JOURNAL OF EDUCATION AND INNOVATION

Research Article

WHOLE SCHOOL PROFESSIONAL DEVELOPMENT FOR COMPENTENCY-BASED INSTRUCTION THROUGH PROFESSIONAL LEARNING COMMUNITY IN PHUKET PROVINCE

Received: November 12, 2023 **Revised:** February 9, 2024 **Accepted:** February 14, 2024

Siriwan Chatmaneerungcharoen[1*]

[1]Faculty of Education, Phuket Rajabhat University, Phuket 83000, Thailand

*Corresponding Author, E-mail: Drsiriwankief@pkru.ac.th

Abstract

In Thailand, reform efforts are often unsuccessful because they failed to understand that teachers play a key role in making educational reforms successful. The competency-based school curriculum development is a key mechanism for successful implementation of the national curriculum framework. However, the problem discovered is that schools continue to lack knowledge and clear guidelines. Teacher and School Quality Program (TSQP) was continuous project that funded by the Equitable Education Fund (EEF), Thailand. This project was a long-term school professional development program (PD) that aimed to educating and coaching teachers and school principal to conduct competency- based instruction (CBI) through active learning. Whole school approach was used as PD design framework. The research objective was to identify, follow and document the processes that science teachers went through as they assimilated. The research accompanied the PD program throughout its 2-year period. There were 25 science teachers, 25 school principals and 4 supervisors who took part in the PD program, were exposed to CBI including coaching skills. The research instruments included teacher portfolios, which contained projects and reflection questionnaires, classroom observations, teacher interviews, and teachers feedback questionnaires. The portfolios contained the projects that the teachers had carried out during the PD program, which included case studies and accompanying student activities. We found that the teachers gradually moved from exposure to new teaching methods and subject matter, through active learning lessons that were an integration-based project, to interdisciplinary, active classroom teaching using the real world situation/ phenomena they developed. Their teaching plans were flexible to student's learning that these teachers gathered along with their practices. Qualitative and Quantitative data confirms these science teachers have positive prospective on CBI and their practices are

moving forward to more open-inquiry instruction through providing active learning with overlapping multiple disciplines that are examined.

Keywords: Whole School Approach, Professional Development, Competency Based Instruction, Active Learning

Introduction

To meet the challenges of the 21st century, students need to be empowered and feel that they can aspire to help shape a world where well-being and sustainability – for themselves, for others, and for the planet– is achievable (Bentley, 2017). The OECD Learning Compass 2030 has identified three "transformative competencies" that students need in order to contribute to and thrive in our world and shape a better future. Competency-based school curriculum development is a key mechanism for successful implementation of the national curriculum framework. However, the problem discovered is that schools continue to lack knowledge and clear guidelines. the development of people first occurs through quality education before expanding to other parts of society. Every sector increasingly recognizes the importance of education, and the concrete effects can be seen in the National Education Act B.E. 2542 and the Amendment B.E. 2545 (No. 2). These Acts prescribe social participation from parents, stakeholders, and different agencies in the management and development of education. Accordingly, educational institutions cooperate with stakeholders and all parts of the community to develop students according to their potential. These actions and principles are specified in the National Education Act as guidelines for education management on the basis of sustainable development which includes 3 main aspects: 1) competitive capability, based on available resources and the institutional capacity; 2) capability to respond to the needs of students and stakeholders; and 3) capability to adapt to local contexts and universality (Panyanuwat, 2014). According to the United National Sustainable Development Goals (SDGs), Goal 4 demands education equality and coverage and emphasizes life-long learning for all. The goal aims to achieve higher quality education with universal principles as well as to increase the number of qualified teachers through international cooperation in teacher training (United Nation, 2015). Teachers are regarded as the main mechanism for driving education reform at the area level, to prepare students. Following these recommendations, several K-12 science programs that stress inquiry have been developed (CTGV, 1992; Krajcik et al., 1998; Linn, 1997; Penner et al., 1998; Songer, 1996). Many of these programs are founded on the assumption that learning occurs best when the students are engaged in finding solutions to real-world problems Evidence gathered from these programs has taught us much about students' abilities and difficulties when they are required to struggle with ill-defined problems. For instance, we have learned that children tend to generate low-level factual questions rather than questions that could extend their understanding (Scardamalia & Bereiter, 1992), do not consider evidence systematically in formulating arguments (Linn,

1992), and are proficient at carrying out procedures but have difficulty focusing their attention on the reasons for these procedures (Krajcik et al., 1998).

