

Thai Pre-Service Teacher Learning Management Model Development for Online Learning and Coaching

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With the emergence of the Covid-19 epidemic the realization that online teaching and learning management became a high priority with many education institutions worldwide. In Thailand, government mandated online learning and coaching solutions became the 'New Normal' imperative across all levels of the educational system. Therefore, the researchers undertook a systematic literature review (SLR) of both Thai and international literature to establish which factors played a key role. From the SLR, a determination was made that the proposed model should contain project-based learning management (PBLM) and online coaching through information communication technology (ICT) systems. The results revealed that the proposed model should contain six main steps which the authors labeled the DSPDPE Model (define, select, plan, do, present, evaluate). The six steps of learning activities included Step 1's planning to enter a project, Step 2's choosing a project topic, Step 3's planning and analysis of work, Step 4's project implementation, Step 5's presentation of study results, and Step 6's project evaluation.

Keywords: learning management model, personalized learning, project-based learning, student teachers, Thailand

INTRODUCTION

The COVID-19 pandemic has had significant effects on the education system, with most heads of academia now advocating line education as a response to this problem (Jin, 2022). Educational institutions face decisions about how to continue the teaching-learning process while safeguarding their lecturers and students from a public health emergency that moved rapidly and was not well understood (UNESCO, 2020). The COVID-19 pandemic has created the largest disruption of education systems in human history, affecting nearly 1.6 billion learners in more than 200 countries. Closures of schools, institutions and other learning spaces have impacted more than 94% of the world's student population. This has brought far-reaching changes in all aspects of our lives. Social distancing and restrictive movement policies have significantly disturbed traditional educational practices.

Reopening of schools after relaxation of restriction is another challenge with many new standard operating procedures put in place (Pokhrel & Chhetri, 2021), which in Thailand has been widely referred to as the ‘*New Normal*’. The level of academic performance of the students is likely to drop for the classes held for both year-end examination and internal examination due to reduced contact hours for learners and lack of consultation with teachers when facing difficulties in learning/understanding (Sintema, 2020).

The COVID-19 pandemic has forced universities to further study and understand the importance of online training for pre-service teachers. Previous research regarding online teaching in teacher preparation programs has been widely conducted to study the impact of online teaching, the factors that influence pre-service teachers’ professional growth, the challenges associated with poor online teaching substructure, the inexperience of teachers, lack of information and resources, complex home environments, and lack of mentoring and support (Huber & Helm, 2020; Jin, 2022; Judd et al. 2020; Kanawapee et al., 2022; Zhang et al. 2020).

After studying and researching, it was found that project-based learning (PBL) management is a learning management concept that can help encourage students to think, act, and know how to solve problems through practical, real-world practice (Kokotsaki et al., 2016). This allows learners to create projects that are developed through study, research, analytical thinking, and step by step synthesis. PBL is also a learning model that connects to Bloom's six-stage cognitive development principles, which include analysis, application, knowledge, comprehension, synthesis and evaluation (Anderson, 1984). PBL also serves as a comprehensive approach to teaching and learning designed to engage students in real world exploration that find problems and fixes them.

Moreover, PBL is a learning process that starts with the pursuit of knowledge, thinking processes, and problem-solving skills. Learners are encouraged to communicate with experts in order to receive accurate advice and guidance from people with knowledge about their fields. Coaches guide learners on how to research and acquire information that can be synthesized into their own body of knowledge. PBLM affects learning management skills, which are essential skills for students studying to be professional teachers. Also, the value of coaching as an approach to human development is increasingly acknowledged, with the ability to use information communication technology (ICT) a critical aspect in facilitating the coaching dialogue and the coaching support processes. ICT also allows greater flexibility and allows expanding the reach to wider audiences (Kanatouri, 2020). ICT media can be used to facilitate the coaching conversation or to complement and enrich the learner's problem-solving and reflection process beyond the coaching dialogue.

