The Enhancing System Thinking and Teamwork Through LEGO® SERIOUS PLAY®: a Case Study in Knowledge and Innovation Management

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Abstract

This study investigated the application of LEGO® SERIOUS PLAY® (LSP) methodology to enhance learning outcomes in the Knowledge and Innovation Management (KIM) program at Chiang Mai University. LSP is a hands-on, interactive methodology where participants use LEGO® bricks to construct three-dimensional models that visually represent abstract concepts, interdependencies, and dynamic challenges. As a critical component of KIM education, system thinking and teamwork are essential skills for navigating the complexities of interdisciplinary innovation. LSP was integrated into the curriculum to provide students with a tool to construct models that visualize interdependencies within smart cities, bridging theoretical knowledge and practical problem-solving. The study's findings, derived from pre-session and post-session surveys, peer evaluations, and reflective exercises, demonstrate significant improvements in system thinking, with students adopting holistic perspectives to address dynamic challenges. By fostering engagement, critical thinking, and collaborative learning, LSP proved to be a powerful methodology in interdisciplinary education. Enhanced teamwork skills were also reported as participants engaged in collaborative tasks that emphasized creativity, communication, and shared decision-making. LSP's metaphorical modeling minimized communication barriers, facilitating equitable participation across diverse learner groups. While LSP is not the sole instrument for achieving knowledge and innovation management, it complements other creativity tools and methods by providing an experiential learning approach that bridges theoretical knowledge and practical application. By promoting active engagement and critical thinking, LSP serves as a transformative educational tool for preparing students for innovation-driven environments. Challenges such as initial learning curves and time constraints were identified, with recommendations for session optimization to enhance outcomes. These results underline LSP's potential for broader application across fields that require system-oriented thinking and interdisciplinary collaboration. Future research should explore its scalability and long-term impact on skill development within KIM and related fields.

Keywords: LEGO® SERIOUS PLAY®, System Thinking, Knowledge and Innovation Management, Smart City, Collaborative Problem-Solving

Introduction

In today's knowledge-driven economy, managing innovation and applying system thinking are essential for organizational success. Graduates of Knowledge and Innovation Management (KIM) programs must navigate complex systems and collaborate effectively within interdisciplinary teams. This demands not only a strong foundation in theoretical knowledge but also the cultivation of practical skills and robust decision-making abilities. To meet these requirements, the KIM program incorporates LEGO® SERIOUS PLAY® (LSP), an innovative methodology that focuses on system thinking, teamwork, and creativity in problem-solving (Kristiansen & Rasmussen, 2014). LSP enables students to model interconnected components of knowledge systems, fostering a systems-oriented mindset through hands-on building, reflection, and iteration (Jarmai & Vogel-Pöschl, 2019). Group activities promote communication, negotiation, and shared decision-making, aligning with the teamwork goals of KIM programs. System thinking allows individuals to view organizations as dynamic, interconnected systems, enabling sustainable solutions, while teamwork fosters creativity and the implementation of innovative ideas (Kozlowski & Ilgen, 2006).

However, despite the increasing emphasis on system thinking and teamwork in KIM education, traditional approaches often fall short in providing interactive and experiential learning opportunities, limiting students' capacity to apply theoretical knowledge to real-world situations effectively. (Duchek et al., 2021). Many pedagogical strategies focus heavily on theoretical instruction, limiting students' ability to visualize complex interdependencies and develop hands-on problem-solving skills. There is a pressing need for innovative learning methodologies that bridge this gap, allowing students to engage in experiential learning while improving their teamwork and decision-making capabilities.

Previous Findings highlight LSP's transformative potential for fostering system thinking and teamwork in knowledge management education (Alzaghou & Tovar, 2018; Cherapanukorn & Jintapitak, 2017; Jintapitak & Kamyod, 2019). The current study contributes to the growing body of research on innovative learning methodologies by evaluating the effectiveness of LSP in fostering system thinking and teamwork within the KIM curriculum. Specifically, it provides empirical evidence on how LSP improves students' ability to identify system interdependencies, enhances collaborative problem-solving, and reduces communication barriers through metaphorical modeling. Additionally, the study offers practical recommendations for integrating LSP into interdisciplinary education, broadening its applicability beyond KIM to fields such as urban planning and healthcare.

