

Case-Based Learning in Self-directed Learning Environment using a Digital Platform to Enhance Public Health Students' Learning Outcome in Graduate Study

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Abstract – This study aimed to assess the learning outcome of students using case-based learning in a self-directed learning environment using a digital platform in graduate program. We collected the scores from 14 students who enrolled in one elective course in academic year 2020-2021. The result of total mean score was 71.66 ± 5.48 . 13 out of 14 students had total score higher than 80%. This small group using the case-based learning approach enhanced their students' learning outcome regarding hospital quality management of graduate study program.

Keywords – case-based learning, self-directed learning, digital platform, quality management

1. Introduction

Technology has become a prominent tool in teaching, learning, and assessment in higher education.

The context of public health education has changed because of stagnant curricula informing education. Many challenges face public health educators to redesign teaching, learning, and assessment to meet the needs and expectations of society in the 21st century [1].

In 2022, the public health institution faced the rapid change in aging population; advances in public health science and technologies; healthcare reform; quality and safety issues in health systems; complex and multifaceted health systems; Covid-19 pandemic; and society demand for quality of graduates.

As Thailand enters the Industrial 4.0 Era, the key challenges facing the faculty of public health are changing teaching and learning platforms and demands from society of quality of graduates and programs. Therefore, public health programs need to prepare graduates with new competencies to work in currently volatile, uncertain, complex, and agile health systems [2].

The Public Health Administration Department, Faculty of Public Health, Mahidol University has an important role and responsibility in preparing the future public health professional workforce with new competencies to resolve in the current public health challenges. In 2018, the Master of Science Program in Public Health Administration was developed based on the outcome framework to meet the needs of stakeholders and society. The new program aims to enable competencies of graduates such as systematic and critical thinking, ability to communicate effectively, capable to innovate, resolve challenges using high order negotiation and collaboration [3]. This higher order thinking from Bloom's Taxonomies needs multiple learning platforms, new programs and course designs, and using technology to enhance lifelong learning [4]. Therefore, the design of learning strategies include active, case-

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based, experiential, blended, and research base learning. Formative and summative assessment are used for each student to ensure the program learning outcome.

One such course was, *Quality Management in Hospitals*, an elective course for first year students, second semester in the Master of Science Program in Public Health Administration in the Faculty of Public Health, Mahidol University. In 2018, the first researcher developed an online course to use technology to support students in self-directed learning (SDL) environments using a digital platform. This course was implemented in academic year 2019. In 2020, the new normal environment of higher education due to COVID-19 pandemic disrupted the normal standard face-to-face classroom teaching, learning, and assessment process. Teachers had to shift from normal face-to-face in the traditional classroom to using digital platforms with remote teaching in this course.

Using self-directed learning through the digital platform MUX, the students login to university email online to learn content in advance in each week totalling four hours. The students reviewed the content from video in sessions 1 to 5, read the support document and performed self-assessment to evaluate themselves using an online quiz. The MUX system recorded the result in each session.

In session five, the teacher assigned a case study in the topic of quality improvement to allow the students to explore their workplace. In this case-based learning, the students understood quality improvement in the real-life context within their workplace. Self-directed techniques enhanced the student learning outcomes such as applying quality improvement knowledge, the critical thinking skills, and decision making to select the quality improvement tools. All these skills proved essential to manage the complex current health service system.

This course used various learning approaches such as SDL environment through a digital platform, virtual face-to-face lectures via WebEx, and case studies to learn the real-life situation in the workplace. These methods of learning aimed to help the students to share their knowledge and reflect on quality improvement in the workplace. The researchers intended to evaluate the outcome of using case-based learning in SDL environments using a digital platform in this course.

2. Objective

This study aimed to assess the learning outcome score of graduate students using case-based base learning in SDL environment through a digital platform.

3. Hypothesis

The learning outcome score of graduate students using case- based learning in SDL through a digital platform was higher than 80% .

