Educational Innovation in Supply Chain Management and Logistics for Active Learning in Latin America

Abstract

Purpose – This study presents a conceptual framework aimed at promoting educational innovation in Supply Chain Management and Logistics (SCM&L). The framework can help to design active learning experiences regarding student learning outcomes that tackle current challenges in the discipline. Emphasizing the significance of linking students' learning to real-world scenarios, the framework enables reflective learning through hands-on engagement in a constructive alignment, overcoming existing pedagogical limitations in the field.

Design/methodology/approach – This study presents a qualitative research methodology that relies on the case study method. Three instances are presented to illustrate educational efforts of active learning in countries of Latin America, Bolivia, Mexico, and Peru, linking real-world relevant situations to disciplinary teaching and learning.

Findings – The innovative learning experiences introduced in this study transform real-world SCM&L operations into distinctive educational opportunities. These experiences facilitate learning not only within traditional classrooms but also in urban areas of the Latin American region, enabling students to interact with educational partners in authentic settings to achieve their intended learning outcomes. These experiences are characterized by their focus on establishing meaningful connections between learning and local communities, businesses, or specific contexts.

Research/limitations implications – The study recognizes various limitations of conceptual, methodological, execution-related, and research process aspects. First, not all academics in the SCM&L discipline may universally acknowledge the importance of educational innovation and active learning experiences because of limited pedagogical awareness. Moreover, execution-related limitations arise from the demanding nature of incorporating active pedagogical approaches into courses, as they can be resource-intensive and time-consuming. Regarding research process limitations, the case study limits generalizability and broader inferences because of its particular views and locations, which require further investigation with other instances across other disciplines and geographical regions for validation.

Originality/value – This research presents a conceptual framework, which is developed from the insights obtained in the three learning experiences to guide future efforts in SCM&L education. The findings demonstrate how to structure active learning experiences based on authentic assessment and illustrate the potential for increased cooperation among institutions in Latin America. It also promotes the recognition of novel SCM&L active learning experiences and highlights some of the benefits of this approach.

Keywords – Supply Chain Management and Logistics, Active Learning, Constructive Alignment, Educational Innovation, Higher Education

Paper type – Research paper

I. INTRODUCTION

This research-to-practice paper focuses on developing new types of learning experiences in Supply Chain Management and Logistics (SCM&L) through innovative pedagogical methods. The endeavor stems from the growing need to align education with current business and societal challenges, future trends, and professional practices. To maintain its appeal as an attractive field of study for students and future specialists, educational innovation in SCM&L must continuously update its designs and embrace recent pedagogical efforts in Higher Education (HE).

As educational innovation evolves, it gravitates towards remote and hybrid learning, wide-reach online content, transformative practical experiences outside the classroom, micro-credentials, and other emerging approaches. Notably, adaptive, context-based, incidental, crossover, and embodied learning, as well as computational thinking and learning through augmentation, are gaining traction (Luna, Chong and Jurburg, 2022). The post-pandemic era has accelerated these changes in traditional education (Code, Ralph and Forde, 2020), paving the way for further progress in these directions.

As universities adapt to the evolving landscape, they need to transform their visions, models, and practices. This shift requires embracing a comprehensive view of innovation that goes beyond traditional passive approaches and instrumental teaching methods. Instead, the focus should be on developing relevant learning outcomes and delivering high educational value to students, employers, communities, and society at large, which are frequently overseen (De Vries et al., 2011; Pan, G. et al., 2021; McDonald, Iscaro and Posey, 2022). Likewise, SCM&L education must respond similarly by adopting systematic and articulated active pedagogical approaches for effective learning (Freeman et al., 2014; Romanovs and Merkuryev, 2019). This view calls for the coherent integration of learning requirements and learning experiences in a constructive alignment for active learning beyond isolated or partial pedagogical perspectives (Bings and Tang, 2011).

However, current research in SCM&L education predominantly focuses on contrasting differences in teaching disciplinary content, competency development, learning outcome definition, and teaching methods, with limited emphasis on suitable pedagogical designs for active learning like experiential learning, challenge-based learning, or service learning (Salinas-Navarro and Rodríguez Calvo, 2020; Salinas-Navarro, Alanis-Uribe and da Silva-Ovando, 2021; Salinas-Navarro et al., 2022). Accordingly, this work recognizes a research gap regarding limited work to guide pedagogical efforts that constructively support the active involvement of learners in the discipline. Hence, this work aims to address this gap and present an integrative perspective on educational innovation, particularly emphasizing active learning, educational value, and relevant learning outcomes. To progress in this direction, a research question can be defined in these terms:

How can learning experiences be constructively designed for SCM&L education to cultivate relevant learning outcomes while incorporating active learning principles?

With this in mind, this paper intends to provide an alternative for developing novel learning experiences that integrate educational requirements into requisite learning activities, thus advancing intended SCM&L learning outcomes. This proposition implies (i) investigating the current state of SCM&L education and exploring the constructive alignment of pedagogical design; (ii) creating a conceptual framework for developing learning experiences in these terms; and (iii) elaborating a research methodology to study learning experience instances. Although this paper focuses on the conceptualization of educational initiatives rather than evaluating the learning impact or students' achievements (which will be explored in future work), it draws insights from existing work in educational innovation within the SCM&L discipline

and mainstream authors in teaching and learning in Higher Education (HE). These insights can help identify key elements supporting effective pedagogical designs.

Based on this foundation, this work unfolds into six further sections. Section II presents the theoretical background concerning existing work in SCM&L education and mainstream authors in pedagogical design to guide this work. Section II introduces the methodological approach of this work based on the case study method. Section IV describes the research results regarding three instances of innovative SCM&L learning experiences at universities affiliated with the MIT Supply Chain and Logistics Excellence Network (MIT SCALE) in Latin America and the Caribbean (LAC). These instances illustrate the ideas of this work and represent collaborative efforts among academics in the region to enrich their practices and contribute to the education of future leaders in the discipline. Section V presents the discussion of the results referring to the main findings, limitations, and future work. It also provides a conceptual framework for educational innovation in the SCM&L discipline as the main contribution of this work is to facilitate the development of novel initiatives within the discipline. Finally, Section VI describes the conclusions of this work amid the research aim and the research questions. These initiatives represent collaborative efforts among academics in LAC, enriching their practices and contributing to the education of future leaders in the region.

II. THEORETICAL BACKGROUND.

A. Educational Innovation in Logistics and Supply Chain Management

In the literature on educational innovation in SCM&L, several authors recognize the importance of creating suitable curricula, updating disciplinary content, and developing instrumental teaching materials (Johnson and Pike, 2009; Lutz, Birou and Walden, 2022). These efforts are traditionally oriented towards knowledge provision, focusing on answering the question of *what to learn* in the discipline. The value of this perspective lies in keeping academic programs up to date with the latest research and practical developments in the field.

