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Development of Learning Management Model by Integrating PhenoBL Approach and DTP to Promote Curriculum Knowledge, Innovative Thinking Ability and Achievement Motivation of Thai Pre-Service Teachers

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Article info

Abstract

This research aims to (1) study problems and needs in learning management of Curriculum Design and Development (CDD) course, (2) develop learning management model by integrating Phenomenon – Based Learning (PhenoBL) approach and Design Thinking Process (DTP) and (3) study results of learning management model implemented. Participants were 3 groups – (1) target groups who gave data about problems and needs were 20 undergraduate students, 4 major instructors and 3 administrators, (2) target group who evaluated the quality of model was 6 experts and (3) experimental sample group was 30 second year undergraduate students from The Faculty of Education, Chiang Mai University (CMU), Thailand who registered for the CDD course in the first semester of 2018 academic year. This section of students had mixed majors. They were chosen by cluster random sampling. This research was operated based on research and development (R&D) process. Research findings found that (1) students did not have important basic knowledge and were assigned to a lot of tasks in each of the courses. Major instructors and administrators identified that course instructor must organize learning to enhance curriculum understanding and develop achievement motivation of students, (2) learning management model, developed by researcher, consisted of 6 components - (i) purpose, (ii) principles, (iii) process in 5 stages - considering phenomenon (CP), analyzing related knowledge (AK), designing innovation (DI), criticizing innovation (CI) and improving and presenting innovation (IPI), (iv) roles of the students and instructors, (v) learning media and resources, and (vi) measurement and evaluation of the learning which verified the quality at a high level and (3) results of model implementation - students had curriculum knowledge, innovative thinking ability, and achievement motivation after learning were higher than prior to learning at the .01, .05 and .01 level of significance in sequence. The results show that the learning management model, developed by researcher, possessed appropriateness and applied to use in developing students' learning quality.

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Introduction

Office of the Higher Education Commission has determined a qualification standard framework for higher education as a guideline for the education management of each curriculum in creating university graduates of virtue and quality with the readiness to serve the community. Five learning outcomes were determined: (1) moral and ethics (2) knowledge (3) cognitive skills (4) interpersonal relationship skills and responsibility and (5) mathematical analytical thinking skills, communication skills and information technology skills. Each curriculum can determine additional learning outcomes to reflect the specific identity of each science (Office of the Higher Education Commission, 2017). For the group of the Education field, the 6th additional learning outcome was determined: Learning management skills, which are the specific identities of Professional Teacher Graduates. All of the curriculum in the group of the Education field needs to include all of the 6 learning outcomes to connect the alignment from curriculum's philosophy, curriculum's subjective, special characteristics of a graduate, structure of the curriculum, courses, measurements and evaluations and educational quality assurance at the curriculum level (Ornstein & Hunkins, 2018; Piruntananon, Jongchaikit, & Neelakup, 1999; Wongyai, 2011), including any curriculum with controlled professions, which needs to be analyzed and to create a curriculum in accordance with those professions' commission's standards to create graduates with ability and quality according to the learning outcomes and standards determined.

The Bachelor of Education Program under the Faculty of Education of Chiang Mai University (CMU) has created a program with the connection of all the 6 above-mentioned outcomes. Furthermore, the courses under the Specification Courses in the Core-course group (Teaching Profession) of the program were designed in accordance with all of the 11 knowledge standards of Teaching Professions of the Teacher's Council of Thailand. One of the important knowledge standards of Teaching Profession of the Teacher's Council of Thailand is the 2nd standard of the Curriculum Development by the Academic Division under the Faculty of Education of CMU, creating the Curriculum design and development (CDD) course in accordance with this mentioned 2nd standard and has managed this individual knowledge for students of each major for the accurate knowledge and understanding in relevant to the curriculum and the development of the curriculum. Furthermore, to own the ability to create or design curriculum in accordance with

the standards determined by the Teacher's Council of Thailand. However, according to the last learning-teaching evaluation of this course, which was summarized into a report by Intasingh et al. (2018), shows that students still misunderstand the meaning and level of the curriculum, incomplete determination of the importance of the factors affecting the curriculum development. They are unable to connect the curriculum's philosophy of the various educational levels, which reflect the fact that student's curriculum knowledge (Chookumpang, 2016; Steiner, 2018) remains lower than expected. Additionally, students have many limitations in practicing the design of the curriculum's innovations i.e. they are not able to imagine the finished work, the designed curriculum lacks the connection with the purpose and the created contents, lack of clear work plan organization, taking too long to create certain elements of the curriculum, some of the created curriculums are unrealistically impractical imagination and still lacks the connection between community's reality and the society, etc. This shows that students have innovative thinking ability at an unsatisfying level, as the innovative thinking is an integration ability of using holistic knowledge, leading to the problem-solving product design or work pieces or important questions asked through the systematic work process and own a thorough inspection of all aspects, thus in the possible dimension, worthwhileness, freshly innovative and able to be used in real-life in accordance with the problematic situation or in the context of such events (De Jager, Muller, & Roodt, 2013; Raviv, Barak, & VanEpps, 2009). The work of students which were evaluated with such low scores may be the root for most of the students to become weary and bored in this course. They may give less importance to the learning, and they may have less achievement motivation (Ambrose et al., 2010; Kuha, 2018; Panich & Susinvorn, 2018) which is bad for students' education.