4. Study Framework

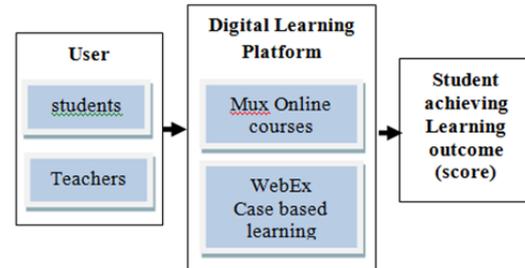


Figure 1. Conceptual Framework

5. Definitions

5.1. A Case Study

Is the descriptive presentation of the content from a real situation. The case study helps students learn from a real situation. In this study, the case study involved quality improvement in the student workplace where the teacher assigned the students in the course *PHAD 661 Quality Management in Hospital*. The students described the situation of quality improvement in their healthcare organization. They presented the context, theory of quality improvement, method and tools used to apply in the healthcare organization. They developed analytical skills in quality improvement to reflect the results in their workplace under the mentoring of the teacher.

5.2. Case Based Learning (CBL)

Is the process of teaching and learning approach where the teacher assigns each student to analyze a case study in the topic of quality improvement within the real situation in their workplace. The purpose is to apply the theory and knowledge content in the course *PHAD 661 Quality Management in Hospitals* to construct the case study. Using CBL, the students learns to developed analytical skills by both quantitative and qualitative approaches, decision making skills to select the most appropriate tool to apply quality improvement knowledge and communication skills through oral and written exercises. This CBL applies the concept of “Seven Jump Process” [5] are described below.

- 1) The case is established: The students select the topic of the case study, identify the quality improvement in their healthcare organization, and collect the key data and information in their

workplace. The issues identified in the case study link to the knowledge content in the course.

- 2) The case is analyzed: The students analyze key data and information of their healthcare organization such as organization profile, situation analysis, and identify key problems to focus on in the case study.
- 3) Brainstorming is performed: The students present the case study to their peers and teacher in virtual face-to-face classrooms using the WebEx platform. The sharing, discussion, suggestions, and question are encouraged to exchange ideas in the classroom with their peers and teacher. In this process, the teacher acts as a facilitator.
- 4) Learning objectives are formulated: The students formulate the objectives, identify the quality improvement method and tools in the case study. The teacher asks the questions to stimulate the students' critical thinking.
- 5) Findings are identified: the students identify the results. These include the organization profile, the concept of quality improvement method, tools, and techniques that are relevant to the case study.
- 6) The results are shared: The students present the result of the case study in the virtual classroom. The purpose of sharing is to enhance the group's ability to learn from their colleague's in different contexts of health service.
- 7) Areas to improve are Identified are identified and integrated in the quality improvement plan of their healthcare organization practices.

5.3. SDL

Is an approach in the adults teaching and learning process. It suggests that the individual learning process is composed of diagnosing individual needs, setting goals, identifying learning sources, selecting appropriate methods, and evaluating the results by themselves. SDL provides a continuous engagement in acquiring, applying and creating knowledge and skills in the context of an individual learner's unique problem [6]. The SDL method aims to offer students education opportunities for lifelong learning. Using this approach, learners are responsible for planning, conducting, and evaluating the progress of their self-study [7]. SDL comprises a concept based on anthropologic theory, involving independence, and self-esteem of human beings. It was stated that all human beings were born with goodness, independence, self-esteem, and self-ultimate potentiality, as well as their self-responsibility. The process consist of learners analyzing their own learning needs, together with their study goals, seeking supports for knowledge, using educational media in learning, and evaluating self- learning [8].

5.4. Digital Platform

Is the online platform that facilitates and supports the interaction. In this study the self-learning support online system of Mahidol University was called MUx.

6. Research Methodology

6.1. Population

The researchers used the data and scores of students in the Master of Science Program in Public Health Administration in the second semester, academic year 2020 to 2021. Nine students enrolled in academic year 2020 and five students in academic year 2021. Altogether 14 students registered in the elective course, *PHAD 661 Quality Management in the Hospitals*.

6.2. Design, Procedure, and Tools

6.2.1. Research design

This study employed the teaching and learning development design. The method of teaching and learning included both asynchronous and synchronous learning. For asynchronous learning, the first researcher developed an online content using video, PowerPoint presentation, support documents and quizzes each week via MUx platform for class in sessions 1 to 5 [9]. For synchronous learning, the teacher used WebEx to meet the students face-to-face every week in virtual classrooms in sessions 1 to 15. CBL in SDL using a digital platform started from session 4, to 5, 6, 8, and 13 to enhance the application of quality improvement knowledge in the course in the workplace-based practice. Sessions 7, 9, 11, and 14 comprised online lecture base teaching.