LITERATURE REVIEW

Learning Management Model (LMM) Elements

Numerous scholars over time have added their thoughts to the theory and philosophy concerning what constitutes learning management and which model is the best (Anderson, 1984; Eggen & Kauchak, 2006; Joyce & Weil, 2000; Joyce et al., 2015; Saylor et al., 1981). From a review of the past and contemporary theory, Table 1 details some of the main elements found in LMMs.

In Thailand, Changwong et al. (2018) discussed LMMs development in an era referred to as ‘Thailand 4.0’ in which critical thinking skills have become a pillar of a new, knowledge-based, digitally enabled economy. Sriwongchai et al. (2015) also showed how a LMM could be applied in Math education and improving creative thinking skills.

TABLE 1
LEARNING MANAGEMENT MODEL LITERATURE SYNTHESIS

Learning management model elements	Tyler (2013)	Glasser (1960)	Klausmeier & Goodwin, (1971)	Brown (1988)	Gerlach et al. (1980)	Anderson (1984)	Joyce and Weil (2000)
Principles, concepts, and basic theories.						✓	✓
Determination of learning management objectives.	✓	✓	✓	✓	✓	✓	✓
Learning management learner status assessment.		✓	✓				
Learning management resource assignments.			✓	✓	✓	✓	✓
Learning management activity processes.	✓	✓	✓	✓	✓		
Learning management assessment.	✓	✓	✓	✓	✓		
Feedback		✓			✓		

Project-Based Learning Management (PBLM)

PBLM is the design of a learning management process that allows students to study, research and acquire new knowledge in order to create new inventions or new methods while working in groups or individually. PBL is a method to relieve student boredom and engage the student through individual or group projects in real-world problems and challenges (Al-Balushi & Al-Aamri, 2014; Kokotsaki et al., 2016). PBL is a student-centered instruction form which is based on three constructivist principles. These principals are learning is context-specific, learners are actively involved in the process of learning, and learners achieve their goals through social interactions and collaboration. PBLM also allows students to use a variety of individual skills on their own with teachers, professors or experts acting as mentors encouraging students to make presentations or disseminating what is emerging promotes better problem-solving skills than traditional lecture-based teaching (Duke et al., 2016; Guskey, 2000; Katz & Chard, 2000). The activities in the project are divided into four important phases including the preliminary planning phase, project start phase, project implementation phase, and the actual work or project in progress phase.

In Thailand, the research team of Srakaew et al. (2021) used PBL to develop a joint Thai/Japan education program for critical economic sector engineers. Using e-learning systems, Zoom face-to-face classes, and a form of the basic Japanese philosophy '*monozukuri*,' the authors reported good success at achieving the project's objectives. Nilsook et al. (2021) also evaluated PBLM and determined from a literature review that for technical and vocational education purposes that five steps were needed including preparation, topic definition, creation and test, presentation, and evaluation.

This is also consistent with Katz and Chard (2000) and Baert et al. (2002) who described PBLM as having five steps including 1) students selecting a topic and form groups, 2) plan a project and present the plans to group members, 3) meet weekly to present what has been done and have discussions and what has been learnt and plan for the next week's work, 4) Prepare project work and make project activities to ensure that the results are satisfactory to everyone, and 5) prepare presentations and proceed according to the project both in terms of content and processes such as participation in a measurement and evaluation process and collaborating within the group of learners and the academic staff. From the review of the literature concerning the PBLM process, Table 2 is presented.

TABLE 2
PROJECT-BASED LEARNING MANAGEMENT PROCESS ANALYSIS

Project-based learning management process	Katz and Chard (2000)	Baert et al. (2002)	Kokotsaki et al. (2016)	Baron (2010)	Ribe & Vidal, (1993)
Project brainstorming to find problems and challenges.	✓	✓			
Creating a good classroom atmosphere.					✓
Stimulating student interest.					✓
Collaborative working groups.			✓		
Students choose a topic.	✓	✓		✓	✓
The process of writing an outline.					✓
Planning, analyzing work, gathering information to find guidelines.	✓			✓	
Having weekly discussions.		✓			
Involvement with professional organizations and experts.			✓	✓	
Implementing a project.	✓	✓	✓	✓	✓
Project results presentation.	✓	✓	✓	✓	✓
Reverse process.					✓
Project evaluation.		✓	✓	✓	✓

Coaching

According to Williamson (2012) coaching changes traditional teacher roles and instead the teacher becomes the ‘coach’ whose job is to ask open-ended questions which promote cognition. Moreover, learners collect information, advice, and guidance from knowledgeable outside experts, which support the learners in performing real-world actions effectively (Rao, 2014; Blanchard & Thacker, 2012; Mink et al., 1993; Knight, 2015).

