

Development of an Integrated Project-Based Learning Model Focused on Building Values, Attitudes, Skills, and Knowledge (VASK) for Multi-Grade Classrooms

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Abstract

This study aims to develop an integrated Project-Based Learning (PBL) model based on Values, Attitudes, Skills, and Knowledge (VASK), specifically designed for small-sized schools and mixed-grade classrooms. Employing a phenomenological study approach with a mixed-methods data structure, the research explores two key questions: What are effective multi-grade teaching models? and how does a teacher professional development program (PD) enhance teachers' ability to implement multi-grade instruction? The study was conducted in collaboration with 45 teachers from five schools across various subjects, including science, mathematics, technology, language, and social studies. It investigates the design and implementation of VASK-based PBL within both classroom and community settings. Data were collected through classroom observations, focus group interviews, and student-teacher reflective journals to assess the model's effectiveness and adaptability. Findings revealed that the VASK-PBL PD program fosters interdisciplinary learning, community engagement, and student empowerment, enhancing critical thinking, problem-solving, and social responsibility. The study also demonstrated that teachers from all five schools successfully designed multi-grade classroom learning management by integrating inquiry-based learning with context-based education rooted in the local environment. This model offers a practical framework for schools facing resource and staffing limitations, providing meaningful learning experiences that support both academic achievement and social development. Additionally, the study contributes to the PBL literature for mixed-grade settings, highlighting the importance of community-based, values-driven education in promoting equitable learning opportunities for small schools.

Keywords: An Integrated Project-Based Learning Model, Multi-grade Classrooms, Professional Development Program

1. Introduction

Amid the fast-paced global changes impacting national economic systems driven by technology and knowledge, Thailand faces the imperative of preparing its citizens for continual adaptation. This requires creating structured mechanisms that support individuals' adaptability to various circumstances. Education serves as a fundamental pillar in fostering human potential, essential for national progress. Thailand has long recognized the significance of education in national development. To align educational goals with future needs, the Ministry of Education, through the Office of the Education Council, crafted the National Education Plan for 2017–2036. This plan aims to provide all Thai citizens with equitable, high-quality education, foster an efficient education management system, and cultivate a workforce with skills matching labor market demands and national development objectives (Office of the Education Council, 2017). Under the 20-Year National Strategy (2018–2037), Thailand has set goals to become a “secure, prosperous, sustainable, and developed nation” guided by the Sufficiency Economy Philosophy, which includes reducing social inequality (NESDB, 2018). While educational achievements from 2009 to 2016 show positive outcomes in various areas, pressing issues remain. In educational access, government policies have expanded opportunities for school-age children, disadvantaged youth, and students with special needs. However, some students still face barriers to full inclusion, and dropout rates persist. Additionally, though educational levels among the working-age population have risen, a substantial portion of the labor force has education below the lower secondary level, emphasizing the need for lifelong learning support (Office of the Basic

Education Commission, 2016).

The Ministry of Education's mission is to ensure accessible and high-quality foundational education for all, as outlined in the National Education Act of 1999 and related legislation (Ministry of Education, 1999). However, small schools continue to face significant challenges in delivering quality education due to limited resources and administrative constraints. Small schools, defined as those with 120 or fewer students, accounted for 41.48% of all schools in 2007. This percentage has continued to rise as declining birth rates and parental preferences for urban education contribute to the consolidation of rural schools (OBEC, 2008). These conditions underscore persistent challenges in small schools, including (1) inadequate educational quality due to insufficient government support and a shortage of teachers, (2) administrative instability resulting from frequent leadership changes, (3) a lack of teaching resources and special needs support, and (4) socioeconomic barriers that hinder student learning. To address these issues, the Office of the Basic Education Commission (OBEC) has developed a strategic framework aimed at improving small school quality. This framework consists of four key strategies: (1) enhancing planning and management systems, (2) improving teaching and quality assurance, (3) fostering sector-wide collaboration, and (4) adapting curricula and staffing models, with an emphasis on multigrade teaching and the integration of local wisdom (OBEC, 2018). OBEC's analysis highlights the need for a model that connects teacher training with curriculum design, particularly for multigrade classrooms in rural settings. In response, this study aims to develop an integrated project-based learning (PBL) model within a school-based professional development (SBPD) framework. By incorporating community contexts into curriculum design, this model seeks to enhance equitable access to quality education and reduce disparities for students in Thailand's remote and small primary schools (OBEC, 2018). Despite ongoing challenges such as limited resources, small budgets, and multigrade classrooms, small schools remain critical in providing educational access to children in hard-to-reach regions. Recognizing these obstacles, the Thai government has introduced various strategies to support small schools, including multigrade teaching methodologies, digital learning tools, and tailored teacher training programs. These efforts aim to bridge the gap in educational access and quality between urban and rural areas (Office of the Education Council, 2019). However, many schools still struggle to implement effective teaching practices due to the absence of clear guidelines and continuous support. Therefore, this study seeks to fill this gap by providing sustained support for teachers working under challenging conditions. The findings will contribute to the development of a practical, scalable model that can be implemented nationwide to enhance the effectiveness of teaching and learning in small schools across Thailand. In both developed and developing countries, multi-grade teaching is a widely adopted instructional approach, particularly in rural or under-resourced areas where student populations are small. This teaching model involves instructing students of different ages, grade levels, and abilities within a single classroom. While multi-grade teaching is often implemented due to resource limitations, research suggests that it presents both challenges and opportunities, requiring innovative pedagogical strategies and specialized teacher preparation to be effective (Berry, 2001). Multi-grade teaching, also known as multilevel teaching, composite classes, vertical grouping, or unitary schooling, differs from mono-grade instruction, where students of the same age and ability are grouped together (Little, 1995). In some countries, such as the United States and Australia, multi-age teaching—where students of different ages learn together intentionally rather than out of necessity—is often associated with multi-grade teaching. However, in developing countries, multi-grade classrooms typically result from logistical constraints rather than a deliberate instructional strategy (Little, 2001). Despite being perceived as a challenge, multi-grade teaching offers several pedagogical and social benefits. Studies indicate that it enhances peer learning and collaboration, where older or more proficient students assist younger or less experienced classmates, fostering cooperative learning, communication skills, and leadership development (Veenman, 1995). Additionally, multi-grade settings promote personalized and flexible learning, as teachers often adopt student-centered instructional strategies to address diverse learning needs, allowing for individualized learning pathways (Mulryan-Kyne, 2007).