The broader significance of system thinking is evident in its application to smart cities, which utilize advanced technologies to improve sustainability, efficiency, and overall quality of life (Caragliu et al., 2011). Utilizing tools like IoT, AI, and big data, these cities optimize systems such as transportation, energy, and governance (Falconer & Mitchell, 2012). However, challenges like data privacy, cybersecurity, and inclusivity persist (Vanolo, 2014). System thinking facilitates holistic urban planning by analyzing interdependencies within smart cities (O'Connor & McDermott, 1997), enabling sustainable and resilient urban development through balanced subsystem integration (Kordova & Frank, 2018).

LSP serves as a dynamic methodology for fostering teamwork by enhancing collaboration, communication, and mutual understanding (Kristiansen & Rasmussen, 2014). Its three-dimensional model-building approach reduces communication barriers and aligns shared goals, while storytelling clarifies individual roles and promotes innovative solutions (Cherapanukorn & Jintapitak, 2017). Originally developed as a business tool, LSP has expanded into education, proving effective in teaching creative problem-solving, system thinking, and teamwork (Schulz & Geithner, 2013; Roos et al., 2004). LSP aligns with constructivist learning theory, which emphasizes hands-on, experiential learning as a means of constructing knowledge. By enabling students to build and refine models iteratively, LSP fosters deeper cognitive engagement and critical thinking. Furthermore, LSP complements systems thinking, a core component of KIM education, by helping students understand complex interconnections through tactile, visual, and collaborative processes.

Studies demonstrate LSP's efficacy in various educational settings. For instance, McCusker (2014) highlights its role in fostering critical thinking, while Nolan (2010) underscores its value in teaching system thinking by helping students model and visualize complex systems (Gauntlett, 2010). LSP also promotes collaboration, as shown by Nerantzi & Despard (2015), who found it improved team dynamics and decision-making through open dialogue and inclusivity (Kaufman & Felder, 2000). Additionally, LSP drives innovation in education, with applications in innovation management courses where students prototype real-world solutions (Alzaghou & Tovar, 2018; Jintapitak & Kamyod, 2019).

Incorporating LSP into the KIM curriculum at Chiang Mai University allows students to construct tangible models representing abstract concepts (Grienitz & Schmid, 2012), enhancing cognitive engagement and collaboration (Hinthorne & Schneider, 2012). Unlike other tools such as Design Thinking and Simulation Games, which have been widely used to enhance problem-solving and collaboration, these approaches are often unable to visually and physically model interdependencies within complex systems. LSP, in contrast, provides a tangible, interactive medium that enables students to construct three-dimensional representations of abstract concepts, facilitating deeper engagement with system dynamics. While LSP is not the only tool available, its unique metaphorical modeling and collaborative storytelling approach set it apart, making it a powerful complement to traditional teaching methods in KIM education. The effectiveness of LSP as a tool to improve learning within Chiang Mai University's KIM program was explored in this research.

Methods and Materials

This section details the implementation of LSP to teach system thinking and teamwork in a graduate program. The study was designed as a qualitative case study with a mixed-methods approach, incorporating both qualitative and quantitative assessment techniques. The primary goal was to examine how LSP enhances key learning outcomes in KIM, including critical thinking, problem-solving, interdisciplinary collaboration, and the ability to model complex systems. A certified facilitator with seven years of experience, trained in LSP Method and Materials since 2017 and completed advanced training in 2021, led the activities. The facilitator's expertise delivered high-quality activities, fostered effective learning outcomes, and ensured strong student engagement. The structured assessment confirmed LSP's effectiveness in enhancing learning, aligning seamlessly with the course objectives.