The researcher, as the instructor of the CDD course, therefore, is interested in developing the learning management model in this course to promote students with the level of curriculum knowledge, innovative thinking ability, and achievement motivation. An interesting concept to be used in the development of the learning management model in the 21st century is the Phenomenon-Based Learning (PhenoBL), which is learning by using phenomenon in the reality as a starting point of the learning process for the students to notice with various aspects interdisciplinary (Mahavijitr, 2017, 2019). Questions or problems were created in order to

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lead to answers and problem-solving with the method of inquiry. Using problems as base or project from the concept of constructivism and integrating the scope of learning to field studies and the online world, combining with the use of technology, focusing on the 21st century's developing skills by linking the studied phenomena with various sciences, enabling students to become up-to-date with the changing data in the digital age, helps create learning inspiration for students to be able to develop one's own work successfully and develop to become creators of knowledge and creators of innovations (Butgatanyoo, 2018; Silander, 2015; Symeonidis & Schwarz, 2016). Furthermore, another important process to be used to develop the ability of innovative thinking of the students is the Design Thinking Process (DTP), which is a creative problem-solving process by focusing on humans as the center, leading to the creation of systematic innovation using various imagination from groups of people of different original majors of the created innovation, which will be used to improve the solutions until the achievement is a perfect innovation (Kidjawan, 2018). Hasso-Plattner Institute of Design at Stanford (d.school) has presented 5 steps of DTP: (1) Empathize (2) Define (3) Ideate (4) Prototype and (5) Test (Sakama, Mori, & Iba, 2017; Vianna et al., 2015), which is a systematic process of operation or development of innovation for the solution according to the needs of the target groups or helps solving problems in various situations precisely via a multi-dimensional fully-covered aspect, which may help to develop students' learning quality while attending this course.

Therefore, the researcher is interested in developing the learning management model by integrating PhenoBL approach and DTP, using the study data on the condition of the problems and needs to manage the learning from the students, major instructors and the administrators to develop a learning management model suitable for the context and purpose of the CDD course to promote the curriculum knowledge for students, which is consistent with the 2nd learning outcome of the higher education qualification framework of knowledge, to promote the innovative thinking ability, which is consistent with the 3rd learning outcome, cognitive skills, and to promote the achievement motivation, which is consistent with the 1st learning outcome, morals and ethics, which elevates the learning quality of student teachers to the level of readiness to graduate as innovative teachers to serve the community, society and the country.

Objectives

1. To study the problems and needs of learning management in the CDD course.

2. To develop the learning management model by integrating PhenoBL approach and DTP to promote curriculum knowledge, innovative thinking ability and achievement motivation of pre-service teachers.

3. To study the results of using the learning management model by integrating PhenoBL approach and DTP to promote curriculum knowledge, innovative thinking ability and achievement motivation of pre-service teachers.

Terms of definition

1. Learning management model means pattern of plan for organizing the learning process with specific beliefs and approaches based on elements in systematic learning management.

2. PhenoBL approach means guidelines for learning management using actual phenomenon in the community or society to be the beginning of learning giving students the opportunity to search for knowledge and find answers or guidelines to solve the phenomenal problems systematically and with clear direction and goals, including integration of knowledge according to the nature of each science context.

3. DTP means steps in thinking leading to creating works or innovative work pieces that could answer the questions or find the way to solve problems through careful inspection and covering various reasonable dimensions.

4. Curriculum knowledge means level of student conceptualization in curriculum content and development measured by curriculum knowledge test that the researcher developed.

5. Innovative thinking ability means the level of thinking needed to create or design innovative curriculum that is accurate in content, new and interesting, having consistency of elements in curriculum, having integration of local content, and appropriate to the level of students' ability. This work is though a systematic work process measured by the evaluation form of innovative thinking ability that the researcher developed.

6. Achievement motivation means drive or desire of students that is needed to do their work to the fullest possibility by focusing on the standard of success, trying and challenging themselves to develop excellence, measured by achievement motivation scale that the researcher developed.

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7. Pre-service teachers means teaching profession students of Faculty of Education, CMU, who registered for the CDD course in the first semester of academic year 2018

Research methodology

The researcher conducted the Research and Development (R & D) process with the following details:

Step 1 Relevant data studies (R_1): The researcher studied and analyzed the essential data for the development of the learning management model, consisting of the
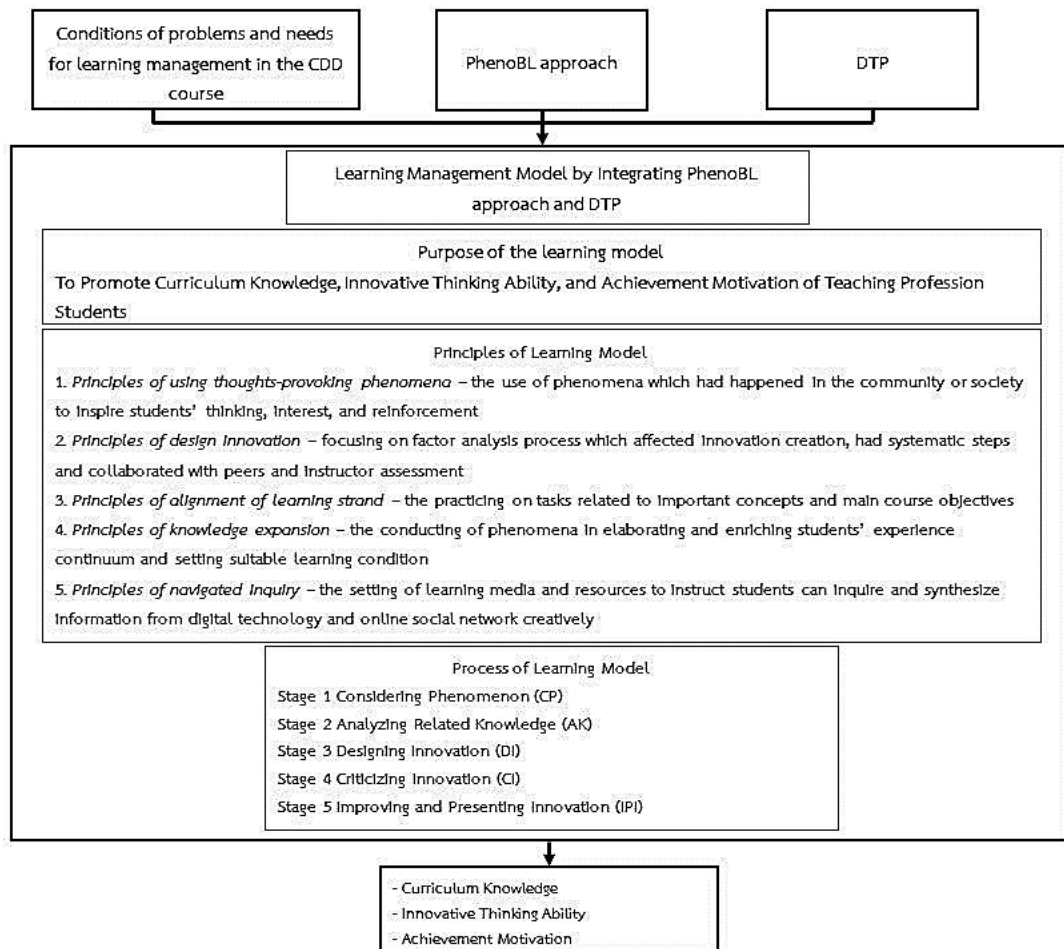