Furthermore, long-term engagement with the same teacher in a multi-grade setting supports continuous learning progression and facilitates stronger student-teacher relationships (Pridmore, 2007). However, multi-grade teaching presents significant challenges. Managing multiple curricula within a single classroom requires extensive preparation and effective time management (Little, 2005). Many teachers lack specialized training to manage the complexities of multi-grade instruction, leading to ineffective teaching practices and lower student outcomes (Juvane, 2005). Additionally, balancing the diverse needs of students across different subjects and age groups is particularly difficult (Berry, 2001; Cornish, 2006; Little, 2007). Another key issue is the absence of explicit multi-grade teaching policies in many countries, resulting in insufficient funding, curriculum adaptation, and teacher training support (Little, 2007). To enhance learning outcomes in multi-grade classrooms, studies suggest implementing effective instructional strategies such as differentiated instruction, thematic teaching, peer collaboration, and self-directed learning activities (Cornish, 2006; Mulryan-Kyne, 2007; Veenman, 1996).

Establishing well-structured classroom environments, with clearly defined learning stations and independent learning resources, further supports students in self-paced learning (Berry, 2001). While multi-grade teaching is often viewed as a solution to teacher shortages, limited research has explored the actual teaching processes occurring within real classrooms. Thus, teacher training plays a crucial role in ensuring the success of multi-grade education. Research highlights the need for both pre-service and in-service training, covering aspects such as classroom management, differentiated instruction, active learning techniques, and curriculum adaptation (Berry, 2001; Little, 2004; Juvane, 2005). Hands-on experiences, such as internships or simulation-based training, can help equip teachers with the confidence and skills necessary for managing multi-grade classrooms effectively (Mulryan-Kyne, 2007). Despite substantial research on multi-grade teaching in various educational contexts, there remains a lack of research specifically addressing Thailand's multi-grade schools. Given the prevalence of multi-grade teaching in Thailand, there is an urgent need for localized research to identify effective instructional strategies and provide policy recommendations for improving teaching and learning in these settings. This study aims to develop and implement an integrated Project-Based Learning (PBL) model tailored to small and mixed-grade classrooms. The model serves as a strategic approach to holistic education, fostering core values, positive attitudes, essential skills, and critical knowledge through real-world, project-based learning experiences. Designed for resource-limited environments, this approach integrates subject areas with real-world applications to enhance student engagement and learning outcomes. Thus, the primary objective of this study is to develop an integrated, multi-grade PBL curriculum, using target schools. This result aims to serve as a model for innovative educational programs, addressing the unique challenges of small primary schools and advancing equitable and high-quality learning experiences for students.

1.1 Research Question

- 1) What are effective multi-grade teaching models?
- 2) How does a teacher professional development program (PD) enhance teachers' ability to implement multi-grade instruction?

1.2 Research Framework

The research framework for this study is founded on the principles of a Whole School Approach, emphasizing collaboration among all stakeholders, including teachers, school leaders, and external partners. This approach treats professional development as a collective responsibility, deeply embedded within the school's operational structure and cultural practices. By addressing the interconnected growth of individuals and the school community, the framework aims to bridge the gap between theoretical concepts and practical application in teacher development. A core component of this framework is the integration of blended learning platforms, which provide flexible and accessible opportunities for ongoing support and skill enhancement. This study focuses on designing a teacher professional development program to establish a model for effective multigrade teaching, as illustrated in the following Figure 1.

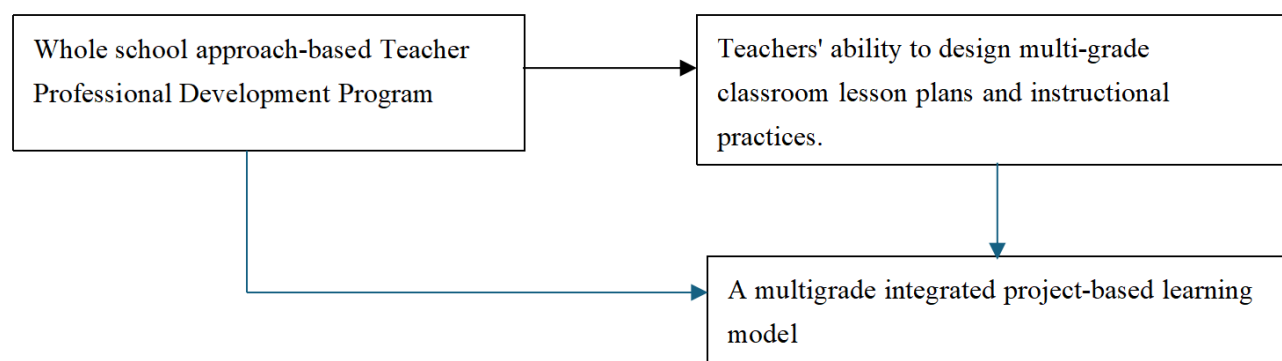


Figure 1. Research framework

1.3 Literature Review

1.3.1 Multiage Education: A Student-Centered Approach to Learning

Multiage education prioritizes student-centered learning over a rigid, curriculum-driven approach (Stone, 2010).