A. Participants

The study involved all 12 students in the Master's program, in the same academic year, in the Knowledge and Innovation Management program at Chiang Mai University. As the entire population of KIM students in that cohort, they completed the same foundational coursework, ensuring a consistent baseline of knowledge. The sample size was determined based on qualitative research guidelines that prioritize in-depth, experiential learning over large-scale statistical generalization. The participants had diverse backgrounds in business, engineering, IT, and the Arts. While most had limited experience with system thinking, they were familiar with teamwork through previous collaborative projects. The participant group consisted of individuals aged 23-28, with an equal gender distribution (six males and six females). Inclusion criteria required students to be actively enrolled in the KIM program and to have completed prior coursework in innovation management, providing a shared academic foundation. Before participating in the LSP sessions, students received introductory instruction on smart cities through lectures and readings, equipping them with the necessary background to engage effectively in the hands-on, interactive learning process facilitated by LSP. This preparatory phase ensured that students had a conceptual understanding of urban systems, allowing them to apply LSP to analyze interdependence within smart city environments.

B. Experimental Setup

The classroom environment was intentionally designed to promote collaboration during LSP activities. Students were divided into groups of four, each seated at tables equipped with a variety of LEGO bricks. The arrangement ensured ease of access to materials, unrestricted interaction between participants, and sufficient space for large-scale model building. The setup encouraged open communication, allowing students to build, present, and discuss their models freely. The LSP program was structured into three phases to enhance learning in System Thinking and Teamwork.

Phase 1: Introduction (30 minutes) Students were introduced to LSP principles and engaged in warm-up exercises, familiarizing themselves with LEGO materials and metaphorical representations. This phase helped reduce learning curves and ensured students were comfortable using LSP as an analytical tool.

Phase 2: Primary Activity (140 minutes) Students constructed detailed models based on prompts related to system interdependencies and teamwork, fostering creativity, reflection, and collaborative discussions. This phase included guided discussions where students iteratively refined their models, demonstrating their understanding of complex relationships. Models focused on smart city components such as energy networks, transportation, and public services. Participants were required to articulate how different elements influenced one another, simulating real-world decision-making.

Phase 3: Reflection and Synthesis (50 minutes) Students presented models, explained thought processes, and discussed real-world applications, consolidating key concepts through peer feedback. Facilitators encouraged critical reflection by asking students to compare their initial assumptions with the final models, highlighting key insights gained during the session.

This structured approach enhanced understanding, enabling students to visualize complex systems and teamwork frameworks effectively.

C. Assessment Tools

The evaluation of LSP in the KIM program assessed its impact on students' system thinking and teamwork skills through a multi-step, mixed-method approach (Flick, 2007).

This study employed a qualitative case study with a mixed-methods approach to investigate the impact of LSP on system thinking and teamwork. The qualitative aspect is reflected in the thematic analysis of students' reflections, peer evaluations, and facilitator observations, while the quantitative aspect is represented by the pre-session and post-session surveys using Likert-scale assessments. To ensure integration between qualitative and quantitative data, the study cross-analyzed trends from the survey results with emergent themes from qualitative feedback, allowing for a more comprehensive understanding of students' learning experiences.

To enhance reliability and validity, multiple measures were implemented. Inter-rater reliability was ensured in peer evaluations, where students assessed one another based on structured rubrics covering communication, collaboration, and problem-solving skills. Additionally, facilitator observations were cross validated against self-reported reflections to reduce bias. The study also employed data triangulation, where survey responses, peer evaluations, and reflections were analyzed together to identify consistent patterns. These approaches enhance the credibility of the findings, though future studies could further strengthen reliability by including independent external raters.

Pre-Session Survey: Students completed a baseline survey to identify initial knowledge gaps and misconceptions about system thinking and teamwork, establishing benchmarks for progress.

Post-Session Reflection and Survey: After LSP activities, students reflected on how LSP enhanced their understanding of system thinking, teamwork, and smart city planning. Open-ended responses provided qualitative insights into their learning experiences.

Peer Evaluations: Group dynamics and collaboration were assessed through peer evaluations, highlighting communication and individual contributions to teamwork success.