Figure 1 Conceptual framework

Conceptual framework

For this study, the researcher developed the learning management model based on data from the study and analysis of the problems and needs for learning management in the CDD course, PhenoBL approach, DTP, performance assessment and principles of learning management model. By focusing on promoting curriculum knowledge, innovative thinking ability and achievement motivation, the summary can be shown in Figure 1.

learning management model development, PhenoBL concepts, DTP, curriculum knowledge, innovative thinking, achievement motivations and performance assessment. Also included are the study of the problems and the needs of the learning management of the CDD course using the Triangulation method (Buason, 2015), with the data collected from students by focus group discussion (Pothisita, 2019) and interviews from major instructors and the administrations of the Faculty of Education, CMU.

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Step 2 Design of the learning management model (D_1): This design involves integrating the PhenoBL concepts and DTP concepts. The researcher applied the data and study results of the problems and the needs from Step 1 for the design of the learning management model consisting of 6 components: (1) purpose of the model, (2) principles of the model, (3) process of the model, (4) role of the students and instructors, (5) learning media and resource and (6) measurement and evaluation of the learning. Then, the further developed version of such learning management model was submitted to 6 experts to find the quality of the developed learning management model by using the learning management model evaluation form. The further developed learning management model was used for the trial run with the pilot study group prior to adjusting the appropriate learning management model to prepare for the experimented group.

Step 3 Experimentation of the learning management model (R_2): The researcher conducted an experimentation of the further developed learning management model for the CDD course in the 1st semester of academic year 2018 from the months of August to November of 2018. The experimental group was 30 second year students of various majors in the 1st section from 6 sections and were chosen by cluster random sampling, by collecting data of curriculum knowledge and achievement motivation both before and after the use of the learning management model. The innovative thinking ability's data were collected at 3 different times: the end of September, October, and November of 2018.

Step 4 The evaluation of the use of the learning management model and the adjustment of the learning management (D_2): The researcher used the curriculum knowledge scores and the achievement motivation levels of the experimental group to compare before and after the learning by using the learning management model. The innovative thinking ability scores were used in the comparison with the determined standard of 70% and considered the potential innovative thinking ability development of the experimental group, then processed and adjusted the evaluation results in terms of the components of the supplementary appropriate model for further implementation.
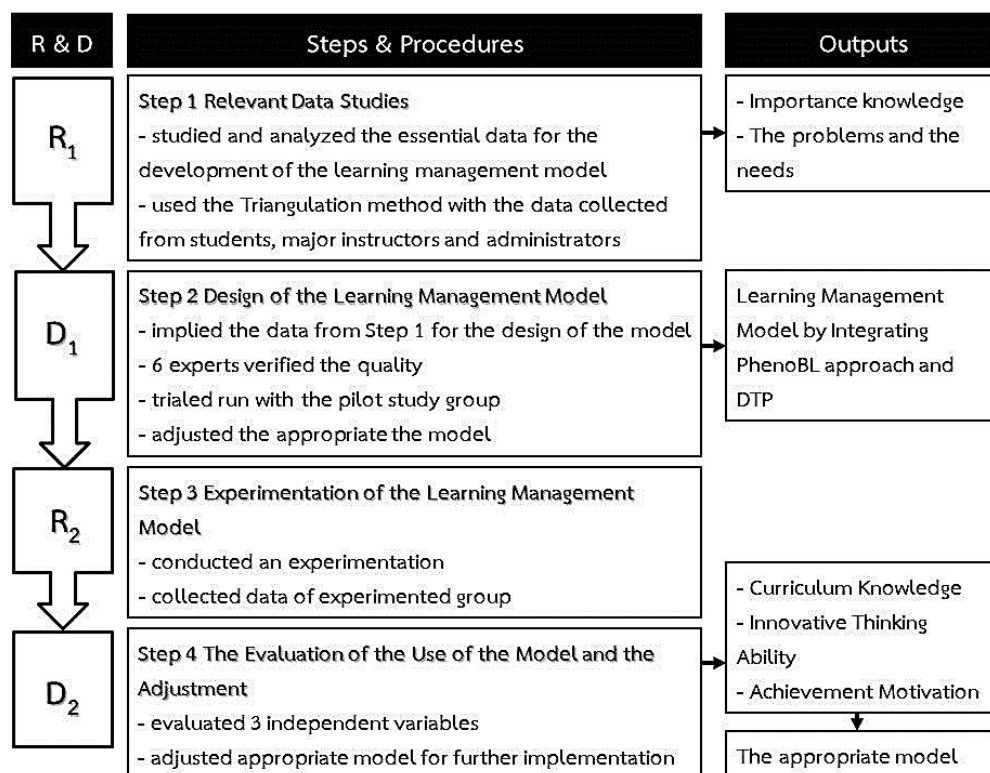
All 4 steps can be summarized as shown in Figure 2.

