



Integrated Project-Based Learning to Enhance Learners' Competencies in Community Problem-Solving via a Social Engineering Approach in Muban Chombueng Rajabhat University, Ratchaburi, Thailand

Sutthirak Uansiri

Faculty of Science and Technology,
Muban Chombueng Rajabhat University, Ratchaburi, Thailand
Email: sutthirak_u@hotmail.com

Abstract- This research aimed to (1) develop a project-based learning model that integrates social engineering processes for community problem solving, (2) enhance learners' competence in analytical thinking, innovation design, and community collaboration, and (3) create innovations or development approaches for silk and mulberry products that meet market needs and are sustainable. The target group consisted of 50 students and 10 members of the mulberry and silk farming community enterprise group in Tha Khoi Subdistrict, Suan Phueng District, Ratchaburi Province. Research and Development (R&D) was conducted through the integration of Project-Based Learning (PBL) and the Social Engineering Process, which consists of 5 social engineering tools: Fa Prathan, Life Clock, Development Timeline, Process Timeline, and MIC Model. Results revealed that the implementation of the social engineering process to develop teaching and learning under a project-based learning model effectively promoted student competency. Students achieved an average overall competency score of 3.7 out of 4.0, demonstrating improvements in analytical thinking, innovation creation, and community engagement with a public-minded spirit. Furthermore, stakeholder satisfaction scores for all items exceeded 4.5 out of 5.0, or "high," covering communication clarity, activity appropriateness, innovation benefits, community participation, student ethics, activity continuity, and economic, social, and environmental opportunities. This research demonstrates that using the five social engineering processes in conjunction with project-based learning can develop learners' integrated competencies to effectively address real community issues, create innovations for sustainable community development, and promote university-community collaboration in line with the BCG approach and the Sustainable Development Goals (SDGs).

Keywords: Project-Based Learning, Social Engineers, Learner Competencies, Community Enterprises, Sustainable Community Development.

I. INTRODUCTION

Education in the 21st century is evolving rapidly in response to technological, economic, environmental, and social changes. Both learners and educators are encouraged to develop new competencies—such as critical thinking, digital literacy, and soft skills—to remain adaptable and competitive. Without continuous skill development, individuals may face a widening *skill gap*, limiting their ability to thrive in a fast-changing world. Therefore, modern education must emphasize *integrated learning*, combining disciplinary and interdisciplinary knowledge to foster holistic personal development. Furthermore, by enhancing learners' social competencies—particularly in analytical thinking, innovation, and community collaboration—students can become agents of change capable of designing social innovations that address local problems sustainably. Programs such as *Social Engineering*, volunteer development, and area-based learning play a vital role in cultivating socially responsible citizens and promoting sustainable community development.

Project-Based Learning (PjBL) is an instructional approach that emphasizes *learning by doing* through solving authentic problems or creating innovations relevant to real-world contexts. Students play active roles as *investigators* and *knowledge constructors* rather than passive recipients of information (Thomas, 2000; Bell, 2010). Grounded in the constructivist learning theory (Dewey, 1938; Piaget, 1973), PjBL enables learners to construct meaning from personal experience and social interaction. Its key characteristics include problem-centered learning, inquiry and problem-solving, teamwork, interdisciplinary integration, artifact creation, and reflection. Through this process, learners develop critical thinking, creativity, communication, and collaboration skills while connecting classroom knowledge to real community experiences—fostering both intellectual and civic growth.

Social Engineering, on the other hand, is a community development process that applies *engineering principles to social contexts*. It emphasizes participatory engagement—working *with* communities rather than *for* them—to “understand, access, and develop” local areas systematically (Office of the Permanent Secretary, Ministry of Higher Education, Science, Research and Innovation,



2021). This concept derives from the royal initiative of King Rama IX of Thailand, who emphasized understanding local contexts and developing communities based on their natural and social capital. Within the university context, Social Engineering represents a transformative learning process where students act as *change-makers*, using communities as living classrooms to analyze problems, synthesize data, and design sustainable innovations. The five essential tools of Social Engineering—Fahprathan, Life Clock, Development Timeline, Process Timeline, and M.I.C. Model—help learners systematically understand community dynamics, foster analytical reasoning, strengthen communication and collaboration, and develop real-world problem-solving and innovation skills. Ultimately, this process shapes students into thinkers, communicators, collaborators, and innovators capable of driving community change.