In this context, a student-centered model is one in which learning experiences are designed to accommodate and respond to the unique needs of each student (Harris, Spina, Ehrich, & Smeed, 2013). Rather than focusing solely on covering grade-level curriculum requirements, multiage classrooms aim to understand and support individual learning progressions (Harris et al., 2013). Multiage classrooms are often integrated into larger mono-grade schools, most of which are government-operated (Cornish, 2010; Veenman, 1995). Additionally, many multiage schools retain grade-specific curriculum structures, incorporating year-level benchmarks and assessments to ensure alignment with broader educational policies. Consequently, while these classrooms function with some elements of multi-grade education, they maintain age-based separations for specific activities such as school camps or extracurricular events (Cornish, 2010). At its core, multiage schooling is an adaptive strategy that enables schools to continue serving their communities effectively even when student enrollments are insufficient to justify one or two teachers per grade level (Cornish, 2010). This model facilitates the viability of smaller schools while simultaneously fostering high-quality, individualized instruction that supports student learning. Instructional approaches in multiage classrooms emphasize individualized learning, where students' unique identities, strengths, and preferences shape their educational experiences. Instead of adhering to a standardized, one-size-fits-all model, teachers in multiage settings facilitate personalized learning pathways tailored to student interests and developmental needs (Aina, 2001; Finegan, 2001). These classrooms foster an environment conducive to differentiated instruction, enabling teachers to tailor learning experiences to each child's cognitive, social, and emotional readiness. Aina (2001) describes multiage classrooms as "natural communities of learners" (p. 219), where student-teacher interactions form the cornerstone of the educational experience. This approach aligns with constructivist learning theories, which emphasize active engagement with peers and the environment as pivotal drivers of meaningful learning. By promoting collaborative and inquiry-based learning environments, multiage settings support the development of critical thinking, problem-solving, and social-emotional skills. Beyond traditional multiage settings, some educational models transcend grade-based structures entirely, establishing what Cornish (2010) refers to as "non-graded schools." These privately operated, independent schools eliminate curriculum constraints, grade-level assessments, and formal age-based classifications. In these environments, students are not assigned to specific grade levels but are instead grouped based on their developmental progress and learning needs. Non-graded multiage classrooms provide teachers with enhanced flexibility in curriculum design, enabling continuous, developmentally appropriate learning trajectories (Cornish, 2010). In contrast to traditional schooling, where students progress through predetermined grade-level milestones, these classrooms prioritize uninterrupted academic and personal growth. This approach supports self-paced learning, intrinsic motivation, and mastery-based progression, ensuring that students acquire foundational knowledge at their optimal pace. Multi-grade classes are typically formed due to shortages in teaching personnel, low student enrollment, or both (Cornish, 2010; Veenman, 1995). This situation is most prevalent in rural and sparsely populated areas, where schools struggle to maintain adequate student numbers to support single-grade classrooms. According to Proehl et al. (2013), multi-grade classes are a common solution in rural communities with declining or low student enrollments. Countries such as Australia (Cornish, 2010), Sweden (Åberg-Bengtsson, 2009), Turkey (Aksoy, 2008), and Finland (Kalaoja & Pietarinen, 2009) have all implemented multi-grade teaching to sustain educational access in underpopulated regions. In multi-grade settings, a single teacher is responsible for instructing students from two or more grade levels simultaneously (Proehl et al., 2013). While this pedagogical approach has potential learning benefits, it is often implemented primarily for administrative reasons—serving to consolidate staffing roles and address disparities in student distribution across classes (Proehl et al., 2013). By adopting a multi-grade structure, schools can efficiently manage limited resources while continuing to provide access to education for students in remote or low-enrollment areas. The terms "multiage" and "multi-grade" are often used interchangeably in academic literature. However, Lindström and Lindahl (2011) introduce the term "mixed age" to describe this type of educational practice. According to their definition, mixed-age classes consist of students from different grade levels who are grouped into a single, heterogeneous class. The formation of these classes is typically driven by demographic, economic, or philosophical reasons with the aim of providing educational benefits to students.

1.3.2 Integrated Project-Based Learning (PBL)

Project-Based Learning (PBL) has gained significant attention in educational research and practice as an instructional approach that engages students in real-world, meaningful tasks. Through PBL, students learn by actively engaging in projects that require critical thinking, collaboration, and application of knowledge to real-life scenarios (Thomas, 2000). Integrated PBL, specifically, incorporates interdisciplinary learning by combining multiple subject areas into a single project, allowing students to explore and connect concepts from different fields, thus enriching the learning experience. This literature review explores the benefits, challenges, and applications of integrated PBL, focusing on its relevance in diverse educational contexts, particularly in remote and small school

settings. Integrated PBL combines traditional project-based learning with interdisciplinary teaching approaches. By merging subjects, such as science, math, social studies, and language arts, into cohesive projects, students are encouraged to make connections across disciplines, promoting a holistic understanding of concepts (Drake & Reid, 2010). Integrated PBL is rooted in constructivist theory, emphasizing active learning, where students construct knowledge through exploration and reflection (Dewey, 1938; Vygotsky, 1978). This approach is valuable in developing 21st-century skills, including critical thinking, communication, collaboration, and creativity (Partnership for 21st Century Skills, 2009).

1.3.3 Values, Attitudes, Skills, and Knowledge (VASK)

The OECD (Organisation for Economic Co-operation and Development) framework for education often emphasizes the development of values, attitudes, skills, and knowledge as essential components for 21st-century learners. Values refer to the principles and standards that guide behavior, fostering social responsibility, equity, and respect. The OECD emphasizes the importance of values in building cohesive societies and encouraging students to contribute positively to their communities. Values include ethics, integrity, respect for diversity, and responsibility towards others and the environment. Attitudes represent learners' disposition towards themselves, others, and the world, which influence motivation and engagement in learning. Positive attitudes like resilience, openness, curiosity, and empathy are seen as vital for personal and social development. The OECD promotes fostering attitudes that encourage lifelong learning, collaboration, and adaptability in an ever-changing world. Skills encompass the abilities required to apply knowledge effectively and adapt to new challenges. The OECD's educational goals encourage not only foundational knowledge in subjects like language, science, and mathematics but also interdisciplinary knowledge that connects different fields.

