Marilu Lam-Herrera

Ph.D. in Learning Sciences
M.A. and B.Sc. in Industrial Design
Teacher
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Curriculum Vitae

Education

Ph.D. in Learning Sciences
University of Calgary - Calgary, AB 2022
Thesis-Based, Design-Based Research and Decolonization. GPA: 4/4

M.A. in Design
Hanyang University - Seoul, South Korea 2016
Thesis-based, Design-Based Research work design innovation for the Healthcare Sector by education.
GPA 4/4

B.Sc. in Design
Universidad del Istmo – Guatemala, Guatemala 2011
Thesis-Based, Ethnocentric (Indigenous and Rural), Community-Based Design. Fashion in Sciences Specialization. Magna Cum Laude

Teaching Degree
Marion G. Bock School – Guatemala, Guatemala
Home Economics. Three years of adult education. One year of work-integrated learning.

Technical Degree in Haute Couture and Artisanship
Academia Judith Serrano de Prado – Guatemala, Guatemala
Three years of haute couture and artisanship skills development by creative imagination manipulating various materials.

Teaching Certifications

CONEXIONES Certificate / Neurosciences and Education - Teaching Preparation Program 2019
CONEXIONES The Learning Sciences Platform
A course to learn how the Brain Learns: Practical applications for the classroom. The learning sciences (education, psychology, neuroeducation, the science of the mind, brain, and education).
Flipped Class modality, Leveraging Technology in Online and Face-to-Face Education
Online course. Duration: 40.5 hours. GPA: 4/4.

TAPP Certificate – Teaching Assistantship, Teaching Preparation Program (TAPP). 2018
Werklund School of Education, University of Calgary, Calgary, AB
Strategies to Teach in Higher Education in Canada. Training to assist new scholars with this transition.
The Program was designed to provide a platform for graduate students and postdoctoral scholars to develop their teaching capacity.
TAPP is a three-level program that helps teachers build a teaching dossier by recording critical aspects of their teaching capacity-building process and evidence of teaching practice.

Teaching Assistant (TA) Badge 2018
Taylor Institute, University of Calgary, Calgary, AB
An evidence-based program to teach practical strategies to help inform and direct course design.
It is aimed to develop course design plans and identify practical techniques for designing, teaching, and evaluating a course, whether the practice is online, in the classroom, or blended.

Educator Preparation Institute Certificate for US Teaching License. 2012

Closed Curriculum. Polk School College, University of South Florida branch, Lakeland, FL

The Educator Preparation Institute (EPI) is a competency-based certification program that offers a state-approved pathway to a Florida Professional Teaching Certificate. Closed Curriculum - GPA: 3.58/4.

English for Academic Purposes Certificate 2011

Polk School College, University of South Florida branch, Lakeland, FL

English for Academic Purposes (EAP) prepares non-native speakers to master English and continue higher education in the US. This year-long course provides intensive practice (reading, writing, grammar, and communication). GPA: 3.68/4.

Research Interest

As an advocate for inclusive education, my passion lies in creating empowering spaces for historically marginalized communities. Through my research, I strive to promote diversity and inclusivity in education, using a transdisciplinary approach that involves design-based research, community-oriented approaches, design-thinking development and interleaving pedagogy. I am committed to working alongside others as an ally to achieve this shared vision.

Work and Research Experience

Education Researcher & Analyst

CPA Western School of Business (CPAWSB) - Edmonton, AB

Dec 2022 to Present

- The Educational Research and Development Analyst is crucial in supporting various practice settings and teams by providing valuable feedback and recommendations based on the latest insights from the learning and social sciences, best practices in higher education, and Indigenous perspectives. In addition, the position involves conducting presentations, conferences, workshops, project evaluations, focus groups, surveys, interviews, and research coordination. The analyst is responsible for conducting comprehensive research to improve learning outcomes across all school departments. This role also requires synthesizing and analyzing qualitative and quantitative data and calls for high flexibility, adaptability, and diverse research methods, theories, and educational components to create an inclusive environment that promotes student success.