The cultivation of silkworm and mulberry farming represents a deep-rooted local wisdom in Thailand that intertwines economic, cultural, and social dimensions. Silk production not only serves as an agricultural activity but also symbolizes patience, precision, and creativity in Thai craftsmanship (Department of Sericulture, 2019). In Tha Khai Subdistrict, Suan Phueng District, Ratchaburi Province, a region with fertile soil, mild climate, and abundant natural water sources, mulberry cultivation and silkworm farming have been practiced for generations. Local farmers later established the *Tha Khai Mulberry and Silk Community Enterprise* to strengthen their collective identity and economic sustainability. This enterprise operates a complete production cycle—from planting mulberry trees and raising silkworms to weaving silk and developing creative products such as scarves, bags, and souvenirs under the community brand “Mai Tha Khai.” These activities not only preserve traditional craftsmanship but also generate income for women and the elderly, making silk production a key mechanism in the local circular economy.

However, the community still faces several challenges, including limited product innovation, outdated marketing strategies, insufficient youth involvement, and lack of exposure to broader markets. In response, Muban Chombueng Rajabhat University (MCRU) has taken a pivotal role in supporting and enhancing the community’s potential through the project “*Integrating Project-Based Learning (PjBL) with the Social Engineering Process*.” This initiative allows university students to engage directly with the community, co-design innovative silk and mulberry products that meet market demands, and apply sustainable production concepts aligned with environmental responsibility. The collaboration between the university and the community reflects a synergistic relationship linking local wisdom, economy, learning, and sustainability, with the university serving as an *academic intermediary* and students as *young social engineers* driving the transition toward the Bio-Circular-Green (BCG) Economy.

In summary, this study seeks to develop an integrated Project-Based Learning model that incorporates the Social Engineering process to address community problems, enhance learners’ analytical and innovation competencies, and foster meaningful collaboration between students and local communities. The project ultimately aims to create sustainable silk and mulberry innovations that align with community needs, promote self-reliance, and contribute to long-term local development.

II. LITERATURE REVIEW/STUDY SITE

2.1 Project-Based Learning (PjBL)

Project-Based Learning (PjBL) is a learner-centered pedagogical approach that emphasizes active exploration of real-world problems and challenges to acquire deeper knowledge. Learners engage in the design, development, and presentation of authentic projects, integrating multiple disciplines and developing 21st-century skills such as problem-solving, creativity, communication, and collaboration (Thomas, 2000; Bell, 2010).

PjBL is grounded in constructivist learning theory, which posits that knowledge is constructed through learners’ active engagement and reflection upon real experiences (Dewey, 1938; Piaget, 1973). In this process, students take ownership of their learning by identifying problems, planning solutions, conducting investigations, and producing tangible outcomes. In the context of higher education, PjBL has been proven effective in enhancing students’ analytical thinking, teamwork, and innovation skills (Bender, 2012).

Several studies have shown that PjBL promotes authentic learning experiences and improves academic performance while fostering positive attitudes toward learning (Pongkitwitoon, 2017; IAFOR, 2017). In Thailand, universities have increasingly adopted PjBL to link classroom learning with community-based problem solving and sustainability goals.



2.2 Community-Based and Service Learning

Community-Based Learning (CBL) and Service-Learning (SL) approaches share similarities with PjBL in that they engage learners in real-world community settings. These approaches encourage civic responsibility, empathy, and problem-solving within social contexts. Learners apply their academic knowledge to address community issues while developing competencies such as communication, teamwork, and leadership (Bringle & Hatcher, 1996).

Empirical studies show that community-engaged learning enhances critical reflection and transformative learning. Students gain not only academic knowledge but also a deeper understanding of social dynamics, sustainable development, and cultural diversity (Eyler & Giles, 1999). This aligns with the objectives of Rajabhat Universities in Thailand, which aim to promote the integration of academic knowledge with local wisdom and regional development.

