RESEARCH ARTICLE

Relationships between Teaching Innovations and Lifelong Learning with Deep Approach to Learning as a Mediator in Pharmacy Students at Burapha University

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Abstract

Objective: To investigate a goodness-of-fit between empirical data and the model of relationships between teaching innovations and lifelong learning with a deep approach to learning as a mediator in pharmacy students at Burapha University. **Methods:** This study was a cross-sectional study collecting the data using a 30-item self-administered questionnaire from 298 2nd - 4th year pharmacy students. **Results:** Innovation of course design (β=0.45, P<0.01) had a higher direct effect on deep approach to learning than innovation of teaching methods (β=0.26, P<0.05), while both of them also had indirect effects on lifelong learning with β=0.15, P<0.01 and β=0.09, P<0.05, respectively. The structural equation model showed a reasonable fit with the empirical data (χ^2=293.21, df=255, P=0.05, RMSEA=0.02 (90% CI=0.00-0.03), SRMR=0.08, TLI=0.98, and CFI=0.99). **Conclusion:** Course designs focusing on knowledge integration and practical application together with appropriate teaching technologies to support learning had relationships with pharmacy students' of deep approach to learning and lifelong learning

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บทความวิจัย

ความสัมพันธ์ระหว่างนวัตกรรมการสอนและการเรียนรู้ตลอดชีวิต โดยมีวิธีการเรียนรู้แบบลุ่มลึกเป็นตัวแปรส่งผ่านในนิสิตเภสัชศาสตร์ มหาวิทยาลัยบูรพา

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บทคัดย่อ

วัตถุประสงค์: เพื่อตรวจสอบความสอดคล้องของข้อมูลเชิงประจักษ์กับโมเดลความสัมพันธ์ระหว่างนวัตกรรมการสอนและการเรียนรู้ตลอดชีวิต โดยมีการเรียนรู้แบบลุ่มลึกเป็นตัวแปรส่งผ่านในนิสิตเภสัชศาสตร์ มหาวิทยาลัยบูรพา **วิธีการ:** การศึกษานี้เป็นการวิจัยภาคตัดขวางที่เก็บข้อมูลด้วยแบบสอบถามจำนวน 30 ข้อ จากนิสิตเภสัชศาสตร์ชั้นปีที่ 2-4 จำนวน 298 ราย **ผลการวิจัย:** นวัตกรรมการออกแบบรายวิชา (β=0.45, P<0.01) มีอิทธิพลทางตรงต่อการเรียนรู้แบบลุ่มลึกสูงกว่านวัตการรมวิธีการสอน (β=0.26, P<0.05) ในขณะที่นวัตกรรมทั้งสองนี้มีอิทธิพลทางอ้อมกับการเรียนรู้ตลอดชีวิตโดยมีค่าน้ำหนัก β=0.15, P<0.01 และ β=0.09, P<0.05 ตามลำดับ การตรวจสอบโมเดลความสัมพันธ์เชิงโครงสร้างพบว่ามีความสอดคล้องกับข้อมูลเชิงประจักษ์ (χ_2=293.21, df=255, P=0.05, RMSEA=0.02 (90% CI=0.00-0.03), SRMR=0.08, TLI=0.98 และ CFI=0.99) **สรุป:** การออกแบบรายวิชาที่สนับสนุนให้นิสิตมีการเรียนรู้แบบบูรณาการและสามารถนำความรู้ไปประยุกต์ใช้ในทางปฏิบัติได้ พร้อมกับมีการนำเทคโนโลยีการสอนที่เหมาะสมเข้ามาช่วยในการเรียนการสอนนั้น มีความสัมพันธ์กับการเรียนรู้แบบลุ่มลึกและการเรียนรู้ตลอดชีวิตของนิสิตเภสัชศาสตร์

คำสำคัญ: นวัตกรรมการสอน การออกแบบรายวิชา วิธีการสอน เภสัชศาสตร์ศึกษา การเรียนรู้แบบลุ่มลึก การเรียนรู้ตลอดชีวิต

Introduction

Teaching innovations and technologies have been intensively developed and implemented in formal and informal education through many countries including Thailand (1-3). This is because it can facilitate more efficient working or studying. Teaching innovations are about creativity of a new learning method through teaching materials, course designs, classroom designs, technologies, social media platforms and online applications. Based on the research framework of Lee Yu-Je (4), teaching innovation composed of two domains, innovation of course design (IND) and innovation of teaching methods (INM) (4). This is consistent with the study by Luca et al. (5) positing that IND and INM were in different steps of designing the learning environment.