On the other hand, other authors emphasize the need to advance the development of appropriate skills and competencies that align with contemporary industrial requirements and future trends. They achieve this by reviewing teaching content and assessment methods, and identifying gaps for curriculum improvement (Gibson, Kerr and Fisher, 2016; Tatham et al., 2017; Sun and Song, 2018; Birou, Lutz and Walden, 2022). Some works, for instance, focus on the identification and integration of necessary SCM&L technical skills, particularly in the realm of Digital Transformation and Industry 4.0 (Salinas-Navarro and Garay-Rondero, 2019). Other studies highlight the importance of developing soft skills such as critical thinking, problem solving, and teamwork, which are vital for professional activities and work coordination (Jordan and Bak, 2016). In these cases, the effectiveness of educational innovation is assessed and evaluated by observing students' learning outcome achievements.

Additionally, some works in SCM&L propose the use of alternative instructional approaches, such as cooperative methods, workshops, guest lecturers, field trips, projects, and active learning methods. The objective is to enhance teaching and learning quality by incorporating experiential learning and real-world situations (Gardner, 2013; van Hoek and Wagner, 2013; Sarder, 2015; Munkácsi and Kasai-Ónodi, 2018). These authors aim to improve pedagogy and the way academics teach by actively supporting students' learning in the classroom. They achieve this through methods such as problem-based learning, project-oriented learning, learning-by-doing, simulators, gamification, and role-playing, among others. Examples of academic resources in this context include the Beer Game, the Gummy Bear Supply Chain Game, GOAL-LOST, Simula Games, the Supply Chain Game, and the Fresh Connection (Sterman, 2001; Pacheco-Velazquez, 2022). These ludic games and online platforms aim to actively engage students in predefined scenarios for problem-solving and decision-making, allowing them to experience simplified real-world situations and develop both disciplinary and personal competencies (Benson and Chau, 2019; Kodzi, 2019). Others promote the use of experiential learning or learning by experience to improve

students' perceptions of learning benefits, develop professional skills, and bridge the gap between graduates' skills and employer expectations (Al-Shammari, 2021). Overall, it is claimed that active learning in SCM&L education enhances student engagement and interaction, leading to improved academic performance (Freeman et al., 2014). These approaches primarily focus on *how to learn* in the discipline.

Nevertheless, while valuable for enhancing students' learning, these efforts tend to concentrate on operational in-classroom aspects of teaching and learning. To create a more comprehensive educational approach, a strategic perspective is essential, where a purposeful declaration aligns with a structure of meaningful learning activities and coherent educational resources, creating *constructive alignment* for learning relevance (Biggs and Tang, 2011).

Currently, work on educational innovation in SCM&L requires systematic integration of learning requirements, pedagogical strategies, instructional approaches, educational resources, and the recreation of learning experiences in a coordinated way, moving beyond isolated or partial aspects. Providing teaching and learning activities with coherence and a holistic perspective is crucial for enriching students' education and enhancing their learning effectiveness (Salinas-Navarro et al., 2020).

Accordingly, this work emphasizes the achievement of constructive alignment by addressing both *what to teach and learn*, as well as *how to teach or learn*. The task involves creating a framework for conceptualizing SCM&L learning experiences that embrace constructive alignment principles to answer these fundamental questions. This consideration is a step forward in answering the research question.

B. Constructive Alignment

The notion of constructive alignment refers to a holistic approach to curriculum design and pedagogy that emphasizes aligning intended learning outcomes with teaching strategies and assessment practices (Biggs and Tang, 2011). It is based on three central principles: (i) intended learning outcomes (ILOs), (ii) teaching and learning activities (TLAs), and (iii) assessment tasks (ATs). The theory posits that effective alignment between these components leads to enhanced student engagement, deep learning, and the development of desired knowledge and skills. To achieve alignment, ILOs should reflect the desired learning outcomes, TLAs should facilitate the achievement of those outcomes, and ATs should authentically assess students' attainment of the intended outcomes.

This approach provides valuable insights for curriculum designers, educators, and educational institutions. By aligning ILOs, TLAs, and ATs, educators can create learning experiences that promote higher-order thinking, deep understanding, and the acquisition of relevant skills. Moreover, the theory encourages the use of student-centered approaches to foster active engagement and self-directed learning.

Despite facing implementation challenges, the constructive alignment theory offers valuable insights that can inform pedagogical practices and improve educational outcomes across diverse contexts. In summary, the constructive alignment theory helps answer both *what to learn* (i.e., ILOs) and *how to learn* (TLAs and ATs) in SCM&L education by providing the essential building elements for designing effective learning experiences.

C. A Framework for Education Innovation in Logistics and Supply Chain Management

Educational innovation should aim to provide effective ways of answering both *what to learn* and *how to learn* within specific academic requirements and contextual situations (Salinas-Navarro and Rodríguez Calvo, 2020). By addressing these questions, educational initiatives can integrate diverse strategies, approaches, and methods for innovation. Figure 1 presents a comprehensive conceptual framework proposed in this work, based on the principles of constructive alignment and active learning. This framework outlines a structure of components that address the research question beyond the partial or isolated consideration of pedagogical tools and methods. It emphasizes defining a constructive alignment with educational purpose while considering situational conditions and contexts to achieve relevant learning outcomes. The framework serves as a guide for studying instances of learning experiences in this work (refer to Sections III and IV). Identifying relevant learning outcomes is essential, considering various

contexts such as industries, communities and societies, to advance human knowledge and progress, and to prepare students for successful future professional paths (Gibson, Kerr and Fisher, 2016). Learning outcomes are written statements of what students should do at the end of a learning experience (Kennedy, 2007).