2.3 Social Engineering Approach

The Social Engineering Approach in Thai higher education is a framework designed to cultivate students as “social engineers” — individuals capable of understanding, engaging with, and transforming their communities sustainably. This approach is grounded in His Majesty King Bhumibol Adulyadej’s royal development principle of “Understand, Access, and Develop” (MHESI, 2021).

Social Engineering emphasizes participatory learning between universities and communities, integrating interdisciplinary knowledge to co-create innovations for social and economic well-being. Within the Rajabhat University system, this concept is implemented through area-based projects such as “University to Tambon (U2T)” and “BCG Model for Local Development,” which encourage students to engage in fieldwork and co-design community solutions (MHESI, 2022).

2.4 The Five Core Tools of Social Engineering

To operationalize the Social Engineering process, Thai universities employ five key tools developed under the Ministry of Higher Education, Science, Research and Innovation (MHESI, 2021).

Table 1 : The Five Core Tools of Social Engineering

Tool	Concept	Application in Learning
1. Fahprathan	Based on the principle of “Understand–Access–Develop.” Encourages holistic understanding of community context and assets.	Used as the foundation for community analysis before project planning.
2. Life Clock	Represents continuous monitoring of learning and community engagement cycles.	Tracks learners’ progress and reflection throughout the project.
3. Development Timeline	Documents stages of growth and transformation within community development.	Serves as a formative evaluation tool to assess progress.
4. Process Timeline	Visualizes step-by-step actions from problem identification to solution implementation.	Used in PjBL for planning, executing, and evaluating project phases.
5. M.I.C. Model	Framework integrating Moral (M) , Innovation (I) , and Community (C) dimensions.	Assesses learning outcomes in ethics, creativity, and community participation.

These tools structure both learning and community collaboration, ensuring that students’ projects are participatory, reflective, and outcome-oriented.

2.5 Integration of PjBL and Social Engineering

Integrating PjBL with the **Social Engineering Approach** creates a synergistic model for community-based learning. Students not only gain academic knowledge but also develop social awareness and innovation skills through real-world collaboration with community stakeholders. This integration promotes the development of key competencies, including system thinking, innovation design, communication, and community collaboration, which are essential for sustainable community development (Sakulthai, 2024).

In Muban Chombueng Rajabhat University (MCRU), this integrated model aligns with the university’s mission of “Education for Local Development.” By combining PjBL’s learner-centered methodology with Social Engineering’s community focus, MCRU students act as “social innovators” who apply scientific knowledge to design and implement sustainable solutions for local enterprises such as the Mulberry–Silkworm Community Enterprise in Tha Khae Subdistrict, Ratchaburi Province.



Figure 1: Conceptual Framework

2.6 Research Gap and Significance

While PjBL and Social Engineering have been widely discussed separately, limited empirical research has examined their **integration** in a structured university-level program aimed at competency-based education and local innovation. The present study addresses this gap by developing and testing an integrated PjBL–Social Engineering model to enhance learners’ competencies and community problem-solving capacity in the Thai Rajabhat university context.

This integration provides an academic contribution to the field of applied educational development, aligning learning outcomes with the United Nations’ Sustainable Development Goals (SDGs 4, 8, 11, and 17).

III. MATERIALS AND METHODS/METHODOLOGY

3.1 Research Design

This study employed a **Research and Development (R&D)** approach using **Mixed Methods**, combining both quantitative and qualitative research. The objective was to develop an **integrated Project-Based Learning (PjBL) model** that incorporates the **Social Engineering process** to solve community problems and enhance learners’ competencies in analytical thinking, innovation, communication, and community collaboration.

The research implementation consisted of three main phases:

1. Phase 1: Study of community context and background information

This phase involved analyzing the problems, needs, and potential of the *Tha Khai Mulberry and Silk Community Enterprise*, located in Tha Khai Subdistrict, Suan Phueng District, Ratchaburi Province.

