

# The Development of a Massive Open Online Course (MOOC) in Nursing Care for Patients with Myocardial Infarction

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**Abstract**—The purposes of this study were to 1) develop the Massive Open Online Course (MOOC) in nursing care for patients with myocardial infarction, 2) examine the learning achievement after learning with the MOOC, and 3) To examine satisfaction towards the MOOC in nursing care for patients with myocardial infarction. The sample consisted of 453 learners who enrolled in nursing care for patients with myocardial infarction through the PSUMOOC system. The MOOC was developed considering components to facilitate learning, including video, learning activities, and self-tests. The instruments used in this study were 1) Achievement Test and 2) Satisfaction Towards MOOC Questionnaire developed by the researchers. The validity and reliability of the instrument were assessed. The differences in learners' scores before and after studying the MOOC, and satisfaction towards the MOOC were examined. Data were analyzed using descriptive statistics and paired t-tests. The findings revealed that there was a statistically significantly higher mean score of the learners' scores at the posttest than at the pretest ( $p < 0.01$ ), indicating higher learning achievement. The learners were very satisfied towards the MOOC in the dimensions of up-to-date content, learning activities, quality of pictures and graphics, and colors used in media of the course.

**Keywords**—massive open online course, nursing care, myocardial infarction

## I. INTRODUCTION

The emergence of new communication and information technologies provides an alternative platform that can be of great benefit to either complement or change our education system. Learners have become accustomed to buzzwords regarding technology-enhanced learning. One of the buzzwords is “MOOC,” short for “Massive Open Online Course” [1]. MOOCs are delivered through an open and distributed e-learning environment. This platform expands the enrolled learners beyond the limit of time (anytime; beyond the scheduled teaching program), space (anywhere; beyond the boundary of a classroom), pace (at each individual's speed of learning), and can be done repeatedly as needed. The design, development, implementation, and evaluation of open and distributed learning systems require thoughtful analysis and investigation of how to use the attributes and resources of the internet and digital technologies in concert with instructional design principles and issues important to various dimensions of online learning environments [2, 3].

A massive open online course, first introduced in 2002, emerged from the institutes aiming at unlimited knowledge to the general public. MOOCs, in the early phase, often emphasized open-access features for all learners. MOOCs have been provided for everyone, including persons who are interested in learning without credit. Many institutes believe that MOOCs provide supporting interactions and preparations among learners

associated with the open learning concept of an open university [4]. While there are benefits, MOOCs currently face several challenges [3]. The major challenges associated with MOOCs are high dropout rates and issues concerning course completion and success [5]. Moreover, obstacles in MOOC are also associated with implementation challenges, for instance, administrative, technical, and participant related aspects [6].

The researchers aimed to develop a massive open online course in nursing care for patients with myocardial infarction to align with higher education in the nursing area to promote learning achievement of the learners for gaining knowledge to apply to other subjects and the strength to sustainably underpin the learners to experience and provide nursing care for patients with myocardial infarction.

## II. THE PURPOSES OF THE STUDY

The purposes of this study were:

- (1) To develop a MOOC in nursing care for patients with myocardial infarction
- (2) To examine the learning achievement with the MOOC in nursing care for patients with myocardial infarction
- (3) To examine satisfaction towards the MOOC in nursing care for patients with myocardial infarction.

## III. RESEARCH METHODOLOGY

The research employed a one-group pretest-posttest design. The sample consisted of 453 learners who enrolled in nursing care for patients with myocardial infarction in the PSUMOOC system.

The research consisted of two phases:

Phase 1: Analyzing and synthesizing related literature to develop the massive open online course in nursing care for patients with myocardial infarction.

The researchers analyzed and synthesized the concepts, principles, theories, and research studies concerning four areas; 1) scope of content, 2) content development, 3) implementation, and 4) evaluation. In this phase, scope of content was identified, content was developed, and implementation of video was conducted and evaluated.