6.2.2. Research Procedures

Developing the online course

The first researcher developed the content of the online *course, PHAD 661 Quality Management in Hospitals* in Digital Platform MUx (Mahidol University Platform). The method in designing and planning teaching, learning, and assessment included three steps of activities as described below:

- 1) March 2018, the first researcher prepared the content of the course.
- 2) April 2018, the first researcher attended the seminar preparing and design online courses (Small Private Online Class--SPOC) organized by the division of education administration, Mahidol University.

- 3) July-October 2018, the first researcher prepared 15 videos (7 to 10 minutes in length), 6 research articles to read, and 5 assessments tools to enhance individual active learning.

Consequently, all 15 videos, support materials, and assessments were designed and planned to align with course learning outcomes, to change the environment of teaching, learning and assessment in this course [9] and upload to the MUX platform. The online course was reviewed by the two experts from Chulalongkorn University and Sukhothai Thammathirat Open University regarding content validity and quality of the online course. The new design of this course intended to use technology to enhance the SDL for adults.

From the constructivist viewpoint and moving towards student-centred philosophy [10], this course used several learning approaches such as 1) CBL; 2) technology enhanced learning; 3) workplace-based learning; and 4) SDL to enhance student outcome in the graduate study. For student assessment, the researcher used rubric score to assess CBL using both oral presentation and written report as the instrument for evaluating student achievement and open book written exam.

The three steps in the research process are described below.

1. Preparation before the course started

- a. One week before the class started, the first researcher sent the MUX Manual online study materials to every student by email. This manual helps students to access the course each week via the MUX platform. The students are required to login with the university account and learn the content in each session by themselves. These activities included watching videos, reading support material and completing their online quiz each week via the MUX online platform. This constituted the asynchronous leaning activity to enhance students' active learning and SDL. This SDL was required for students before they met with the teacher in the virtual classroom.
- b. Class orientation: In the course syllabus, class learning objectives, course learning outcome, method of teaching and learning, and assessment were explained to all students during the introduction of session one.

2. Learning in the virtual classroom and CBL

2.1. The virtual face-to-face in the classroom

- a. In each session, the teacher used IT (the MUX online platform of Mahidol University and the WebEx platform) to enhance the digital skills of the students. This new learning environment enhanced student SDL. The students could login

to study anytime and anywhere. In each session, the content and core knowledge were divided to three subtopics. Each subtopic lasted 7 to 10 minutes in length. These videos contents were available 24 hours for students to learn at their own pace. The students used Mahidol University email to login to the online lesson before meeting the teacher in the virtual classroom via the WebEx platform face-to-face every week.

- b. In the virtual classroom, sessions from 1 to 5, the students discussed the key concepts from the video, summarized the key issues, and shared with their peers and teacher. This flipped classroom technique enhanced the active learning of the students, where the teacher acted as facilitator. The teacher asked questions to encourage the students to link key issues to their workplace to prepare them for developing CBL.
- c. In session 5, students shared their initial case study with their peer and teacher. These activities aimed to enhance the students' deep learning skills such as analytical, critical thinking, conceptualizing, application and communication skills [11]. In addition, the assigned CBL enhanced individual student ability to explore quality management in their workplace and develop students' deep learning in systematic thinking and analyzing the application of principle of quality management in their own settings [11]. In addition, the assessment scoring rubric was explained to students in oral presentations and written report case studies.

The students analyzed quality improvement techniques in their workplace and presented their case study in the class weeks 6, 7, and 8. The teacher listened to the students' presentations and provided feedback to each student. Using this approach, the students had opportunities to learn from their peer in different contexts because students came from different level of Thai healthcare services. The student workplaces varied from primary care to tertiary care and public to private sector. Using formative assessment and feedback each week, the students continued learning and adding on the key content in their case study. Teachers facilitated and guided students in the process of learning.