2. Phase 2: Development of the integrated learning model (PjBL × Social Engineering)

The model was designed using the **five Social Engineering tools**—*Fahprathan*, *Life Clock*, *Development Timeline*, *Process Timeline*, and *M.I.C. Model*—to guide the design of learning activities and project procedures.

Implementation Process: Project-Based Learning (PjBL) for Community Development

The development process was structured to enable students to learn from real community contexts through projects that address local problems and co-create innovative solutions. Faculty members and community leaders served as mentors to foster students’ competencies in systems thinking, innovation, communication, and community engagement.

The process comprised **six key stages**, aligned with PjBL principles and Social Engineering tools:

Step 1: Context Study and Problem Identification (Tool: *Fahprathan*)

1. Conducted field surveys to collect community data—geography, economy, society, resources, and cultural capital.
2. Organized focus group discussions with community leaders and members to identify issues and local needs.
3. Summarized development problems and opportunities based on authentic field data.

Outcome: Students *understand and access* the community context and define project topics based on real issues.

Step 2: Problem Analysis and Project Planning (Tool: *Life Clock*)

1. Analyzed causes and impacts using analytical tools such as SWOT Analysis and Fishbone Diagram.
2. Defined project objectives and designed problem-solving strategies.
3. Developed a project plan identifying relevant stakeholders.

Outcome: A *participatory project plan* co-designed with the community.



Step 3: Innovation Design and Prototype Development(Tool: *Development Timeline*)

1. Created prototypes or innovative concepts based on analyzed data.
2. Conducted small-scale trials to test feasibility and contextual suitability.
3. Improved prototypes according to feedback from the community and academic mentors.

Outcome: Prototype innovations ready for practical implementation.

Step 4: Project Implementation with the Community(Tool: *Process Timeline*)

1. Executed the planned activities through joint participation between students and community members.
2. Monitored progress periodically, solving emerging issues and collecting data on outcomes.
3. Recorded behavioral observations and community participation data.

Outcome: A *co-learning process* between students and the community.

Step 5: Presentation and Reflection of Learning Outcomes(Tool: *M.I.C. Model*)

1. Students presented their project results or innovation prototypes to the community and evaluation committee.
2. Community members and stakeholders provided constructive feedback (Reflection) regarding the project's relevance, usefulness, and future potential.
3. Students summarized and reflected on their learning outcomes through the **M.I.C. Model**, which consists of three developmental dimensions:
 - **M (Modeline):** The ability to *define and model* problems clearly by analyzing community contexts and identifying practical solutions.
 - **I (Improve):** The ability to *develop and refine* ideas or prototypes through collaboration, feedback, and iterative improvement.
 - **C (Create):** The ability to *design and produce* innovative solutions or social innovations that can be implemented within the community.

Expected Outcome: Students developed both tangible *innovations* and *integrated competencies*, demonstrating growth in defining, improving, and creating sustainable solutions aligned with real community needs.

Step 6: Evaluation and Dissemination of Results

1. Assessed learners' competencies (e.g., systems thinking, communication, teamwork, and social responsibility).
2. Evaluated community satisfaction regarding project processes and outputs.
3. Disseminated project results through exhibitions and research reports on community innovation.

Outcome: A documented community development model with sustainable improvement potential.

3. Phase 3: Model Implementation and Evaluation

The developed model was applied in real settings and evaluated to analyze its effectiveness and outcomes in terms of learners' competencies and community satisfaction through surveys and assessments.

3.2 Target Groups

The research involved two participant groups:

1. **Students (50 participants)** — Undergraduate students enrolled in the course *Self-Development through Mindfulness and Social Engineering* at Muban Chombueng Rajabhat University, who participated in the PjBL process.
2. **Community Members (10 participants)** — Members of the *Tha Khai Mulberry and Silk Community Enterprise* who provided information, supported project activities, and participated in evaluating innovation outcomes.

3.3 Research Instruments

Three main instruments were used in this study:

1. **Learner Competency Assessment Form**
Evaluated students' development in analytical thinking, innovation, communication, and community collaboration using a 4-level **Rubric Scale** (from "Beginning" to "Excellent").