IND enable students to be able to integrate knowledge from the course and other courses with a practical, flexible and innovative ability to make a more substantial contribution to the relevant areas in the future (4). There are various examples of IND such as problem-based learning, collaborative/cooperative learning, project-based learning, case-based learning, action learning, evidence-based learning, practice-based learning, and problem solving learning (6, 7). Implementing case studies and real situation in the class and encouraging students to produce creative and innovative works to solve problems and provide values to society are also considered as other examples of IND.

INM is about using new and meaningful methods for teaching and assessment in class. The methods could be creative platforms, cloud technologies, online education, online communication, and electronic whiteboards to solve teaching problems and being able to bring the lecturers' creativity into play (4). Some examples of INM in this context were Facebook, Line, Email, YouTube, Video Clips, and Google. In healthcare and pharmacy education, there were numerous INM used in courses such as class

electronic presentations, websites, e-mail, social media, evidence-based education, and blending problem-based learning with web technology (8-11). The reasons of these were INM have been proven effective in promoting students' desirable learning outcomes such as critical thinking, creativity, problem solving, active learning, and lifelong learning (LLL) (12, 13).

Moreover, some scholars found that IND can influence students' deep approach to learning (14, 15). A couple studies presented that INM have an impact on students' deep approach to learning (DAL) (16, 17). Other scholars also found that students' progression including DAL was positively affected by the use of teaching innovations and technologies (4, 8, 18-20). This is consistent with the theory of Biggs' 3P model (Presage, Process, and Product) indicating that teaching innovation which was considered as presage can influence students' DAL (considered as process) and this in turn influences students' desirable learning outcomes (considered as product) including LLL (21).

DAL refers to an intention to understand the materials to be learnt and seek meaning. It is based on intrinsic motivation and oriented by students' intention to plug into the content of the task to get a deep understanding (22-24). Students adopting DAL can be anticipated that they would obtain high quality learning outcomes such as deep understanding, independent learning, critical and creative thinking, problem solving, and other LLL attributes (24). DAL was also found to have a positive association with LLL, especially establishing of goals and the self-direction of learning (23).

LLL means learning throughout the lifespan. It is widely used as a goal for education and as an essential workplace component to improve knowledge and skills (12). It also means learning capacities across a lifetime that require motivation and competence in self-regulation (25). Prominent attributes of lifelong learners included abilities in goal setting, applying appropriate knowledge and skills, engaging in self-

direction and self-evaluation, locating required information, and adapting their learning strategies to different conditions (26). LLL is a central educational goal and a relatively new construct in higher education and though widely used in education (12, 27, 28). All major stakeholders, graduates, employers, faculties and accrediting agencies of higher education agreed that LLL is critically important given the rapid pace of change of society (27). McKauge et al. (29) supported that in each health profession, there is an increasing emphasis on reflective practice and LLL to maintain practice competencies. Particularly, in pharmacy education, LLL has been in priority tasks of academic providers to prepare students for the changing health landscape.

Conceptual framework

Based on the above literature review, this research conceptual framework can be obtained as shown in Figure 1.

Obviously, a major new direction for higher education institutes is enhancing LLL for students (12, 28) as a result of rapid changes and updates in knowledge, information, and skills. It has been particularly considered in sciences and healthcare areas. Therefore, healthcare professionals including pharmacists are expected to acquire new and updated knowledge and skills in their fields. They can then provide services and take care patients with qualified international standards since there are not only Thai patients in Thailand, but a huge number of foreign patients as Thailand has been recognized as a medical and biopharmaceuticals hub of Asia (30). Moreover, many researchers affirmed that LLL is a vital attribute for pharmacists. It has been thus emphasized in pharmacy education that pharmacy students can obtain this skill to maintain professional competencies through their work life (29, 31).