Figure 2 Research procedures

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Research tools

1. The recording form of the student group discussion is a recording form of data discussed in the student group of students who passed the CDD course, which consists of open-ended questions regarding the problems in learning management of the course and the needs of the students related to the learning management of this course in terms of the content, instructors, learning activities, learning media and resources and the assessment. This group discussion recording form was quality-proven by 3 experts who considered the content validity by finding the Index of Items and Objectives Congruence (IOC), which showed the value from 0.80-1.00.

2. The major instructors and administrators interview form is a Semi-Structure Interview Form, consisting of questions regarding the learning behavioral problems of students and the needs to develop the students via the learning in the CDD course. This interview form was quality-proven by 3 experts who considered the accuracy in terms of the content. The IOC shows the value from 0.80-1.00.

3. The learning management model evaluation form consists of a 5-level Rating Scale with 4 quality considerations: Utility, Feasibility, Propriety, and Accuracy (Sanders, 1994; Stufflebeam & Shinkfield, 2007). This learning management model evaluation form was quality-proven by 3 experts considering the content validity. The IOC shows the value from 0.60-1.00.

4. Curriculum knowledge test is an 80-question multiple-choice test of 4 choices consisting of 5 essential knowledge tests: 10 basic curriculum knowledge questions, 15 curriculum development questions, 20 curriculum development-effecting questions, 20 questions for educational curriculum of various levels, and 15 school curriculum questions. This curriculum knowledge test was quality-proven by 5 experts, considering the content validity. The IOC shows the value of 0.60-1.00. Furthermore, this test has a difficulty index (P) from 0.20-0.56, a discrimination value by each question (r_{xy}) of 0.20-0.58 and the reliability value (α) of 0.86.

5. Innovative thinking ability assessment form is a rubric assessment form for the scoring of each curriculum innovative work piece created by students in 3 main work pieces: learning unit level curriculum, curriculum by course level, and school curriculum. The researcher has created sub-criteria for the assessment by extracting the documents of Oliva & Gordon II (2013), Ornstein & Hunkins (2018) and Sutthirat (2017):

(1) validity, (2) interesting, (3) congruency, (4) integration and (5) learnability. This innovative thinking ability assessment form was quality-proven by 5 experts, considering the content validity. The IOC shows the value of 0.80-1.00.

6. Achievement motivation scale is 5-level Rating Scale, consisting of 30 questions regarding the behaviors reflecting the learning achievement motivation of students. This achievement motivation scale was quality-proven by 5 experts, considering the content validity. The IOC shows the value of 0.60-1.00. Furthermore, this scale has a discrimination value by each question (r_{xy}) between 0.39-0.66 and the reliability value (α) of 0.89.

Participants

1. The target group used for the study of the problems and the needs of the learning management of the CDD course:

1.1 Second year students of the Faculty of Education, CMU: 2 groups, 10 students in each group, 20 students in total by volunteer sampling for focus group discussion.

1.2 Major instructors; 1 from each of the 4 majors resulting in 4 instructors in total by purposive sampling for interviewing.

1.3 Three administrators of the Faculty of Education, CMU, selected by purposive sampling for interviewing.

2. The target group used for the learning management model evaluation consists of 6 experts: 3 curriculum and instruction experts, 2 experts of course teaching professionals, and 1 measurement and evaluation expert selected by purposive sampling.

3. The population and sample used for the learning management model experiment:

The population means the students of the Faculty of Education, CMU, who registered for the CDD course in the first semester of academic year 2018 of 6 sections, 167 students in total.

The sample (experimental group) means 30 students in the 1st section selected by cluster random sampling.

Data analysis

1. Data from problems studying and the needs of learning management in the CDD course are qualitative data. Researcher analyzed data by content analysis, synthesis of issues, and descriptive explanation.

2. Quality evaluation data of learning management model. Researcher used the average finding, standard deviation, and interpreting results compared with the

interpreting result criteria that are specified as follows (Leekitwattana, 2015):

Average 4.50 – 5.00 mean very high
Average 3.50 – 4.49 mean high
Average 2.50 – 3.49 mean moderate
Average 1.50 – 2.49 mean low
Average 1.00 – 1.49 mean very low

3. Data of scores of curriculum knowledge. Researcher used the average finding of standard deviation, percentage and t-test and compared the results before and after learning with learning management model that the researcher developed and interpreted result percentage compared with interpreting result criteria that are specified as follows:

Percentage 80 – 100 mean excellent
Percentage 70 – 79 mean good
Percentage 60 – 69 mean fair
Percentage 50 – 59 mean quite low
Percentage 0 – 49 mean need to improve

4. Data of scores of innovative thinking ability. Researcher used the average finding, standard deviation and interpreting results compared to interpreting result criteria that specified the same as step 3 included using t-test compared innovative thinking ability scores with criteria 70 percentage specified and considered the trend development of innovative thinking ability scores 3 times in 3 sub-tasks.