Phase 2: Developing the MOOC in nursing care for patients with myocardial infarction. The researchers used the information from Phase 1 to create the MOOC course. In this phase, the MOOC in nursing care for patients with myocardial infarction was developed and refined to meet the learners' needs and facilitate learners to achieve learning outcomes. The MOOC was prepared considering components to facilitate learning, including video, learning activities, and self-tests.

Video was created concerning 1) video lecture content from simple to complex content; 2) video interface designed to facilitate learners' needs and pace of learning. Learners were able to navigate according to their needs. Text of the video was also provided to aid learning as needed. Learning activities were created, including case studies, chat room, discussion board, and quiz. Self-test was provided for each lesson.

After the course and contents of the MOOC in nursing care for patients with myocardial infarction were constructed, the MOOC was validated by three experts with expertise in caring for patients with cardiovascular diseases and e-learning. The revision was then performed according to the experts' comments and suggestions.

Research instruments were 1) Achievement test, a multiple-choice test to measure learners' learning achievement that was examined for its reliability using Kuder-Richardson (KR-20) formula; and 2) Satisfaction towards MOOC questionnaire developed by the researchers comprising 5 Likert scales items, ranging from 1 (least satisfied) to 5 (very satisfied). The satisfaction towards MOOC was examined to measure satisfaction with the content, sequence of the content, attractiveness of presentation, case studies, learning activities, quality of pictures and graphics, and colors used in media of the course.

Data analysis of this research was performed by examining the differences in learners' scores before and after studying the MOOC using paired t-tests. Before analyzing the data, the assumption of normality was examined by checking standardized skewness and standardized kurtosis. The results of testing the assumption indicated that the assumption was met. The data obtained from satisfaction towards MOOC questionnaire were analyzed using descriptive statistics.

## IV. RESEARCH RESULTS

The MOOC in nursing care for patients with myocardial infarction is derived from collecting, analyzing, and synthesizing related published data. The MOOC format is composed of 1) Content: distributed mainly in video-lecture format and focused on a complete course, e-learning, module content, learning media, sources of information, and references, 2) Various Learning tools: such as Learning Management System (LMS) and PSUMOOC, an online learning platform provided by Prince of Songkla University to aid in delivery of educational programs 3) Implementation: content resources delivered through online and multimedia, sources of development and delivery, and open licensing of content by strictly complying with the intellectual property rights.

The course content focuses on essential content regarding nursing care for patients with myocardial infarction. The detail of the course content is as follow.

- (1) Essential knowledge of myocardial infarction; consisting of anatomy and physiology of the heart, risk factors of myocardial infarction, pathophysiology of myocardial infarction, and complication of myocardial infarction
- (2) Diagnosis of myocardial infarction; physical examination, clinical manifestation, laboratory investigation, electrocardiogram, and differential diagnosis
- (3) Nursing care for patients undergoing cardiac catheterization and percutaneous coronary intervention; consisting of indication for cardiac catheterization, indication for percutaneous

coronary intervention, types of percutaneous coronary intervention, nursing care before, during, and after cardiac catheterization and percutaneous coronary intervention, nursing care to prevent complication, and nursing care for patients with myocardial infarction in critical phase

- (4) Medication for patients with myocardial infarction; consisting of antithrombotic drugs, antiplatelet drugs, beta-blockers, angiotensin converting enzyme inhibitors, and angiotensin receptor blockers
- (5) Nursing care for secondary prevention; consisting of prevention of restenosis, prevention of cardiovascular event recurrence, healthy dietary behaviors, modification of risk factors, and factors related to health behaviors
- (6) Integration of eastern wisdom in nursing care for patients with myocardial infarction; consisting of advantages of integrating eastern wisdom in nursing care for patients with myocardial infarction, eastern modalities including meditation, yoga, tai-chi, and massage.

Video lecture content was created to facilitate learners' learning and motivation to learn. The animation was created. Importantly, the real situation in cardiac catheterization laboratory was included in the video.