Student Interviews: Semi-structured interviews offered in-depth, personalized reflections on how LSP fostered the development of system thinking and collaborative skills.

This comprehensive evaluation revealed that LSP significantly improved cognitive understanding and interpersonal collaboration, providing robust evidence of its effectiveness in experiential learning.

D. Limitations and Future Research

While this study provides valuable insights into the application of LSP in enhancing system thinking and teamwork, several limitations should be acknowledged. This study did not seek Institutional Review Board (IRB) approval as it was conducted within a classroom setting to explore the feasibility of expanding into a formal classroom-based research study in the future. The primary objective was to test the process with a cohort of 12 master's students—the entire student population of this class—to allow for an in-depth understanding of individual and group learning dynamics. This approach enabled a detailed examination of participants' experiences, cognitive development, and teamwork skills, ensuring a comprehensive qualitative assessment.

Additionally, this study served as a pilot to evaluate the effectiveness of structuring LSP activities within the constraints of a standard academic schedule. The focus was on optimizing activity sequencing and engagement strategies to align with the curriculum timetable, ensuring that LSP could be effectively integrated into the course framework. Future research should build on these findings by conducting a broader study with a larger sample size, allowing for comparative analysis across different cohorts. Furthermore, incorporating a control group or alternative teaching methods would help isolate the specific impact of LSP on system thinking and teamwork.

Another important direction for future research is the formalization of assessment tools to measure long-term learning outcomes. By expanding the study into a structured educational research framework with IRB approval, future studies can explore how LSP contributes to knowledge retention, problem-solving capabilities, and interdisciplinary collaboration in Knowledge and Innovation Management programs. Additionally, studies could investigate the adaptation of LSP to hybrid and online learning environments, ensuring its scalability and relevance across different educational settings.

Results

The integration of LSP in the KIM course improved students' system thinking and teamwork skills. To assess these changes, a combination of pre-session and post-session surveys, peer evaluations, and observational data was used to evaluate student learning outcomes. The results indicate a significant enhancement in students' ability to analyze system interdependencies, articulate cause-and-effect relationships, and engage in collaborative problem-solving.

A. Pre-LSP and Post-LSP Assessment and Data Collection

As shown in Fig. 1 and 2, the pre-LSP and post-LSP session assessments were conducted using structured evaluation tools designed to measure improvements in system thinking and teamwork. The pre-session survey captured baseline data on students' ability to map system components, recognize interdependencies, and identify feedback loops within complex systems. The post-session survey assessed changes in these abilities after participating in LSP activities.

The numbers presented in the graphs were derived from Likert-scale survey responses, where students rated their confidence and ability levels in system thinking and teamwork before and after engaging in LSP sessions. Additionally, qualitative data from peer evaluations and facilitator observations were used to corroborate the quantitative findings. The mixed-method approach ensured a comprehensive analysis of the impact of LSP on students' cognitive and collaborative skills.

To further clarify the assessment methodology, the experimental setup now explicitly outlines the procedures used for collecting and analyzing pre-session and post-session data. The integration of these assessment tools into the methodology ensures transparency in how the study measured the effectiveness of LSP.