1.4 Research Participants

This research was conducted in destination schools under the “Kru Rak Thin” project, focusing on small schools in remote areas across Krabi, Phang Nga, Satun, and Trang provinces, involving a total of five schools. Participants included teachers, school administrators, community leaders, local knowledge holders, and educational supervisors from the respective authorities. They were selected through a purposive sampling method based on the following criteria:

- 1) Teacher: 45 School teachers from destination schools under the “Kru Rak Thin” project who expressed a consistent interest in participating in the research.
- 2) School Administrators: 5 administrators from destination schools who showed continuous interest in participating in the research.
- 3) Community Leaders, Local Experts, and Educational Supervisors: Fifteen individuals comprising community leaders, local scholars, and educational supervisors.

This selection ensured that the study captured insights from a diverse range of stakeholders critical to the implementation and development of the curriculum in rural, multigrade learning environments.

2. Research Methodology

The research team adopted a phenomenological study approach, focusing on understanding and exploring the genuine perceptions, meanings, and thoughts of individuals regarding their actions and experiences. This methodology also emphasizes collecting data from events and environmental contexts influenced by development processes. The research was based on the conceptual framework of Husserl (1965) and employed Descriptive Phenomenology; a form of phenomenological research aimed at describing specific phenomena as experienced through direct exploration. This method avoids pre-determined hypothesis testing, relying instead on intuiting to gain insights. The findings were then translated into practical applications and lessons for designing and implementing strategies in real-world contexts. While conducting a phenomenological research methodology follow Figure 2.

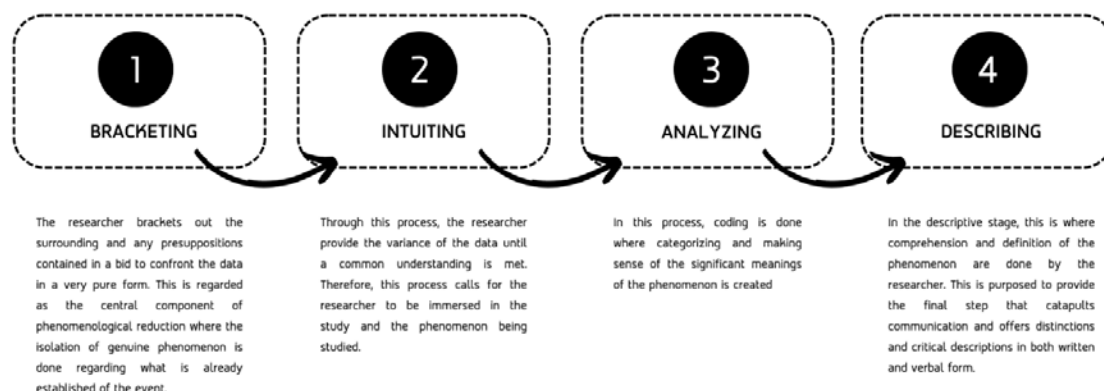


Figure 2. Phenomenological research methodology

This research aims to develop a professional development model for science teachers using a school-based approach to promote STEM literacy through the utilization of outdoor STEM education resources in the southern region of Thailand. It also seeks to create an integrated learning model aligned with local contexts, driving educational innovation in the Phuket Education Sandbox area. The research follows a Mixed Methods Approach employing a Multistage Evaluation Design that integrates both Convergent Design and Explanatory Sequential Design (Creswell, 2015; Klangphahol, 2018; Creswell & Plano Clark, 2018). The study focuses on iterative program development and evaluation to ensure continuous improvement.

2.1 Research Phases and Steps

Phase 1: Need Assessment for Promoting Ingrated Instruction. This phase involves identifying the needs and developing a model to promote integrated instruction for multigrade classroom.

1) Identifying Teachers' Needs: Surveying and analyzing the essential requirements for promoting Ingrated Instruction. This phase involves identifying the needs and developing a model to promote integrated instruction.

2) Analyzing Causes of Needs: Determining root causes and proposing strategies to address identified needs.

3) Developing Integrated Instruction. This phase involves identifying the needs and developing a model to promote Multigrade Instruction Model: Designing the model based on need assessment results, incorporating insights from research and evaluation tools.

Phase 2: Development of the Multigrade Instruction Model. This phase focuses on developing, implementing, and refining the Integrated Instruction promotion program.

1) Instrument and Measures Development: Designing qualitative instruments for program evaluation.

2) Integrated Instruction Development Program Implementation: Developing and implementing the integrated instruction promotion model using outdoor STEM education resources.

3) Follow-Up and Refinement: Assessing the program's impact through qualitative and quantitative evaluations and refining the model for greater effectiveness.

3. Research Result

As research was conducted alongside school-based workshops and lesson plans delivered through a Professional Learning Community (PLC) platform, 45 research participants collaborated with colleagues in mathematics, technology, language, and social studies to apply insights from previous online PLC coaching sessions. Data collected through classroom observations, focus group interviews, and reflective journals from both students and teachers demonstrated how these participants designed and implemented lesson plans in their classrooms and communities.

3.1 Teacher Professional Development Program

The result presents that research on teacher professional development under the project for developing a model of integrated multi-grade learning management using the context of destination schools in the "Kru Rak Thin" project as a base divides the process into 5 steps as following Figure 3.