Media specification is the way to determine tools used in content development. This study used a non-commercial or free-of-charge service, for instance, Open-Source Software. The tools are (1) E-book, (2) Website, (3) Picture, and (4) Video.

Content Development details are as follows:

- (1) Participants in this research were nurses and nursing students. It is essential to specify a target group to obtain appropriate program development.
- (2) Level of content difficulty should be aligned with the learners' capabilities.
- (3) Open licenses, namely creative commons, is the permission that allows promoting and using the learning resources and structures in an online course of MOOC for free to the public under conditions decided by the providers. The use of MOOC would most benefit every country once the open licenses are accepted worldwide. MOOC could be constructed based on the creative commons' attribution license to:

- 3.1 Give the author or licensor the credits (CC BY);
- 3.2 Give the author or licensor the credits and distribute derivative works only under a license identical (CC BY-SA);
- 3.3 Give the author or licensor the credits and copy, distribute, display, and perform only verbatim copies of the work; not derivative works or remixes (CC BY-ND);
- 3.4 Give the author or licensor the credits and copy, distribute, display, and perform the work and make derivative works and remixes only for non-commercial purposes (CC BY-NC);

3.5 Give the author or licensor the credits and distribute derivative works only under a license identical only for non-commercial purposes (CC BY-NC-SA), and;

3.6 Give the author or licensor the credits and copy, distribute, display, and perform only verbatim copies of the work; not derivative works or remixes for non-commercial purposes (CC BY-NC-ND).

- (4) Content and media development
  - 4.1 Analyze the needed contents
  - 4.2 Develop contents
  - 4.3 Evaluate the content and provide feedback from experts before applying as a MOOC in nursing care for patients with myocardial infarction
  - 4.4 Develop the MOOC in nursing care for patients with myocardial infarction to be incorporated into the PSUMOOC system
  - 4.5 Develop video, media, and other tools in the PSUMOOC system, evaluated by the experts prior to implementation
- (5) Implementation: The distribution of the MOOC was incorporated into the online learning platform in the PSUMOOC system
- (6) Lessons and activities designed in the MOOC: The lessons were formulated from foundation knowledge to complex knowledge and skills to provide nursing care for patients with myocardial infarction. The MOOC activities include using questions to gain learners' attention. The elements of the MOOC are: 1) Introduction, 2) Objective, 3) Content, 4) Activity, 5) Resources, 6) Evaluation, 7) Instructors' profile, 8) Bulletin Board, 9) Chat Room and Discussion Board for the learners to exchange knowledge and encourage interaction between learners and instructors.
- (7) Assessment: Pretest was provided at the beginning of the course. A quiz was offered at the end of each lesson and used as formative assessment for self-improvement. The final posttest was conducted at the end of MOOC as summative assessment.

The MOOC in nursing care for patients with myocardial infarction was developed. The expected learning achievements after studying with the MOOC were specified as follows:

- (1) Learners could explain the concept of diagnosis and holistic nursing principles for caring for patients with myocardial infarction.
- (2) Learners could describe nursing care in pharmacotherapy, nursing care for patients undergoing percutaneous coronary intervention, discharge planning, and cardiovascular health promotion.
- (3) Learners could describe the significance and principles of cardiac rehabilitation.
- (4) Learners could analyze and conduct a nursing care plan for patients with myocardial infarction in a case scenario.

- (5) Learners could integrate eastern wisdom in nursing care for patients with myocardial infarction.

MOOC Learning activities were designed to facilitate learners' learning and motivation to learn. Self-study from video stimulated learners' attention, provided clear understanding and insight for procedures related to treatment and nursing care for patients with myocardial infarction. Self-study from provided learning resources, articles, and other learning activities that were offered to augment learning. The proportion of the MOOC activities is described in Fig. 1.