STEM Researcher, Partnering with Teachers on the Design of Inquiry for Socio-Scientific Computational Thinking

Werklund School of Education, University of Calgary – Calgary, AB

Nov 2016 to Apr 2022

- For six years, I investigated how to support professional learning experiences in the computational modelling of complex systems.
- I worked with Indigenous and non-Indigenous teachers, emphasizing socio-ecological issues that are locally relevant to the participants as the topic of modelling and integrating multiple forms of modelling. My Ph.D. research, Grafemos, is linked to this project.

STEM Research Assistant, Disability, Augmentative and Alternative Communication (AAC) and Science Education Project

Werklund School of Education, University of Calgary – Calgary, AB

Oct 2021 to Apr 2022

- I reviewed relevant literature, identified secondary data sources, performed a thematic analysis of works of literature and secondary data, conceptualized literature review papers, and contributed to conceptualizing the empirical study design and analysis of AAC public videos and recordings.

Social Sciences Research Assistant, Resettlement Process and Integration Paths of Syrian and Rohingya Refugees in Canada Project

Faculty of Social Sciences, University of Calgary – Calgary, AB
Sep 2021 to Dec 2021

- Responsible for transcribing interviews and video recordings, assisting in organizing data, updating the Study's Master List, and organizing the research team's work.

STEM Data Analyst, Math Mind Initiative (MMI) Project

Werklund School of Education, University of Calgary – Calgary, AB
May 2018 to Aug 2018

- Responsible for the data analysis of the MMI project at the Werklund School of Education at the University of Calgary. It included observing and analyzing diverse math lessons recorded in video.

LMKBE Project Manager and Research Assistant, Learning Mathematics at Kainai Board of Education (LMKBE) Project

Kainai Board of Education and Werklund School of Education, University of Calgary and Kainai Nation, AB
Feb 2018 to Jul 2018

- I was the Project Manager for the LMKBE Project, a joint effort of the Werklund School of Education, the University of Calgary, and The Kainai Board of Education. My responsibilities included scheduling classroom observations in coordination with teachers, principals, and other research assistants, observing mathematics lessons, conducting interviews, and conducting qualitative data analysis.

Symposium Coordinator and Research Assistant, International Society for STEM in Education

Werklund School of Education, University of Calgary - Banff and Calgary, AB
Feb 2018 to Jul 2018

- Recruiting volunteers, program development, registration management, audiovisual and presentation coordination, and event consultation.

Research Assistant, Canadian Test of Basic Skills (CTBS) Test

The University of Calgary, Werklund School of Education – Calgary, AB
Jan 2017 to Dec 2017

- I administered the CTBS test to support the Math Minds Initiative. My responsibilities included giving instructions, observing, and clarifying children's doubts.

Research Assistant, Mathematics Concepts Study

The University of Calgary, Werklund School of Education – Calgary, AB
Jan 2017 to Feb 2017

- I was responsible for creating transcriptions of observations and teachers' insights developed through the Engagement in Mathematics Concepts Study, translating Spanish to English, and developing a database.

Research Assistant, Canadian Test of Basic Skills Test (CTBS) Test

The University of Calgary, Werklund School of Education – Calgary, AB
Nov 2016 to Dec 2016

- I was a Research Assistant for the Canadian Test of Basic Skills at WSE University of Calgary. The project supported the Math Minds Initiative by administering the CTBS test mid-year school year.

Professional Affiliations

ICICLE, International Consortium for Innovation and Collaboration in Learning Engineering affiliated to Higher Education MIG, Global Localisation SIG, and Design for Learning SIG 2024
International Society of Learning Sciences 2018 to Present
University of Calgary Alumni 2022 to Present
Ixcoj Ajkem Mayan Woman Council's Ally and Friendship 2005 to Present
American Educational Research Association 2018 to 2022

Teaching Experience

Training and Workshops
CPA Western School of Business. Edmonton, AB. Dec 2022 to Present
I provide online training and workshops to support CPAWSB staff and update them on educational trends and research findings.