At this present time, there is no study showing that the teaching innovation of pharmacy courses in Thailand can develop students' LLL. Therefore, this study aimed to investigate relationships between the teaching innovations, IND and INM, and LLL with DAL as a mediator in pharmacy students at Burapha University.

Methods

This research was a cross-sectional study. This study was approved by ethics committees for human research, Burapha University (Hu095/2561).

Participants

This study collected the data from pharmacy students in the second to fourth year registering in the

IND: Innovation of course design

DAL: Deep approach to learning

INM: Innovation of teaching methods
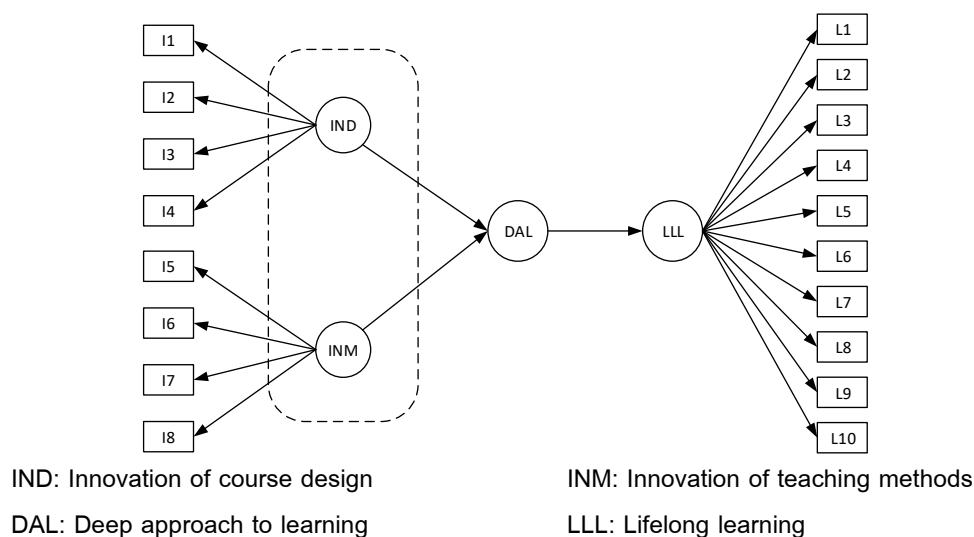
LLL: Lifelong learning

Figure 1. Conceptual framework

second semester of academic year 2018 at Faculty of Pharmaceutical Sciences, Burapha University. The first, fifth and sixth year pharmacy students did not include in this study because the first year students did not take any pharmacy courses in the semester 2. The fifth and sixth year students were all in their internship outside the Faculty during that semester. Data collection was conducted in February-March 2019

According to Hair et al. (32), sample size for structural equation modeling should be 5-10 times of estimated parameters. In this study, there were 123 estimated parameters. Therefore, sample size for this study should be at least 123 x 5 = 615 samples. Taking into account of 15% non-response rate or incomplete questionnaires, the total sample size should be 708.

This study adopted two-stage sampling method. At first stage, a pharmacy course using any teaching innovation for each 2nd, 3rd, and 4th year students was selected purposively. At second stage, 113, 109, and 89 students from 2nd, 3rd, and 4th year, respectively, were randomized by proportional stratified random sampling. There were totally 311 participants in this study.