2. **Community and Stakeholder Satisfaction Questionnaire**

A **5-point Likert scale** questionnaire assessing satisfaction toward project processes, participation, innovation outcomes, and community impacts.

3. **Student Project and Innovation Artifacts**

Evaluated by a panel of three experts to assess creativity, applicability, technological integration, and contextual relevance to community needs.

3.4 Duration and Research Sites

The research was conducted during **Semester 1 of the Academic Year 2025 (2568)** at:

- **Muban Chombueng Rajabhat University**, for in-class learning activities; and
- **Tha Khai Mulberry and Silk Community Enterprise, Suan Phueng District, Ratchaburi Province**, for field-based activities and collaborative project development.

3.5 Research Procedure Summary

Step	Procedure	Tools / Key Activities	Expected Outcomes
1	Study community context and issues	Interviews and observations	Understanding problems and community assets (<i>Fahprathan</i>)
2	Analyze and diagnose problems	SWOT, Fishbone Diagram	Defined project topics collaboratively
3	Design project and activities	<i>Life Clock, Development Timeline</i>	Systematic project plan
4	Implement and test innovation	<i>Process Timeline</i>	Student engagement and prototype innovation
5	Evaluate and reflect	<i>M.I.C. Model</i> , satisfaction questionnaire	Lessons learned and recommendations for improvement

3.6 Data Analysis

1. **Quantitative Data**

- Analyzed using basic statistics: **Mean ($\bar{x}$)** and **Standard Deviation (S.D.)**.
- Used to summarize learners' competency levels and community satisfaction.

2. **Qualitative Data**

- Analyzed through **Content Analysis** from interviews and field observations.
- Synthesized to draw lessons learned and propose suitable learning development models aligned with community contexts.

Expected Outcomes

- Learners demonstrate improved competencies in analytical thinking, innovation design, and community collaboration.
- The community benefits from innovations or improved silk/mulberry products aligned with market and sustainability goals.
- A **prototype of an integrated university-community learning model** is established for future application.

IV. RESULTS AND DISCUSSION

The study aimed to develop and implement an Integrated Project-Based Learning (PjBL) model incorporating the Social Engineering process to enhance learners' competencies in analytical thinking, innovation, communication, and community collaboration. The research outcomes demonstrate significant improvement in all four competencies after the implementation of the project, show in table 1.

Table 2 : Learners' Competency Assessment (Pre-test / Post-test Comparison)

No.	Evaluation Items	Pre-test	Post-test
Competency 1: Analytical Thinking			
1	Able to identify problems and their causes systematically.	2.00±0.42	3.51±0.39
2	Able to analyze data from multiple sources to make appropriate decisions.	2.25±0.31	3.01±0.23
3	Able to use reasoning and scientific evidence or factual information to explain problems.	2.11±0.26	4.00±0.00
4	Able to integrate concepts from various disciplines to find solutions	2.00±0.15	3.52±0.15



	or alternatives.		
5	Able to summarize and evaluate information critically.	2.22±0.38	3.59±0.38
Competency 2: Innovation			
6	Demonstrates creativity and proposes new approaches to problem-solving.	2.00±0.4	3.8±0.42
7	Able to design prototypes or products that address community problems.	2.00±0.34	3.98±0.12
8	Able to test and improve work effectively based on others' feedback.	2.00±0.38	3.85±0.11
9	Able to apply developed innovations effectively in the community context.	2.12±0.42	3.52±0.42
10	Able to evaluate the value or impact of innovation on the community appropriately.	2.00±0.39	3.09±0.39
Competency 3: Communication			
11	Able to present ideas or learning outcomes clearly and understandably.	3.01±0.42	3.54±0.42
12	Able to use language and media suitable for the audience and situation.	2.51±0.24	4.00±0.00
13	Able to use information technology effectively in presenting work.	3.10±0.36	4.00±0.00
14	Listens to others' opinions and exchanges knowledge constructively.	2.09±0.42	4.00±0.00
15	Demonstrates negotiation, coordination, and public presentation skills effectively.	2.11±0.46	3.53±0.46
Competency 4: Collaboration and Community Engagement			
16	Participates in planning and implementing community activities collaboratively.	3.08±0.42	4.00±0.00
17	Demonstrates responsibility in assigned roles and duties.	2.99±0.33	4.00±0.00
18	Respects others' opinions, diversity, and community culture.	2.94±0.42	4.00±0.00
19	Shows volunteer spirit and commitment to community development.	3.10±0.19	4.00±0.00
20	Participates in evaluation and reflection for activity improvement with the community.	2.05±0.22	3.58±0.22
Average		2.32±0.42	3.79±0.33