Teaching Assistant and Instructional Design
Sam & Cloe Academy – Seoul, South Korea. 2014 to 2015
I taught and created educational activities for children aged 5-16 to practice English lessons through games and didactic materials.

Training, Design & Development
Living Culture, S.A. – Guatemala City, Guatemala. 2006 to 2009
Owner. Instructor and consultant on productivity for public and private organizations, focusing on human-machine interface, time efficiency, accuracy, work-study improvement, and production line optimization.

Teacher
Academia Mallorca – Guatemala City, Guatemala. 1997 to 2006
Owner. Curriculum and instruction design, adapting instruction to the needs of diverse adult groups. I taught courses oriented to adult education, design, wardrove manufacturing, and handcrafting.

Fellowships & Awards

Eyes High Doctoral Recruitment Scholarship 2016-2020. University of Calgary
It is given to the best and brightest doctoral students from around the world in support of the University of Calgary's Eyes High vision of becoming one of Canada's top five research universities. Full scholarship.

NIIED Global Korea Scholarship 2012-2016. Korean Government
It allows international students to study at higher education institutions in Korea to enhance international exchange and deepen friendship between Korea and participating countries. Full scholarship.

Solidarity Award Dr. Ernesto Cofiño Ubico 2011. 3rd Place Universidad del Istmo
Merit Award for Outstanding Solidarity-Research Projects. In the Category of Design Research, Guatemala

Professional Services & Projects

Project Participant - *Studying the Effectiveness of Elementary and Middle School Science Education Outreach Programs*
2022. University of Maryland College Park (UMCP), College Park, MD
Findings and results were part of my Graduate Project.
Original and innovative project working with teachers. A Design-Based Research on complexity thinking activities based on Indigenous and Western ways of knowing.

Volunteer - *Skills Exploration Days Design Challenge*
2019. Skills Canada Alberta, WinSport International Arena, Calgary, AB
I worked at the Glue Station, supervising and aiding students using hot glue guns to assemble prototypes and guiding and providing equipment for the participant groups.

Participant - *Ideas Conference Leading Educational Change*
2017. Galileo.org and Werklund School of Education University of Calgary, Calgary, AB
My duties included preparing nametags and conference information packages, greeting and guiding participants, assisting with registration, attending and observing sessions before the host and participants, and providing best practices for room hosting, among other things.

JCPenney Logistics Store Associate
2009 – 2012. JC Penney - Lakeland, FL
I submitted innovative ideas to the Spark Idea JCP Program and ranked 6th out of 2000 employees. 25 of my ideas were implemented in the facilities to improve sorting processes. Tasks include sorting, loading, quality control, scanning, Baller machinery operation, and Safety and process.

General Coordinator - ***Graduation Fashion Parade "Identity without Borders"***
2006. Universidad del Istmo de Guatemala, Guatemala City
Coordinating the final graduation project for the Industrial Design, Fashion in Sciences Specialization required advanced management skills, exceptional attention to detail, and the ability to delegate tasks to diverse teams.

General Coordinator - ***Solidarity Project "Dressing the Music"***
2005. Universidad del Istmo de Guatemala, Guatemala City
The project was nominated for the Dr. Ernesto Cofiño Solidarity Award. It involved designing, producing and donating outfits for the Kids Symphony Orchestra at the National Conservatory in Guatemala.

Participant - ***Solidarity Project for the Pediatric Oncology Department of Hospital Roosevelt***
2004. Universidad del Istmo, UNIS, Guatemala City
The project won the First Place Solidarity Dr. Ernesto Cofiño Award—involved visits and entertainment with patients and families and preparing medical kits for the department.

Team Coordinator - ***Solidarity Project to Benefit the Sor Lucia Rogé Nutrition Center***
2003. Universidad del Istmo, UNIS, Guatemala City
Project nominated for the Dr. Ernesto Cofiño Solidarity Award. Hospital Hermano Pedro.
I organized the team to gather donations of materials and funding and coordinated the elaboration of mattresses for the center's cribs.

