Supplementary Material

Article Title: School-University Partnerships for Place-Based Educational Administration Innovation: Fostering Innovative Co-Creator Learners

Document S1: Representative Case Study and Implementation Manual: The T-FIVE Model at Tessaban 5 (Wat Hat Yai) School

Section 1: School Context and Strategic Rationale

1.1 Background and International Collaboration

Tessaban 5 (Wat Hat Yai) School is a primary school located in urban Songkhla (comprising 590 students and 43 staff members). Situated in an urban area characterized by cultural diversity, the school's primary asset is its role as a leading environmental institution. It maintains a strategic partnership with the World Wildlife Fund (WWF) to drive initiatives focused on reducing plastic consumption and promoting the use of eco-friendly alternative materials.

1.2 Place-based Problem Identification

The project working group conducted a Four-Sector Focus Group involving representatives from Education, Government, Private, and Civil Society/Community sectors. University mentors served as Facilitators, assisting the school in "decoding" community-specific challenges. Through this collaborative process, water hyacinth in local community waterways was identified not only as a problematic weed affecting the ecosystem but also as a high-potential resource for value-added transformation into sustainable plastic alternatives.



Figure S1. Four-sector focus group session to identify community-specific challenges.

1.3 Strategic Decision: Narrowing the Focus for Quality

Initially, the school intended to develop 21st-century skills holistically. However, academic mentors provided a crucial Strategic Recommendation: attempting to develop such a broad range of competencies within the limited timeframe of a single semester would compromise the precision and depth of the assessment. Consequently, a collective decision was made to "Narrow the Focus" specifically toward "Creative and Innovative Thinking." This strategic alignment enabled teachers to design intensive learning activities and tangibly measure the transformation of Grade 5 students' competencies.

Section 2: Innovation Design and Administrative Framework

2.1 The T-FIVE Administrative Model

The school and the university collaborated to co-design an administrative structure aimed at transitioning the traditional instructional system toward a robust **Innovation Ecosystem**. The framework consists of five key pillars:

- **T (Team):** Establishment of a multidisciplinary task force within the school, with the university providing expert support as a dedicated Coaching Team.
- **F (Focus):** A strategic commitment to a specific thematic challenge: developing innovative products from water hyacinth.
- **I (Integration):** An interdisciplinary approach integrating four core subjects: Science, English, Integrated Studies 1, and Integrated Studies 2.
- **V (Variety):** The utilization of diverse learning environments and resources, encompassing both in-school facilities and external community sites.
- **E (Evaluation):** The implementation of authentic assessment focused on longitudinal development and competency growth rather than rote memorization.

2.2 Strategic Time Management

With guidance from the university, the school restructured its academic timetable to create a dedicated space for innovation. The traditional "Friday Afternoon Volunteer Sessions" (3 hours per week) were repurposed into a high-intensity "Innovation Lab." This strategic reallocation provided a total of 39 instructional hours per semester, allowing for deep, uninterrupted engagement in the innovation process.

Section 3: The Innovation Competency Blueprint and Pedagogical Design

To ensure that the educational administrative innovation at Tessaban 5 (Wat Hat Yai) School was both systematic and measurable, the research team and university mentors collaborated with the institution to define the "Innovation Competency Blueprint" and the instructional framework as follows:

3.1 The Innovation Competency Blueprint

The blueprint operationalizes Creative and Innovative Thinking Skills into four core behavioral dimensions. These dimensions were utilized as the primary criteria for designing the four learning stations—Discovery, Design, Production, and Public Relations—and for developing the multi-stakeholder assessment tools.

Table S1. Operational Definitions and Behavioral Indicators for Creative and Innovative Thinking Skills.