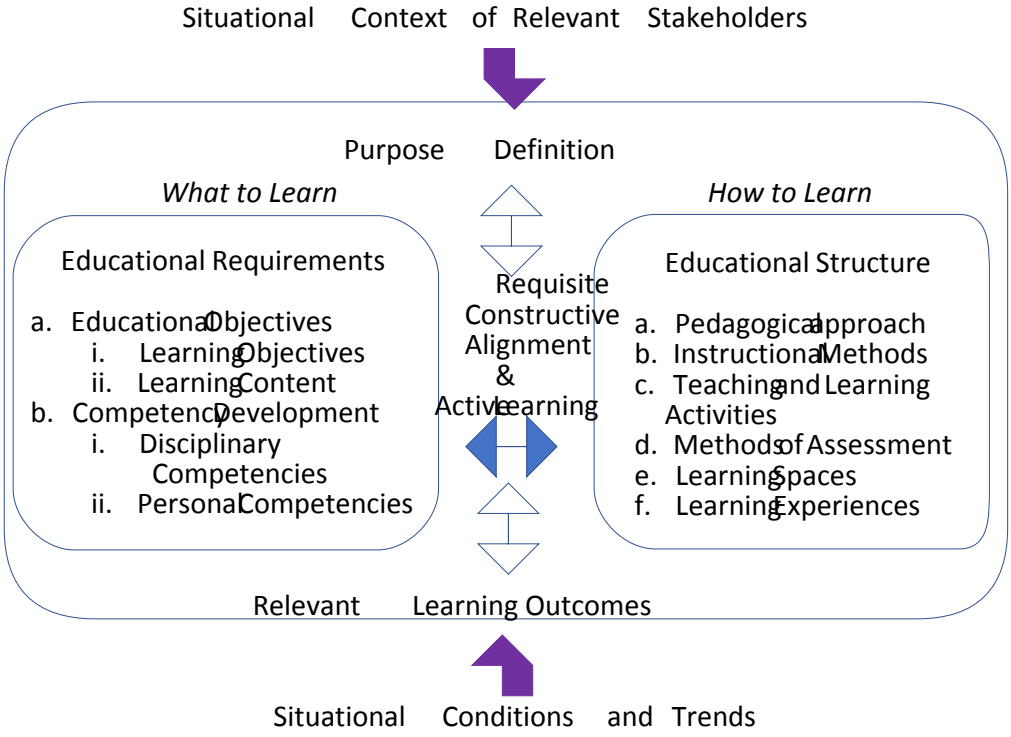

Fig. 1. A Framework for Innovative Learning Experiences (own elaboration)

Within the framework, *what to learn* encompasses educational requirements, such as educational purpose, learning objectives, competencies, and academic content, all within the specific situational context and conditions of the learning environment. This holistic approach establishes the value contribution of education for students and other participants. Furthermore, addressing the question of *what to learn* prompts profound reflections on the educational purpose within Higher Education institutions (HEI) and how this translates into specific learning objectives and content. A stronger focus on educational models helps define the delivery of educational value, quality, and benefits to students and relevant stakeholders, shaping the institution's long-term positioning. This also involves developing the necessary formative educational profile of students. From this view, developing competencies involves accumulating knowledge, abilities, attitudes, and values necessary for effective functioning in different contexts and tasks (Kennedy, 2007).

When discussing *what to learn*, the focus should extend beyond specific disciplinary contents dictated by academic preferences or limitations. Instead, the emphasis should be on developing relevant competencies that transcend disciplinary boundaries (Datar, Garvin and Cullen, 2011). On the other hand, *how to learn* pertains to producing and delivering educational purposes and value. This involves detailing the conceptualization of pedagogical approaches, instructional methods, teaching and learning activities, assessment methods, learning spaces, and specific learning experiences for students. A pedagogical approach must consider how people learn and promote high-impact student engagement in educational activities, individually and collaboratively, both within and outside the classroom (Lalley and Miller, 2007).

Instructional methods, such as experiential learning, challenge-based learning, and collaborative learning, play a crucial role in conducting active learning (Kolb, 1984; Apple, 2010; Laal and Laal, 2012). This work focuses on Kolb's experiential learning cycle to promote reflective and real-world practical activities, along with challenge-based learning that incorporates immersive, relevant, and contemporary study situations (Kolb, 1984; Apple, 2010).

To assess educational results, competencies are evaluated through learning outcomes, which provide evidence of students' actual work, actions, and behavior. Formative and summative approaches are employed to ensure authentic assessment of student's achievements, measuring worthwhile, significant, and meaningful intellectual accomplishments (Wiggins, 2011). Instructors must design suitable instruments or rubrics to evaluate and assess students' learning outcomes throughout the entire educational experience.

Another vital component in the educational structure is learning spaces, which represent social domains of interaction where students learn (Salinas-Navarro and Garay-Rondero, 2019). These spaces may include in-classroom or out-of-classroom activities in closed, open places, or virtual environments, utilizing diverse educational resources. Conceptualizing and creating appropriate learning spaces are crucial in supporting students' learning activities and experiences, as they form the foundation and embodiment of educational strategies.

Furthermore, learning experiences refer to the situations in which students engage in learning activities and interact with peers, academics, and other learning partners to achieve their learning objectives (Abbiss, 2012). However, learning experiences may require adapting to varied circumstances during their execution, including different formats of program deliveries, academic terms, or disruptive and uncertain situations and events.

Overall, the framework presented in Figure 1 serves as a guide for conceptualizing a wide range of learning experiences while maintaining coherence among situational contexts and conditions, educational purposes, requirements, structure, and intended learning outcomes. This framework is in line with the research question by providing a constructive alignment for active learning, which is operationalized in the next section through a methodology to advance the aim of this work.

III. METHODOLOGY

This work proposes a qualitative research methodology based on the case study method (Tharenou, Donohue and Cooper, 2007). By adopting this approach, this methodology aims to deductively explore the nuances, complexities, and unique characteristics associated with learning experiences in specific contexts according to the framework in Figure 1. The case study unfolds in six stages: (i) defining the case; (ii) selecting the case(s); (iii) collecting data; (iv) analyzing the data; (v) interpreting data; and (vi) reporting the findings (Crowe et al., 2011).

In defining the case study, a research question, existing literature, and theoretical issues in SCM&L education were previously defined in Sections I and II to inform the researchers of what to observe and investigate in practical instances.

The selection of a case entails multiple learning experience instances of SCM&L courses in HE from affiliated universities with the MIT SCALE Network in LAC. Collaborative efforts for educational innovation have been undertaken in this network, which includes over 40 prestigious universities, to achieve supply chain management and logistics excellence by creating innovative solutions for diverse supply chain stakeholders.

One of the research tracks within the network concentrates on educational innovation to enhance the skill set of future SCM&L professionals and address current limitations in the field. Despite progress, traditional education remains prevalent in LAC, as discussed in the MIT SCALE conferences (Salinas-Navarro and Rodríguez-Calvo, 2020). SCM&L education across member universities tends to be heavily classroom-oriented, with limited incorporation of novel pedagogical approaches, and weak connections with real-world challenges and relevant stakeholders, thereby compromising learning relevance. In most of these cases, academics neither recognize the importance of active methods. However, three universities have stood out as leaders in developing novel learning experiences with exceptional results in student research outputs.

Accordingly, three initiatives from these universities were selected to study the educational components of SCM&L learning experiences within the structure of Figure 1. Each initiative offers instances of enriched teaching and learning activities on pertinent SCM&L topics in Bolivia, Mexico, and Peru.