Team Coordinator - ***Project to Benefit Sor Lucia Rogé Nutrition Center***
2002. Universidad del Istmo, UNIS, Guatemala City
I coordinated teams and activities to entertain the children with malnutrition disorders at the Center with music and games.

Teacher at FUNDABIEM's School for Parents - ***Foundation for People with Disabilities***
1991. Marion G. Böck School, and FUNDABIEM, Guatemala City
I worked as a teacher at the School for Parents of patients attending therapy. I designed activities and curriculum for the instruction and diverse educational activities for the parents.

Languages

- **English**, Fluent
- **Spanish**, Native
- **Korean**, Low Intermediate

Skills

- Instructional Design
- Contextual inquiries and surveys
- Design, Complexity, Computational Thinking
- Management and coordination
- Design-Based Research
- Community-Based projects
- Research and Development
- Fieldwork and online inquiry
- Design and Instructional Strategies
- Neurosciences, brain, and education
- Conceptual brainstorming
- Communicator
- Innovative, problem solver
- Complexity education
- Indigenous Knowledge
- Teamwork
- Meticulous and detail-oriented
- Pragmatic
- Excellent spatial skills
- Data Collection and Analysis
- Adult education
- Microsoft, Google, Teams, Outlook
- Industrial process innovation
- Administrative
- Analytic Skills
- MS Office applications

Publications: Research Work

Lam-Herrera, M. (2022). *Grafemos: Design for Complexity Education Based on Maya-Kaqchikel and Western Perspectives.* [Doctoral dissertation thesis, University of Calgary].

Lam-Herrera, M. (2016). *Study on Human-Centered Design Strategy Aimed at Promoting Design Innovation in Guatemala – Focused on the Health Sector*. [Master's thesis, Hanyang University].

Lam-Herrera, M. (2011). *Organización para la puesta en marcha de una microempresa de confección, aplicada a la asociación Ixil para el desarrollo económico y social (AIDES), en Nebaj, Quiche* [Organization, Processes and Methods, for the implementation of a micro clothing, addressed to the Ixil Development Association (AIDES) in Acul, Nebaj, Quiché, Guatemala]. [Bachelor's thesis, Universidad del Istmo de Guatemala]

Active Participation

ICICLE – International Consortium for Innovation and Collaboration in Learning Engineering

Higher Education Market Interest Group, and Global Localisation and Design for Learning Special Interest Groups member.

Grafemos organization, Leader

The Grafemos organization focuses on teachers' professional development by bringing complexity education based on Indigenous perspectives to the Mayan communities. It follows a learning engineering process seeking to contribute to the efforts of decolonizing complexity education and providing PD to formal and informal community school teachers.

Allyship and Collaborative Work

Indigenous Learners in Accounting (ILA) Initiative. AFOA AB and CPAWSB, Edmonton, AB. 2023 - Present

Allyship with the Ixcoj Ajkem Mayan Woman Weavers Council. Grafemos: Design for complexity education based on Maya-Kaqchikel and Western perspectives. Santo Domingo Xenacoj, Guatemala, and the University of Calgary, Calgary, AB. 2017 - 2022

Book Chapter - First Author. 2019

Lam-Herrera, M., Council, Ixcoj Ajkem, & Sengupta, P. (2019). Decolonizing Complexity Education: A Mayan Perspective. In *Critical, Transdisciplinary and Embodied Approaches in STEM Education* (pp. 329-348). Springer, Cham. DOI: 10.1007/978-3-030-29489-2_18

Project Participation – Researcher. Apr 2018 - Apr 2022

Partnering with Teachers on the Design of Inquiry for Socio-scientific Computational Thinking, US National Science Foundation Award # 1842358.