1. Creative Thinking	**2. Elaboration and Originality**	**3. Creative Collaboration**	**4. Achieving Successful Innovation**
1.1 Identifying new opportunities within emerging problems.	2.1 Observing subtle details often overlooked by others.	3.1 Respecting diverse viewpoints despite personal disagreement.	4.1 Planning the innovation development process systematically.
1.2 Developing novel methods for task execution.	2.2 Synthesizing unrelated concepts into a cohesive idea.	3.2 Opening to new ideas and integrating perspectives from others.	4.2 Developing and evaluating innovations iteratively throughout the process.
1.3 Analyzing problems from multiple perspectives.	2.3 Producing original work that distinguishes itself from peers.	3.3 Asserting and presenting personal ideas confidently within a group.	4.3 Assessing final outcomes and the overall impact of the developed innovation.
1.4 Employing diverse and adaptable working methods.	2.4 Seeking unconventional solutions to challenges.	3.4 Exchanging knowledge and experiences proactively with others.	4.4 Refining and improving flaws continuously to enhance innovation quality.
1.5 Revising personal ideas based on new information or evidence.	2.5 Modifying problem-solving strategies as circumstances evolve.	3.5 Collaborating smoothly with others to achieve shared objectives.	4.5 Using digital technology to strategically communicate innovations to society.

3.2 The 4 Learning Stations (39 Instructional Hours)

University mentors assisted in designing a 39-hour instructional timeframe, divided into four primary stations to translate the aforementioned competencies into practice:

1. **Discovery Station (6 Hours):** Focused on data collection and community context analysis to identify the innovation challenge.
    - *Hours 1–3:* Investigating waste problems and waste segregation techniques.
    - *Hours 4–6:* Off-site investigation at the Municipal Water Quality Improvement Office (Inquiry-based learning).
2. **Design Station (9 Hours):** Focused on planning and developing creative concepts.
    - *Hours 7–9:* Seeking inspiration at the Institute for Southern Thai Studies.
    - *Hours 10–15:* Researching water hyacinth product data and drafting design prototypes
3. **Production Lab (15 Hours):** Focused on hands-on implementation through **Trial and Error**.
    - *Hours 16–18:* Material preparation and production process experimentation.
    - *Hours 19–30:* Role division for production, testing, refinement, and knowledge sharing.
4. **Public Relations Station (9 Hours):** Focused on presentation skills and technology integration.
    - *Hours 31–33:* Learning advertising principles and the use of AI (Canva) for branding.
    - *Hours 34–39:* Designing promotional media and presenting innovations

3.3 Expert Validation

The Innovation Manual and instructional plans underwent a rigorous review for content validity and suitability by a panel of three academic experts.

- **Overall Evaluation:** The innovation was highly rated for its interdisciplinary integration and strong connection to the local community (Place-based). The development process was found to be theoretically sound, feasible, and measurable, effectively promoting holistic learning across knowledge, skills, and attitudes.

3.4 Iterative Refinement Process

Although the initial evaluation reached an acceptable standard, the research team and university mentors performed an **Iterative Refinement** based on the experts' recommendations:

1. **Activity Alignment:** Refining the details of activities in each station to ensure they were clearly aligned with the learning goals for primary-level students.
2. **External Synergy:** Increasing the involvement of external agencies and local experts to provide specialized technical knowledge.
3. **Assessment System Enhancement:** Developing comprehensive assessment tools that allowed for the longitudinal tracking of individual student progress.

The Role of Mentorship: University mentors served as **Coaches**, overseeing the refinement of the manual in close alignment with expert feedback. This ensured that the innovation served as a highly effective tool for fostering student innovation competencies prior to its full implementation in the second semester of the 2024 academic year.

Section 4: Implementation of Innovation through Integrated Learning Stations

Following the collaborative drafting phase with university mentors, the school transformed traditional classrooms into "Innovation Labs." A Station-based Learning approach was implemented over a total of 39 instructional hours. This intensive program engaged 78 Grade 5 students (divided into 19 groups) in developing their creative and innovative thinking skills through the following 4 stations:

Station 1: Discovery and Awareness (Discovery Station – 6 Hours)

- **Strategic Focus:** Identification of local environmental problems and their ecological impacts.
- **Process:** Students conducted field investigations of community waste issues and participated in a study visit to the Municipal Water Quality Improvement Office to analyze the impact of water hyacinth on the local ecosystem.