Referring to data collection, this follows the conceptual framework in Figure 1 concerning the following questions:

a) What is the course/learning experience background information?

b) What is the educational purpose of the educational experience?

c) What is the situational context in which the learning experience takes place, considering relevant stakeholders and existent conditions and trends?

d) What are the intended learning outcomes of the learning experience?

e) What are the existing educational requirements regarding educational objectives and competency development?

f) What is the pedagogical approach, instructional methods, activities, methods of assessment and learning spaces involved in the learning experience?

As per this work, data was gathered through various methods depending on data availability and accessibility. Accordingly, data was obtained from reviewing course manuals, specifications and syllabi, teacher surveys and interviews, and other institutional documentary sources such as assignment briefs. Because this work focuses on pedagogical design, accessing teachers' views becomes paramount to elucidate the structure of learning experiences. An interview template based on Figure 1 was proposed for conducting interviews and integrating documentary information (see Section IV). It is worth mentioning that during the interview conversation, the interviewer (one of the authors) clarified the underlying concepts to the interviewees (three of the authors) to help them understand their questions. The interviews took place remotely because of the geographically scattered location of participants over video chats and emails. Consequently, the collected data comprised direct reports from instructors and text extracts from the referred documents. This data has been summarized and reported in the subsequent sections.

The data analysis was twofold, first looking at the individual component cases, and second, making comparisons across cases. Attention was paid to variations across each case and, where relevant, the relationship between different causes, effects, and outcomes. Data was coded and organized as summarized descriptions following the category structure of Figure 1 to allow the key elements, both derived from the literature and emerging from collected data, to be easily retrieved at a later stage. The initial coding frame provided by Figure 1 helped capture these issues and was applied systematically to the whole dataset across the analysis of the individual instances. The data analysis is presented in Section IV as part of the case study.

Interpreting data points to making sense of the emerging issues and patterns with the supporting body of literature regarding the research question. Attention was paid to understanding constructive alternatives to develop active learning experiences and the development of relevant learning outcomes in SCM&L education. This was about unveiling the details of *what to learn* and *how to learn* within an educational purpose and the situational context and conditions setting up a learning experience. The interpretation of data also allowed for the further identification of findings, limitations, and future work. In this way, the framework of Figure 1 was revisited to incorporate the new insights into the conceptual framework to validate/reshape the initial understanding of the constrictive alignment of learning experiences for relevant learning outcome development in SCM&L education. A revisited framework represents the main contribution of this work to guide further efforts in learning experience design and teaching practice improvement. Data interpretation is discussed in Section IV.

Finally, in the reporting of findings, results are presented in Section IV individually, providing specific contextual information about each learning experience instance but also collectively amalgamated as a case study that sheds light on the research question.

Overall, adopting the case study method allowed for an in-depth exploration of the research topic within its real-life context. By adopting this approach, the study intends to provide a comprehensive understanding, generate new insights, and inform practical implications within the given field of study.

Throughout the research process, ethical considerations are adhered to, ensuring participants' privacy and confidentiality, including identity anonymity and protection of sensitive information. Overall, this methodology emphasizes a contextualized understanding of study situations, incorporation of multiple perspectives to enhance the reliability and credibility of findings, theory-led exploration to generate new insights, and qualitative exploration of the complex and multifaceted social situation while bridging the gap between theory and practice to maintain practical relevance.

IV. RESULTS: EDUCATIONAL INNOVATION FOR SCM&L AT THE MIT SCALE NETWORK LAC

Following the research approach, a case study is conducted focusing on LAC, a region facing significant challenges in supply chain performance, sustainable development, and economic growth. In this context, there is a growing demand for skilled talent in companies and an urgent need to enhance the quality of Higher Education (HE) institutions (ECLAC, 2019).

However, the HE landscape in the region is mainly limited and lags in various educational aspects, as evident from global reports such as the QS World University Rankings and The Times Higher Education World University Rankings. To remain relevant, these universities must address their challenges. Thus, HE institutions in LAC should adopt a perspective of social development, learning-centered education, entrepreneurship, and research-based teaching for social impact (Henriquez Guajardo, 2018). Education in the region should equip students to face the modern world, cultivate capable citizens, and develop purposeful visions and skills to tackle industry and societal issues. The World Bank also recommends that HE in the region should reduce dropout rates, improve students' employability, and enhance their earnings prospects (Ferreyra et al., 2017).

The three initiatives reported here as part of the MIT SCALE Network in LAC illustrate how the framework characterizes educational components for innovation in SCM&L education in the region to overcome the existing educational challenges and barriers. Each initiative offers enriched teaching and learning experiences on pertinent SCM&L topics in Mexico, Bolivia, and Peru. Following the research methodology, each reported initiative represents an instance of a learning experience, described within the structure of Figure 1.

A. The Social Lab for Sustainable Logistics

One initiative is the Social Lab for Sustainable Logistics (SLSL), established at Tecnologico de Monterrey in Mexico City. The SLSL integrates Supply Chain Management and Logistics (SCM&L) with sustainability challenges within the curriculum of industrial engineering education. This integration occurs through various avenues, including curricular courses, electives, and capstone projects, with most of them spanning a sixteen-week semester duration. The SLSL is designed to create learning experiences that address contemporary SCM&L issues in megacity urban areas, with a particular focus on their implications for sustainability. These experiences adopt a multi-stakeholder systemic perspective, considering environmental, social, and economic aspects. The primary objective of the SLSL is to foster students' development of both disciplinary and sustainability-related learning outcomes by engaging them in active and real-world activities. Through such activities, student's motivation, engagement, and relevance of learning are enhanced (Kong, 2021). The learning outcomes are mapped to the student outcomes list of the ABET accreditation body.

Within the SLSL, problem-solving applications are explored in areas like last-mile logistics, retail operations, and urban freight transportation, with a specific emphasis on sustainability challenges related to food security, environmental protection, energy conservation, health and well-being, and social equality and inclusion.

In the context of the SLSL initiative, the IN2005 System Dynamics course explores various problem situations related to SCM&L operations in neighborhoods. This course utilizes systemic tools such as causal-loop models, archetypes, patterns of behavior diagrams, and stock and flow models to address issues of retailers, consumer behavior, mobility of heavy goods vehicles (HGVs), gas emissions, solid waste generation, and other relevant aspects.

Through this learning experience, students gain a deeper understanding of the underlying factors influencing food supply, food chain inefficiencies, and strategies to improve grocery supply in response to challenges like the COVID-19 pandemic. For example, students studied disruptions in home food supply during the pandemic to assess their impact on food availability, accessibility, and affordability. By collecting data, analyzing it, and building System Dynamics models, students identify leverage points and propose policy interventions to address counterintuitive behaviors in urban food chains.

The IN2005 System Dynamics course also explores the impact of hospital operations on urban mobility, nanostores' role in food security and malnutrition, and solid waste generation in retail operations. These topics effectively connect System Dynamics principles with the sustainability of cities and communities for systemic problem solving and decision making.