Conferences and Articles

2024

Andrews, R., Ip, Y., & Lam-Herrera, M. (2024). Engaging Indigenous Learners: A Partnership Initiative between Indigenous and Non-Indigenous Institutions. *Conference on Postsecondary Learning and Teaching*. Taylor Institute for Teaching and Learning, University of Calgary. Calgary, AB. [Manuscript submitted]

2021

Lam-Herrera, M., Ixcoj Ajkem Council, & Sengupta, P. (2021). Decolonizing Agent-Based Modeling: An Axiological Reorientation from a Mayan Perspective in Expansive Modeling: Broadening the Scope of modelling in K-12 education. *International Conference of Learning Sciences*. Bochum, Germany. doi.dx.org/10.22318/icls2021.827

2020

Lam-Herrera, M., Ixcoj Ajkem Council, & Sengupta, P. (2020). Design and Decolonization for Complexity Education: Grafemos Learning Environment. *Canadian Society for the Study of Education Conference 2020*. Northwestern University, London, Ontario, Canada. Cancelled-covid-19.

Lam-Herrera, M., Ixcoj Ajkem Council, & Sengupta, P. (2020). Decolonization, Agent-Based Modeling, and Restructuration. In the Restructuring Concepts and Tools through a Complexity Perspective Session presented at the *American Educational Research Association, AERA*. San Francisco, CA. Canceled-covid-19.

2019

Lam-Herrera, M., Ixcoj Ajkem Council, & Sengupta, P. (2019). Grafemos: Complexity Education and Decolonization. *Learning Sciences Graduate Students Conference*. Northwestern University, Evanston, IL, US.

Lam-Herrera, M., Ixoqi' Aj Kemola' Community Council, & Sengupta, P. (2019). Integrating Agent-Based Modeling and Indigenous Perspectives for Complex Systems Education. *American Educational Research Association 2019, AERA.* Toronto, Canada.

2018

Ostrowski, C. P., Becker, S., Diaz, Z., Lam-Herrera, M., & Rothschuh, S. (2018). Exploring the margins of the field: Rethinking STEM in education. *International Conference of the Learning Sciences (ICLS).* London, UK.

Lam-Herrera, M., Ixoqi' Aj Kemola' Council, & Sengupta, P. (2018). Decolonizing Complexity Education: A preliminary study. *International STEM in Education Conference*. Brisbane, Australia.

Lam-Herrera, M., Ixoqi' Aj Kemola' Council, & Sengupta, P. (2018). Grafemos: Creating a Space for Decolonization in Complexity Education. *Learning Sciences Graduate Students Conference*. Nashville, US.

Lam-Herrera, M. (2018). Grafemos: Bridging Indigenous and Western Perspectives on Design, Complexity, and Computation in Elementary Grades. *Deepening the Dialogue in the WSE School of Education Symposium*. University of Calgary, Canada.

2017

Lam-Herrera, M. (2017). Presentation: Grafemos, Research Graduate Project. *EDLS Colloquia Graduate Student, WSE School of Education Symposium*. The University of Calgary.

2016

Ostrowski, C. P., Bedilu, L., Bastani, R., Becker, S., Dìaz, Z., Gatti Jr., W., Lam-Herrera, M., & Rothschuh, S. (2016). Learning in Everyday Context as Seen Through Mediated Action. *Graduate Research Symposium of Werklund School of Education*. University of Calgary, Canada.

Lam-Herrera, M. (2016). Estudio sobre Estrategia Diseño Centrado en el Humano Orientado a Impulsar la Innovación de Diseño en Guatemala-Enfocado en Sector Salud [Study on Human-Centered Design Strategy to Enhance Design Innovation in Guatemala, Focused on Healthcare Sector]. *Nature, Society and Environment Academic and Scientific Journal CUNSURORI* [Naturaleza, Sociedad y Ambiente Revista Académica y Científica], Universidad de San Carlos de Guatemala.3: 31-58.

2015

Lam-Herrera, M. (2015). Employing the UCD to Engage and Innovate the Healthcare Environment in Guatemala. *KODDCO Conference Designing for Social Change*. Seoul, South Korea.