Before final presentation at weeks 14 to 15, teachers sent the scoring rubric criteria to every student and explained the criteria to evaluate their final oral presentation and written report. Students were assessed using rubric score and feedback from their peers and teacher. Research showed that deeper learning took place when learners could apply classroom gathering knowledge to real-world setting using case study [8]. Students learned to investigate,

design, and manage their own pace of learning by case study with the support from teachers.

The teacher played a role as a facilitator. For example, the teacher checked whether the level of complexity of the case study was appropriate for students and helped them gain confidence regarding what they were learning. The discussion helped the students go through the cycle of concrete experience, reflective observation, abstract conceptualization and active experiment [12].

To ensure the students stay with the scope of question, Teachers provided effective feedback and conducted ongoing formative assessment. The basic principle was that feedback helps to clarify the performance. It also provides opportunities to close the gap between the current and desired performance [13]. Teachers showed the students how they used scoring rubric concerning their work. In addition, the teacher also had the students provide feedback to their own work and other work. The scoring rubric served as the tool for self-assessment. This helped the students to develop and revise their case study reports.

6.2.3. Research Tools

The researcher developed three research tools for summative assessment of the course. These included 1) the open book written final exam; 2) the scoring rubric assessment for oral case study presentation; and 3) the scoring rubric assessment for written report case study. The content validity of these tools was reviewed by five experts. Using the Index of Congruence (IOC), total score from five experts were summarized as detailed below.

1. The open book final exam (Total score 20). The IOC index was 1.00.
2. The scoring rubric assessment for the oral case study presentation (Total score 30). The IOC score was more than 0.73.
3. The scoring rubric assessment for written report case study (Total score 30). The IOC score was 1.00.

With the criterion more than 0.5, the tools were accepted to use in this study.

6.3. Statistical Analysis

Descriptive statistics was used to analyse the general characteristics of the population and achieving the learning outcome score. The percentages of individual scores in each learning outcome compared with possible maximum score were presented. The overall mean and standard deviation of each learning outcome were also analyzed.

6.4. Ethics Approval

This study was approved by the Ethics Review Committee for Human Research of the Faculty of Public Health, Mahidol University. (Protocol No. 162/2564 Research with Exemption on December 9, 2021).

7. Results

Part 1. General characteristics of the population.

The number of students totalled 14. Most of the population were female (77.88%), and mean age was 31.36 ± 3.10 . The minimum was 25 years, and the maximum was 36 years. Most students' (92.86%) marital status was single, and (85.71%) were working in public hospitals. According to the students' academic background, most (85.71%) related to health science education (Table 1).

Table 1. Characteristics of student's enrollment in the course, academic year 2020-2021 (n = 14)

Characteristic of students	Number	Percent
Sex		
Male	2	22.22
Female	12	77.78
Age (Year)		
25-27	1	7.14
28-30	5	35.71
31-33	4	28.57
34-36	4	28.57
Min = 25, Max = 36 Mean± Standard Deviation = 31.36 ± 3.10		
Marital status		
Single	13	92.86
Married/Divorce	1	7.14
Location of work		
Public hospital	12	85.71
Private hospital	1	14.29
Academic background		
Related with health science education	12	85.71
Not related with health science education	2	14.29

Part 2. Achieving learning outcome score

The achieved learning outcome scores of graduate students using CBL in SDL using a digital platform were analysed using percentage, mean and standard deviation. Table 2 illustrates the score of 14 students.

The highest total score was 97.25% and the lowest score was 74.75%. The highest written case report score was 100% and the lowest score was 78 %. The highest oral case presentation was 98% and the lowest score was 78 %. The highest final written exam score was 95% and the lowest score was 65 %.

Table 3 reveals the mean score of the final written exam was 16.79 ± 1.86 . The highest score was 19 and

lowest score was 13. For CBL, the oral presentation mean score was 27.04±1.91 and written report mean score was 27.84±2.05. The total mean score was 71.66±5.48. The highest score was 77.8 and the lowest score was 59.8. More than 90% of graduate students using CBL in SDL in digital platform achieved learning outcome score more than 80% (92.9%).