Measures

A 30-item self-administered questionnaire was used to collect data. The questionnaire composed of four sections including demographic information (3 items), teaching innovation (8 items), DAL (9 items), and LLL (10 items). A 5-point Likert scale ranging from strongly agree (5) to strongly disagree (1) was used to measure teaching innovation, DAL, and LL. Teaching innovations consisted of two domains, innovation of course design (IND) and innovation of teaching methods (INM). Each domain composed of four questions. These questions were developed by Lee (4). Measure for DAL was modified from the Thai version of a revised two-factor study process questionnaire (R-SPQ-2F) (33). The pharmacy students' LLL was measured by the scale adapted from Kirby et al.'s (26). Thai version of the questionnaires is displayed in appendix. All items

were reviewed for appropriateness in Thai pharmacy educational contexts by three experts. Both item content validity index (I-CVI) and content validity for scale (S-CVI) of the instrument were 1.00, which were accepted as good content validity (34). Reliability tests with 30 non-samples showed Cronbach's alpha of each latent variable larger than 0.70 (see Table 1), indicating satisfactory coefficients. (35)

Data Collection

Questionnaires were distributed to participants with subject information sheets and consent forms at end of a course session. Data were collected anonymously. Participants returned the questionnaires by dropping into a sealed box within a week. A reminder for returning the questionnaires was posted at pharmacy student activities board.

Data Analysis

Descriptive analyses were performed by SPSS statistic software. Confirmatory factor analysis (CFA) was first conducted to test model fit of each latent variable, then followed by structural equation modeling (SEM) for testing the study model. Both steps were conducted using Mplus 8.3 (36). Maximum likelihood estimation method was used in this study. Model fit was evaluated using the following indices: 1) Chi-square (χ^2), Degree of freedom (df), P-value; 2) Root Mean Square Error of Approximation (RMSEA) (90% Confidence Interval); 3) Standardized Root Mean Square Residual (SRMR); 4) Tuker-Lewis Index (TLI); and 5) Comparative Fit Index (CFI). The cutoff criteria for RMSEA and SRMR value should less than 0.07 and 0.08, respectively. TLI and CFI value should greater than 0.95 (37-44). Modification index was used to adjust model (see Appendix).

Results

Descriptive Analysis

All 311 participants returned the questionnaires. However 298 questionnaires were usable. Majority of

Table 1. Means, standard deviations, correlation and reliability among variables

	IND	INM	DAL	LLL	Cronbach's Alpha	Mean	SD
IND	1				0.72	3.63	0.62
INM	0.51**	1			0.77	3.52	0.70
DAL	0.49**	0.42**	1		0.84	3.12	0.60
LLL	0.30**	0.24**	0.42**	1	0.76	3.32	0.45

**correlation coefficient with P<0.01

the subjects were female (73.83%), being students in the second year (35.91%), in the third year (34.56%) and the fourth year (29.53%), respectively. Mean grade point averages of participants was 2.98.

Means, standard deviations, correlation among variables, and reliability of the instruments were presented in Table 1. According to Hinkle et al. (45),

magnitudes of correlation coefficients can be divided into four groups including very highly correlated (0.90-1.00), highly correlated (0.70-0.90), moderately correlated (0.50-0.70), and poorly correlated (0.30-0.50). It can be said that most relationships were low while a relationship between IND and INM was at moderate level.

Table 2. CFA of innovation of course design, innovation of teaching methods, deep approach to learning, and lifelong learning

variables	Factor Loading		R^2
	β	S.E.	
Innovation of course design (IND)			
(χ2=0.26, df=2, P=0.88, RMSEA=0.00 (90% CI=0.00-0.06), SRMR=0.01, TLI=1.02, and CFI=1.00)			
I1 My lecturers suggest me to apply core concepts and theories in this course to solve problems in real situations.	0.47**	0.05	0.22**
I2 My lecturers often use case studies for the class discussion.	0.44**	0.06	0.19**
I3 I can freely bring creativity into my assignments and group works.	0.73**	0.05	0.53**
I4 My lecturers allow me to flexibly integrate knowledge with my innovative ability to create values for society.	0.83**	0.04	0.68**
Innovation of teaching methods (INM)			
(χ2=0.91, df=1, P=0.34, RMSEA=0.00 (90% CI=0.00-0.15), SRMR=0.01, TLI=1.00, and CFI=1.00)			
I5 My lecturers shared course materials, updated knowledge, and others relevant information with me via online communication channels such as Email, Facebook, and Line.	0.45**	0.06	0.21**
I6 My lecturers demonstrated the course contents by using cartoon animation, videos, and websites, which motivated me to pay more attention.	0.68**	0.05	0.47**
I7 My lecturers allow me to communicate, ask, and discuss about this course via online channels such as Email, Facebook, and Line.	0.51**	0.06	0.26**