Lam-Herrera, M. (2015). Human-centred Design: The Key to Integrate and Innovate in the Health Sector of Guatemala [Human-Centered Design clave para Integrar e Innovar en el Sector Salud de Guatemala]. *ALTUM Magazine, No. 9*. Guatemala, Guatemala.

2013

Author: Ph.D. K. Bonilla. Speaker: B.Sc. M. Lam-Herrera. (2013). The Identities of the Latin American Societies and Integral Globalization, Cultural Relevance in Social Services in Guatemala. International Conference of Institute of Iberoamerican Studies. Busan University of Foreign Studies. Busan, South Korea

2005

Lam-Herrera, M. (2005). The usefulness of the work of Wardrobe Designer Industrial in Guatemala. Universities Exchange Conference. Universidad del Istmo, UNIS, Guatemala.

My recent work*, in brief*

GRAFEMOS: Design for Complexity Education Based on Maya-Kaqchikel and Western Perspectives

This study seeks to contribute to decolonization efforts in complexity education at the K-12 levels. While research on complex systems in K-12 education and computational modelling has been deeply intertwined (Goldstone & Wilensky, 2008; Resnick & Wilensky, 1998), my work arises from the concern that this body of work has largely been grounded in Eurocentric traditions. Eurocentrism postulates that European languages, knowledge systems, and culture are scientific, civilized, and superior to Indigenous and non-European perspectives (Smith, 2012). This situation is not surprising, given that Bang et al. (2013) remind us that despite recent emphases on place-based, embodied, and cultural-historical approaches in science education, Indigenous voices and perspectives still need to be more prominent in the realm of K-12 science education research.

Background

In complexity education, computational models have been proven effective tools for helping young learners understand emergent phenomena (e.g., Danish, 2014; Goldstone & Wilensky, 2008; Wilkerson-Jerde & Wilensky, 2015). Emergent phenomena (Holland, 2000) are complex, non-linear processes (e.g., ecological interdependence) derived from simple, linear interactions among many individual agents (e.g., simple interactions between predators and prey). While a substantial body of literature shows that computational modelling can help even elementary-grade students understand complex systems (e.g., Danish, 2014), rarely have scholars who use computational models of complex systems focused on decolonial approaches.

At the same time, there is a growing body of scholarship on decolonization and reconciliation in science education (Bang & Marin, 2015; Lowan-Trudeau, 2018) and education research (Gramigna & Estrada, 2020; Kovach, 2012; Smith, 2012; Smith et al., 2018; and others) that can influence the scholarship on complexity education and computational modelling for K-12 settings; this is the motivation for my study.

My Relationship with the Ixcoj Ajkem Mayan Woman Weavers Council

This study is based on my personal history and experience in the world of Mayan textile design in Guatemala. I have a relationship with the women of Santo Domingo, who have been members of the Council since 2005. This organization is comprised of Guatemalan citizens who identify with Mayan heritage. They are activists and educators committed to preserving Mayan weaving art and textile design traditions. They have a weaving school for girls in the locality. Unlike Canada, the government of Guatemala does not recognize Indigenous land or language rights (GANC, 1985). As per the government mandate, all schools in Guatemala have been directed to teach only in Spanish. Due to this, the use of Mayan languages among younger generations has declined significantly. This lack of usage is a critical concern because Mayan knowledge is primarily passed down orally from the elders to the younger generations. Therefore, Textile Art holds immense importance as Mayan epistemologies are deeply ingrained in it. This art is visible in the wardrobes of the community's women, expanding transmission beyond the spoken language. The Council's mission is to safeguard cultural

and historical traditions. The Mayan textile art practice mastered by these women involves using ancestral symbolic representation passed from mothers and grandmothers to younger generations. This art's symbols, colours, and compositions transmit actions, emotional states, environmental elements, and narratives. We decided to work in allyship for the Grafemos project through our friendship.