To develop a sustainable organization is to build a solid foundation for each component of that organization. Starting with the personnel in the organization who must be the ones with the potential. Because the organization can grow sustainably, it must be supported and driven by effective personnel. Schools are considered organizations of learning. It is a place for incubating knowledge. skills and experience for students. On the other hand, it is a place to practice and replenish knowledge. Professional experience and life skills for students, teachers, communities, and localities. The development of an organization that is a school cannot happen only because of the administrators. or just one teacher. But it requires building a community that is powerful enough to bring about big or broad change. The whole school system development concept that aims for all parties involved to develop together systematically (Whole School Approach) is therefore a guideline for sustainable school development by emphasizing the entire school management system. Gathering information for use in school operations. learning management and learning activities. Student care system in terms of learning, health, safety, participation with the community and parents through various school activities, with the core of the teacher professional development project for the entire school system for competency-based learning management through the community model. The concept of area-based education is concerned with collecting experience in the community, which is accomplished by analyzing the national curriculum and designing supplementary curriculums for students to learn through experiences in their communities. To make it conform to the specific community needs and conditions, every part of a community can assist in developing the supplementary curriculum to make the learning meaningful and to help the students become pro-active citizenship (Mangkhang, 2017). Area-based education responds to the needs of societies, cultures, and the environment, and it is managed through the cooperation of various parties in education, the private sector and local sector, with the mutual goal of using education to bring success to their area. Accepting and realizing the importance of what the school wants to develop which is the approach that this project uses Is to encourage schools to build learning communities for professional development that are suitable for the context of the school, students, teachers, and local communities to be able to drive further when the project is completed. Therefore, the project has led to the concept of Professional development learning community as a framework to develop a professional development model that fulfills the needs of teachers. By designing the development process of the teacher professional community from the concept of Sparks and Loucks Horsley (Sparks and Loucks Horsley, 1989, pp. 40-57), 5 characteristics are presented. the teacher himself (Individually guided) with observation and assessment (Observation and assessment) by providing opportunities for teachers to observe and feedback from fellow teachers. Teachers are involved in the development process (Involvement in a development process) emphasizing investigation Search (Inquiry) from the use of action research methods. (Action-based research) or may use the method of quality circles (Quality circles) or may use the method of total quality management (Total quality management) Creating a learning community for professional

development This emphasizes the process by which members jointly define vision, goals, missions, and professional development activities. There are results and effects in learning transformation (Learning Transformation), positive behavioral change for teachers, manage learners and related people to be “quality people”, which affects the quality development of learners, educational quality, and the quality of the country in the end. From the importance mentioned above, it is consistent with the proposal to develop the potential of teachers and educational personnel of the Office of the Higher Education Commission (2013) that proposed the problem. Production and development of stationed teachers that there is a lack of a continuous development system. Teachers are unaware of new academic trends. Innovative research and teaching practices. As a result, teachers are unable to adjust their learning management according to social changes. In addition, the development of active-duty teachers is in the form of individual training programs that are not holistic and inconsistent with the school context. In addition, there is a lack of follow-up assistance to put the knowledge gained into practice in the actual classroom. considered a broad and strong integration of collaboration. Phuket Rajabhat University expects that the professional integration of teachers and educational personnel who are “learning community for professional development” of teachers and educational personnel will lead to the development of teaching and learning, administration and educational institution reform that leads to the development of learner quality. The quality of education in the 21st century and its ever-changing challenges “Community for professional development, professional development” for maximum benefit to learners as well as creating professional advancement for members to match their status "Professional teacher" is truly an important tool for driving communities to learn for professional development.

The importance of the project to promote teaching and learning that focuses on developing 21st century skills with students and solving problems in the classroom is the development and study of the classroom (Lesson Study) and continuous support (Coaching). There is practice at the classroom (Classroom Practice) to help support teachers to create what they want and bring it into practice in the classroom. For the goal of learning management in this project is to create and produce potential citizens who can live in a world that is changing happily (Well-being). Competency-based learning is an educational approach that focuses on the mastery of specific skills and knowledge rather than the completion of a predetermined curriculum or set amount of time. This approach has gained importance in recent years due to several key reasons: 1) Personalized Learning: Competency-based learning allows students to progress at their own pace and focus on areas where they need more support or challenge. This personalized approach ensures that each student can achieve mastery and reach their full potential; 2) Real-World Relevance: Competency-based learning emphasizes the acquisition of practical skills that are directly applicable to real-world situations. This helps students develop the abilities they need to succeed in their future careers and become productive members of society; 3) Mastery Orientation: By focusing on mastery rather than grades or completion, competency-based learning encourages a growth mindset and a focus on continuous improvement.

Drawing from the significance and rationale, coupled with the initial phase of data collection involving classroom observations and interviews, it becomes evident that school principals, teachers, and supervisors hold varying perspectives regarding the design of active learning lessons for competency-based instruction (CBI). Additionally, they encounter hurdles in crafting lessons that harmonize with the national science curriculum to foster competency-based classrooms. As a result, this professional development initiative, targeting 25 teachers, is tailored to reform these educational systems and bolster teachers' competencies in competency-based learning instruction. The primary aim is to advocate for and enhance TSQP schools, thereby improving their overall school system. The Whole School Approach (WSA) is a comprehensive educational strategy that centers on enhancing various facets of a school's environment, culture, and practices to elevate student learning outcomes and overall well-being. Acknowledging that student success hinges not solely on classroom teaching quality but also on the broader school milieu and support mechanisms, this approach aims to cultivate holistic educational environments conducive to optimal student development.

Objectives

1. To examine the Thai science teacher perspectives on competency-based instruction.
2. To develop a framework for science lesson designing in competency-based instruction.
3. To develop a program based on whole school approach to enhance teachers, school principals and area supervisors to collaborative work for competency practice in real classroom.
4. To explore the Thai science teachers' perspectives on Competency education outcomes connected with real-world problem-solving and 21st-century skills.

Research Methodology

The design and conceptualization of effective professional development in this study were guided by a blended model of Guskey (2000), are based upon the research of Sparks and Loucks-Horsley (1989) and Drago-Severson (1994) as cited in Guskey (2000) with concept of whole school approach. Elementary science teacher preparation professional learning from lesson design to reflection cycle and culminating in the coaching experience. An essential feature of the program was a triad partnership between science teachers, coach, school principal, and community that was designed to have each member bring a different set of expertise to the classroom. The triads work together during the first phase to introduce upper elementary students to use integrating concepts from different subjects to complete their projects in the science teacher's classroom. The second framework, articulated by Moore, Stohlmann et al. (2014) and Moore et al. (2014), emphasizes the importance of rich and engaging contexts for learning, engineering design experiences that embrace failure as a learning opportunity, and student-centered pedagogies promoting teamwork and communication skills. While these two frameworks provided the basis for our research, we further grounded our work in literature focusing on STEM integration in elementary classrooms. This literature ultimately informed the professional

development model used to help teachers align their practices with the Next Generation Science Standards (NGSS; NGSS Lead States, 2013).