5. Data of achievement motivation level. Researcher used the average finding, standard deviation, and interpreting results compared to interpreting result criteria that specified the same as step 2 including using t-test comparing the before and after studying results by learning management model that researcher developed.

The Research variables

Independent variable is learning management model by integrating PhenoBL approach and DTP.

Dependent variables are curriculum knowledge, innovative thinking ability, and achievement motivation.

Results

1. Results of the study on the problem conditions and the needs of learning management in the CDD course.

1.1 In terms of problem conditions
1) Data from students concluded that
1.1) Problems about basic knowledge and original experience. Students do not have basic knowledge about curriculum of elementary, vocational, and secondary. Still, they have the understanding of core curriculum basic education.

1.2) Problems about the workloads, most students learned many subjects. Their workloads were many. This affected the efficiency and quality of each workload.

1.3) Problems about learning activity. Students indicated that in the classroom, there was mainly a lecture for knowledge, group activities, and self-studying. Nonetheless, the class did not have activities that promoted advanced thinking.

2) Data from major instructors and administrators concluded that students had the level of thinking ability not as high as they should. Students felt tired studying and had more self-study behavior.

1.2 In terms of the needs
1) Data from students concluded that
1.1) The needs of learning activities. Students wanted to have integrated learning activities, natural learning management methods not focusing on lecture only, and spending time to learn each hour effectively.

1.2) Workload needs. There were not too many work assignments. The focus was on evaluation practice in classroom or evaluate according to actual conditions.

2) Data from major instructors and administrators. It was concluded that the students wanted teachers teaching the CDD course to enhance the understanding of curriculum correctly, comprehensive, and modern. They also stressed on using the tasks that had meanings in according to the nature of curriculum science and focusing on learning proactively, including helping to develop achievement motivation for the students to have the effort to study in teaching profession successfully and to their full potential.

2. Learning management model that researcher developed consisted of the model purpose, model principles, learning management process, media and learning sources, role of learners and teachers, and learning measurement and evaluation. It was qualified by 6 experts shown on 4 items below.

Table 1 Average, standard deviation and interpretation of the result of the quality of learning management model evaluation

Quality of model	Mean	Standard deviation	Interpretation
1. Utility	4.47	0.63	High
2. Feasibility	4.23	0.57	High
3. Propriety	4.47	0.56	High
4. Accuracy	4.25	0.56	High
Total	**4.35**	**0.58**	**High**

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Table 1 shows that 6 experts evaluated the quality of learning management model that the researcher developed. The overall average is at a high level if considered separately on each item. It was found that all 4 items which are utility, feasibility, propriety, and accuracy are at a high level.

3. Results of using learning management model that the researcher developed found that

3.1 Score level of students' curriculum knowledge as shown on table 2.

Table 2 Comparison results of average score level of students' curriculum knowledge before and after studying by learning management model that the researcher developed (full score of 80 points)

Score of curriculum literacy	n	$\bar{x}$	S.D.	Percentage	df	t
Before learning	30	29.89	10.64	37.36	29	-18.69**
After learning	30	64.38	8.06	80.47	29	

**p < .01

From table 2, shows that before studying, students had the score level of curriculum knowledge at the average of 29.89 points, 37.36 percentage in the level of need to improve and after studying by learning management that the researcher developed. Students had a score level of curriculum knowledge at the average of 64.38 points, 80.47 percentage in the excellent level. When comparing before and after studying, it was found that after studying by learning management model, students had the score level average, level of curriculum knowledge higher than before studying with statistical significance at the level .01.

3.2 Students' innovative thinking ability as shown on table 3.

Table 3 Comparison results of average score of students' innovative thinking ability during study by learning management model that researcher developed, compared with the criteria 70 percentage that specified

Score of innovative thinking ability	n	Full scores	$\bar{x}$	S.D.	Percentage	df	t
1st	30	20	15.03	1.95	75.17	29	2.85*
2nd	30	40	32.31	2.35	80.77	29	9.89*
3rd	30	40	33.31	2.26	83.27	29	12.60*
Total	**30**	**100**	**80.65**	**4.26**	**80.65**	**29**	**13.46***

*p < .05

Table 3 shows that students' innovative thinking ability scores in overall average is 80.65% higher than criteria 70% that is specified with statistical significance at the level .05. When considering each work

piece 3 times, it was found that the 1st time has an average ability score of 75.17%, the 2nd time has an average ability score of 80.77%, and the 3rd time has an average ability score of 83.27% All 3 times are higher than criteria 70% that are specified with statistical significance at the level .05.

Moreover, the development trend of students' innovative thinking ability scores through the work piece design of innovative curriculum 3 times is shown on Figure 3.
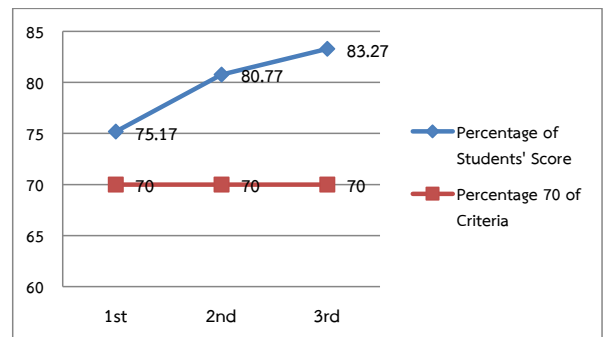

Figure 3 Development trend of students' innovative thinking ability scores 3 times

Figure 3 shows that students have the development of innovative thinking ability in continuity higher from the 1st time to the 3rd time and passed criteria at 70% as specified each time. The 1st time was at a good level. The 2nd time and the 3rd time were at very good levels.