Table 2. CFA of innovation of course design, innovation of teaching methods, deep approach to learning, and lifelong learning (continued)

variables	Factor Loading		R^2
	β	S.E.	
I8 My lecturers applied a game-based learning platform (e.g. Kahoot), online application or video clip created by students as evaluation tools to assess my understanding in this course.	0.76**	0.06	0.57**
Deep approach to learning (DAL)			
(χ2=31.50, df=22, P=0.09, RMSEA=0.04 (90% CI=0.00-0.07), SRMR=0.03, TLI=0.99, and CFI=0.99)			
D1 I find that at times studying gives me a feeling of deep personal satisfaction.	0.67**	0.04	0.45**
D2 I work hard at my studies because I find the material interesting.	0.71**	0.03	0.51**
D3 I find most new topics interesting and often spend extra time trying to obtain more information about them.	0.74**	0.03	0.54**
D4 I feel that virtually any topic can be highly interesting one I get into it.	0.82**	0.03	0.67**
D5 I spend a lot of my free time finding out more about interesting topics which have been discussed in different classes.	0.68**	0.04	0.47**
D6 I make a point of looking at most of suggested readings going with lectures.	0.59**	0.04	0.35**
D7 I find that studying academic topics can at times be as exciting as a good novel or movie.	0.59**	0.04	0.34**
D8 I test myself on important topics until I understand them completely.	0.68**	0.04	0.46**
D9 I find that I have to do enough work on a topic so that I can form my own conclusions before I am satisfied.	0.32**	0.06	0.11**
Lifelong learning (LLL)			
(χ2=18.66, df=17, P=0.35, RMSEA=0.02 (90% CI=0.00-0.06), SRMR=0.03, TLI=0.99, and CFI=1.00)			
L1 I prefer problems for which there is only one solution.	0.99**	0.00	0.98**
L2 I can deal with the unexpected and solve problems as they arise.	0.54**	0.06	0.29**
L3 I am able to identify key points or some problems of situations while others cannot see it.	0.61**	0.05	0.37**
L4 I prefer to be a self-directed learner.	0.63**	0.05	0.39**
L5 I feel others are in a better position than I am to evaluate my success as a student.	0.87**	0.01	0.76**
L6 I love learning for its own sake.	0.54**	0.06	0.29**
L7 I try to relate academic learning to practical issues.	0.63**	0.05	0.40**
L8 I feel it is difficult to locate information when I need it.	0.21**	0.05	0.04*
L9 When I learn new topics, I try to relate it to what I already know.	0.57**	0.05	0.33**
L10 It is my responsibility to make sense of what I learn from my faculty.	0.44**	0.06	0.19**

** P<0.01, * P<0.05

Confirmatory Factor Analysis

CFA of each latent variable, IND, INM, DAL, and LLL, showed that all had a satisfactory fit to the data with all fit indices meeting the recommended criteria with RMSEA < 0.07, CFI > 0.95, TLI > 0.95, SRMR < 0.08 (37, 38) Factor loadings of each measurement model are shown in Tables 2.

Structural Equation Model

SEM of IND, INM, LLL with DAL as a mediator was presented in Figure 2.

The hypothesized model showed a satisfactory fit to the data with χ^2=293.21, df=255, P=0.05, RMSEA=0.02 (90% CI=0.00-0.03), CFI=0.99, TLI=0.98, and SRMR=0.08 (37-44). The structural equation model validation result showed a reasonable fit with empirical data of 298 students.

IND had a stronger positive effects on DAL (β=0.45) comparing with INM (β=0.26). DAL had positive relationship with LLL (β=0.34). IND and INM accounted for 43.00% of variances in pharmacy students' DAL and DAL accounted for 11.00% of variance in LLL. Table 3 showed total, direct, and

indirect effects in the model. IND and INM had indirect effects on LLL with standardized coefficients of 0.15 and 0.09, respectively.