This research employed mixed-method research methodology with various data from research instrument to ensure trustworthiness of research result. In order to study the development of science teachers for competency-based instruction, multiple data sources have been used during the research process. In interpretive study, classroom observation, individual interview, questionnaire, integrated-based lesson plan, written reflection, and group discussion are preferred to assess all teachers' knowledge with their thinking, actions, and reasons in the specific context and setting. The researcher observed and video recorded the implementations of the integrated curriculum units in the 2021 school year for these twenty-five teachers as their classroom coach. In total, 50 observations were conducted. Curriculum units ranged in length from 4 to 15 days. The length of the class periods was typically around 50 min. After each teacher implemented their competency based integrated curriculum unit, they were interviewed by researcher (university supervisor) using a semi-structured interview protocol; this occurred at most a weeks after the last day of their curriculum unit implementation. This interview was structured to allow participants to reflect on their implementation, and since the researcher had previously observed the compet4ency based unit implementation, the questions were somewhat personalized to their implementation. Interviews ranged in length 1 hour. Detail of research participants were presented as table 1.

Table 1 Research Participants

Research Participants	Grade Level	Teaching Subject	Role	Teaching Experience
T1, T2, T3, T4, T5, T6, T7, T8, T9	Grade1-3	Elementary Subjects	Classroom Teacher	3-5 Years (4 teachers) 7-9 Years (5 teachers)
T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T21, T22, T23, T24	Grade4-6	Science, Technology, Project-based Subject	Subject Teacher and Classroom Teacher	1-2 Years (1 teachers) 3-5 Years (9 teachers) 7-9 Years (5 teachers)
T25	Grade7-9	Science Subject	Subject Teacher	7-9 Years (1 teachers)

The purpose of this study is to examine whether enactments of the 'What is PD program that can develop these schools based on whole school approach to enhance teachers, school principals and area supervisors to collaborative work for competency practice in real classroom?' that can support

students' efforts to construct and transfer new scientific knowledge and 'designedly' skills to the solution of a new real-world science-related problem in a real-world setting. This study utilizes a mixed-method study with three phrases:

Phase 1: This phase employed a quantitative study to interview the Thai teachers' perspectives and their practices of competency-based education. A total of 25 science teachers in the schools located in Phuket province, selected purposively participated in this study. An adaptable questionnaire con structs 2 parts relevant to competency education. The first part covers 5 subtitles: 1) necessity; 2) suitable for the innovative trend of teaching and learning; 3) challenges; 4) integration of subjects; 5) Real-world in competency education. While the second part concentrated on the challenges of applying competency education in teaching Science. The statistics focus on descriptive analysis using Excel.

Phase 2: This phase implemented lesson teaching. This phase employed a qualitative study to interview the Thai teachers' perspectives and their practices of competency-based education: 1) Purpose: Identify the challenges when applying competency education in teaching in science and designing lesson content connected with real-world problem-solving developing students' 21st-century skills; 2) Location and participants: 1 lecturer in universities, 25 teachers, and 25 student teachers were involved in this experimental process. We conduct experimental teaching in an extra class in 25 schools, Phuket province. This experiment was carried out for 2 year, from year 2021, to 2022, inclu ding classroom observation, lesson design planning to guide students and teach in class for two semesters on May 20, 2021, and March 10, 2022; 3) Real-world situation: In this study, we apply STEM education in teaching the lesson of "Integration with local contexts" by connecting with a real story to encourage students apply the science knowledge and skills to solve a problem in real life. The real story selected for this study was that a disabled person using a wheelchair moves at home, and the steps inter fere with him. He wishes that he can move on his own to limit the support of people around him. One of the things that can assist him is wheelchair ramps. The ramps are designed for people in wheelchairs to be able to move on themselves and must be complied with construction regulations. The learning outcomes expect not only for students to satisfy the core characteristics of competency education but also to help students develop a sense of community and improve practical skills in society.

Phase 3*:* Qualitative study: Purpose: To explore the Thai students' experiences of STEAM education outcomes connected with real-work problem-solving and 21st-century skills. Based on this, the new knowledge will share the Phuket context in applying competency education in teaching and learning. A total of 25 science teachers involved in this study will participate in the survey to get general feedback after studying the competency-based lessons mentioned above. 25 students who directly joined as project members participated in the focus group interview. All interviews were transcribed verbatim before coding and analysis. Data analysis with theme development.

These steps ensure that the research instruments are well-designed and aligned with the research objectives, leading to valuable data for improving science education and teacher

development. Data collection was conducted between September 2021 and October 2022, using purposive sampling. The study focused on science teachers who were willing to participate in the professional development program for technology knowledge to enhance their science teaching in alignment with the core indicators and central content of the science curriculum (revised in 2017). Following data collection, the analysis consisted of both qualitative and quantitative approaches. Qualitative Data Analysis: Content analysis and document analysis were employed to analyze research data from the case study. The results were used to generate conclusions, which were then linked to foundational theories to explain technology knowledge understanding and practices among the case study participants. The researcher meticulously examined and categorized the responses, using an interpretive framework, to systematize conclusions from the empirical data. The researcher reviewed the responses of science teachers and, if necessary, consulted three experts in science education to ensure accuracy and alignment with the researcher's interpretation. Discussions and recommendations were made during the expert consultation process to address any discrepancies or groupings of responses that did not align with the researcher's interpretation. Please note that this is a complex process, and the quality of data analysis in qualitative research is essential for producing valid and reliable findings. It involves a deep understanding of the data, coding, and interpretation, as well as expert input to ensure the trustworthiness of the results.