Furthermore, PBL requires learners to listen to their coaches and experts and probe deeper into the meaning of their projects. Learners should be non-judgmental and coaches should be trusted. Good coaches share several characteristics including the ability to welcome other teachers, the identification of their teaching goals, the ability to listen intently to those being coached, the creation of an environment which supports curious and inquisitive learners, and the ability to ask thoughtful, open-ended questions that promote reflection (Williamson, 2012). Also, good coaches provide feedback in non-traditional ways using data from observations or teacher comments to provide precise and non-judgmental feedback. Finally, good coaches listen to other teachers’ points-of-view (Knight et al., 2015).

Various methods for coaching effectiveness have been suggested by the literature (Table 3), but one effective method using a three step process. These are:

- (1) *Identify the goals.* Coaches and teachers together set goals and choose teaching strategies that should be followed, with a focus given to student outcomes.
- (2) *Learn.* After teachers and coaches have set goals and have chosen teaching strategies, teachers must learn how to use them as teaching coaches. This means explaining and developing teaching strategy models.
- (3) *Improve.* Coaches monitor how teachers use teaching strategies, and whether students achieve their goals.

Also, multiple authors have suggested that the coaching process consists of three steps including a 1) pre-observation meetings, 2) classroom observation, and 3) post-observation meetings (Costa and Gramston, 2002; Knight et al., 2015; Zepeda. 2019).

TABLE 3
COACHING PROCESS ANALYSIS RESULTS

Coaching or coaching process	Knight et al. (2015)	Zepeda (2019)	Costa and Gramston (2002)	Sweeney and Harris (2016)	Haas (1992)	Williamson (2012)
Target identification	✓			✓	✓	
Student Assessment/Reality Check				✓		
Pre-coaching meeting/planning		✓	✓		✓	✓
Coaching or observing	✓	✓	✓	✓	✓	✓
Analysis			✓			
Reflection after coaching	✓	✓		✓	✓	✓
Application and tracking			✓	✓		

Information Communication Technology (ICT)

Concepts concerning the use of ICT have been an evolutionary one with commonly known concept being defined with the age of the mainframe computer. During this era information systems were thought of as a means of collecting (input) of various elements about related data, which was then processed (process) by using a computer to organize, change and store the results (output) (Edwards, 1985). However, with the advent of the first generation of personal computers (PCs), computer networking, and then the public availability of what is now called the Internet and the Web, the processes involved are better thought of as an amalgamation of many technologies and software which today is commonly referred to as information communication technology or ICT.

Also evolutionary in nature but critical to educators at all levels have been the advent of social media platforms (Line and Facebook), smartphones, learning management systems (LMS), and cloud-based/Internet-connected platforms for almost any purpose. Therefore, all this can still be comfortably referred to under the umbrella term of 'ICT'. However, what is critical to understand in all this explosion of technology and capability has been their impact of how institutions and educators use (or do not use) the capability as oftentimes the student is way ahead of the teacher. Therefore, it is critical that pre-service/student teachers are made aware of these innovations and quickly come up to speed in how to implement them and correctly use them in both the traditional classroom setting and online under the 'New Normal' (Ruenphongphun et al., 2021; Siripongdee et al., 2021; Srikan et al., 2021; Wannapiroon & Pimdee, 2022).

In Indonesia, Tarihoran et al. (2021) added that online teaching is feasible, inexpensive and needs to be a part of the country's undergraduate training programs. The authors also added that for online learning to be successful, there must be support from both educational institutions and the government.

Research Questions

1. What elements should a project-based learning management model using student-centered coaching through the use of ICT have?
2. How many steps should a PBLM model using student-centered coaching through the use of ICT have?
3. What should be the scope of ICT use?