Discussion and conclusion

Teaching innovations, IND and INM, can be created by lecturers to process and design their teaching and student assessment before classes. New technologies, activities, social media, platforms, course designs, and teaching methods are some examples of teaching innovations (4, 13). The teaching innovations have been implemented in higher education across countries because of their benefits in term of heightening students' critical thinking, creativity, problem solving, active learning, deep approaches to learning, and LLL (4, 12, 13, 46, 47).

At present, it has been no information on the relationships between teaching innovations and pharmacy students' LLL in Thailand. This study thus aimed to investigate model of relationships between teaching innovations, IND and INM, and the pharmacy students' LLL with DAL as a mediator. The results found that both IND, creating a course of teaching for students
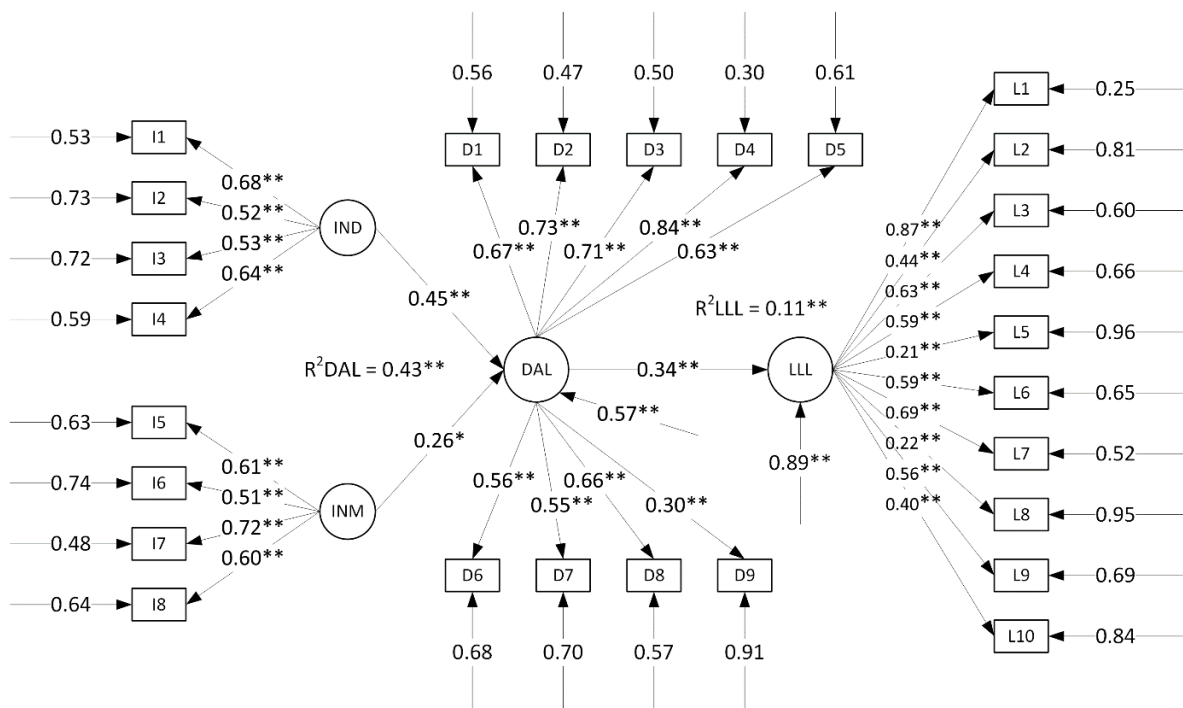

Figure 2. Results from SEM of the hypothesized model in the study (** P<0.01, * P<0.05)

Table 3. Total effect, direct effect, and indirect effect of predictor variables in the model

variables	DAL			LLL		
	total effect	direct effect	indirect effect	total effect	direct effect	indirect effect
IND	0.45** (0.12)	0.45** (0.12)	-	0.15** (0.05)	-	0.15** (0.05)
INM	0.26* (0.12)	0.26* (0.12)	-	0.09* (0.04)	-	0.09* (0.04)
DAL	-	-	-	0.34** (0.05)	0.34** (0.05)	-