Results

This study employs an explanatory sequential design mixed-method research methodology, beginning with quantitative research using interview and classroom observation to collect their opinions from 25 pilot schools in Phuket of the TSQP, then continue to a qualitative multi-case study using focus group discussions with administrators and teachers and finally moving to qualitative research using perception and practice assessments that was present by effect size. According to the findings, the main idea behind the development process framework for competency-based school curriculum is to focus on success in developing learners' learning competencies related to work and life. The curriculum development process includes the following components: 1) competency-based curriculum design focuses on determining core competencies and developing appropriate learning designs; 2) learning management that focuses on competency development and learning assessment that emphasizes individual progress; and 3) competency-based curriculum management, which includes appropriate study time structure, adequate preparation for action, and evaluation for continuous improvement. Effective Professional learning focus less on formal structures or roles and more on capitalizing on the community’s own agency and energy. Consequently, are-based movement grow and emerge in response to changes in membership, emerging interests, and evolving goals. WSA professional learning often have a regular rhythm or cycles of activities that maintain steady engagement with the community. This growth is facilitated by open, collaborative dialogue within and outside the PD, helping members learn from each other, but avoiding “group think” by inviting new and challenging

ideas into the community. In our context, the WSA-PD were formed around the common challenge of improving student outcomes amid supporting schools to develop. The regular cycles of delivering courses each term and meeting weekly were intended to promote critical collaborative discussions. These findings are critical for implementing the national curriculum framework effectively.

Phase 1: Teacher Perspectives and Practices on Competency based Instruction.

1. Teacher Perspectives of Competency base Instruction that are described with active learning and integration teaching

1.1 The Necessity of Applying Active Learning for competency Education

In this study, 96% of respondents expressed the belief that incorporating active learning into science education in Thailand is essential. The active learning approach encompasses four components: employing higher-order thinking questions, integrating hands-on activities, fostering collaborative work, and promoting student-driven knowledge construction. Furthermore, over 96% of respondents endorsed the notion that utilizing active learning techniques significantly enhances students' competency levels and is well-suited to contemporary trends in science education. This underscores the adaptability of competency-based education to innovative teaching and learning practices in science.

1.2 Challenges Level in Applying Active Learning in the Teaching of Science

Most respondents were aware of the importance of using STEM education in teaching science, only 10.6% of respondents were using this approach in their teaching practice, 27.7% were looking for solutions, and 48.9% were unsure of their understanding of competency-based instruction and were studying about it to apply in their teaching practice. These results show that respondents face many challenges in applying STEM education in their teaching practices.

1.3 The Frequency Level of Integration of Current Lessons before attending WSA professional development program.

Table 2 Level of Implementation Integration of Lesson Design (Before attending the project)

Level of Curriculum Integration	Level of Implementation Integration (Fogarty, 1991)	Lesson Design	Science Teachers	Classroom Implementation	Level of Authenticity Promotes Empathy
Infusion	connected	Teaching topics within science subject are connected. Two small circles are two areas inside a	T1, T2, T6, T7, T8, T9, T10, T11, T12, T13, T14, T15, T16, T18,	Mainly teaching by a teacher with individual subject but connecting between learning topics	Level 1 Leading by teacher

Level of Curriculum Integration	Level of Implementation Integration (Fogarty, 1991)	Lesson Design	Science Teachers	Classroom Implementation	Level of Authenticity Promotes Empathy
		subject which are connected to create a common theme (the outside circle). This is integration within an individual skill.	T19, T20, T21, T22, T24, T25		
Parallel	Shared	Team planning or teaching that involves two disciplines focuses on share concepts, skills, and attitude.	T3, T4, T5, T17, T23,	Brining two disciplinaries/ subjects' teachers together into a single focused on student creation. Using overlapping scientific mathematics and technological as organizing elements	Level 1 leading by teacher.
Multidisciplinary	N/A	N/A	N/A	N/A	N/A
Interdisciplinary	N/A	N/A	N/A	N/A	N/A
Transdisciplinary	N/A	N/A	N/A	N/A	N/A

2. Teachers' Perspectives of Challenges and Opportunities in the Lesson Designing in Applying Competency-based Instruction in Teaching Science Grade 1-6

2.1 Challenges

Factor	The level of occurrence and promotion				
	Beginning	2 Months Experience	4 Months Experience	6 Months Experience	1 Year Experience
Supporting from school principal	84% in low level 5 % in medium level 11% in high level	11% in low level 5 % in medium level 11% in high level	10% in low level 5 % in medium level 11% in high level	5 % in medium level 11% in high level	5 % in medium level 11% in high level
Coaching and mentoring by school team and supervisors	84% in low level 5 % in medium level 11% in high level	11% in low level 5 % in medium level 11% in high level	10% in low level 5 % in medium level 11% in high level	5 % in medium level 11% in high level	5 % in medium level 11% in high level
Materials (Curriculum, Textbooks, Teaching Equipment)	84% in low level 5 % in medium level 11% in high level	11% in low level 5 % in medium level 11% in high level	10% in low level 5 % in medium level 11% in high level	5 % in medium level 11% in high level	5 % in medium level 11% in high level
Time to design Competency-based Instruction	84% in low level 5 % in medium level 11% in high level	11% in low level 5 % in medium level 11% in high level	10% in low level 5 % in medium level 11% in high level	5 % in medium level 11% in high level	5 % in medium level 11% in high level
Teacher Professional Development related teacher's need	84% in low level 5 % in medium level 11% in high level	11% in low level 5 % in medium level 11% in high level	10% in low level 5 % in medium level 11% in high level	5 % in medium level 11% in high level	5 % in medium level 11% in high level

Phase 2: Applying competency-based instruction in Designing the Active Learning Lessons and Preparing School Team based on Whole School Approach (WSA) when Teaching Science in Elementary Levels.