METHODS

This study used a systematic literature review to analyze both Thai and foreign documents, books, research, and articles related to PBLM, coaching, online teaching, and ICT use in education. Purposive sampling was used to select 73 primary papers. A qualitative research method was used to conduct a content analysis, with standard definitions selection using keywords to create findings in four primary areas. These included elements of the proposed learning management model including PBLM theory, coaching theory, and ICT development process theory. The numerical and area data results are shown in Table 4.

TABLE 4
STUDY DATA SOURCES

Resources	Data Source Type	Number	Total
Thailand	Books	13	36
	Research articles	23	
International	Books	11	37
	Research articles	26	
Total			73

RESULTS

The DSPDPE Model Basic Concepts

The researcher synthesized the literature and theories related to LMM development from the research provided by Anderson, (1984) Brown (1988), Gerlach and Ely (1980), Glasser (1960), Joyce et al. (2015), Klausmeier and Goodwin (1971), and Weil (2000). From these studies, five main elements were identified. These included 1) principles, concepts and basic theories, 2) objectives, 3) resources, 4) activities and/or steps, 5) learning evaluation. Each component is detailed as follows:

Project-Based Learning Management (PBLM)

The researcher synthesizes the process of project-based learning management from the theoretical concepts of Baert et al. (2002), Baron (2010), Katz and Chard (2000), Ribe and Vidal (1993), and Williamson (2012). The specific details are outlined and presented in Table 5.

Coaching Using ICT

The researchers synthesize coaching procedures from Costa and Gramston (2002), Haas (1992), Knight et al. (2015), Sweeney & Harris (2017), Williamson (2012), and Zepeda (2019). In summary, the process of learning management using coaching methods consists of three steps. These are:

1. *Identification and planning before coaching.* At this initial step coaches and teachers collaborate in selecting a teaching strategy that can meet the preset goals. Coaches help teachers get a clear picture of the environment, often times through the use of video/ICT to record classroom events (Knight, 2018). Next, the identification of measureable goals is worked out. After data collection, coaches ask teachers open ended questions. Once a measurable goal has been agreed upon, both the coach and the teacher choose a teaching strategy that the teacher is comfortable with in an effort to hit the established goals. Goals that make the biggest difference for learners are easy, powerful, reachable, emotionally compelling, and student-centered (Knight et al., 2015).
2. *Observe and learn.* Once agreement has been made between the coach and teacher, the teacher must learn how to implement the teaching strategy. Thus, it is the coaches' job to explain and outline effective teacher strategies. Instructions need to be clear and precise. Checklists are effective tools in doing this. However, the checklist is flexible and can be modified as the

project develops. Goals also provide a way to assess whether teachers' modifications help or damage the teaching strategies they use. Finally, watching and observing other classroom environments can be highly effective in developing the teaching model. Today, this can be done easily over the Internet using YouTube or in more traditional environments, observing other teachers' classrooms.

3. *Improve and reflect on the results after coaching.* Good coaches monitor their teachers' chosen teaching strategy. Once again, video recording is highly effective in doing this which can be captured to through something as simple as a smart phone. Also, observation and assessment data should be used on student work and a determination made as to the students reaching their goals or not (Knight et al., 2015). Weekly meetings between coaches and teachers should determine if goals are being met and if not, what new strategy can be implemented to meet these goals. Forward movement requires constant modification until the goals are reached.

Information Communication Technology Development

There is a vast array of ICT tools that coaches and teachers today can use to effectively implement their PBLM and coaching strategies. As previously mentioned, video cameras of yesteryear became the smartphone camera of today. Campus computer networks of the past have become the cloud-based LMS (e.g. Moodle, Schoology, Google Classroom) which is connected to from anywhere at any time by smartphones and a Wi-Fi connection (Poondej & Lerdpornkulrat, 2019; Wongpratoom & Sranamkam, 2019). Even inexpensive satellite connections are becoming available in remote and rural environments due to the innovation of companies such as Starlink (Herath, 2021). Today newer teaching pedagogies such as blended learning and flipped classrooms rely on ICT as the foundation for their effectiveness (Banyan et al., 2016; Chigeza & Halbert, 2014; Pipitgool et al., 2021; Siripongdee et al., 2021).