** $P<0.01$, * $P<0.05$

to be able to integrate knowledge from the course and other courses with a practical, and flexible innovative ability, and INM, using creative platforms, cloud technologies, online education, online communication, and electronic whiteboards to solve teaching problems and bring students' motivation, showed significantly direct impacts on DAL. Specifically, IND had higher significant effects on DAL than INM. The results were similar to previous studies showing the course design and roles of lecturers are crucial because the design can help students to develop themselves to become more independent and self-regulated learners Teaching methods including teaching and learning technologies can be influenced by the design and they are to support student learning as tools and resources, not conceived as substantially contribution to the development of comprehension (1, 48-50). Another research supported that overall course design should be concerned rather than technologies (15).

The finding also revealed that the teaching innovations had indirect relationships with the pharmacy students' LLL. Many studies have found that the teaching innovations and technologies including information technologies and telecommunications contributed to the further development of LLL (2, 12, 51), and these results support finding in this study.

Due to the significant relationships among IND, INM, DAL and LLL of pharmacy students, it could be concluded that well-developed course designs with

useful learning technologies as supporters have relationships with the pharmacy students' DAL, which in turn expanding LLL through their professional life.

Implications and Future Research

There were several implications from this study. First, lecturers should pay attention to their course design to allow students to become creative, integrate and apply knowledge to the real situations. Moreover, lecturers should take into account that most technologies, social media, and applications could be effective when incorporating in a course, but most of the technologies are not mainly designed for educational purposes. Therefore, it is essential for the lecturers to properly select and carefully implement them to fit with the course design based on systemic research, and sound pedagogy.

This study had a couple of limitations. Time and resource limitation restricted the population for data collection. The sample size of this study was less than the minimum amount and the subjects were the students from only one Faculty of Pharmaceutical Sciences at Burapha University. Data from other Faculties of Pharmaceutical Sciences in Thailand should be collected in order to gain a better generalizable conclusion.

Acknowledgements

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Appendix

Questionnaire Items in Thai

Innovation of course design (IND)

I1 อาจารย์ของฉันแนะนำให้ฉันนำหลักการและทฤษฎีสำคัญต่างๆ ของรายวิชานี้มาแก้ปัญหาที่เกิดขึ้นในสถานการณ์จริง

I2 อาจารย์ของฉันมักนำกรณีศึกษามาให้นิสิตอภิปรายในห้องเรียน

I3 ฉันสามารถใส่ความคิดสร้างสรรค์ลงไปในงานที่ได้รับมอบหมายได้อย่างเต็มที่ ทั้งในงานเดี่ยวและงานกลุ่ม

I4 อาจารย์อนุญาตให้ฉันประมวลและรวบรวมความรู้ต่างๆ เข้ากับความสามารถด้านนวัตกรรม ได้ตามความถนัดของฉัน เพื่อสร้างคุณค่าให้แก่สังคม

Innovation of teaching methods (INM)

I5 อาจารย์แชร์เอกสารประกอบการสอน ข้อมูล และความรู้ใหม่ แก่ฉันทางช่องทางการสื่อสารออนไลน์ต่างๆ เช่น อีเมล เฟสบุ๊ค และ ไลน์

I6 อาจารย์ของฉันอธิบายเนื้อหาของรายวิชานี้โดยใช้การ์ตูนแอนิเมชั่น คลิปวีดิโอจากยูทูป และเว็บไซต์ต่างๆ มาประกอบการอธิบาย ซึ่งจูงใจให้ฉันตั้งใจฟังมากขึ้น

I7 อาจารย์อนุญาตให้ฉันติดต่อ สอบถาม และอภิปราย เกี่ยวกับรายวิชานี้ได้ทางช่องทางออนไลน์ เช่น อีเมล เฟสบุ๊ค และไลน์ เป็นต้น

I8 อาจารย์ใช้แพลตฟอร์มการเรียนรู้โดยใช้เกมส์เป็นฐาน เช่น Kahoot การให้นิสิตสร้างสรรค์แอพพริเคชั่นหรือคลิปวีดีโอต่างๆ เกี่ยวกับหัวข้อที่ได้เรียน เป็นเครื่องมือในการประเมินความเข้าใจของฉันในการเรียนวิชานี้