3.3 Achievement motivation of students as shown on table 4.

Table 4 Comparison results of students' achievement motivation level before and after studying learning management that the researcher developed (estimate section 5 levels)

Level of achievement motivation	n	$\bar{x}$	S.D.	df	t
Before learning	30	2.91	0.28	29	-10.01**
After learning	30	3.53	0.38	29	

**p < .01

From table 4, it shows that before studying, students had achievement motivation on average in moderate level. After studying learning management model that the researcher developed, students had achievement motivation level at the average of 3.53 points at a higher level. When comparing before and after studying, it was found that after studying learning

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management model that the researcher developed, students had achievement motivation average at a higher level than before studying with statistical significance at the level .01.

Discussion

The researcher hereby would like to discuss the research results as follows:

1. According to the study of the problems and the needs to arrange the learning, students are swamped with workloads and dislike learning by only attending the class lectures. Also, the major instructors and the administrators anticipate arranging for the learning in the CDD course within the same means. They require the integration of learning activities by using the tasks inconsistent with the scientific nature of the course and focus on proactive learning. Nevertheless, possibly due to the drastically changed learning behavior of students in the 21st century, namely, students of this era are categorized in the Gen Z group, who could search for various data and information via the digital technology and online media rapidly (Laohajaratsang, 2018; Nasongkhla, 2018). They can access the learning resources freely, have creativity, are fond of challenging activities and new ways, dare to risk in exchange for outstanding performance (Cilliers, 2017; Mohr & Mohr, 2017; Seemiller & Grace, 2016;) and have variously different learning styles (Blaz, 2016; Intasingh, 2016; Lang, 2016), especially those students registered in the CDD course. The CDD courses were mixed in each learning majors, which means that the learning management by only lecturing cannot actually serve the needs of students of this era. Furthermore, the mentioned study of the problems and the needs also reflects the importance of determining the vision of the Faculty of Education of CMU, which states that "The Faculty of Education of CMU is the leading institution in producing and developing teachers and personnel in the educational field with the expertise in advanced pedagogy" (Faculty of Education, CMU, 2016), which aims to arrange the learning and teaching sessions truly consistent with the learning nature of this era's students by using the model, technique and innovative, and various learning managing methods to increase the learning quality for the students.

2. According to the research results, after learning with the learning management model developed by the researcher, students are at a higher level of curriculum knowledge level compared to prior learning in a significantly outcome with the statistical level of .01,

possibly due to the learning management model developed by the researcher with clear format principles for the development of students' knowledge learning outcome, consisting of principles of using thoughts-provoking phenomena, innovation design principles, alignment of learning strand principles, knowledge expansion principles, and navigated inquiry principles. Moreover, the phenomena used for the stimulation of the learning is integrated in the consistency with or similar to students' actual life-style, which enables students to benefit from their actual past experience (Mahavijitr, 2019). Also, students are self-aware of which source of knowledge they still lack via thoughtful investigations by physically visiting the community or inquiring via digital technologies, enabling easier understanding of the course, which is meaningful for students (Dechakub & Yindeesuk, 2018; Panich & Susinvorn, 2017), resulting in higher level of curriculum knowledge level compared to prior learning significantly, which relates to Pescarmona (2016), Phornkul (2018), Phuvipadawat (2011) & Wiriyaveekul (2016) who stated that learning management using actual life experience or tangible situations for the integration of the learning management assuredly results in positive learning outcome of students in every level of education. Since students can refer to such stories or situations with their essential knowledge or the courses, resulting in profound understanding and the ability to extend the use of such knowledge and expand one's own knowledge limitations.

3. According to the appeared research results, students' innovative thinking ability score in overall average of 80.65% is 70% above criteria, defined with statistical significance at the level of .05 and was increasingly developed in all 3 evaluations, possibly due to learning management model developed by the researcher, which emphasizes the process leading to the creation of a clear work system. Starting with stage 1: Considering Phenomenon (CP), stage 2: Analyzing Related Knowledge (AK), stage 3: Designing Innovation (DI), stage 4: Criticizing Innovation (CI), and stage 5: Improving and Presenting Innovation (IPI), enabling students to correctly and appropriately innovate and design the curriculum innovation, which is the essential work of the course, especially the use of actual social phenomena as thoughts stimulator. For instance, the local knowledge of Lanna villagers, which was excluded from the teaching by neglect, expected ethics from government agencies, Thailand 4.0 development plans, etc. Furthermore, this learning management model aims

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that the learning outcome of students categorized as the process skill, which has arranged for students to attend the practical trainings and repeatedly practice for several times, resulting in step by step expertise in students' innovative thinking. Also, the knowledge was linked and applied with the curriculum development principles. Students have the chance to review their own work toward the course. Additionally, they are informed of the scoring criteria in advance and advised by the instructor, resulting in 70% higher innovative thinking ability than determined, which is related to Khemmanee (2015) and Bamiro (2017), who stated that for the teaching principles of process skills, the instructor should provide students with scenarios to practice. Whereby, the instructor gradually give advice as necessary, provide support and feedback occasionally, allow students to practice regularly until they are able to perform by themselves. This included determining questions or scenarios of different and various types for students to keep practicing until they reach the expert level and in relation with Panmanee (2014) and Sinlarat (2018), who have stated that the ability of innovative thinking, or the so called innovation, it is necessary for students of the current era, whereas the successful development of Thailand essentially depends on the ability of the new generation.