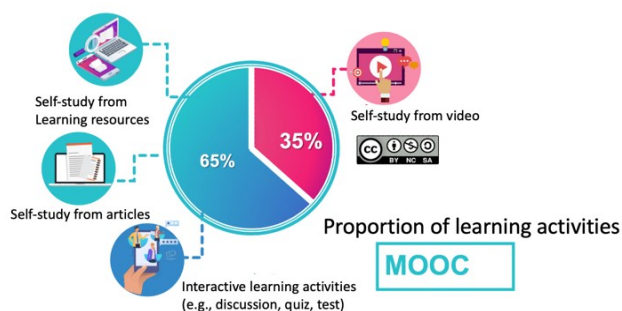


Figure 1. Proportion of MOOC activities.

Learners' scores obtained from the Pretest were used as before learning scores. Learners' final posttest scores were used as after learning scores. Paired t-test was used to analyze the difference in learners' mean scores before and after learning with the MOOC.

Results from the study revealed that learners' mean score at posttest was statistically significantly higher than pretest ( $p < 0.01$ ), indicating learning achievement of learning using MOOC in nursing care for patients with myocardial infarction as presented in Table I.

TABLE I. COMPARISON OF LEARNERS' MEAN SCORES BEFORE AND AFTER LEARNING WITH THE MOOC USING PAIRED T-TEST

| Testing  | Mean  | SD   | t     | df  | p      |
|----------|-------|------|-------|-----|--------|
| Pretest  | 25.49 | 9.12 | -4.08 | 452 | < 0.01 |
| Posttest | 36.06 | 4.11 |       |     |        |

TABLE II. THE LEARNERS' SATISFACTION TOWARDS MOOC IN NURSING CARE FOR PATIENTS WITH MYOCARDIAL INFARCTIONS

| Learners' satisfaction                                   | Mean | SD    | Interpretation |
|--|------|-------|----------------|
| The content is up to date                                | 4.65 | 10.88 | Very satisfied |
| The sequence of content facilitates understanding        | 4.30 | 9.42  | Satisfied      |
| Presentation is attractive and facilitates understanding | 4.46 | 9.10  | Satisfied      |
| The case studies in the course are sufficient and clear  | 4.46 | 9.66  | Satisfied      |
| The learning activities in the course are appropriate    | 4.51 | 9.76  | Very satisfied |
| The quality of pictures and graphic                      | 4.68 | 11.22 | Very satisfied |
| The colors used in media of the course                   | 4.54 | 9.81  | Very satisfied |

Results of the learners' satisfaction towards MOOC in nursing care for patients with myocardial infarction revealed that the learners were satisfied towards MOOC in

nursing care for patients with myocardial infarctions in the dimensions of sequence of the content, attractiveness of presentation, and case studies in the courses. The learners were very satisfied towards the MOOC in the dimensions of the up-to-date content, learning activities, quality of pictures and graphics, and colors used in media of the course (Table II).

## V. DISCUSSION

The results of this study showed that technology could promote the achievement of learners to acquire learning outcomes. Facilitating appropriate online learning environments is vital for learners' comprehension and learning achievement. Findings from this research were consistent with previous research studies in supporting learners' learning achievements through MOOC. Duangnim [7] reported that massive open online learning environments supported learners' learning achievement. The learners' posttest scores of learning achievement were significantly higher than their pretest scores at 0.01 level of significance and the results of the learner satisfaction study were at the highest level. In addition, massive open online learning also promoted learners' self-directed learning.

The results of this study were consistent with existing studies. Ochaampawan [8] reported the research results of the development of massive open online course integrated with podcasts on nursing patients with arrhythmia and interpreting electrocardiograms to enhance nursing learners' learning achievement. The participants were undergraduate nursing learners. The findings revealed that there was significantly higher learning achievement of the learners in the posttest than in the pretest at 0.01 level of significance. In addition, learners' satisfaction with MOOC on integrating with podcasts was reported at the high level.