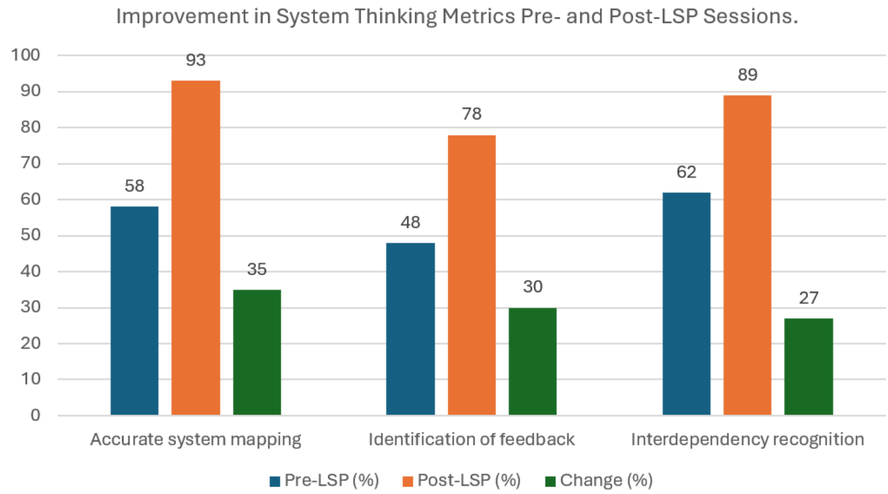

Figure 1 Improvement in System Thinking Metrics Pre-LSP and Post-LSP Sessions

Fig. 1 illustrates the increase in correct system mappings by students, where post-session evaluations showed a 35% improvement in the identification of interdependencies between city components. The effectiveness of LSP activities was evident in the over 70% of students who could accurately articulate system feedback loops, indicating a strong grasp of cause-and-effect dynamics.

Pre-assessment surveys indicated that many students were initially hesitant to engage in group discussions, with 45% rating their teamwork skills as "below average." Post-LSP assessments, however, showed an increase in self-reported teamwork skills, with 80% of participants rating their teamwork as "effective" or "highly effective."

Fig. 2 illustrates the shift in teamwork skill ratings before and after the LSP sessions. Observational data collected during the sessions also supported this improvement, with facilitators noting an increase in collaborative problem-solving and ideation.

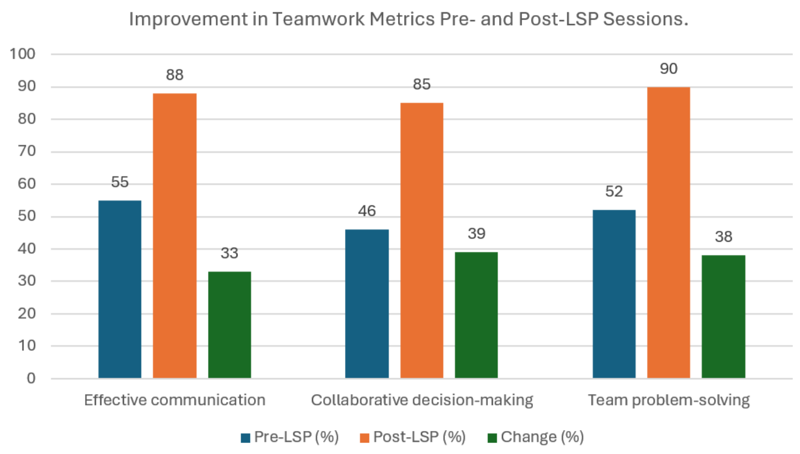

Figure 2 Improvement in Teamwork Metrics Pre-LSP and Post-LSP Sessions

Student reflections highlight LSP's impact on system thinking and teamwork. Students gained insight into interdependencies, noting how changes in one area, like energy, affect others, such as healthcare. LSP promoted collaboration by improving communication and problem-solving skills as students collaboratively built shared smart city models, significantly enhancing their teamwork capabilities.

B. Enhancement of Creativity, Problem-Solving, and Decision-Making

The LSP enhanced system thinking, creativity, and problem-solving by fostering critical thinking and incorporating diverse perspectives. Through LSP, students modeled smart city systems, effectively identifying inefficiencies and proposing innovative solutions.

Fig. 3 illustrates a Smart City model's interconnected components using metaphors to represent complex ideas, including abstract concepts. LSP simplifies this through guided steps, fostering creativity, experimentation, and insights. Students developed innovative solutions for sustainable energy integration, mirroring real-world practices.

Figure 3 A Smart City model reflecting their knowledge through LSP

C. Implications for Knowledge and Innovation Management Education

LSP transforms Knowledge and Innovation Management learning by fostering active engagement, critical thinking, and innovation. It enables students to construct, reflect, and discuss system components, complementing traditional theoretical instruction effectively.