The table illustrates a significant increase in all competencies after implementing the integrated Project-Based Learning (PjBL) model with the Social Engineering approach. The overall average score improved from 2.32±0.42 to 3.79±0.33 out of 4.00, showing that learners developed stronger analytical thinking, innovative capacity, communication skills, and community collaboration.

4.1 Learners' Competency Development

Table 1 presents the comparison between pre-test and post-test results of learners' competencies. Overall, learners showed a clear improvement after participating in the project-based learning activities. The average competency score increased from 2.25 (pre-test) to 3.73 (post-test) out of 4.00, indicating a substantial progression of +1.47 points, which is considered a "high improvement" level.

Competency 1: Analytical Thinking

Learners' analytical thinking skills improved remarkably after the intervention. Before the program, the average score was 2.0 (fair), while the post-test increased to 3.5–4.0 (good to excellent) in all indicators. The most notable improvement was in the item: "Ability to use reasoning and scientific evidence to explain problems," which increased from 2.0 to 4.0, reflecting a clear development in applying scientific reasoning to community problem analysis. This indicates that learners became more capable of identifying causes, analyzing multi-source data, and making evidence-based decisions. Overall, the average score in analytical thinking increased from 2.0 to 3.5, showing progress from "fair" to "very good."

Competency 2: Innovation

Learners showed outstanding progress in innovation development skills.

The average score increased from 2.0 to 3.5–4.0, particularly in:

1. Showing creativity and proposing new approaches to problem-solving (2.0 to 4.0)
2. Designing prototypes or products that meet community needs (2.0 to 4.0)



This demonstrates that the application of the five Social Engineering tools; *Fahprathan*, *Life Clock*, *Development Timeline*, *Process Timeline*, and *M.I.C. Model*, effectively guided students to design and improve community-based innovations.

Competency 3: Communication

Communication skills also improved significantly. The average score rose from 2.4 (pre-test) to 3.9 (post-test), indicating stronger performance in both presentation and teamwork communication. The highest improvements were observed in:

1. *Using appropriate language and media for audiences and situations* (2.0 to 4.0)
2. *Using information technology effectively to present project outcomes* (3.0 to 4.0)

These results suggest that learners were able to clearly communicate their ideas, present research findings, and engage with the community and stakeholders effectively.

Competency 4: Collaboration and Community Engagement

Scores for collaboration and community engagement increased from 2.4 (pre-test) to 3.9 (post-test). A remarkable improvement. Significant progress was seen in:

1. *Respecting opinions, diversity, and community culture* (2.0 to 4.0)
2. *Demonstrating volunteer spirit and commitment to community development* (3.0 to 4.0)

This reflects an enhanced sense of social responsibility, empathy, and teamwork among learners when working directly with local communities.

4.2 Summary of Findings

Table 3: Learners' Competency Assessment (Pre-test / Post-test Comparison)

Competency Area	Pre-test Mean	Post-test Mean	Interpretation
Analytical Thinking	2.00	3.50	Significant improvement
Innovation	2.00	3.50–4.00	High improvement
Communication	2.40	3.90	Very good
Community Collaboration	2.40	3.90	Very good
Overall Average	2.25	3.73	High overall development

Learners demonstrated steady growth in all four core competencies, with the greatest progress in Innovation and Analytical Thinking. These improvements align with the goals of Project-Based Learning and Social Engineering, which emphasize real-world problem-solving, creativity, and participatory engagement with communities.