Pungchompoo [9] studied the development of innovation in nursing education regarding a massive open online course in gerontological nursing. The research aim was to support learning and teaching in nursing education by following the Thai National Education Policy 4.0. The findings were that after participating the MOOC, learners' learning outcomes were statistically significantly higher than before participating the MOOC ( $p < 0.05$ ).

## VI. RECOMMENDATIONS

From the implications of these results, the researchers proposed recommendations for implementation and further research as follows:

- (1) The design of MOOC is flexible and can be adjusted according to the characteristics of learners to achieve specific learning outcomes.
- (2) The instructors should be well prepared before implementation of the course.
- (3) Prior to implementing the MOOC, a meeting should be set with instructors, learners, and all stakeholders to clarify expected learning outcomes, learning processes, and learning activities.

- (4) The commitment of all parties is significant to the effectiveness and success of a MOOC implementation.

## VII. CONCLUSION

The MOOC in nursing care for patients with myocardial infarction was developed and refined covering essential content to meet learners' needs and expected learning outcomes. Learning resources and learning activities were incorporated to facilitate and motivate learning, including video with animation and real situations, case studies, and self-tests. The results of this study demonstrated that MOOC enhanced learners' learning achievement. Satisfaction towards MOOC was reported. The results provided insight for utilizing MOOC as a promising learning modality to promote effective and sustainable learning, and facilitate learners' self-directed and life-long learning. Additionally, MOOC expands opportunities and increases the accessibility of learning.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHOR CONTRIBUTIONS

CK designed the MOOC and the study; OK identified the learning activities, and collected data; CK and OK analyzed data; CK, TC, ST, SS, KSH, PR, and TL carried out the MOOC; CK and OK wrote this paper. All authors had approved the final version.

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## REFERENCES

- [1] B. H. Khan, *User Interface Design for Virtual Environments: Challenges and Advances*, Hershey, PA: IGI Global Publishing, 2012.
- [2] W. D. Milheim, "Massive Open Online Courses (MOOCs): Current applications and future potential," *Educational Technology*, vol. 53, no. 3, pp. 38–42, 2013.
- [3] R. M. Quintana and Y. Tan, "Characterizing MOOC pedagogies: Exploring tools and methods for learning designers and researchers," *Online Learning*, vol. 23, no. 4, pp. 62–84, 2019. doi: 10.24059/olj.v23i4.2084
- [4] M. Yilan, "The online interface and social inclusion: A MOOC study in Turkey," *Journal of Interactive Media in Education*, vol. 1, no. 12, pp. 1–10, 2020. doi: 10.5334/jime.558
- [5] I. Bingol, E. Kursun, and H. Kayaduman, "Factors for success and course completion in massive open online courses through the lens of participant types," *Open Praxis*, vol. 12, no. 2, pp. 223–239, 2020.
- [6] M. Ponnaiah, T. Bhatnagar, P. Ganeshkumar, *et al.*, "Design and implementation challenges of massive open online course on research methods for Indian medical postgraduates and teachers-descriptive analysis of inaugural cycle," *BMC Medical Education*, vol. 22, 369, 2022. doi: 10.1186/s12909-022-03423-6
- [7] A. Duangnim, W. Napapongs, O. Kaosaiyaporn, *et al.*, "Development of massive open online learning environments to promote self-directed learning based on constructivist approach," *Journal of Information and Learning*, pp. 1–13, 2021.
- [8] K. Ochaampawan, O. Kaosaiyaporn, W. Atisabda, and C. Kritpracha, "Development of massive open online course integrating with podcasts on nursing patients with arrhythmia and reading electrocardiogram to enhance nursing learners learning achievement," in *Proc. 2nd SEA-STEM International Conference (SEA-STEM)*, 2021, pp. 19–21. Doi: 10.1109/SEA-STEM53614.2021.9668119
- [9] W. Pungchompoo, N. Suwankruhasn, and B. Saengru, "Developing of innovation in nursing education: A Massive Open Online Course (MOOC) in gerontological nursing," *Nursing Journal*, pp. 103–110, 2017.

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