Fig. 4 highlights a portion of a Smart City model focused on education. The image depicts a structure with two child figures standing at different levels, connected by a slider. At first glance, one might interpret this as a playground. However, the students used this model to explain their vision of a creative education system for a Smart City, addressing issues in traditional education. The model symbolizes solutions to challenges such as difficulty in understanding content, lack of flexibility in applying knowledge, and educational inequality.

Figure 4 A close-up of the Smart City model illustrating educational concepts

D. Real-world applications and Skills Development

LSP addresses language barriers by enabling non-English-speaking students to express complex ideas through three-dimensional LEGO models and metaphors. This hands-on approach enables students to connect concepts with their existing knowledge, enhancing comprehension, engagement, and communication. By minimizing reliance on language proficiency, misunderstandings and errors in analysis are reduced.

Fig. 5 illustrates a Smart City model designed with Universal Design principles, featuring diverse representations of individuals, including infants, the elderly, and workers, symbolizing inclusivity and balance. Developed collaboratively, the model embodies a shared vision for addressing the needs of all residents. LSP facilitates the visualization of interdependencies, fosters collaboration, and enhances problem-solving, offering students practical experience in managing knowledge flows and equipping them to tackle global, innovation-driven challenges.

Figure 5 The Smart City model illustrating the concept of Universal Design

A comparative analysis of pre-session and post-session results highlights LSP's effectiveness in fostering deeper learning and collaboration. Before engaging in LSP, students often struggled to articulate system interdependencies and feedback mechanisms. Post-session reflections indicated that the physical modeling and storytelling aspects of LSP helped students conceptualize complex relationships more intuitively. The increase in teamwork metrics aligns with the participatory nature of LSP, which encourages peer-to-peer interaction, active listening, and shared decision-making.

Additionally, student reflections revealed that LSP's interactive format reduced anxiety associated with verbal communication, particularly for students with diverse linguistic and academic backgrounds. This finding reinforces the idea that LSP minimizes participation barriers, making it an inclusive tool for interdisciplinary education.

Discussion

The effectiveness of LSP in enhancing system thinking and teamwork skills among graduate students in the KIM program. The findings reveal that LSP's interactive and experiential methodology provides significant advantages over traditional teaching approaches by fostering a deeper understanding of complex systems and improving collaboration among diverse participants.

A. System Thinking and Visualization

This study highlights one of LSP's most significant benefits: its ability to foster a holistic understanding of systems through visualization. By constructing physical models of abstract and complex systems, students could represent interdependencies within smart cities. This practical method facilitated tangible explorations of system dynamics, promoting a holistic view and identifying key leverage points for sustainable solutions, crucial for real-world problem-solving (Grienitz & Schmid, 2012; O'Connor & McDermott, 1997).

B. Teamwork and Collaborative Problem-Solving

The group-oriented nature of LSP activities promoted effective teamwork by emphasizing communication, negotiation, and shared decision-making. LSP enhanced student collaboration and confidence, as evidenced by peer evaluations and reflections, reinforcing its ability to build trust and inclusive group dynamics (Nerantzi & Despard, 2015; Roos & Victor, 2018).

C. Bridging Language and Cultural Barriers

LSP's reliance on three-dimensional modeling and metaphors minimized the reliance on verbal communication, enabling students from diverse linguistic and cultural backgrounds to express complex ideas effectively. This inclusive approach allowed participants to contribute equitably, reducing misunderstandings and facilitating a shared vision—a crucial aspect of teamwork in globalized, interdisciplinary settings (Cherapanukorn & Jintapitak, 2017).

D. Creativity and Innovation in Learning

The iterative process of building, reflecting, and adapting models fostered creativity and critical thinking among students. By simulating real-world scenarios such as smart city planning, LSP encouraged innovative problem-solving and practical applications of system thinking. This aligns with the experiential learning framework, which emphasizes active engagement and hands-on exploration (LEGO Group, 2010; McCusker, 2014).