1. Conducting of School-based Professional Development (SPD) using Lesson Study and Professional Development (School Principal, Science Teacher, Supervisor, Student Teacher, TSQP Coach (Researcher))

Table 3 Level of Implementation Integration of Lesson Design (Experiencing the project)

Level of Curriculum Integration	Level of Implementation Integration (Fogarty, 1991)	Lesson Design	Science Teachers	Classroom Implementation	Level of Authenticity Promotes Empathy
Multidisciplinary	Webbed	The squared is a broad theme based on knowledge of many disciplines. The disciplines are taught separately but lean to the common theme	T1, T6, T9	Motivating for students coach students see connections between ideas. Theme was created carefully and thoughtful, with relevant and rigorous content	Level 2 leading by teacher and students.
Interdisciplinary	Threaded	The line goes through the circles expresses a skill that needs to be developed through some disciplines. The content of the disciplines is only a tool to develop the skill (social skills, thinking skills, technology)	T1, T2, T3, T4, T5, T6, T7, T9	Thinking skills, social skills, multiple intelligences, and study skills are threaded throughout the disciplines. Students learn the process, or they are learning, facilitating future transfer of learning.	Level 2 leading by teacher and students.
	Integrated	Priorities that overlap multiple disciplines are examined for common skills, concepts, and attitudes.	T8, T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20,	Encourages students to see interconnectedness and interrelations, students are motivated as they see these connections. Requires inter-depart mental	Level 3 leading by students, teacher, and community

Level of Curriculum Integration	Level of Implementation Integration (Fogarty, 1991)	Lesson Design	Science Teachers	Classroom Implementation	Level of Authenticity Promotes Empathy
			T21, T22, T23, T24	teams with common planning and teaching time.	
Transdisciplinary	Immersed	Learner integrates by viewing all learning through the perspective of one area of interest. Integration takes place within the leaner. Narrowing the focus of the learner.	T10, T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T21, T23, T24	Combining different subject areas into one cohesive lesson. This approach allows students to see the connections between different topics and apply their knowledge in a meaningful way. Here is an example of an immersed integration lesson design:	Level 4 leading by students, teacher, and community
	Networked	Learner directs the integration process through selection of a network of experts and resource.	T22, T13, T25,	The focus is on creating opportunities for students to engage in authentic and meaningful learning experiences that extend beyond the traditional classroom walls. This can be achieved through activities such as online research, virtual field trips, online discussions, and collaborative projects with students from other schools or countries	Level 5 leading by students, and community. Pro-active with leaner stimulated by new information, skills, or concepts.

School-based Professional Development (SPD) includes Lesson Study. This professional development team consists of School Principal, Science Teacher, Supervisor, Student Teacher, TSQP Coach (Researcher)) While teaching science using competency-based instruction has been informed as a good idea in Thailand, the

use of competency-integrated education in teaching Science practice is still difficult to implement. The findings revealed that real-life situations have been concerned with integrating Science into the classroom though using situation, event, or phenomena.

2. Case Studies of Competency-based Lessons and Implementation

The multi-case study revealed important findings to explain the results of the quantitative research. Immersed integration lesson design is a teaching approach that combines different subject areas into one cohesive lesson. This approach allows students to see the connections between different topics and apply their knowledge in a meaningful way. Here is an example of an immersed integration lesson design:

Table 4 Case Studies of Competency-based Lessons and Implementation

Subject Areas	Science, Math, and Language Arts	
Objective	Students will explore the concept of sustainability by designing and building a model eco-friendly city.	
Step 1	Introduction (Language Arts)	- Begin the lesson by reading a short story or article about sustainability and its importance. - Engage students in a discussion about the key ideas and concepts they learned from the reading.
Step2	Brainstorming (Science and Math)	- Divide students into small groups and provide them with a list of sustainable practices and technologies. - In their groups, students should brainstorm and discuss how these practices and technologies can be incorporated into a model eco-friendly city. - Encourage students to consider the environmental, social, and economic aspects of sustainability.
Step 3	Planning and Design (Math)	- Provide each group with graph paper and rulers. - Instruct students to draw a blueprint of their model city, including buildings, parks, transportation systems, and energy sources. - Encourage students to use appropriate scale and measurements in their designs.
Step 4	Construction (Science and Math)	- Provide students with recycled materials, such as cardboard, paper, and plastic bottles. - In their groups, students should use these materials to construct their model eco-friendly city based on their blueprints. - Encourage students to collaborate, problem-solve, and make adjustments as needed.
Step 5	Presentation (Language Arts)	- Each group should present their model city to the class. - Students should explain the sustainable practices and

Subject Areas	Science, Math, and Language Arts	
Objective	Students will explore the concept of sustainability by designing and building a model eco-friendly city.	
		technologies incorporated into their design and discuss the benefits of their eco-friendly city. - Encourage students to use descriptive language and persuasive techniques to convey their ideas effectively.
Step 6	Reflection (Science, Math, and Language Arts)	- Lead a class discussion on the challenges and successes encountered during the project. - Ask students to reflect on the connections between science, math, and language arts in the context of sustainability. - Have students write a short reflection essay on what they learned and how they can apply these concepts to their own lives