Figure S2. Off-site learning activities to foster inspiration.

Station 2: Design and Application of Local Wisdom (Design Station – 9 Hours)

- **Strategic Focus:** Creative thinking, refinement, and complexity.
- **Process:** Students studied local heritage at the Institute for Southern Thai Studies and researched the properties of water hyacinth fibers to design "unique and feasible" products.
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Figure S3: Gaining inspiration from local cultural arts.



Figure S4. The process of drafting designs and preparing materials.

Station 3: Innovation Production Lab (15 Hours)

- **Strategic Focus:** Creative collaboration and problem-solving (Successful Innovation).
- **Process:** As the most intensive phase, this station focused on "Trial and Error" in processing water hyacinth fibers and manufacturing prototypes according to assigned group roles.



Figure S5: Quality preparation process for water hyacinth fibers.



Figure S6. Prototyping water hyacinth products

Station 4: Communication and Digital Branding (AI & Branding – 9 Hours)

- **Strategic Focus:** Communicating innovation value to society and digital literacy.
- **Process:** Students learned marketing techniques and utilized AI-driven applications (**Canva**) to create advertisements and group presentations.



Figure S7. Learning digital tools and designing promotional media.



Figure S8. Students presenting their innovative projects with confidence.

Section 5: Mentoring and Coaching System

The university's involvement extends beyond mere evaluation; it functions as a "hands-on coach," actively participating in the developmental process:

5.1 The Role of University Coaches

The mentoring team serves as professional coaches for teachers, facilitating their transition from "lecturers" to "**learning facilitators.**" This transformation emphasizes the use of **scaffolding and inquiry-based questioning techniques**, empowering students to investigate and discover solutions independently.

5.2 Continuous Supervision and Clinical Support

The mentoring team, comprising educational experts, supervisors, and product design specialists, conducted two major field visits to Tessaban 5 (Wat Hat Yai) School.

First Field Visit (2 weeks post-implementation):

- **Observations:** Students demonstrated high engagement and interest in station-based learning, particularly in community-based investigations and solution design. Teachers showed improved capacity in interdisciplinary integration and successfully collaborated with community experts as guest speakers, ensuring learning was deeply rooted in the local context.
- **Challenges and Recommendations:** Initial challenges included aligning academic content with hands-on activities and developing effective assessment tools. Mentors provided guidance on documenting learning reflections and utilizing assessment instruments that accurately reflect student development.



Figure S9. University mentors providing on-site coaching.

Second Field Visit (2 months post-implementation):

- **Observations:** Significant growth was observed in student enthusiasm for collaborative work and real-world problem-solving. Teachers gained substantial confidence in managing interdisciplinary curricula and effectively bridging content across multiple subjects.
- **Strategic Recommendations:** Mentors provided expertise in developing specialized **Rubrics** to evaluate creative and innovative thinking skills systematically. Additionally, the implementation of Student Portfolios was recommended to provide a longitudinal and concrete record of student progress.



Figure S10. University mentors observing student activities.

5.3 Inter-school Professional Learning Communities (PLC)

The university acted as the primary host for Inter-school PLC sessions involving the four network schools in the project. These sessions provided a platform for Tessaban 5 School to share its "operational challenges," such as time management and administrative logistics, for collective brainstorming. This collaborative environment fostered cross-contextual learning and strengthened the professional empowerment of teachers across the entire network.



Figure S11. Inter-school Professional Learning Community (PLC) sessions hosted at Thaksin University: (a) The first session focusing on operational challenges and school-level administrative logistics; (b) The second session consolidating success factors and long-term continuity strategies among the four pilot schools.