Learning Management Model Objectives, Resources and Media

The objectives of the LMM are to develop learning management skills of pre-service teachers. Resources for this objective include personal computers and laptops, smartphones, tablets, notebooks, and digital pens as well as personal and cloud based software such as Google and learning management system (LMS) software such as Moodle, Schoology, and Google Classroom (Kanawapee et al., 2022; Sittisak et al., 2022). Student teacher Internet connectivity can be achieved via terrestrial connections, wireless/Wi-Fi signals, and satellite connections.

Learning Management Activities

Pre-teacher learning management skill development using a project-based learning management model combined with coaching through ICT/online systems consists of six steps (Table 5). Each step is detailed as follows:

- *Step 1: Planning to enter a project* means developing an understanding between teachers, coaches and students about the development goals and learning management time. Step 1 also involves preparing students in the learning management development, ICT use, related media, and learning measurement and evaluation tools.
- *Step 2: Selecting a project topic* involves students researching topics to understand and select a topic for their project. Learning tools identified in Step 1 should be used to solve the problems found.
- *Step 3: Work planning and analysis* means that students understand the details of the project and prioritize the project development by receiving the correct advice from the coach through use of ICT and online dialogue.
- *Step 4: Project implementation* means that students take the results from earlier steps and develop the project according to the plan and analysis of the work using Step 1's tools.

- *Step 5: Presentation of study results* in the project means providing information about the results of the project's development and the method used by presenting the data and demonstrating the experimental project.
- *Step 6: Project evaluation* means examining the quality of the projects that students have developed to assess the learning management skills of the student teachers, the instructors, and mentors to assess the skills of the LMM in teaching.

Learning Management Model Assessment

Assessment is accomplished both during and after each project's completion. During each project, each student is assessed at each step (1-5) to assess their project knowledge, skills and attitudes. Assessment after studying involves evaluating the student teacher's training experience. The learning management process is detailed in Table 5.

TABLE 5
THE LEARNING MANAGEMENT PROCEES

Learning Management Process	Learning Management Process Roles	Period
<p>DEFINE Step 1: Planning to enter a project (Implementation of learning management plans No. 1, No. 2 and No. 3)</p>	<p>Lecturer</p>	9 hours
<p>SELECT Step 2: Choosing a project topic (Proceed according to the learning management plan No. 4)</p>	<p>Coach (1) Examine the advice request and give advice using the ICT system. Lecturer (2) Teachers lead students in conversation to encourage students to share their past school learning management experiences. (3) Teachers ask students to present learning management problems from their past observation experiences and then make a presentation using the <i>Coggle</i> mind map program. Presentations should be allocated five minutes each (Kamrozzaman et al., 2019). (4) Teachers associate the problem with the current learning situation and context. (5) Instructors supplement information on needs assessment results necessary for learning management skills of teaching professional students from stakeholders, and point out the importance of learning management plans, technology, media learning measurement, and evaluation tools (Sittisak et al., 2022). (6) Teachers bring the students into the learning management process using project topics discovered by the students themselves. Projects then apply knowledge learned from learning units 1, 2 and 3. (7) Examine the advice request and give advice using the ICT system.</p>	3 hours