Grafemos Environment

Grafemos comprises a Complexity Education Activity and Toolkit that integrates the Mayan textile design perspectives of Xenacoj with elements of Western practices on complexity education and computational modelling. The Maya culture comprises many cultures and languages; in Xenacoj, the Kaqchikel is predominant. Since Grafemos was informed by the Ixkoj Ajkem Council Elders, we, the Council, and I agreed that their voices and experiences were referred to as Maya-Kaqchikel's epistemologies.

The study focused on centring the voices and experiences of Xenacoj's teachers—from formal and informal schools—to explore how they experienced Grafemos embodied modelling and multi-agent simulations to model complex socio-scientific phenomena. To posteriorly design and practice their complexity education activities based on these experiences.

The following research questions were raised in this study:

a) How do schoolteachers in Xenacoj integrate Western and Kaqchikel ways of life and knowing (i.e., epistemologies) with modelling and teaching complex systems and running models' simulations in their classrooms?
    a. How do these teachers design activities and representations of interconnectedness and understand complex, emergent phenomena using Western and Kaqchikel epistemologies?

The modelling activities reported in this study showed how teachers experienced and integrated their traditional ways of knowing with elements of Western approaches during workshops to model complex systems in their classrooms.

At the very outset, it is essential to remark that the study's point was not to compare computational models with Grafemos or any other form of modelling. Instead, the focus is synergistic. Each form of modelling was based on the community's interest during my previous visits (I mention this in more detail in the thesis work, method chapter).

The main discovery was that in contrast to the computing and complexity education field, in which mechanistic and technocentric approaches have largely dominated, in Xenacoj, the teachers-participants designed complexity education activities and created diverse forms of representation that incorporated Kaqchikel knowledge of their textile weaving art. Moreover, these representations were ethically and ecologically focused and involved multi-level reasoning. Amid growing interest in the Learning Sciences in issues of ethical and axiological perspectives in educational design (Bang, 2020; Espinoza et al., 2020; Gutiérrez, 2006; Vossoughi et al., 2020), the study seeks to contribute to the literature on educational computing and complex systems in K12 education by highlighting how pre-colonial, non-Western narratives and representational practices can inform and re-shape the design of computational modelling technologies for complex systems education.

Overall, this work's heterogeneity stands in sharp contrast to technocentric and device-centric approaches in computational modelling and science education. Furthermore, a primary focus on Western lenses such as computational thinking (Weintrop et al., 2016; Wing, 2008) or mechanistic reasoning (Hmelo-Silver & Azevedo, 2006; Russ et al., 2008) for educational design would orient our analysis away from many of these dimensions and maintain the analytic focus only on disciplinary practices and concepts rooted in Western perspectives.

Findings

The empirical chapters reveal the heterogeneity or diversity in the participants' work in the form of

a. disciplinary practices involved in modelling science and computational modelling,
b. community-centred, moral, and affective understandings tied to their lived experiences around land and water, as well as painful lived experiences such as alcoholism and teenage pregnancies,
c. their sociopolitical knowledge related to land and water (e.g., knowledge of the town's water purification and policies on water regulation), and
d. centring intergenerational ways of knowing by inviting and engaging community Elders alongside children in their modelling activities.

Finally, we should not be satisfied with working on changes limited to talking about tolerance and passing information. This lack of action could keep us floating on the surface without reaching real change. Scholars must recognize the hegemonic nature of Western lenses in decolonizing science, computing, complexity education, and STEM education. The only way is to make participants from all cultures participate in designing and refining pedagogical means that resonate with all *peoples*.

Dr. Marin's words have eloquently inspired the need for this change:

"If, in our role as researchers we are to engage in future-making that disrupts systems of colonialism, racism, and human domination over the natural world, then we need diverse ways of seeing the socio-ecological relationship in peoples' lives as they develop in particular places and on particular land [and] waters" (Marin, 2020, p. 312).