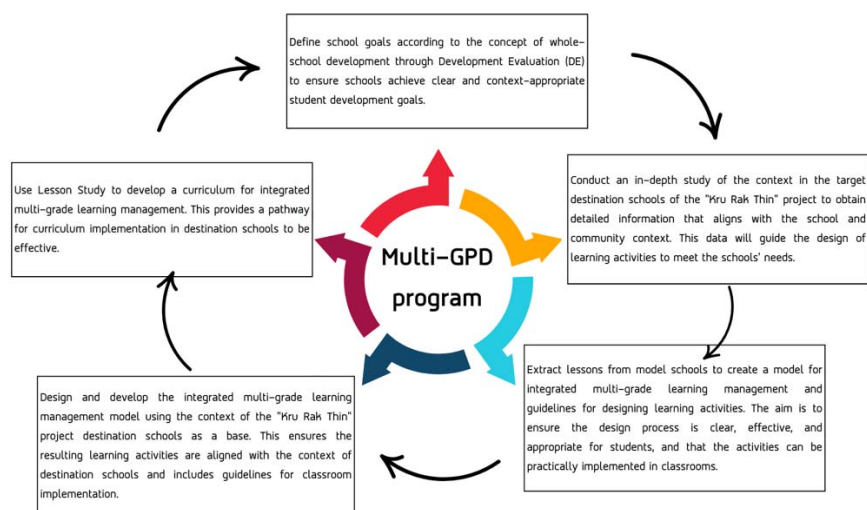


Figure 3. Multi-grades professional development program

This research conducted a multigrade-teaching professional development program. The program's first step involved defining school goals based on the concept of whole-school development through Development Evaluation (DE). This step ensured that schools achieved clear and context-appropriate student development goals. The second step involved conducting an in-depth study of the context in the target destination schools of the "Kru Rak Thin" project. This study provided detailed information that aligned with the school and community context. This data guided the design of learning activities to meet the schools' specific needs. The third step involved extracting lessons from model schools to create a model for integrated multi-grade learning management and guidelines for designing learning activities. The aim was to ensure that the design process was clear, effective, and appropriate for students. Additionally, the activities were designed to be practically implemented in classrooms. The fourth step involved designing and developing the integrated multi-grade learning management model using the context of the "Kru Rak Thin" project destination schools as a base. This ensured that the resulting learning activities were aligned with the context of the destination schools and included guidelines for classroom implementation. The final step involved using lesson study to develop a curriculum for integrated multi-grade learning management. This provided a pathway for curriculum implementation in destination schools to be effective.

3.2 Multi-grades Teaching PBL Model

From the above teacher professional development process, the researcher has extracted lessons from using Lesson Study to develop a multi-grade learning management model based on Project-Based Learning (PBL) combined with social science tools, referred to as VASK-Project Based Learning (VASK-PBL). This model allows students to explore topics of their interest, leading to the determination of a teaching theme in the multi-grade classroom. Learning activities were designed with complexity levels tailored to students' varying abilities in each group. In Phase 1, five schools implemented the VASK-PBL model. Themes were determined collaboratively by students through an inquiry-guided learning design. The researcher used Lesson Study alongside creating PLC (Professional Learning Community) cycles. It was found that schools A and C were able to design multi-grade learning where students in each group selected topics of interest based on data collected using social science tools. The analysis of the multi-grade learning management model implemented in five schools was summarized into 10 steps, which were evaluated by three experts. Feedback was collected through interviews to provide guidelines for activity organization within the learning model. Expert feedback on the multi-grade lesson plans included the following details in Table 1.

Table 1. Expert feedback on the multi-grade lesson plans

Aspects	Expert's Feedback
Goals and Learning Design	Strategies for effective implementation of learning activities. <i>"Given the diverse learning abilities, skills, and needs among students in a multi-grade classroom, differentiated instruction is essential to ensure that all students progress at their own pace. Differentiated instruction can be effectively implemented in lesson design by providing the same content with varying levels of complexity, known as tiered assignments. Additionally, students should have multiple options for demonstrating understanding, such as choice-based learning approaches involving essays, projects, and presentations. Teachers should have strategies to group students based on ability, interest, or learning style, enabling peer tutoring and collaboration (flexible grouping)"</i>
Learner's Styles and Context	Suggestions to ensure alignment with students' interests and the schools' contexts. <i>"Teachers should use questionnaires, interviews, or informal discussions to understand students' interests, hobbies, and career aspirations. Additionally, they should observe student behavior and engagement levels in different activities. Involving students in co-creating learning topics by allowing them to select themes for projects fosters greater engagement and ownership of their learning. Integrate Community and Cultural Contexts into Learning Learning activities should be designed to reflect the local culture, traditions, and livelihood activities to make learning more meaningful and relevant. Teachers can involve local experts, artisans, or business owners in classroom discussions or projects. Incorporate service-learning projects where students solve real community problems through Project-Based Learning (PBL) approaches, allowing them to explore real-world challenges. Enhance Assessment Strategies to Reflect Individual Progress A professional development (PD) program should ensure that teachers understand how to align learning objectives with student abilities and measure progress holistically. Effective assessment strategies include portfolio-based assessments. Allowing students to track their own learning journey over time. Student Self-Assessments and Peer Evaluations: Encouraging reflection and self-improvement. Varied Assessment Methods: Teachers should offer multiple ways for students to demonstrate their learning, including presentations, hands-on demonstrations, and creative projects. By aligning instructional strategies with students' interests and the school's context, educators can create engaging, meaningful, and effective learning experiences that promote both academic success and personal growth"</i>
Implementation	Recommendations for improving the model's practicality in diverse classroom environments <i>"A rigid curriculum may not suit the diverse needs of students in multi-grade classrooms. Flexible instructional models ensure inclusivity and differentiated learning. Therefore, teacher and school team should develop a modular curriculum that allows for cross-grade integration and thematic learning through project-based and inquiry-based learning to allow students to progress at their own pace. During the implementation, researcher and teachers must make sure that the classroom establishes clear routines, rules, and expectations to create a structured learning environment. A rotational learning model, where students engage in different learning stations (teacher-led, peer-led, independent tasks) should use in the lesson desing. For example, of a rotational learning model can have: Station 1: Teacher-led instruction. Station 2: Peer-based learning and discussion. Station 3: Self-paced, technology-based activities."</i>

Expert Feedback on Multi-Grade Learning Model Development is presented as below.

"...Student Ability Assessment: Teachers should evaluate students and use the results to group students appropriately. Designated areas should be created for students needing additional development to practice. Teachers can also prepare students individually based on assessment results before teaching and create a conducive classroom environment..." **Expert 1** (Interviewee, June 4, 2024).