By integrating science, math, and language arts into this lesson design, students can explore sustainability from multiple perspectives and develop a deeper understanding of the topic. This immersive approach also promotes critical thinking, collaboration, and creativity among students. Students in the normal class are often unsuccessful in applying Mathematics in real situations. However, in this study, teachers have well-designed plans and instructions for students to achieve this. The action plan is described as follows: The result of the pedagogical experiment presents that during the working process, the groups must state the advantages and disadvantages of the option that the group chooses. In each group, the leader divides specific tasks among members. Students confirm the requirements and constraints that the teacher proposes for this activity.

3. Continually Changings Whole School After Collaboratively Working under TSQP Project.

3.1. Development of TSQP School Leaning Ecosystem that Encourages to have high Authenticity Promotes Empathy

Schools in the TSQP 2-PKRU network are leading the way in using technology to improve management and operations, as well as to keep information up to date. The goal of the operation is to develop self-improving schools that are motivated to improve themselves. They work together with the central TSQP 2-PKRU team, the area coaches, and the school-level coaches to create a "learning community" where teachers are part of the community and work together with principals and other teachers. They also serve as a "learning center" that shares knowledge, experiences, learning innovations, and management using technology with principals, teachers, students, parents, community leaders, education districts, and other relevant ministries. This collaboration support to create positive learning ecosystem for their students. From the development of 25 schools, the schools can become a network as a "learning community." Therefore, the schools must be a "learning organization" and the most important part of being a Whole School Approach is to have an environment that supports learning. The support comes from the Q-Coach or the Q-Network, which focuses

on working together as a network using the IT system (Q-Info) to make school work easier, support students more, and have an evaluation system to develop students (Q-Classroom) in the form of Formative Assessment and use the Developmental Evaluation to support the learning of all 25 schools continuously.

As for the project to support teacher and school development to continuously improve the quality of education, the 2nd generation in 2020 by Phuket Rajabhat University (TSQP 2-PKRU), the past collaboration with 25 schools has transformed the schools as a whole. The success of the project is the changes that occurred in the schools, the administrators, teachers, communities, and students. It promotes teamwork in schools to work towards the same goal, which is the development of competencies, skills in the 21st century, and desirable qualities. In implementing the TSQP 2-PKRU project, it focuses on the tool called "Whole School Transforming," which uses deep reflection to bring about change. This tool emphasizes the importance of building "self-awareness" of the school administrators to define their role as creators of academic development teams in schools through continuous coaching and creating a professional learning community (PLC). Most students who study integrated learning unit according to STEM education are highly excited. Therefore, learning integrated subjects with STEM education is attractive, and emphasizing to students. In networked lesson design, the focus is on creating opportunities for students to engage in authentic and meaningful learning experiences. This can be achieved through activities such as online working, collaborative research, virtual field trips, online discussions, and collaborative projects with students from other schools or countries. The key principles of networked lesson design include:

1. Connectivity: Networked lesson design emphasizes the importance of connecting students with a wider audience and resources. This can be done through online platforms, social media, and video conferencing tools, allowing students to interact with experts, professionals, and peers from different backgrounds.

2. Collaboration: Networked lesson design encourages collaborative learning, where students work together on projects, share ideas, and provide feedback to one another. This can be facilitated through online platforms and tools that enable real-time collaboration and communication.

3. Authenticity: Networked lesson design promotes authentic learning experiences by connecting students with real-world problems and contexts. This can be achieved by incorporating real-world scenarios, case studies, and simulations into the lesson plan.

4. Personalization: Networked lesson design recognizes the diverse learning needs and interests of students and provides opportunities for individualized learning. This can be done through the use of adaptive learning technologies, personalized learning platforms, and student-driven projects.

5. Reflection: Networked lesson design encourages students to reflect on their learning experiences and make connections between their new knowledge and their prior knowledge. This can be facilitated through online journals, blogs, and reflective discussions.

Overall, networked lesson design aims to transform traditional teaching and learning practices by leveraging the power of networked technologies to create engaging, collaborative, and personalized learning

experiences for students. The study indicates that these 25 schools have their own Professional Development (PD) Models that is designed with lesson study and PLC for the development of teachers and students. This study provides successful evidence of applying competency education in teaching science with other subjects in Thailand. This study indicates that TSQP Program supported 25 science teachers to create their integrated lessons that build students' efforts to construct and transfer new science knowledge and 'designedly' problem-solving skills to the solution of a new real-world design problem in a real-world setting. There were 25 classes participated in TSQP.

Currently, totally there are 85 schools participate in the project. Along the development, the TSQP project has evolved into a foundation for advancing educational management innovation in Phuket province. Project management involves collaboration with the Provincial Education Office and the Provincial Governor to utilize the TSQP project as a framework for driving school self-development at all levels, from schools to networks. The project's success is defined by the changes that occur within the school, including school administrators, teachers, the community, and students. It emphasizes collaborative and academic-based management at the school level and policy-level management at the agency level, promoting the creation of "teamwork." Success is measured through student learning outcomes that emphasize competency development, 21st century skills, and desirable attributes. This working collaboration have promoted the creation of a "teamwork" culture in schools and external network institutions. This emphasizes the involvement of families, communities, school committees, higher education institutions, and the private sector in developing school management to achieve the Core Learning Outcome framework. Online PLC Coaching is shared to facilitate the development of school innovation in various situations and enhance student learning. School-level teamwork is characterized by research and development (R&D), with schools developing a professional development model using learning communities to enhance professional skills.