Over the years (2017 to 2021), the SLSL has involved more than two hundred students, leading to the production of approximately one hundred student papers. Several of these papers were presented at the MIT SCALE conferences, with one winning first place in the 2017 student paper competition. Moreover, the initiative has resulted in the publication of two book chapters and one business article, and seven students have had the opportunity to conduct research stays at renowned institutions like the MIT CTL, Washington University in St. Louis, Eindhoven Technical University, and the CTL.

The analysis of data shows that answers related to *what to learn,* intended learning outcomes, and educational requirements were mostly obtained from the course syllabus as explicitly described in this document. However, the purpose definition; situational conditions, trends, and context; and *how to learn* in terms of the educational structure, were obtained from the instructor's reported answers. Table I provides a summary of propositions concerning the educational components of the SLSL, organized under the framework presented in Figure 1.

Table I. The Structure of the SLSL (IN2005 System Dynamics)

	SLSL Tecnologico de Monterrey- IN2005 System Dynamics
Situational Context Relevant Stakeholders	Educational partners: Tecnologico de Monterrey and academic partners from society, communities, and organizations in the Mexico City metropolitan area.
Situational Conditions and Trends	Urban SCM&L operations and their effect on the sustainability of cities and communities regarding issues of last-mile logistics, retail operations, and urban freight transportation with an impact on food security, environmental protection, energy-saving, health and well-being, and social equality and inclusion.
Purpose Definition	To develop students' disciplinary and sustainability-related learning outcomes through active and real-world activities that enhance their motivation, engagement, and learning relevance.
Relevant Learning Outcomes	ABET student outcomes: • The ability to function in multidisciplinary teams made up of other students and professionals of the highest level. • The ability to identify, formulate and solve engineering problems, being aware of their environmental impact.
Educational Requirements	• Course objective: To utilize the basic concepts and tools of system dynamics to study organizational or social processes through the development, implementation, validation, and maintenance of system dynamics models. • Academic content as described in the course syllabus.
Educational Structure	• Pedagogical approach: Active individual and collaborative learning. • Instructional methods: Experiential learning. • Learning activities to engage a concrete experience, reflective observation, abstract conceptualization, and active experimentation concerning:

	○ Classroom-based teaching on disciplinary subjects, and conceptual exploration activities. ○ Onsite observation and immersion in urban communities regarding the impact of SCM&L operation on the sustainability of cities and communities. ○ Independent research work (individually and in teamwork) to reflect and identify leverage points and develop proposals for policymaking. • Assessment methods: A formative assessment through application cases follow-up and a summative assessment through a report/student paper submission and presentation. • Learning spaces: Classrooms and public spaces in local communities such as parks, streets, and local businesses. • Learning experiences: Nanostores' impact on food security, waste generation in SCM&L operations, disruption of food chains during the COVID-19 pandemic, and the impact of SCM&L operations on urban mobility.

An interpretation of these data regarding the supporting literature shows:

a) There is a wide awareness of the situational context, conditions, and trends to nurture the learning experience. The surrounding situation and local stakeholders are seen as enablers of learning and provide an opportunity to enhance learning relevance, student engagement, and motivation (Gibson, Kerr and Fisher, 2016).

b) Despite a standard definition of learning outcomes and educational requirements, the educational purpose and *how-to-learn* structure are enhanced by the incorporation of an active learning approach and methods, which resonate in the definition of learning activities, assessment methods, learning spaces, and the overall conceptualization and execution of the learning experience under a constructive alignment (Lalley and Miller, 2007; Biggs and Tang, 2011).

c) The instructor has full ownership of the pedagogical design and explicitly incorporates experiential learning to enhance the learning experience under a specific purposive perspective (Kolb, 1984).

d) Students carry out directed and independent reflective and practical individual and collaborative active work.

e) The learning space is extended to consider learning activities outside the classroom within the city and small local businesses (Salinas-Navarro et al., 2020), and assessment methods are adapted to fit the educational purpose and authentic assessment (Wiggins, 2011).

f) The learning experience produces a link to sustainability topics and recreates non-traditional applications for industrial engineering education.

B. The Taquiña Challenge

An additional initiative in LAC refers to the Taquiña Challenge at Universidad Privada Boliviana (UPB) in Cochabamba, Bolivia. By 2019, fifteen challenge-based learning experiences were developed to position this educational approach as a core component of the academic positioning of the UPB. This implementation aimed at bringing students closer to industry and real-life problems in alignment with the disciplinary learning outcomes and the institutional mission. The learning challenges allowed for growing disciplinary competencies in students and interpersonal skills resulting from their collaboration.

The Taquiña Challenge was a pioneering implementation of SCM&L courses for the Industrial and Systems Engineering Department under an instructional model of five to seven-week modules. This challenge involved a company partner in the beverage industry of Bolivia, creating the Taquiña Challenge for the improvement and optimization of SCM&L operations. The challenge experience was later extended to other disciplines to impact additional undergraduate courses such as System Dynamics, Innovation and Creativity, and Industrial Safety. Later, a comprehensive academic proposal based on CBL was created for

other UPB undergraduate programs, considering their educational characteristics and positioning in the Bolivian region.

The Taquiña Challenge aimed to enhance the efficiency of warehousing operations for beverage products by improving loading and unloading times. This challenge was integrated into two courses: Integral Logistics (IL) and Industrial and Administrative Systems (IAS), with students from both courses forming blended groups. Raw data on trucks' loading and unloading per client was provided on-site, which IAS students analyzed to identify patterns. Students collaboratively collected additional data and used logistics and warehousing concepts and tools to propose solutions aligned with the intended learning outcomes. These proposals were presented to the company's board of directors, and students received feedback on their work.

The initiative had numerous benefits for students, faculty, external partners, and the institution. Students gained valuable experience and competency development, enhancing their employability and recognition in the labor market. Faculty members were exposed to new pedagogical approaches and recognized the importance of evolving their instructional practices and academic profiles. External partners gained insights into higher education and the potential for collaborations to address their challenges, recruit students, and create internal training programs.

Over the years, the Taquiña Challenge engaged a significant number of students in SCM&L challenges, leading to successful presentations at prestigious conferences and competitions. The experiences also motivated students to participate in other international challenges and academic programs related to logistics and supply chain management. The initiative fostered a culture of research and collaboration at UPB's Center for Logistics Operations, contributing to the institution's growth and impact in the field of SCM&L education and practice.

The analysis of data shows that answers related to *what to learn,* intended learning outcomes, and educational requirements were mostly obtained from the course syllabus as explicitly described in this document. However, the purpose definition; situational conditions, trends, and context; and *how to learn* in terms of the educational structure, were obtained from the instructor's interview. Table II summarizes the second of these initiatives, the Taquiña Challenge, according to Figure 1.