Deep approach to learning (DAL)

D1 ฉันพบว่าเมื่อใดก็ตามที่ฉันกำลังเรียน ฉันรู้สึกว่าฉันพึงพอใจอย่างมาก

D2 ฉันตั้งใจเรียนอย่างมากเพราะฉันพบว่าเอกสารประกอบเรียนมีความน่าสนใจ

D3 ฉันพบว่าหัวข้อเรียนใหม่ส่วนมากน่าสนใจและบ่อยครั้งฉันจะหาเวลาศึกษา หาข้อมูลเพิ่มเติมเกี่ยวกับหัวข้อนั้นๆ

D4 ฉันรู้สึกว่าเนื้อหาต่างๆ มีความน่าสนใจอย่างมาก เมื่อฉันเริ่มเรียนรู้มันอย่างตั้งใจ

D5 ฉันใช้เวลาว่างส่วนใหญ่ที่ฉันมีกับการศึกษาเพิ่มเติมในหัวข้อที่น่าสนใจซึ่งเป็นเรื่องที่ได้นำไปใช้ในวิชาอื่นๆ

D6 ฉันตั้งใจอ่านและศึกษาเอกสารต่างๆ ที่อาจารย์แนะนำให้อ่านเพิ่มเติม ซึ่งเอกสารเหล่านี้ช่วยทำให้ฉันมีความเข้าใจในชั้นเรียนมากขึ้น

D7 ฉันพบว่าการเรียนหัวข้อทางวิชาการหลายๆ หัวข้อในเวลาเดียวกันน่าตื่นเต้นพอๆกับการอ่านนวนิยายหรือดูภาพยนตร์

D8 ฉันนำหัวข้อสำคัญทดสอบตัวฉันจนกระทั่งฉันเข้าใจเรื่องทั้งหมด

D9 ฉันพบว่าฉันจะต้องขยันให้มากกับหัวข้อที่เรียน เพื่อที่ฉันจะได้สามารถสรุปประเด็นสำคัญออกมาด้วยตัวเอง ฉันจึงจะพอใจ

Lifelong learning (LLL)

L1 ฉันชอบปัญหาประเภทที่มีวิธีแก้ปัญหาเพียงวิธีเดียว

L2 ฉันสามารถจัดการกับปัญหาที่เกิดขึ้นโดยไม่ได้คาดการณ์มาก่อน และสามารถแก้ปัญหาต่างๆ ที่เกิดขึ้นได้

L3 ฉันสามารถระบุประเด็นสำคัญหรือปัญหาบางอย่างๆ ของสถานการณ์ต่างๆ ได้ ในขณะที่เพื่อนๆ ไม่สามารถระบุได้

L4 ฉันชอบที่จะศึกษาเรียนรู้ด้วยตนเอง

L5 ฉันรู้สึกว่าเพื่อนๆ ประสบความสำเร็จทางด้านการเรียนมากกว่าฉัน

L6 ฉันรักการเรียนรู้เพื่อการเรียนรู้จริงๆ ไม่ได้คิดถึงสิ่งอื่นใด

L7 ฉันพยายามที่จะประยุกต์ความรู้ทางวิชาการต่างๆ ที่ได้เรียนมา ใช้แก้ปัญหาที่เกิดขึ้นจริงในทางปฏิบัติได้

L8 ฉันรู้สึกว่าการค้นหาข้อมูลที่ฉันจำเป็นต้องใช้ เป็นเรื่องที่ยากสำหรับฉัน

L9 เมื่อฉันได้เรียนหัวข้อใหม่ๆ ฉันจะพยายามคิดว่ามันมีความสอดคล้องกับหัวข้อที่ฉันเคยรู้มาก่อนหน้าอย่างไรบ้าง

L10 มันเป็นความรับผิดชอบของฉันที่จะต้องเข้าใจในสิ่งที่ฉันได้เรียนมาจากคณะ