in Automatics Control and Operational Research from Paul Sabatier University of Toulouse. His research activities cover but not limited to modelling systems and IT solutions for Africa. Prof. FAYE is a member of the Senegalese society of complex systems. From March 2018 to January 2022, he was Director of the Higher School of Engineering Sciences and Techniques of Amadou Mahtar MBOW University, in charge of Cooperation. Previously, he was at the Polytechnic Higher School of Cheikh Anta DIOP University and led the Electrical Engineering department from August 2010 to September 2012. After being co-opted by the African and Malagasy Council for Higher Education (CAMES) in its transitional phase (2007-2011), Prof. Roger Marcelin FAYE, Full Professor of Automatics (CAMES, 2014), chairs July 2018 – July 2024 of the Specialized Technical Committee “Sciences and Techniques of Engineer” of CAMES. Professor FAYE has several scientific productions to his credit, including two books. He is a Knight of the National Order of the Lion of SENEGAL.

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Daniel Lee Kleinman is Associate Provost for Graduate Affairs in the Office of the Provost and Professor of Sociology in the College of Arts & Sciences. He provides leadership for the University's graduate education initiatives, working closely with the Provost and the Deans to articulate an institutional voice and promote continued excellence in graduate education. Central to these efforts are supporting interdisciplinary and co-curricular education and research, working to increase interdisciplinary and professional development opportunities for BU's 13,000 graduate students, and nurturing new

collaborations between the Charles River campus and Medical Center campus graduate programs. Additionally, Daniel works to enhance the quality of the full graduate experience through the ongoing development and review of graduate programs, the facilitation of University Fellowship programs, and the recruitment and retention of a strong, diverse pool of degree candidates. In 2018, Daniel's role was expanded to include oversight of the University's Academic Program Review process, which works to increase the quality and impact of programs on both campuses. Before his arrival at BU in 2017, Daniel served as Senior Associate Dean (and previously as Associate Dean for Social Sciences) in the Graduate School at the University of Wisconsin, Madison, where he was also a Professor in the Department of Community and Environmental Sociology. A sociologist by training, he is a nationally recognized leader in the interdisciplinary field of Science and Technology Studies whose work has been supported by competitive grants from the National Science Foundation and the National Endowment for the Humanities.

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Matthew D. Linton is the senior manager for programs and publications at the Council of Graduate Schools where he directs the Strategic Leaders Global Summit on Graduate Education. He currently manages and is co-PI of the National Name Exchange (NSF #2336484), which aims to expand access to graduate education for underrepresented students from the United States and Canada. His work at CGS has included the publications Microcredenials and the Master's Degree: Understanding the National Landscape to Support Learners and the Workforce, Making a Grad School Plan: From Application to Orientation, and The Organization and Administration of Graduate Education (with Julia Kent). Prior to joining CGS in 2018, Matthew received his doctorate in history from Brandeis University where he was a Crown and Mandel fellow. His research has appeared in The Washington Post, The Journal of American-East Asian Relations, and the Rockefeller Archive Center's IssueLab.

Shireen Motala is the SARChI Chair: Teaching and Learning in July 2020 at a Tier 1 level with its inception in October 2020. This national research chair is supported by the Department of Higher Education and Training (DHET) and by the National Research Foundation (NRF), South Africa. Prof Motala was the Head: Postgraduate School (PGS), University of Johannesburg (UJ) until September 2020 and is professor in the Faculty of Education (FoE), UJ. She is a member of the Academy of Science in South Africa (ASSAf). She has held numerous leadership roles related to higher education including Chairperson of the Education Policy Consortium (2006-2010), Chairperson of the UNESCO South African Commission (2001-2006) and first inaugural president of the South African Research Association (SAERA) (2013-2014). She was appointed by the Minster of Higher Education and Training to serve on the Council of Higher Education (CHE) for two terms from 2010-2018. In 2013, she served on the Ministerial Committee to review the national Senior Certificate examination. She is currently a trustee at the South African Institute for Distance Education. An NRF rated researcher, she has initiated collaborations between universities across Africa and with Asia and Europe and this has led to the formation of long-term regional and international partnerships. Her research record is substantial and includes publications in journals and books and editorship of local and international journals. Her research interests and expertise are in the areas of education financing and system reform, access and equity, and education quality in schooling and higher education.

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Patricia Villasana Ramos has been working for over 25 years in the field of Foreign Trade and International Logistics, collaborating with government agencies such as COFOCE Guanajuato, private companies, and chambers and associations. Since 2003, she has been a founding partner and Associate Director at Vitrade, where she conducts international market research, as well as analyses to optimize business logistics and plan international supply chains. Since 1996, she has taught at various higher education institutions in León, Guanajuato, at both undergraduate and master's levels, with subjects related to international market research, transportation logistics, business logistics, and supply chain management. Since 2006, she has been involved in administrative roles at the Universidad De La Salle Bajío, currently serving as the General Director of Graduate Studies.

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Wei Yang was born in 1954 in Beijing. He received his Ph.D. degree from Brown University, USA in 1985. Currently, he is the President of Association of Chinese Graduate Education, a Professor of Zhejiang University, a Member of Chinese Academy of Sciences and the Head of Technological Science, Received Honorary Doctor degrees from Brown University, Northwest University, University of Bristol, Aristotle University, and Hong Kong Polytechnic University.From 2006 to 2013, he served as president of Zhejiang University. From 2013 to 2018, he served as president of National Natural Science Foundation of China (NSFC).