Table II. The Structure of the Taquiña Challenge

	Taquiña Challenge UPB- II3012 Integral Logistics and IA7013 Industrial and Administrative Systems
Situational Context Relevant Stakeholders	Educational partners: UPB and a beverage industry company in Cochabamba, Bolivia.
Situational Conditions and Trends	SCM&L operations of the beverage industry in Bolivia to improve their performance and operational efficiency in the local context.
Purpose Definition	To provide experiential learning activities to undergraduate students that improve their links with local organizations and boost their future careers and position the UPB in the local educational context with innovative educational approaches.
Relevant Learning Outcomes	ABET student outcomes: • The ability to identify, formulate and solve engineering problems, being aware of their impact on the environment where they are. • An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
Educational Requirements	• Integral Logistics course objective: Achieve theoretical and practical learning about the correct functioning of different logistics systems, at all levels.

	• Industrial and Administrative Systems course objective: Achieve theoretical and practical capability to determine and design management key indicators for decision support systems. • Academic content as described in the courses' syllabus.
Educational Structure	• Pedagogical approach: Active individual and collaborative learning. • Instructional methods: Challenge-based learning and experiential learning. • Learning activities to actively engage students in experiential and challenge-based learning experiences with beverage-industry logistic operations in warehousing operations concerning: o Classroom-based teaching on disciplinary subjects, and conceptual exploration activities. o Onsite observation and immersion in logistic facilities regarding warehousing operations. o Independent research work (individually and with teamwork) to propose the reduction of loading and unloading times in warehouse sites. o Onsite mentoring to receive guidance and discuss ideas. • Assessment methods: Formative assessment through follow-up meetings. Summative through report and presentation of the challenge outcomes. • Learning spaces: Classrooms and the company's logistic and warehousing facilities. • Learning experience: SCM&L decision-making and operations improvement in warehousing logistics.

The interpretation of data indicates:

a) There is the identification of a particular company that is partnered to nurture the learning experience because of the complexity and relevance of its operations, which fits *what to learn* and the development of the intended learning outcomes in the course. The surrounding stakeholders are seen as enablers of learning and provide an opportunity to mentor students, enhance the university's strategic position with innovative education, and build on employability, as an educational value (Gibson, Kerr, and Fisher, 2016).

b) A standard definition of learning outcomes and educational requirements is reframed to accommodate an active educational purpose and the *how-to-learn* structure is enhanced by the incorporation of challenge-based learning and experiential learning. Consequently, the definition of learning activities, assessment methods, learning spaces, and the overall conceptualization and execution of the learning experience are transformed to produce a constructive alignment (Lalley and Miller, 2007; Biggs and Tang, 2011).

c) The instructor created the pedagogical design and intended to use novel active pedagogical methods (individual and collaborative) to enhance the learning experience (Kolb, 1984; Apple, 2010).

d) Students carry out directed and independent reflective and practical individual and collaborative active work.

e) The learning space is extended to consider learning activities outside the classroom in public places and company facilities (Salinas-Navarro et al., 2020), and assessment methods are implemented according to authentic assessment principles (Wiggins, 2011).

f) The novel learning experience is taken as an opportunity to enrich the applicability of learning content.

C. The Engineering Value Management Course

The undergraduate course of Engineering Value Management (EVM) at Universidad del Pacifico in Lima, Peru, offers various urban logistics projects for students to explore, such as SCM&L for micro and small firms, disaster relief, retail operations for emerging markets, food and agribusiness, and urban observatories. Throughout the sixteen-week course, students are tasked with characterizing urban areas using the MIT square-kilometer methodology to study various aspects like healthy food landscapes, cash flow for small firms, humanitarian logistics, nanostore challenges, dynamic consumption patterns, and grocery demand baskets. They collect data from their communities through surveys, interviews, and observation, and conduct comprehensive literature reviews to propose improvement solutions. During sixteen weeks, students develop a topic with primary data collection through surveys, interviews, and observation, and secondary data through comprehensive literature review analyses. Table IV summarizes the educational components of the EVM challenge according to Figure 1.

Initially, in this course, students answer triggering questions regarding their readiness and preparation, understanding of a business situation, access to relevant data, and finally, community impact. By answering these questions students are taken into a reflective and practical pathway to undertake experiential learning. Specifically, the nanostore challenge takes place over a sixteen-week academic period. Working in groups of four or five students, participants assume different roles and integrate concepts to comprehend the implications of their decisions on a new product, service, or process. Students can analyze the outcomes and gain a visual understanding of the effects of their decisions on the entire business.

The course learning units consist of selecting companies, fostering entrepreneurship, navigating business uncertainties, and identifying business opportunities. By the end of the course, students are expected to substantiate their decisions by conducting thorough analyses, research, and planning across various scenarios characterized by turbulence, unpredictability, and uncertainty. They are required to formulate proposals and develop prototypes of products, services, or processes, accompanied by their respective business models, considering the associated trade-offs and challenges. Finally, students deliver short papers submitted to the MIT SCALE conferences.

As a result of this work, Universidad del Pacifico produces around twelve student papers per year. This initiative delivers meaningful education quality and impact in the MIT SCALE conferences with nine group presentations and a first-place award in the student paper competition in 2016; fifteen group presentations and an honorary mention at the student paper competition in 2018; nine group presentations and the honorary mention at the student paper competition in 2021; and seven group presentations delivered in the 2022 conference.

Therefore, Universidad del Pacifico has forged new connections and strengthened its relationship with the local community and organizations, establishing itself as a hub that connected diverse local actors, incorporated their challenges into academia and heightened the relevance and social impact of educational activities. This learning challenge has spurred the emergence of academic spin-offs, generating various benefits that extended beyond the original course's instructional objectives.

Similarly, the analysis of data shows that answers related to *what to learn,* intended learning outcomes, and educational requirements were mostly obtained from the course syllabus. However, the purpose definition; situational conditions, trends, and context; and *how to learn* were obtained from the interview with the instructor. Table II summarizes the data analysis of this initiative according to the framework in Figure 1.

Table III. The Structure of the Value Engineering Management Initiative

	UP Value Engineering Management
Situational Context Relevant Stakeholders	Educational partners: Nanostore owners.