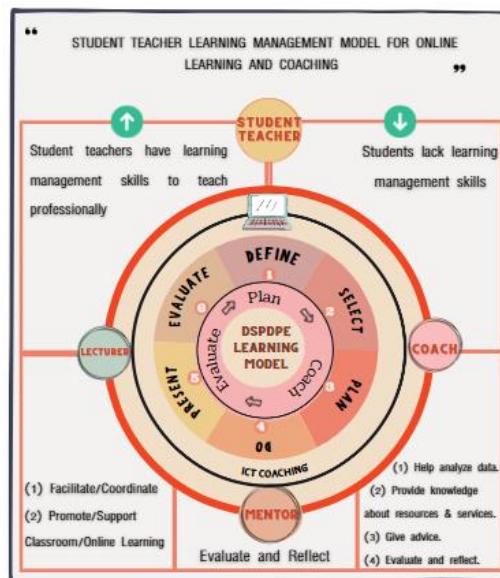
Learning Management Process	Learning Management Process Roles	Period
	<p>Students</p> <p>(1) Students share their past learning management experiences from other previous schools.</p> <p>(2) Students analyze and select learning standards and indicators for project development.</p> <p>(3) Students make worksheets for Unit 4, Part 1, Determination of Learning Objectives according to Learning Standards and Indicators.</p> <p>(4) Students seek advice from teachers and coaches through ICT systems.</p>	
<p>PLAN</p> <p>Step 3: Planning and analysis of work (Proceed according to learning management plan No. 4).</p>	<p>Coach</p> <p>(1) Examine the request for advice and give advice through the ICT system.</p> <p>Lecturer</p> <p>(2) The teacher’s example of a learning management plan using technology, media, learning measurement, and evaluation tools are linked and consistent.</p> <p>(3) Verify the request for advice and give advice through the ICT system.</p> <p>Student</p> <p>(1) Students make worksheets for Unit 4, Part 2, Planning and Analysis of Learning Management Plans for technology, media, learning measurement, and evaluation tools. Show connections using a mind map.</p> <p>(2) Students ask questions through the ICT system to promote learning management skills of pre-service student teachers.</p> <p>(3) Students submit worksheets for Unit 4 using the ICT system.</p>	3 hours
<p>DO</p> <p>Step 4: Project implementation of the project (Proceed according to the learning management plan No. 5)</p>	<p>Coach</p> <p>(1) Examine the request for advice and give advice through the ICT system.</p> <p>(2) Examine the results of the development of a learning management plan, technology, media, measurement and evaluation tool learning outcomes and its’ feedback.</p> <p>Lecturer</p> <p>(1) Explain project assessment criteria to students.</p> <p>(2) Examine the request for advice and give advice through the ICT system.</p> <p>(3) Examine the results of the development of a learning management plan, technology, media, measurement and evaluation tool learning outcomes and its’ feedback.</p> <p>Student</p> <p>(1) Develop a learning management plan, technology, media, measurement and evaluation tool.</p> <p>(2) Ask for advice through the ICT system</p> <p>(3) Submit the development results data using the ICT system.</p> <p>(4) Verify giving advice through the ICT system.</p> <p>(5) Improve, edit and submit new work through the ICT system.</p>	6 hours

Learning Management Process	Learning Management Process Roles	Period
<p>PRESENT Step 5: Presentation of the project's (Proceed according to Learning Management Plan No. 6)</p>	<p>Coach (1) Provide additional suggestions for the development of a learning management plan, technology, media, measurement and evaluation tool.</p> <p>Lecturer (1) Explain the evaluation criteria to students. (2) Evaluate the results of project development and project utilization. (3) Reflect on the results of project development and project improvement guidelines</p> <p>Student (1) Present the results of project development and role-play the project. (2) Reflect on the results of the project's development</p>	6 hours
<p>EVALUATE Step 6: Project Evaluation</p>	<p>Mentor (1) Evaluate the development and implementation of the learning management plan, technology, media, measurement and evaluation, and learning outcomes in schools. (2) Give suggestions for improvement.</p> <p>Lecturer (1) Evaluate the use of the learning management plan, technology, media, measurement and evaluation, and learning outcomes in schools (2) Give suggestions for improvement.</p> <p>Student (1) Evaluate the use of the learning management plan, technology, media, measurement and evaluation tool for Teachers' Vocational Training Schools. (2) Listen to suggestions for improvement.</p>	3 hours
Total Hours		30 hours

Learning Assessment

The study's learning assessment was conducted to ascertain and compare the learning management skills of the students. To do this, there was a randomized controlled group and an experimental group using the DSPDPE Model (Figure 1). Specific measurements were made after the experiment with assessment evaluation conducted on student teacher ICT skills as it related to teaching subject dialogues with coaches and mentors and the ability to provide information, advice, and suggestions to create or develop work according to the scope of work assigned. Finally, the assessment process reflected on project performance, with a Learning Management Skills Assessment Form given to all participants.