An integrated lesson design is an approach to lesson planning where multiple subjects or content areas are combined into a single cohesive lesson. This approach helps students make connections between different subjects and apply their learning in a meaningful way. When designing an integrated lesson, there are several key components to consider:

1. Identify the learning objectives: Determine what you want students to learn and be able to do by the end of the lesson. These objectives should align with the standards and curriculum of the subjects being integrated.

2. Select the subjects to integrate: Choose the subjects or content areas that will be integrated in the lesson. Look for natural connections between subjects or find ways to connect seemingly unrelated topics.

3. Determine the focus: Decide on the main focus of the lesson. This could be a specific concept, skill, or theme that will be explored through the integration of multiple subjects.

4. Plan the activities: Develop activities and tasks that engage students and provide opportunities for them to apply their learning across the integrated subjects. These activities should be hands-on, interactive, and promote critical thinking.

5. Assess student learning: Determine how you will assess student understanding and progress towards the learning objectives. This could include formative assessments during the lesson, as well as summative assessments at the end.

6. Reflect and revise: After the lesson, reflect on its effectiveness and make any necessary revisions for future implementation. Consider student engagement, understanding, and the overall integration of the subjects.

By designing integrated lessons, educators can create a more holistic and engaging learning experience for students. It allows them to see the connections between different subjects and how they relate to the real world. Integrated lesson design also promotes higher-order thinking skills and helps students develop a deeper understanding of the content. Title: Exploring the Concept of Integration through Real-Life Applications

Discussions

This result presents that competency-based instruction was built from designing an integrated curriculum as one that "brings together content from different disciplines in a meaningful way to focus upon issues and areas relevant to student lives. Humphey and Ellis (1981, p. 11) defined integrated curriculum as "one in which children broadly explore knowledge in various subjects related to certain aspects of their environment." In exploring the natural environmental problems, which may be social, physical, or economic in nature, issues are presented in the class in holistic way. This mode of presentation allows for clarity, wider perception, deeper understanding, and application of concept learnt. Integrated teaching and learning are an offshoot of constructive school of thought in which learners are expected to construct their own knowledge, and in the process create meaning to learning process. The task of construction of meanings by learners is worthwhile but largely remains a daunting task in a system where rigid single subject approach dominates. Various forms of curriculum integration have been identified. They include course integration, cross-curriculum integration, programme interaction, school wide integration, career academics (Chernus & Fowler, 2010). An integrated curriculum as an instructional approach that incorporates key content from multidiscipline; clearly defined educational objectives and uses authentic applied problems (problem-based learning) to engage and challenge students. 25 science teachers in this study have a high perspective on the necessity to apply competency-based education and integration education is adaptable to the innovation trends in teaching and learning. However, respondents in this study report face many challenges in applying competency-based instruction in teaching integrated subjects. Leopp (1999) highlights some salient factors for impactful implementation of integrated curriculum: 1) Teachers must undertake professional development programme; 2) A shift from didactic model of teaching to constructivism and constructionism-based method; 3) Teachers are encouraged to become member of learning communities for cross fertilization of ideas. Integration requires pooling ideas from various experts in related field of study depending on the nature of the integration; 4) Teachers need to be more skillful in facilitating small group learning; 5) The use of authentic assessment by the facilitators is absolute. Authentic assessment focuses on higher level of objective than achievement score

test. Attitudinal changes, skill acquisition, performance objectives are effectively measured with the aid of authentic assessment; 6) Teachers' ability to manage experimental-oriented instruction is very essential; 7) There is need for joint support of the school administrators and teachers. Administrator would need to offer moral support and commensurate resources to implement integration; 8) Adequate information to all the stakeholders such as the parents, members of the community where the school is located about the proposed method and associated foreseeable changes, otherwise misconception by the outside group can create tension; and 9) Finally, a systemic reform will ease potential tension as against a drastic change.

The findings have significantly supported the previous studies such as Dare, Ellis and Roehrig (2018) and Ryu et al, (2019) when emphasizing the role of the teacher perspective on the importance of competency education and how to integrate STEM subjects in teaching STEM lessons. Integrated curriculum aids students' ability to acquire skills, such as critical thinking, problems solving and analytical capacity. Critical thinking is easily crystallized because of the inter-connections across content (Kain, 1993). During instructional process, a competent teacher is expected to utilize relevant theoretical perspectives in educational thought to teach. Themes and instructional contents in integrated curriculum are drawn from real life issues and problems within students' locality to compliment the planned curriculum. Teachers employ Socratic-questioning method to define problems, proffer solutions and construct meanings. The use of this method to teach familiar issues do not only ensure readiness, but learners propensity also to learn is strengthened. This process of learning possesses inherent capacity for learners to be well equipped in acquisition and deepening of critical analysis, problem-solving and reflexive thinking skills. Development of problem-solving skill itself is handsomely challenging and rewarding. It stimulates the capacity to 'create new dendrite connections' capable of making further connections (Jenson, 1998). The presentation of learning using familiar examples which can stimulate the learners to think critically make integration model imperative. Learners' input is part of the contents to be taught, this fosters democratic traits. Teacher can adopt methods in which learners are 'forced' to develop cooperative skills, peer relationship skills, and participative learning skills. Integrated curriculum has also been discovered to stimulate learners' motivation towards learning and increased interest in school activities. Positive attitude such as high rate in school attendance is directly linked to the use of integrated curriculum (Kain, 1993). Along with research implementation, 25 science classrooms have changed to apply project-based learning strategies through the STEM lesson design and the student learning outcomes connected with the 21st skills. Wahono et al. (2020) This finding has been significantly supported by Hau et al. (2020) when authors suggested that competency education pedagogy connects with project-based learning theories and practices to help teachers overcome challenges and bring enormous benefits for students' development.