Situational Conditions and Trends	Nanostore operations in neighborhoods, usually operating as a family business. 120,000 nanostores in Lima, a megacity with 11 million inhabitants.
Purpose Definition	To provide experiential learning activities to undergraduate students that improve their links with communities through the study of nanostores.
Relevant Learning Outcomes	ABET student outcomes: • The broad necessary education to understand the impact of engineering solutions in a global, economic, and social context. • An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
Educational Requirements	Students are expected to substantiate entrepreneurial business decisions by conducting thorough analyses, research, and planning across various scenarios characterized by turbulence, unpredictability, and uncertainty. Academic content as described in the course syllabus.
Educational Structure	• Pedagogical approach: Active individual and collaborative learning. • Instructional methods: Challenge-based learning and experiential learning • Learning activities to actively engage students in experiential challenge-based learning experiences with nanostore owners through practical immersion and in-classroom modular curricular teaching, concerning: o Classroom-based teaching on disciplinary subjects and conceptual exploration activities. o Onsite observation and immersion in nanostore facilities regarding operations' functioning. o Independent research work (individually and in teamwork) to propose novel business opportunities and operational improvements to nanostores. • Assessment methods: Formative assessment through follow-up meetings and summative through a report, presentation, and a student paper. • Learning spaces: Classrooms, nanostores' facilities, and surrounding neighborhood areas. • Learning experiences: Develop business opportunities and operations improvements for nanostores thriving in the local neighborhood environments.

The interpretation of data for this instance indicates:

a) There is an identification of small family businesses and local communities to enrich learning activities in the course. The surrounding situational conditions and stakeholders are seen as enablers of learning and provide an opportunity to strengthen links with the community from a business perspective (Gibson, Kerr and Fisher, 2016).

b) A standard definition of learning outcomes and educational requirements are complemented with an active educational purpose to enhance learning relevance and the *how-to-learn* structure is adapted by the incorporation of experiential and collaborative learning. Consequently, the definition of learning activities, assessment methods, learning spaces, and the overall conceptualization and execution of the learning experience are transformed to produce a constructive alignment (Lalley and Miller, 2007; Biggs and Tang, 2011).

c) The instructor conceptualized the pedagogical design and explicitly used novel pedagogical methods to enhance the learning experience (Kolb, 1984; Apple, 2010).

d) Students carry out directed and independent reflective and practical individual and collaborative active work.

e) The learning space is extended to consider learning activities outside the classroom in public places and business facilities (Salinas-Navarro et al., 2020), and assessment methods are implemented according to authentic assessment principles (Wiggins, 2011).

f) The novel learning experience is taken as an opportunity to enhance students' citizenship and knowledge applicability concerning disciplinary content.

Summing up, the three cases keep consistency in amalgamating the use of active learning, constructive alignment, and authentic assessment for learning outcome development. However, the three learning experiences implement a purposive perspective in which instructors autonomously define *how to learn* by aligning the situational conditions and context in favor of actively enriching the learning experiences with a clear sense of delivering enriched educational value beyond the learning and teaching of disciplinary content. A combination of directed, independent, individual, and collaborative work exists to undertake reflective and practical activities, inside and outside the classroom and universities. By doing this, the learning experiences point to enhanced learning relevance and student engagement. With this in mind, a revised version of Figure 1 is presented in Figure 2 to incorporate these elements.

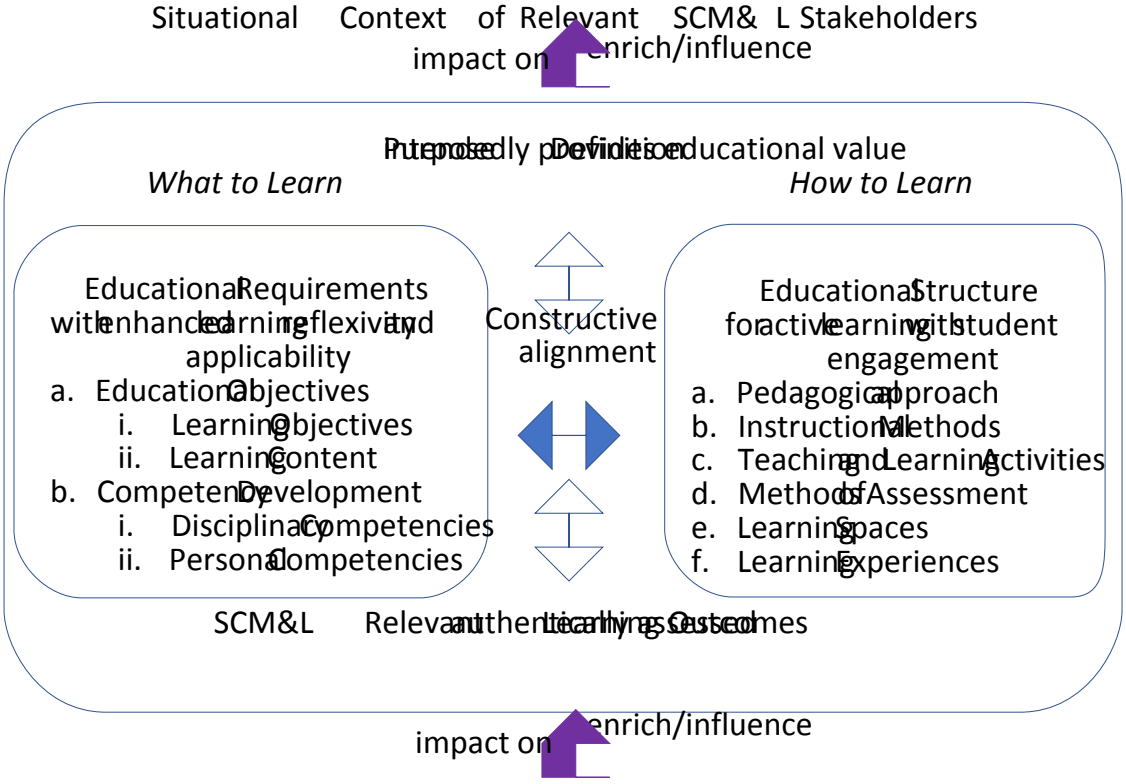

Fig. 2. A Revised Framework for Innovative Learning Experiences (own elaboration)

V. DISCUSSION OF RESULTS

A. Findings and Contributions

This study introduces a conceptual framework for educational innovation in SCM&L education, aiming to create active, relevant, and high-value learning experiences that address contemporary challenges in the field. The framework emphasizes the importance of connecting students' learning with real-world situations, enabling reflective learning through experiential engagement.

The framework focuses on purposeful educational efforts that align with specific situational contexts and conditions, achieved through a structured arrangement of learning activities embedded within learning experiences. It addresses the educational requirements of what needs to be learned and outlines an approach to how learning should take place, resulting in constructive alignment and the authentic assessment of intended learning outcomes. The exploration of active learning experiences within the MIT SCALE Network for LAC allowed for clarifying these notions and demonstrated its potential in meeting diverse academic and institutional expectations, providing educational benefits to students and other educational stakeholders.