"...For classroom management, teachers must provide detailed steps for teaching under this model to design learning activities appropriate for the student group arrangement. Teachers should also prepare the learning environment, including resources, encourage students to set their own learning goals and establish processes to achieve them. Students should also self-evaluate their learning outcomes. Group students based on visual, auditory, and kinesthetic learning styles (Learning Style) or the Theory of Multiple Intelligences to promote meaningful exchanges. Teachers should provide multiple ways for students to communicate, such as classroom discussions and participation in online social platforms..." **Expert 2** (Interviewee, June 4, 2024).

"...Diverse Problem Setting: Teachers should allow students to set various scenarios based on real-world experiences. Schools within communities should ensure students have opportunities to interact with the community. For multi-grade teaching, teachers should use Social Science Tools. The teachers should guide students in selecting appropriate social science tools based on different contexts and goals. While not all tools need to be used, it is crucial to train students to analyze collected data effectively. This is especially important

in connecting basic subject indicators with the inquiry-based teaching process. In aspect of Teacher's Role, Teachers should act as facilitators, guiding individualized learning, encouraging higher-order thinking through probing questions, and fostering positive interactions. Safety and Fieldwork Preparation: Emphasize safety during fieldwork, control the atmosphere in real-world scenarios, and prepare students for entering real school settings. This includes promoting good personality traits, proper etiquette, effective communication with the community, time management for fieldwork, and evaluating student performance during activities..." **Expert 3** (Interviewee, June 4, 2024).

This expert feedback highlights critical aspects of assessment, classroom management, individualized learning, integration of community interaction, and preparation for real-world application to enhance the multi-grade learning model effectively. In collaboration with the researcher, an educator, these teachers integrated best practices in lesson design and implementation from the 25 TSQP schools. Consequently, the integrated VASK (Values, Attitudes, Skills, and Knowledge) project-based learning approach was implemented in both school classrooms and community settings. The classroom activities began with a contextual study or phenomenon investigation. Teachers introduced image cards (a board game) to assess students' prior knowledge about their community. Each student participated in the game. Students and the teacher explored their community context using Google Maps, guided by questions such as: *What shapes or boundaries do you observe on the map? What features do you notice (e.g., mountains, rivers, forests)? How can you categorize these features (natural vs. human-made)? and What other important community sites are missing from Google Maps?*

Following this exploration, students divided into groups of 3-5 to create a social map based on initial findings and conducted a field survey, potentially integrated with extracurricular activities or family outings over the weekend. Each group presented their social map through a Gallery Walk, where classmates added information using Post-its to enhance each other's maps. Students then responded to questions about local experts in the community, marking these on the social map and summarizing them in a "Community Knowledge" chart. After compiling data with social science tools—such as timelines, social maps, resource maps, and the Community Knowledge chart on the ABCD (Asset-Based Community Development) method—students individually noted issues or questions of interest and placed them on the maps. Groups discussed and selected a common topic or question. These students respond to the teacher's question regarding local experts in the community, marking these on the social map and summarizing in a "Community Knowledge" chart. After groups compile data using social science tools such as timelines, social maps, resource maps, and the Community Knowledge chart on the ABCD (Asset-Based Community Development) method (Figure 4). Individually, students write down issues or questions of interest and place these on the maps. Groups discuss and agree on a common topic or question.

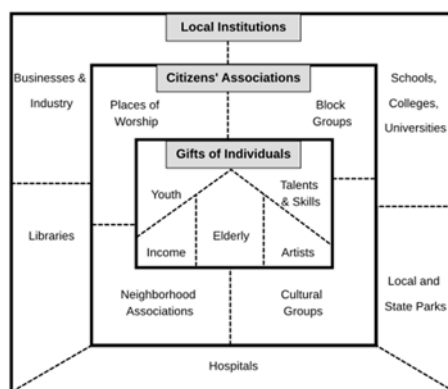


Figure 4. ABCD diagram

Groups gathered feedback on their selected topic using "I Like, I Wish, I Wonder" to analyze their topic or problem, identify gaps in their understanding, and plan further data collection. Subsequently, groups refined their topics or problems, using tools like problem trees to analyze issues, impacts, and causes (Figure 5). They presented findings and examined relationships between issues.

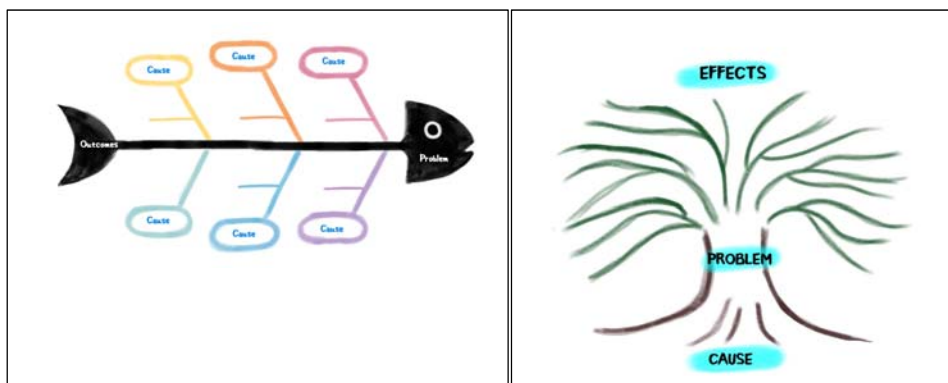


Figure 5. Cause-and-Effect diagram (a fishbone diagram, problem tree)

Each group then chose a specific topic or question for further study. The teacher provided additional case studies, which students analyzed, creating a V diagram (Figure 6) to map their investigation.