References

Bang, M. (2020). Learning on the move toward just, sustainable, and culturally thriving futures. *Cognition and Instruction 38*(3), 434–444.

Bang, M., & Marin, A. (2015). Nature–culture constructs in science learning: Human/non-human agency and intentionality. *Journal of Research in Science Teaching 52*(4), *530–544.*

Bang, M., Marin, A., Faber, L., & Suzukovich III, E. S. (2013). Repatriating Indigenous technologies in an urban Indian community. *Urban Education, 48*(5), 705-733.

Danish, J. A. (2014). Applying an activity theory lens to designing instruction for learning about the structure, behavior, and function of a honeybee system. *Journal of the Learning Sciences, 23*(2), 100-148.

Espinoza, M. L., Vossoughi, S., Rose, M., & Poza, L. E. (2020). Matters of participation: Notes on the study of dignity and learning. *Mind, Culture, and Activity*, 27(4), 325-347

Goldstone, R. L., & Wilensky, U. (2008). Promoting transfer by grounding complex systems principles. *The Journal of the Learning Sciences, 17*(4), 465–516.

Gramigna, A., & Estrada, Y. (2020). Comparación de epistemologías: el diálogo entre el epos maya y el logos "occidental". *Revista Egresados, 1*(7), 131-143.

Guatemala Asamblea Nacional Constituyente [GANC]. (1985). Constitución política de la República de Guatemala. Centro Nacional de Libros de Texto y Material Didáctico, Ministerio de Educación.

Gutiérrez, K. (2006). White Innocence: A Framework and Methodology for Rethinking Educational Discourse and Inquiry. *International Journal of Learning, 12*(10).

Hmelo-Silver, C. E., & Azevedo, R. (2006). Understanding complex systems: Some core challenges. *The Journal of the Learning Sciences, 15*(1), 53-61.

Kovach, M. E. (2012). *Indigenous methodologies: Characteristics, conversations, and contexts*. University of Toronto Press.

Lowan-Trudeau, G. (2018). Indigenous methodologies revisited: Métissage, hybridity, and the Third Space in environmental studies. In *New moral natures in tourism* (pp. 181-193). Routledge.

Marin, A. M. (2020). Ambulatory sequences: Ecologies of learning by attending and observing on the move. *Cognition and Instruction 38*(3), 281–317.

Resnick, M., & Wilensky, U. (1998). Diving into complexity: Developing probabilistic decentralized thinking through role-playing activities. The *Journal of the Learning Sciences, 7*(2), 153-172.

Russ, R. S., Scherr, R. E., Hammer, D., & Mikeska, J. (2008). Recognizing mechanistic reasoning in student scientific inquiry: A framework for discourse analysis developed from philosophy of science. *Science education*, *92*(3), 499-525.

Smith, L. T. (2012). *Decolonizing methodologies: Research and Indigenous peoples*. London: Zed Books.

Vossoughi, S., Jackson, A., Chen, S., Roldan, W., & Escudé, M. (2020). Embodied pathways and ethical trails: Studying learning in and through relational histories. *Journal of the Learning Sciences, 29*(2), 183-223.

Weintrop, D., Beheshti, E., Horn,M., Orton, K., Jona, K., Trouille, L., & Wilensky, U. (2016). Defining computational thinking for mathematics and science classrooms. *Journal of Science Education and Technology, 25*(1), 127–147.

Wilkerson-Jerde, M. H., & Wilensky, U. J. (2015). Patterns, probabilities, and people: making sense of quantitative change in complex systems. *Journal of the Learning Sciences 24*(2), 204–251.

Wing, J. M. (2008). Computational thinking and thinking about computing. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 366*(1881), 3717–3725.

Links

LinkedIn:	ResearchGate:	Academia:	Website:
linkedin.com/in/marilú-lam-herrera-b53049186	researchgate.net/profile/Marilu-Lam-Herrera	marilulamherrera.academia.edu	https://www.marilulam-herre com/

Canadian Status

Permanent Resident since August 2022