Furthermore, the study contributes to prioritizing and coordinating pedagogical research by exploring the achievements of learning outcomes through active and experiential implementations in different contexts for SCM&L education. It offers examples of innovative learning experiences that inspire new developments within the LAC region and beyond, encouraging a departure from conventional approaches in SCM&L education. Hence, this work contributes to illustrating instances of active learning experiences in SCM&L beyond traditional disciplinary applications.

The novel learning experiences presented in the study translate real-world SCM&L operations and challenges into unique educational opportunities. These experiences foster learning both inside and outside of traditional classrooms, particularly in urban areas of LAC, facilitating interactions between students and educational partners within authentic scenarios to achieve intended learning outcomes. They share a common emphasis on establishing connections between learning and local communities, companies, or contexts, utilizing active and collaborative learning approaches, and incorporating hands-on instructional methods to promote reflective learning. For SCM&L education, this represents a contribution as real-world and live study situations for active learning are limitedly reported in the literature.

Moreover, the benefits of this work extend beyond learning experiences. The implementation of the framework has led to new collaborations with the MIT SCALE Network for LAC, resulting in partnerships for disciplinary work, faculty training, and the generation of publications on educational innovation in the field.

Tables I-III provide a summary of the initiatives, outlining the structure of what needs to be learned and how to learn it. This includes defining situational circumstances, purposes, learning outcomes, educational requirements, and the structures that constitute educational mechanisms for facilitating learning experiences. These tables highlight the practical application of the framework in real-life educational settings, highlighting its effectiveness in creating meaningful and impactful learning opportunities.

However, the main contribution of this work is a transferable conceptual framework provided in Figure 2 for developing further innovative learning experiences. The framework integrates mainstream pedagogical concepts of instructional design complemented with the case study findings. That is, on the one hand, it highlights the importance of active learning, constructive alignment, and authentic assessment; and on the other hand, it integrates these concepts with specific descriptions of *what to learn* and *how to learn* in a purposive way to produce educational value and developing intended learning outcomes across different contexts, disciplines, or geographical regions.

Accordingly, the research question of this work presented in Section 1 is addressed in this work by proposing a conceptual framework that shows *how to constructively design learning experiences for SCM&L education to cultivate relevant learning outcomes while incorporating active learning principles*. This work also illustrates instances of this proposition in practice to clarify the notions.

Referring to criteria of research criteria (de Zeeuw, 1996; Vahl, 1997), this work addresses (internal) validity by proposing a methodology that links the research process with the existing conceptual constructs in the body of literature. Moreover, reliability is addressed by providing a step-by-step methodology that consistently allows for the subsequent collection, usage, and reporting of data from different learning experience instances. It also considers the identification of deviations in results to reformulate statements and test the proposed framework. Regarding transferability, as the results' generalizability, this research study's findings might not apply to other contexts, situations, times, and populations as learning experiences can differ from other instances in their contextual conditions or circumstances, leading to different results and interpretations.

B. Limitations

The study acknowledges several limitations related to conceptual, methodological, execution-related, and research process considerations. First, the need for educational innovation and active learning experiences may not be universally recognized by all academics in the SCM&L discipline, as some may prioritize different types of teaching and learning approaches and improvements. Within the MIT SCALE Network for LAC, most academic members do not participate in developing innovative pedagogical applications, but their focus is on disciplinary research, which opens the possibility for future investigation. Hence, incorporating additional colleagues into the regional collective efforts becomes a challenge to enrich SCM&L education. However, by disseminating this type of work, a growing interest could emerge in the community. Additionally, the focus on active approaches, such as experiential and challenge-based learning, also leaves room for exploring other pedagogical alternatives.

Execution-related limitations arise from the resource-intensive and time-consuming nature of integrating active pedagogical approaches into courses. This can affect teacher workloads and require significant preparation and coordination with partners, making the implementation process challenging. Administrative and academic regulations may also hinder pedagogical changes, and recruiting companies for learning experiences can be challenging. Hence, future developments require this consideration.

In terms of research process limitations, the case study methodology adopted in this work limits generalizability and broader inferences because of the focus on particular cases and circumstances. The study provides an in-depth understanding and insights into specific educational initiatives within the MIT SCALE Network for LAC, but it does not include a comprehensive evaluation of the framework's impact on student learning achievements or opinions. Therefore, further instances of active learning experiences for SCM&L education are required for (re)formulating statements and testing the proposed framework in other situations and contexts through falsification (de Zeeuw, 1996; Popper and Popper, 2008). Moreover, the researchers' subjectivity and bias represent an additional limitation regarding their interest in active, experiential, and reflective learning. Data collection, analysis and interpretation involved the researchers as participating subjects, which affects data independence.

Overall, while the conceptual framework offers valuable insights into SCM&L learning experience innovation, addressing these limitations will be crucial to further validate its effectiveness and applicability in diverse educational contexts within the SCM&L discipline and beyond.

C. Future work

Furthermore, it is imperative to continue the testing and validation of the proposed framework to ascertain its efficacy in enhancing students' learning outcomes, satisfaction with their learning experiences, and the recognition of learning relevance. This necessitates a new comprehensive set of methods to facilitate future investigations in this area. Thus, this perspective raises the complementary question of how to assess learning effectively. Additionally, this viewpoint entails the development of new initiatives and learning experiences within the current participating universities, as well as the expansion of this work to cover other HE institutions and diverse learning scenarios. This represents a novel agenda for educational innovation, to identify new possibilities for advancing SCM&L education in the LAC region.

Nevertheless, despite this work has been conducted in the Latin American region, the research question remains valid at the global level. The existing body of literature shows the highlighted limitations at the international level, which makes it necessary to investigate the topic in other regions. Different educational challenges may exist across countries and universities concerning active learning and learning relevance, which turns out important to contrast and investigate for similarity identification regarding what to learn and how to learn in different contexts and circumstances. For the SCM&L discipline, further investigation is suggested regarding international SCM&L issues to expand the identification of situational conditions and contexts across borders and globally, which might expand student awareness and enrich learning outcomes at this level. By doing these, this work might increase its transferability and validity.

VI. CONCLUSION

This study emphasizes the necessity to cultivate innovative learning experiences within the field of SCM&L education, in light of existing limitations that hinder the provision of comprehensive, active, high-value, and relevant learning opportunities for students. Consequently, this research puts forth a conceptual framework that draws upon the principles of constructive alignment, active learning, and the integration of innovative instructional methods. The purpose is to facilitate the recreation of active learning experiences that yield pertinent learning outcomes in authentic real-world settings for SCM&L education and provide high educational value. This perspective considers both the content and methodology aspects of learning in the discipline, offering a complementary approach to determining *what to learn* and *how to learn*. The application of this framework is illustrated, demonstrating its pertinence in facilitating relevant active learning across various practical scenarios in the Latin American region. The research limitations demand the development of further application cases in different contexts and situations to formulate and test new statements about the framework.

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