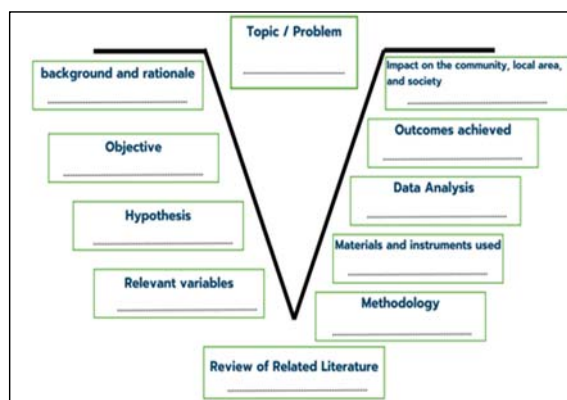


Figure 6. V diagram

From this diagram, students sought information from diverse, reliable sources and consulted local experts as needed. They developed a self-assessment plan for their knowledge and skills related to the topic and created a project timeline with specific steps. Each group documented their study plan as a mind map of the topic. Groups followed their plan, documenting progress at each stage, noting successes, challenges, and areas for improvement. Individually, students reflected on their learning by answering questions such as: “What knowledge and concepts were used?” (with the option to create a concept map) and “How does the product or project relate to the process?” The teacher provided criteria and timing for group presentations. Students shared their findings, with peers providing feedback through “I Like, I Wish, I Wonder.” At the end of the lesson, groups shared their results and discussed plans for further study or potential applications of their findings. Using a phenomenon framework, the following model provides a structured approach to Project-Based Learning (PBL) that highlights Values, Attitudes, Skills, and Knowledge (VASK), as outlined in Table 2.

Table 2. 10 Steps of VASK- Project based learning for multi-grade instruction model

Multi-grade Teaching Step	Classroom
Step1: Context Exploration/ Phenomenon Study	<p><i>Activity:</i> Students explore their community or school context using social science tools to present situations they have learned about.</p> <p><i>Role of Students:</i> Engaging with the real context to gain insights about their community.</p> <p><i>Role of Teachers:</i> Guiding and supporting students by asking questions.</p> <p><i>Tools:</i> Mapping tools, resource maps, timelines, and knowledge diagrams.</p>
Step 2: Sparking Interest	<p><i>Activity:</i> Students identify topics in their community they want to study further.</p> <p><i>Role of Students:</i> Collecting and comparing information about their community.</p> <p><i>Role of Teachers:</i> Assisting students with questions and facilitating group discussions.</p> <p><i>Tools:</i> Community maps and observational tools.</p>
Step 3: Information Gathering	<p><i>Activity:</i> Students gather data through observations, interviews, or online research.</p> <p><i>Role of Students:</i> Conducting interviews and forming questions.</p> <p><i>Role of Teachers:</i> Encouraging students to identify what they know and what they need to research.</p> <p><i>Tools:</i> Interview questions.</p>
Step 4: Data Analysis	<p><i>Activity:</i> Students analyze data to understand community relations and environmental impacts.</p> <p><i>Role of Students:</i> Recognizing patterns within the community.</p> <p><i>Role of Teachers:</i> Prompting analysis by comparing similarities and differences.</p> <p><i>Tools:</i> Fishbone diagrams and problem trees.</p>
Step 5: Defining Research Questions	<p><i>Activity:</i> Students identify the main issues or topics they wish to investigate.</p> <p><i>Role of Students:</i> Planning and outlining what they know and need to find out.</p> <p><i>Role of Teachers:</i> Guiding team planning and discussion.</p> <p><i>Tools:</i> V-Diagram.</p>
Step 6: Developing Concepts and Skills	<p><i>Activity:</i> Students build planning skills related to their selected topics.</p> <p><i>Role of Students:</i> Practicing skills to organize and plan work.</p> <p><i>Role of Teachers:</i> Supporting students in conceptual planning.</p> <p><i>Tools:</i> Activity sheets, geography materials.</p>
Step 7: Planning and Design	<p><i>Activity:</i> Students develop a project plan in groups.</p> <p><i>Role of Students:</i> Structuring the plan collaboratively.</p> <p><i>Role of Teachers:</i> Helping outline steps and providing feedback.</p> <p><i>Tools:</i> Mind mapping.</p>
Step 8: Implementation	<p><i>Activity:</i> Students execute their plan and test their ideas.</p> <p><i>Role of Students:</i> Engaging hands-on, problem-solving.</p> <p><i>Role of Teachers:</i> Encouraging students to ask questions and adapt.</p> <p><i>Tools:</i> None specified.</p>
Step 9: Reflection	<p><i>Activity:</i> Students reflect on their learning outcomes.</p> <p><i>Role of Students:</i> Identifying insights gained from the project.</p> <p><i>Role of Teachers:</i> Facilitating discussions and reflections.</p> <p><i>Tools:</i> None specified.</p>
Step10: Presentation of Results	<p><i>Activity:</i> Students compile and present their project outcomes.</p> <p><i>Role of Students:</i> Structuring their presentations to communicate their findings.</p> <p><i>Role of Teachers:</i> Guiding group work and setting assessment criteria.</p> <p><i>Tools:</i> Infographic design tools.</p>

4. Research Conclusion

This integrated VASK project-based learning emphasizes experiential learning, where students investigate their communities and develop key skills through guided exploration and analysis. For a suitable model for integrated project-based learning in multigrade classrooms within remote schools, which incorporates community context, include the following characteristics: 1) the learning projects should be centered around themes relevant to the local community, such as local agriculture, cultural practices, environmental issues, or community needs. This makes learning more meaningful and engaging for students, allowing them to connect school activities with their surroundings; 2) activities should be designed to allow students from different grades to work together, fostering collaboration across age groups. This approach can enhance peer learning, where older students guide younger ones, creating a supportive learning environment; 3) the curriculum should be adaptable to the specific needs and resources available in each community; 4) teacher play a dual role as facilitators of learning and as connectors between the school and community. They guide students through projects and foster partnerships with community members to enrich learning experiences; 5) project-based assessment methods should focus on the process and outcomes of the project, evaluating students on problem-solving, collaboration, and application of knowledge.