Table 2. Individual scores of students (n=14)

Students	Final written exam (score 20) (%)	Oral case presentation (score 30) (%)	Written case report (score 30) (%)	Total score (score 80) (%)
no.1	18 (90%)	27.6 (92.00%)	27 (90.00%)	72.6 (90.75%)
no.2	18 (90%)	28.8 (96.00%)	30 (100%)	76.8 (96.00%)
no.3	19 (95%)	28.8 (96.00%)	30 (100%)	77.8 (97.25%)
no.4	14 (70%)	24.6 (82.00%)	27 (90.00%)	65.6 (82.00%)
no.5	18 (90%)	28.2 (94.00%)	28.5 (95.00%)	74.7 (93.00%)
no.6	19 (95%)	28.8 (96.00%)	30 (100%)	77.8 (97.25%)
no.7	17 (85%)	25.5 (85.00%)	29.4 (98.00%)	71.9 (89.88%)
no.8	15 (75%)	25.5 (85.00%)	27 (90.00%)	67.5 (84.38%)
no.9	13 (65%)	23.4 (78.00%)	23.4 (78.00%)	59.8 (74.75%)
no.10	17.5 (87.5%)	29.4 (98.00%)	29.1 (97.00%)	76 (95.00%)
no.11	15.5 (77.5%)	24.9 (83.00%)	24 (80.00%)	64.4 (80.50%)
no.12	19 (95%)	29.4 (98.00%)	29.4 (98.00%)	77.8 (97.25%)
no.13	15.5 (77.5%)	27.3 (91.00%)	28.2 (94.00%)	71 (88.75%)
no.14	16.5 (82.5%)	26.4 (88.00%)	26.7 (89.00%)	69.6 (87.00%)

The same rates were found in oral and written scores. However, only 64.3% of graduate students obtained final score more than 80%. (Table 4).

Table 3. Descriptive of learning outcome score

Learning Outcome Score	Mean	sd	Min	Max
Final	16.79	1.86	13	19
Oral	27.04	1.91	23.4	29.4
Organization profile (analytical skill)	6.84	0.65	5.7	7.5
Identify QM approach/technique	6.69	0.49	5.7	7.5
Apply theory to practice	6.77	0.46	6.0	7.2
Presentation style	6.75	0.65	5.7	7.5

Written	27.84	2.05	23.4	30
Organization profile (analytical skill)	6.90	0.54	5.7	7.5
Identify QM approach/technique	6.94	0.57	5.7	7.5
Apply theory to practice	7.05	0.52	6.0	7.5
Completion of writing element	6.94	0.51	6.0	7.5
Total	71.66	5.48	59.8	77.8

Table 4. Percentages of graduate students having more than or equal to 80% of learning outcome score

Learning Outcome Score	Students who having score more than or equal 80%
Final	64.3
Oral	92.9
Organization profile (analytical skill)	92.9
Identify QM approach/technique	85.7
Apply theory to practice	100
Presentation style	92.9
Written	92.9
Organization profile (analytical skill)	92.9
Identify QM approach/technique	92.9
Apply theory to practice	100
Completion of writing elements	100
Total	92.9

8. Conclusion and Discussion

Quality management is a principle using data and communication to integrate quality into an organization’s culture. It involves more application of management and is closer to health science and medicine education. The design of this course used CBL in SDL through a digital platform in *PHAD 661 Quality Management in Hospital* to move from teaching to adult learning.

This research revealed that 92.9% of students had achieving of learning outcome score more than 80% (13 from a total number 14 students). The empirical evidence reveals that using CBL enhanced the performance of the students in both of oral and writing skills. However, the final score revealed that 64.3 % of students achieved a learning outcome score more than 80% (10 from a total number of 14 students). These could be explained in that the academic background and workplace experience of these four students may have the affected their performance.

In addition, CBS is recommended to be implemented in health care field [5], [14], [15], [16]. J.E. Thiethwale et. al. stated that CBL enhanced effective learning in small groups through authentic

practice and worked well with the online learning environment [17].

CBL in SDL using a digital platform should be incorporated in the *PHAD 661 Quality Management in Hospitals* course. This approach can be used to assist graduates student in applying quality management knowledge in practices in real life situations, the decision-making skills to select the most effective methods and tools, and analytical skills to identify the problem and check for the improved result after implementing a plan or project. This instructional model met with 21st century education because it enhanced critical thinking, communication, collaboration, and creative skills of the students. This approach is appropriate during the COVID-19 pandemic and the university had to shift from face- to- face in the classroom to online.

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