Recommendations

Recommendations for Future Research

1. A manual for the area-based approach should be developed to encourage the transversal competency development of in-service and pre-service teachers in other subject areas in the Phuket Education Sandbox Area.

2. Studies on the competency development of students in different education innovation areas should be compared to discover the student transversal competencies consistent with the needs of each area.

3. The area-based approach to social studies in-service and pre-service teachers should be studied and followed up during their teaching internship.

4. The key components of WSA professional learning for Thai educational contexts may include; 1) Leadership and management: Ensuring strong leadership and effective management practices to create a supportive and conducive learning environment.; 2) Curriculum and instruction: Developing a curriculum that is relevant, engaging, and aligned with educational standards, as well as implementing effective instructional strategies that cater to diverse learning needs;3) Student support services: Providing comprehensive support services such as counseling, mentoring, and academic assistance to address students' social, emotional, and academic needs; 4) Parent and community involvement: Fostering partnerships with parents, families, and community members to create a collaborative educational environment and promote active involvement in students' learning; 5) School climate and culture: Cultivating a positive school climate characterized by respect, inclusivity, and a sense of belonging, which contributes to students' motivation, engagement, and overall well-being; and 6) Professional development: Offering ongoing training and professional development opportunities for teachers and staff to enhance their knowledge, skills, and instructional practices.

References

Bentley, T. (2017). Brief comments on Creating new value and Taking responsibility section of Education 2030. Education 2030 - Conceptual learning framework: Background papers The Future of Education and Skills: Education 2030. *The 6th Informal Working Group (IWG) Meeting* (p. 95). Paris: France.

Chernus, K., & Fowler, D. (2010). Integrated curriculum: Lessons for adult education from career and technical Education. *National Institute for Literacy.* Washington DC.

CTGV. (1992). The Jasper series as an example of anchored instruction: Theory, program description, and assessment data. *Educational Psychologist*, 27, 291–315

Dare, E. A., Ellis, J. A., & Roehrig, G. H. (2018). Understanding science teachers' implementations of integrated STEM curricular units through a phenomenological multiple case study. *International Journal of STEM Education*, 5, 4. https://doi.org/10.1186/s40594-018-0101-z

Fogarty, R. (1991). *How to Integrate the Curricula*. Palatine, IL: IRI/Skylight Publishing.

Guskey, T. (2000). *Evaluating professional development*. Thousand Oaks, CA: Corwin Press.

Hau, N. H., Cuong, T. V., & Tinh, T. T. (2020). Students and teachers' perspectives of the importance of arts in steam education in Vietnam. *Journal of Critical Reviews,* 7(11), 666-671.

Humphreys, A. H., Post, T. R., & Elli, A. K. (1981). *Interdisciplinary methods, a thematic approach*. Softcover, Goodyear.

Jensen, E. (1998). *Teaching with the brain in mind*. Virginia USA: Association for Supervision and Curriculum development Alexandria.

Kain, D. L. (1993). Cabbages and kings: Research directions in integrated/interdisciplinary curriculum. *The Journal of Educational Thought*, 27(3), 312-331.

Krajcik, J. S., Blumenfeld, P. C., Marx, R. W., Bass, K. M., Fredricks, J., & Soloway, E. (1998). Inquiry in project-based science classrooms: Initial attempts by middle school students. *Journal of the Learning Sciences*, 7, 313–350.

Linn, M. C. (1992). The computer as learning partner: Can computer tools teach science? In L. Sheingold, G. Roberts, & S.M. Malcolm (Eds.), *This year in school science 1991: Technology for teaching and learning* (pp. 31–69). Washington, DC: American Association for the Advancement of Science.

Linn, M. C. (1997). Learning and instruction in science education: Taking advantage of technology. In D. Tobin & B.J. Fraser (Eds.), *International handbook of science education* (pp. 265–293). Dordrecht, The Netherlands: Kluwer

Loepp, F. L. (1999). *Models of curriculum integration*. Retrieved from http://scholar.lib.vt.edu/ejournals/JOSTS/Summer-Fall-1999/Loepp.html

Mangkhang, C. (2017). *Ideology: Social Studies Curriculum for all.* Bangkok: Chulalongkorn University Press.

Penner, D. E., Lehrer, R., & Schauble, L. (1998). From physical models to biomechanics: Adesign-based modeling approach. *Journal of the Learning Sciences,* 7, 429–449.

Ryu, M., Mentzer, N., & Knobloch, N. (2018). Preservice teachers' experiences of STEM integration: Challenges and implications for integrated STEM teacher preparation. *International journal of technology and design education*, 29(3), 1–20.

Scardamalia, M., & Bereiter, C. (1992). Text-based and knowledge-based questioning by children. *Cognition and Instruction*, 9(3), 177–199.

Sparks, D., & Loucks-Horsley, S. (1989). Five models of staff development for teachers. *Journal of Staff Development,* 10(4), 40–57.

United Nations. (2015). *World Population Ageing 2015*. New York: Department of Economic and Social Affairs Population Division.

Wahono, B., Lin, P. L., & Chang, C. Y. (2020). Evidence of STEM enactment effectiveness in Asian student learning outcomes. *International Journal of STEM Education*, 7, 36