Portfolios, presentations, or community exhibitions can be part of the assessment process, making learning visible to the community; 6) the model integrates local knowledge and resources to create learning materials and activities, making education relevant to students' lives. For example, science lessons might involve studying local flora and fauna, or math lessons could include budgeting for a community project; and 7) Emphasis on Real-World Skills and Values: Beyond academic content, the model emphasizes skills like teamwork, communication, and critical thinking, as well as values like responsibility, community involvement, and respect for local culture. This approach ensures that learning is closely tied to the students' immediate world, which is particularly beneficial for small, remote schools. It empowers students with relevant skills and knowledge that can be applied directly within their communities, promoting lifelong learning and community engagement. To address the question, "How does a teacher professional development (PD) program enhance teachers' ability to implement multi-grade instruction?", this research emphasizes the significance of ongoing PD programs in equipping teachers with the necessary skills and strategies for effective multi-grade teaching. PD programs provide teachers with pedagogical strategies, classroom management skills, and adaptive teaching techniques that can enable them to meet the diverse needs of students across different grade levels. A crucial aspect of effective PD design is the integration of differentiated instruction training, which helps teachers tailor instruction to students at varying academic levels, ensuring that all learners receive appropriate challenges and support. Additionally, PD programs train teachers to integrate and adapt curricula to align with multi-grade settings. This allows for efficient lesson planning and fosters interconnected learning experiences across different grade levels. To support successful multi-grade instruction, PD programs must also offer hands-on training in classroom management, including time management, student grouping strategies, and engagement techniques, creating a more organized and productive learning environment. Moreover, PD programs equip teachers with strategies to promote student collaboration, peer learning, and self-directed study, which reduces dependency on direct instruction and encourages student autonomy. An effective PD program also enhances teachers' ability to assess student progress through formative assessments, alternative evaluations, and individualized feedback, ensuring that students in different grade levels achieve their learning goals. By providing comprehensive training and continuous support, PD programs empower teachers to successfully implement multi-grade instruction, ultimately improving student outcomes in diverse educational settings.

5. Research Discussion

The Teacher and School Quality Program (TSQP) and Kru Rak Thin have been promoting integrated project-based learning (PBL) in rural schools. These programs are designed to create curricula and instructional approaches that address the unique needs of small, remote schools, reducing educational disparities and enhancing student learning outcomes through community involvement (Equitable Education Fund, 2020). Research identifies several strategies to overcome the challenges associated with integrated PBL and maximize its benefits. Engaging with local communities can provide students with resources and knowledge not typically available in traditional classrooms. In rural settings, community members can share their expertise, enriching students' learning experiences (Smith & Sobel, 2010). School-Based Professional Development or Continuous training and collaborative planning sessions for teachers can enhance the effectiveness of integrated PBL, particularly in small and remote schools. School-based professional development helps teachers adapt PBL to their unique contexts (Darling-Hammond et al., 2009) and allowing flexibility in curriculum design enables teachers to tailor projects to available resources and specific community needs, which is particularly valuable in resource-limited settings (Drake & Reid, 2018). Integrated PBL represents a powerful approach to education that fosters student engagement, promotes interdisciplinary learning, and builds essential skills. While it presents unique challenges, particularly in resource-limited contexts, integrated PBL offers a viable solution for enhancing educational quality in remote and small schools. By leveraging local contexts, involving communities, and supporting teachers through ongoing professional development, integrated PBL can be tailored to diverse educational environments, providing students with meaningful and equitable learning experiences. However, despite its benefits, integrated PBL presents specific challenges, especially in curriculum design and resource allocation: Effective integrated PBL requires teachers who are well-prepared in interdisciplinary instruction and project-based methodologies. Teachers often need additional support and professional development to implement integrated PBL effectively (Han, Capraro, & Capraro, 2015). To enable teachers to effectively implement integrated PBL, school principals and networking teams must provide support in terms of materials, technology, and, when necessary, specialized spaces like laboratories. In resource-limited settings, such as remote or small schools, these constraints can hinder the successful adoption of integrated PBL (Buck Institute for Education, 2015). Additionally, incorporating integrated PBL can be time-intensive, requiring extensive planning, project execution, and assessment. Teachers may find it challenging to integrate PBL into an already packed curriculum (Moss & Van Duzer, 1998). Studies indicate that in remote and small schools, integrated PBL serves as an effective instructional model. Research shows that

multigrade and small schools' benefit from integrated PBL as it aligns well with mixed-grade teaching strategies. By using community-based projects, teachers make learning locally relevant and engaging, helping students connect classroom content with their community's real-world needs (OBEC, 2018). Additionally, integrated PBL allows these schools to address challenges related to limited resources and teaching staff by fostering peer learning, where older students assist younger ones within the same project.

6. Research Implication

The findings of this study provide several implications for future research in the field of Project-Based Learning (PBL) and integrated instructional models, particularly in resource-limited, mixed-grade classroom settings as following:

- 1) Future studies could investigate the scalability of the VASK (Values, Attitudes, Skills, and Knowledge) PBL model across diverse educational settings. Research could focus on adapting the model to varying school sizes, grade configurations, and community resources to understand its broader applicability.
- 2) To assess the lasting effects of the VASK-PBL approach, longitudinal studies could examine its impact on students' academic performance, critical thinking, and social skills over several years. Such studies could provide insight into how integrated, values-driven learning impacts student growth in the long term.
- 3) Future research could delve deeper into the role of community involvement in PBL, particularly in rural settings. By exploring how local expertise, resources, and real-world issues can enhance learning experiences, studies could highlight strategies to strengthen the connection between schools and their surrounding communities.
- 4) Given the unique structure of mixed-grade classrooms, further research is needed on effective assessment methods that accurately capture student progress in a PBL environment. Studies could examine formative and summative assessment tools that reflect both individual and group learning in mixed-grade and small school settings.

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Authors contributions

All authors contributed meaningfully to the conception, design, and implementation of the research. Siriwan Chatmaneeerungcharoen led the overall project coordination, developed the conceptual framework, and prepared the manuscript. Phatsaraporn Sahakit was responsible for curriculum design, data collection, and classroom implementation. Additional researchers provided methodological guidance, performed data analysis, and supported the interpretation of findings. All authors reviewed and approved the final manuscript.

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The authors confirm that they have no financial interests or personal relationships that could be perceived as influencing the work presented in this paper.

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