E. Comparison of LEGO® SERIOUS PLAY® (LSP) with Other Tools or Methods in a Similar Context

LSP stands out from methods like Design Thinking and Simulation Games by offering deeper system-wide understanding and fostering creativity. While Design Thinking emphasizes user-centered problem-solving through structured stages, it often falls short in analyzing complex system interconnections. In contrast, LSP's distinctive features—tactile modeling and storytelling—go beyond technical capabilities, enabling participants to construct physical models that vividly represent holistic relationships. This approach makes it easier to identify hidden problems and visualize cascading the effects tangibly and engagingly.

LSP offers greater flexibility than Simulation Games, fostering deeper engagement and understanding through tactile interaction and storytelling, enhancing both learning and teamwork.

F. The Impact on Developing Deep Skills Beyond Other Tools

LSP is a powerful tool for cultivating holistic understanding by enabling participants to construct three-dimensional models that reveal interdependence within complex systems, such as smart cities. This approach shifts participants from fragmented thinking to a system-oriented perspective, allowing them to visualize how changes in one component ripple through the entire system.

LSP uniquely fosters creativity and storytelling through iterative model-building and narrative-sharing. This process encourages experimentation and enhances the communication of complex ideas in an innovative yet accessible way. LSP's use of metaphors and physical models facilitates clear communication across diverse backgrounds.

Lastly, LSP greatly enhances system thinking and collaboration by fostering shared understanding and teamwork. Its tactile and visual methodology creates an inclusive environment where participants of all expertise levels can contribute equally, making it an invaluable tool for interdisciplinary problem-solving and innovation.

G. Challenges and Recommendations

Despite its benefits, the implementation of LSP faced challenges, including an initial learning curve and time constraints. Students required time to become familiar with LSP principles and materials, which could be addressed by extending the introductory phase in future sessions. Additionally, the time-intensive nature of LSP activities limited the depth of exploration in some cases, suggesting the need for tailored session designs that balance the depth and breadth of learning outcomes.

H. Broader Implications

As education and professional environments increasingly prioritize systems thinking and interdisciplinary collaboration, LSP has emerged as a transformative framework that equips participants to tackle complex, interconnected challenges. In urban planning, LSP supports modeling stakeholder dynamics and optimizing resource allocation, while in healthcare, it aids in visualizing patient care pathways and fostering collaborative decision-making within multidisciplinary teams.

The success of LSP in the KIM program highlights its broader potential across fields such as engineering, healthcare, and urban planning, where interdisciplinary collaboration is essential. For example, LSP can enhance project management and systems integration in engineering and promote patient-centric innovation processes in healthcare.

Future research should investigate the long-term effects of LSP on skill development and its adaptability to diverse learners and organizational contexts. By seamlessly bridging theoretical concepts with practical applications, LSP emerges as a vital tool for addressing the increasing complexity of global challenges in education and professional settings.

Conclusion and Suggestions

This study highlights the transformative potential of LSP in advancing system thinking and teamwork skills among graduate students in the KIM program at Chiang Mai University. By integrating LSP into the curriculum, students engaged in hands-on activities that enabled them to visualize complex systems and explore interdependence within smart cities. This structured methodology effectively bridged the gap between theoretical understanding and practical application, fostering a deeper comprehension of abstract concepts.

Key findings reveal that LSP significantly enhanced students' cognitive and collaborative skills. Participants gained valuable insights into system dynamics and developed essential teamwork abilities, including effective communication, negotiation, and shared decision-making. By employing physical models and metaphors, LSP minimized participation barriers, ensuring inclusive and equitable contributions from diverse learner groups. Furthermore, LSP acted as a catalyst for creativity and innovation. Through active engagement, reflection, and iterative problem-solving, students proposed sustainable and innovative solutions for real-world challenges, demonstrating LSP's applicability in disciplines requiring interdisciplinary collaboration and system-oriented thinking.

A. Addressing Knowledge Gaps and Scalability of LSP

While this study provides strong evidence of LSP's effectiveness, it also identifies areas for future exploration. One key gap is the need for further research on how LSP can be adapted for larger and more diverse participant groups. The current study was conducted with 12 students, the full cohort of the KIM master's program in that academic year, allowing for detailed individual and group-level analysis. However, in broader applications, scaling LSP effectively requires strategic facilitation methods.