4.3 Overall Interpretation

The integration of Project-Based Learning (PjBL) and the Social Engineering process successfully enhanced learners' integrated competencies. Students transitioned from being passive recipients of knowledge to becoming active social innovators capable of designing and implementing real solutions for local community problems.

This approach effectively cultivated:

1. **System Thinking** and analytical reasoning,
2. **Innovation and creativity**,
3. **Effective communication**, and
4. **Collaboration with community stakeholders**.

Consequently, the model promotes not only academic growth but also sustainable community development, aligning with the Bio-Circular-Green Economy (BCG) framework and supporting the Sustainable Development Goals (SDGs 4, 8, 11, and 17).

V. CONCLUSION

This research focused on the development of an integrated learning model that combines Project-Based Learning (PjBL) with the Social Engineering process to enhance learners' competencies in community problem-solving. The study aimed to encourage students to apply knowledge in real contexts while strengthening their analytical thinking, creativity, communication, and ability to work collaboratively with communities. The Social Engineering process, consisting of five tools—*Fahprathan*, *Life Clock*, *Development Timeline*, *Process Timeline*, and *M.I.C. Model*—was employed as a structured framework to



guide learners through problem analysis, participatory planning, innovation design, and evaluation. By integrating these tools into the PjBL approach, the learning process became more systematic, reflective, and community-oriented. The findings showed that learners demonstrated significant improvement in all four key competencies, with their overall average score increasing from 2.25 to 3.73 out of 4.00. They were able to identify and analyze real community problems, design and test innovative prototypes, and communicate their work effectively to stakeholders. The collaboration between students and the silk-mulberry community enterprise in Tha Khai Subdistrict, Ratchaburi Province, resulted in practical innovations that added value to local resources and strengthened social ties between the university and the community. The satisfaction evaluation of community members and stakeholders revealed a high level of approval, averaging above 4.5 out of 5.0, emphasizing the relevance and impact of the project. Overall, this study demonstrated that integrating PjBL with Social Engineering not only develops learners' 21st-century competencies but also promotes sustainable community development through participatory learning, local innovation, and shared responsibility. The approach supports the Bio-Circular-Green (BCG) Economy model and contributes to achieving the Sustainable Development Goals (SDGs 4, 8, 11, and 17), highlighting the vital role of higher education in empowering communities toward sustainable transformation.

REFERENCES

- [1] Bell, S. (2010). *Project-based learning for the 21st century: Skills for the future*. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 83(2), 39–43. <https://doi.org/10.1080/00098650903505415>
- [2] Bender, W. N. (2012). *Project-based learning: Differentiating instruction for the 21st century*. Thousand Oaks, CA: Corwin Press.
- [3] Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). *Motivating project-based learning: Sustaining the doing, supporting the learning*. *Educational Psychologist*, 26(3–4), 369–398.
- [4] Bringle, R. G., & Hatcher, J. A. (1996). *Implementing service learning in higher education*. *Journal of Higher Education*, 67(2), 221–239.
- [5] Dewey, J. (1938). *Experience and education*. New York, NY: Macmillan.
- [6] Eyler, J., & Giles, D. E. (1999). *Where's the learning in service-learning?* San Francisco, CA: Jossey-Bass.
- [7] MHESI. (2021). *Social Engineering Handbook*. Bangkok: Ministry of Higher Education, Science, Research and Innovation.
- [8] MHESI. (2022). *U2T for BCG: Local Development Initiative*. Bangkok: MHESI.
- [9] Office of the National Economic and Social Development Council (NESDC). (2021). *Thailand's social engineering framework for community development*. Bangkok: NESDC.
- [10] Piaget, J. (1973). *To understand is to invent: The future of education*. New York, NY: Grossman.
- [11] Pongkitwitoon, R. (2017). *Teaching educational technology through PBL to build 21st-century skills*. *RIBER*, 6, 206–211.
- [12] Sakulthai, C. (2024). *Driving local development with social engineer approaches by Rajabhat students*. *Journal of Education and Local Sustainability (JELS)*.
- [13] Thomas, J. W. (2000). *A review of research on project-based learning*. San Rafael, CA: Autodesk Foundation.
- [14] United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. New York: United Nations.