4. According to the research results, after learning through the learning management model, students, on the average, have higher level of achievement motivation than prior to the learning with statistical significance at the level .01. Thus, possibly due to learning management model developed by the researcher, where the steps in the learning process is in sequence of the innovative work development and determined from lower complexity to higher complexity which gradually fulfills the entire picture of success until the work is accomplished as determined by the standards. Furthermore, the instructor provided suggestions in complying with the procedures occasionally, resulting in correct work according to the determined standards. Besides, the learning process stage 4, Criticizing Innovation (CI), also allow classmates to participate in commenting on each other's work piece, resulting in multiple points of views for one's own improvement and development, receiving support and motivation from classmates, affecting students to be eager to elevate their own work piece to be better and to use the suggestions of both the instructor and classmates in developing their own work piece toward perfection. Students, therefore, have greater achievement motivation

when learning according to this learning management model, consisting with Pintrich (1994) and Dembo & Seli (2016), who stated that there are 3 parts of factors affecting the motivation: (1) Internal Factor; believe, expectation and personal needs toward anything or any story, (2) Sociocultural Factors; the social circumstances forming a person to be determined to successfully complete any work according to the cultural standards of such person's habitat and (3) Classroom Environment Factors; the environment and ambiance within the classroom, which is part of the stimulation and support for students' learning. If the classroom is set up for positive interactions for students, either from students to lecturer, students to students, students to the chapter, and students to learning materials, it certainly results in elevated level of achievement motivation.

Conclusion and suggestion

Learning management model, developed by researcher, consisted of 6 components - (i) purpose, (ii) principles, (iii) process in 5 stages - considering phenomenon (CP), analyzing related knowledge (AK), designing innovation (DI), criticizing innovation (CI), and improving and presenting innovation (IPI), (iv) roles of the students and instructors, (v) learning media and resources and (vi) measurement and evaluation of the learning which verified the quality at a high level and (3) results of model implementation - students had curriculum knowledge, innovative thinking ability, and achievement motivation after learning were higher. From these results shows that learning management model, developed by researcher, possessed appropriateness and was applied in developing students' learning quality.

However, suggestions resulting from the research are as follows:

1. The ability of innovative thinking needs time and practice continuously. According to the first ability of innovative thinking score evaluations, students have the score of 75.17%. Due to the result of the research, this is slightly higher than criteria. Therefore, at the earlier terms of the learning management to promote innovative thinking, the instructor should start by allowing students to practice or work on uncomplicated work piece and with low difficulty in order for the students to connect the knowledge and link with the essential principles of the course and start to gain inspiration to create a work piece. Also, the instructor should participate in providing suggestions during this early stage, specially depending on the context, which

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improves the ability of innovative thinking for the students more effectively.

2. The achievement motivation is an intangible abstraction. The researcher therefore depends on appropriate measuring method and tools, which can truly reflect achievement motivation. The research shows the result, that after the learning arrangements using the model developed by the researcher, students have the average achievement motivation level of 3.53. Even if it is considered to be at a high level, however, this is still not satisfying. Therefore, the instructors who intend to promote students' achievement motivation should include the images of successful work pieces for the students to acknowledge by showing the best practice and learn from it and provide as learning support for students to see the benefit of the work piece or outcome they are working on, which will create better achievement motivation.

3. A policy promoting the use of PhenoBL approach and DTP for the learning management covering each educational level should be implied, from early childhood education, secondary education and vocational education, to prepare the younger generation to own the ability to think innovatively. The boundaries of the level of innovative thinking ability assessment can be determined and defined appropriately according to each age, including reference to the standards and indicators or essential capacity of the curriculum.

Suggestion for the next research

1. The PhenoBL approach and the DTP should be used in other learning skill developments of teaching profession students, particularly the necessary skills for such course and integrated toward pedagogical content knowledge.

2. The following variables and the data collecting methods should be added i.e. thoughts through reflective writing, collaborative skills observation, communication skills evaluation for the presentation, etc. to help develop the students and reflect the necessary skills for learning in the 21st century.

References

Ambrose, S. A., Bridges, M. W., DiPietro, M., Lovett, M. C., & Norman, M. K. (2010). *How learning works: Seven research-based principles for smart teaching.* New Jersey, NJ: Jossey-Bass.

Bamiro, A. O. (2017). *Effects of guided discovery and think-pair-share strategies on secondary school students' achievement in Chemistry.* In M. Arief (Ed.), Teaching and Learning in Practice. New York, NY: Magnum Publication LLC.

Blaz, D. (2016). *Differentiated instruction: A guide for world language teachers.* (2nd ed.). New York, NY: Routledge.

Buason, R. (2015). *Qualitative research in education.* (5th ed.). Bangkok: Chulalongkorn University Press.

Butgatanyoo, O. (2018). Phenomenon based Learning for developing a learner's holistic views and engaging in the real world. *Journal of Education Studies, Chulalongkorn University, 46*(2), 348-365.

Chookumpang, C. (2016). *Curriculum research and development concept and process.* Bangkok: Chulalongkorn University Press.

Cilliers, E. J. (2017). The challenge of teaching generation Z. PEOPLE: *International Journal of Social Sciences,* Special Issue *3*(1), 188 – 198.

De Jager, C., Muller, A., & Roodt, G. (2013). Developing creative and innovative thinking and problem-solving skills in a financial services organisation. *SA Journal of Human Resource Management,11*(1), 1-10.

Dechakup, P., & Yindeesuk, P. (2018). *Collaborative active learning and PLC for development.* Bangkok: Chulalongkorn University Press.

Dembo, M. H., & Seli, H. (2016). *Motivation and learning strategies for college success: A focus on self-regulation learning.* (5th ed.). New York, NY: Routledge.

Faculty of Education, Chiang Mai University. (2016). *Philosophy, vision, mission and aim.* Retrieved April 1, 2019, from http://www.edu.cmu.ac.th/viewdetail.php?cID=55

Intasingh, S. (2016). Alternative education: Differentiated curriculum and instruction. *Veridian E-Journal,* Silpakorn University, *9*(2), 1188-1206.