In certified LSP facilitation, facilitators are trained to design and tailor activities to different group sizes and objectives. The methodology itself is proprietary, meaning that specific facilitation strategies cannot be publicly detailed. However, LSP is known to be highly adaptable, with effective implementation ranging from one-on-one executive coaching to group sizes of 10-12 participants per facilitator, which is considered the optimal ratio for maintaining activity depth and engagement. When group sizes exceed 12 participants, an additional facilitator or an assistant should be introduced for every 10–12 participants to ensure the quality and depth of engagement. Alternatively, when only one facilitator is available for a larger group, activity assistants should be added at a similar 10–12:1 ratio to help manage subgroups effectively. In large-scale settings, the facilitator may adopt the role of Lead Facilitator, overseeing multiple smaller groups while ensuring a cohesive and structured learning experience.

Larger LSP sessions demand more time, resources, and careful facilitation to maintain discussion quality, potentially requiring technical support. Implementing LSP presents a learning curve and time-constraint challenges. Pre-session guidance can mitigate learning curves, and session redesign or extended time can address time constraints.

B. Comparing LSP with Other Creativity and Learning Methodologies

LSP's tactile, metaphorical, and interactive qualities distinguish it from Design Thinking and Simulation Games. Unlike Design Thinking's structured steps, LSP offers physical modeling. Simulation Games, while immersive, lack LSP's creative flexibility. Further research should compare LSP with other methods to clarify its strengths and weaknesses.

C. Future Research and Applications Beyond Education

While this study focused on the educational application of LSP within smart city planning, LSP is a versatile methodology with broader implications across multiple fields. Future studies could explore its adaptability in healthcare, urban planning, engineering, and business innovation. For example:

Healthcare: LSP could be used for visualizing patient care pathways, fostering cross-disciplinary collaboration between medical teams, and improving patient-centric innovation strategies.

Urban Planning: LSP can help model stakeholder dynamics and resource allocation, facilitating sustainable decision-making among policymakers.

Engineering and Business Innovation: The methodology can be leveraged to prototype complex systems, optimize project management, and enhance strategic decision-making.

D. Conclusion and Recommendations for Implementation

LSP improves collaborative problem-solving, system thinking, and communication, vital for innovation, by providing an interactive and practical learning experience. This study establishes LSP as a highly effective tool for fostering system thinking, teamwork, and creativity within KIM education. Its hands-on approach effectively bridges the gap between theoretical knowledge and practical application, making it a valuable methodology for preparing students to thrive in innovation-driven environments. However, further research is necessary to explore its scalability, long-term impact, and broader interdisciplinary applications.

Future efforts should focus on expanding research to accommodate larger and more diverse participant groups while developing detailed strategies for scaling facilitation. Investigating long-term skill retention among students who have undergone LSP-based training will provide deeper insights into its lasting educational value. Comparing LSP with other experiential learning methodologies, such as Design Thinking and role-playing simulations, will help define its unique impact and advantages. Additionally, exploring its role in professional training programs and industry applications beyond the academic setting will allow for greater adaptability. Developing facilitator training programs tailored for large-scale educational and corporate applications will ensure that LSP maintains its effectiveness across various domains.

By addressing these areas, LSP can be further refined and adapted to meet the evolving needs of interdisciplinary education and professional development. Strengthening its application in diverse settings will reinforce its role as a transformative tool for enhancing system thinking, collaboration, and problem-solving in both academic and professional environments.

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Author Contributions

Author 1: Contributed to conceptualization, facilitated the experimental process using LEGO® SERIOUS PLAY®, designed the methodology, conducted investigation, collected data, performed data analysis and interpretation, contributed to manuscript writing, and participated in manuscript review and editing.

Author 2: Contributed to conceptualization, and development, provided foundational knowledge management and innovation on smart cities through lectures, and participated in manuscript review and editing.

Conflict of Interests

The authors declare no conflicts of interest related to this study.

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