Section 6: Empirical Results and Impact Analysis

This section presents the tangible outcomes resulting from the implementation of the **T-FIVE Model** and the **Integrated Learning Stations**. The data were synthesized from student, teacher, and parent surveys, an analysis of the innovative products, and behavioral observations in public forums.

6.1 Competency Development

Assessments conducted pre- and post-implementation revealed significant growth in four primary competency dimensions:

1. **Creative Thinking:** Students transitioned from passive learners to active observers who can "**identify opportunities within problems**" (e.g., transforming aquatic weeds into raw materials). They demonstrated the ability to invent diverse methodologies and adapt to new information.
2. **Refinement and Complexity:** Students showed heightened attention to detail (color, pattern, and form) and successfully integrated seemingly unrelated concepts into unique, sophisticated products.

3. **Creative Collaboration:** There was a marked increase in respectful dialogue, openness to new ideas, and seamless communication within teams to achieve collective goals.
4. **Successful Innovation:** Students demonstrated systematic planning and the ability to perform **formative assessments** during the production phase. Furthermore, they successfully leveraged digital tools (AI/Canva) to communicate the value of their innovations.

6.2 Tangible Outputs: 19 Group Prototypes

By completing the journey through the learning stations, all 19 student groups successfully transformed raw water hyacinth into functional, sustainable products as alternatives to plastic:

- **Groups 1 & 3:** Eco-friendly Bowls
- **Groups 2 & 4:** Partitioned Trays
- **Groups 5 & 13:** Handcrafted Bags
- **Group 6:** Yeti Cup Carriers
- **Group 7:** Keychains
- **Group 8:** Coasters
- **Group 9:** Tissue Boxes
- **Group 10:** Vases
- **Group 11:** Straw Hats
- **Group 12:** Baskets
- **Group 14:** Pencil Cases
- **Group 15:** Plant Pots
- **Group 16:** Bracelets
- **Group 17:** Cat Toys
- **Group 18:** Modern Lamps
- **Group 19:** Sustainable Footwear (Sandals)

6.3 Public Dissemination: "Empowering Learning" Exhibition

On March 16, 2025, at Thaksin University, students presented their work at the Provincial Educational Innovation Network exhibition:

- **Pitching:** Students fluently presented their environmental problem-solving processes and product designs. Their presentations were natural and clearly reflected a strong sense of "Student Ownership."
- **Social Impact:** The exhibition booth drew significant attention as a model for transforming a "community weed problem" into "value-added products." This outcome directly supports the WWF's goals of reducing plastic waste and improving local water quality.



Figure S12. Students confidently presenting their innovations.

6.4 Strategic Reflection (Lessons Learned)

Reflections from the inter-school seminar involving four institutions, mentors, and university experts highlighted the following success factors:

1. **Inspiration:** Using a place-based problem (water hyacinth) in collaboration with a global organization like WWF acted as a powerful catalyst, aligning the goals of both teachers and students.
2. **Transformation:**
    - **Students:** Developed self-directed learning capacities and a deeper place-attachment to their community.

- **Teachers:** Enhanced their professional competency in designing interdisciplinary, competency-based curricula that respond to community needs.
- **School:** Elevated its status to a "Prototype School for Educational Innovation," capable of fostering strong partnerships with external stakeholders.

3. **Success Factors:**

    - **Narrowing the Focus:** Clearly defining the strategic target (Innovation Skills) ensured the project's direction remained clear.
    - **Collaborative Teams:** Internal teamwork was the primary engine driving the project's execution.
    - **External Mentorship:** Continuous **coaching** from the university and active community involvement provided the necessary diversity and sustainability for the innovation to thrive.

Summary: The outcomes at Tessaban 5 (Wat Hat Yai) School demonstrate that an administrative innovation rooted in community problems and supported by a systematic university-mentoring system can effectively transform students from "knowledge recipients" into "**Innovative Co-creators**" prepared for future challenges.



Figure S13. Strategic reflection and knowledge sharing with regional stakeholders during the Innovation Symposium