Khemmanee, T. (2015). *Decode philosophy of sufficiency economy to teach thinking process.* Bangkok: Chulalongkorn University Press.

Kidjawan, N. (2018). Design thinking process: New perspective in Thai Healthcare System. *Thai Journal of Nursing Council, 33*(1), 5-14.

Kuha, A. (2018). *Psychology for everyday life.* (3rd ed.). Songkla: Neo Point (1995).

Lang, J. M. (2016). *Small teaching: Everyday lessons from the science of learning.* San Francisco, CA: Jossey-Bass.

Laohajaratsang, T. (2018). *Innovative educational information technology for Thailand 4.0 era.* Chiang Mai: Tong Sam Design.

Mahavijitr, P. (2017). Educational innovation from Finland. *IPST Journal, 46*(209), 40-45.

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Thai Pre-Service Teachers

Mahavijitr, P. (2019). Application of phenomenon-based learning and active learning in elementary education course to enhance 21st century learning skills. *Journal of Education Khon Kaen University, 42*(2), 73-90.

Mohr, K. A. J., & Mohr, E. S. (2017). Understanding generation Z students to promote a contemporary learning environment. *Journal on Empowering Teaching Excellence, 1*(1), 9.

Nasongkhla, J. (2018). *Digital learning design.* Bangkok: Chulalongkorn University Press.

Office of the Higher Education Commission. (2017). *Handout of internal educational quality assurance in higher education level.* (3rd ed.). Bangkok: Parppim.

Oliva, P. F., & Gordon II, W. R. (2013). *Developing the curriculum.* (8th ed.). Singapore: Pearson Education South Asia Pte Ltd.

Ornstein, A. C., & Hunkins, F. P. (2018). *Curriculum foundations, principles and issues.* (7th ed.). New Jersey: Englewood Cliffs.

Panich, V., & Susinvorn, V. (2017). *Sciences and arts of teaching.* Bangkok: Parppim.

Panich, V., & Susinvorn, V. (2018). *A little improvement of teaching, big impact.* Bangkok: Parppim.

Panmanee, A. (2014). *Practice to think, think to creative.* Bangkok: Chulalongkorn University Press.

Pescarmona, I. (2016). *Status problem and expectations of competence: A challenging path for teachers.* In W. Jolliffe (Ed.), Learning to learn together: Cooperation, theory, and practic. Oxon, OX: Routledge.

Phornkul, C. (2018). *Knowledge construction process of teacher: Case study with Integration.* Bangkok: Chulalongkorn University Press.

Phuvipadawat, S. (2011). *Teaching principles for student development and authentic assessment.* Bangkok: Doungkamon Publishing.

Pintrich, P. R. (1994). Student motivation in the college Classroom. In K. W. Prichard, & R. M. Sawyer (Eds.), *Handbook of college teaching: Theory and application.* Westport, CT: Greenwood.

Pirunthananon, N., Jongchaigit, M., & Neelakup, S. (1999). *Standard-based education: Approach to practice.* Bangkok: Mac.

Pothisita, C. (2019). *Sciences and arts of qualitative research: Guides for social science students and researchers.* (2nd ed.). Bangkok: Amarin Printing and Publishing.

Raviv, D., Barak, M., & VanEpps, T. (2009). *Teaching innovative thinking: Future directions.* Retrieved January 12, 2019, from https://peer.asee.org/teaching-innovative-thinking-future-directions.pdf

Sakama, N., Mori, H., & Iba, T. (2017). *Creative systems analysis of design thinking process.* Proceedings of 7th International Conference on Collaborative Innovation Networks (COINs17), 14th -17th September 2017, Detroit, Michigan, USA. Retrieved February 3, 2018, from http://detroit17.coinsconference.org/papers/COINs17_paper_17.pdf

Sanders, J. R. (1994). *The program evaluation standards.* California: SAGE Publications, Inc.

Seemiller, C., & Grace, M. (2016). *Generation Z goes to college.* New York, NY: Jossey-Bass.

Silander, P. (2015). *Rubric for phenomenon based learning.* Retrieved October 5, 2016, from http://www.phenomenaleducation.info/phenomenon-based-learning.html

Sinlarat, P. (2018). *Principles of curriculum and instruction management.* Bangkok: Chulalongkorn University Press.

Steiner, D. (2018). *Curriculum literacy in schools of education?: The hole at the center of American teacher treparation.* Retrieved September 30, 2018 from https://learningfirst.com/wp-content/uploads/2018/11/Curriculum-literacy-in-schools-of-education-FINAL-2911.pdf

Stufflebeam, D. L., & Shinkfield, A. J. (2007). *Evaluation theory, models, and applications.* San Francisco, CA: Jossey-Bass.

Sutthirat, C. (2017). *Curriculum development: Theory to practice.* (6th ed.). Bangkok: V Print (1991).

Symeonidis, V., & Schwarz, J. F. (2016). Phenomenon-based teaching and learning through the pedagogical lenses of phenomenology: The recent curriculum reform in Finland. *Forum Oświatowe, 28*(2), 31–47. Retrieved October 5, 2016, from http://forumoswiatowe.pl/index.php/czasopismo/article/view/458

Vianna, M., Vianna, Y., Adler, I., Lucena, B., & Russo, B. (2015). *Design thinking.* London: MJV Press.

Wiriyawechkul, C. (2016). *Teaching techniques for teachers.* (3rd ed.). Bangkok: Chulalongkorn University Press.

Wongyai, W. (2011). *Curriculum development in higher education.* (2nd ed.). Bangkok: R & Print.

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