**FIGURE 1
FINAL DSPDPE MODEL**



Note. DSPDPE = define, select, plan, do, present, evaluate

DISCUSSION

From the literature review strong support was obtained for project-based learning’s effectiveness in teaching, learning, and coaching. PBL is an educational philosophy that involves students collaborating in solving real problems with real projects (Scott, 2021). Multiple recent studies across the US have shown that PBL students significantly outperform students in traditional methods classrooms (Lucas Education Research, 2021a). Also, PBL success crosses income, racial, and gender lines as it involves active learning, which then leads to deeper engagement and understanding, as engagement is the gateway to learning (Lucas Education Research, 2021b).

Thus, the importance of a student teachers’ use of a PBLM becomes an essential tool in a new teacher’s future teaching toolbox. Moreover, since the global COVID-19 pandemic has left many wondering about the future of the traditional classroom and how effective online teaching is as a replacement, knowledge concerning ICT and online teaching has become another critical tool in the pre-service teacher’s toolkit (Chigeza & Halbert, 2014).

The study has also demonstrated the importance of coaching’s effectiveness, especially in the student teacher classroom, whether in the traditional setting or online. Technical tools for effective coaching evaluation have evolved from the video camera to the smartphone camera. Evaluation methods have moved from the video camera’s projector screen to personal YouTube channels and cloud based LMS video clips.

Specifically, in a study from a PBLM qualitative case study from Diawati et al. (2017), it was shown that an effective PBLM can increase a student’s creative thinking skills while creating a positive classroom experience and better understanding of innovation in engineering and science projects. PBLM has also been identified as an effective online tool in multiple intelligence ability and its use in how the brain processes information (Tiantong & Siksen, 2013).

Concerning online learning and ICT’s use in accessing the platforms and tools in achieving it, some have referred to online learning as a revolutionary tool in higher education (Tiantong & Siksen, 2013). Critical aspects often mentioned in online education’s success is the ability for students to now ‘go to class’ from anywhere, at any time. This capability is always mentioned as a significant feature in the flipped classroom teaching and learning method (Pipitgool et al., 2021). Online learning through ICT also enables

a more student-centered approach with multiple studies and organizations stating the significant importance of this style in critical and creative thinking development (Santoso et al., 2018). In Thailand and elsewhere, online learning is now synonymous with the recently mandated directives of the ‘New Normal’ for educators (Callo & Yazon, 2020).

Moreover, Almulla (2020) has added that PBLM helps foster student participation by providing opportunities to share and discuss knowledge. It also helps develop thinking skills and develop innovation. PBLM is therefore very suitable for students which are consistent with Neacșu (2021), who said that coaching can change students' thinking, planning, and behavior. It also creates satisfaction in learning and can also apply coaching to develop the teacher profession in the future.

CONCLUSION

The study’s intent was to conduct a systematic literature review of both Thai and foreign studies to determine the level of support for an online learning management model to use with Thai pre-service teachers in a project-based learning environment through the assistance of teaching coaches. The results revealed that PBL is a globally accepted teaching pedagogy growing in significance and importance each and every year. PBL popularity comes from its methods in teaching learners how to solve real-world problems, to think critically, master engineering and science principles, learn collaboration and communication skills, as well as project management skills. Through a process of learner inquiry, complex questions, problems, and challenges are investigated and solutions sought. 21st century skills and core academic content are taught, along with higher order thinking skills (HOTS) such as critical thinking and analytical thinking.

In conclusion, the proposed DSPDPE model can be used to successfully achieve online, project-based learning. This is particularly true for student teachers when combined with coaching and knowledge of ICT and its associated platforms and online tools. The pre-service teacher LMM synthesized from this study will be very helpful in guiding the pre-service teachers, their coaches and mentors, as well as the students they teach. Thus, educational institutions should apply the DSPDPE model to help student teachers use project-based learning and online resources to develop student-centered 21st century skills essential for the nation’s sustained development and success.

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