

# SYNERGIZING THE ACADEMIC CREDIT BANK SYSTEM AND THE THAI NATIONAL DIGITAL LEARNING MASSIVE OPEN ONLINE COURSE PLATFORM FOR LIFELONG LEARNING: A DATA-MINING APPROACH

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## ABSTRACT

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**Received:** 25 February 2025

**Revised:** 20 August 2025

**Accepted:** 27 August 2025

**Published:** 18 November 2025

### Citation:

Thammetar, T., Khlaisang, J.,  
& Theeraroungchaisri, A.  
(2025). Synergizing the  
academic credit bank system  
and the Thai national digital  
learning massive open online  
course platform for lifelong  
learning: A data-mining  
approach. *Humanities, Arts  
and Social Sciences Studies*,  
25(3), 721–735.  
[https://doi.org/10.69598/  
hasss.25.3.275987](https://doi.org/10.69598/hasss.25.3.275987)

This study analyzes user behavior to support the development of Thai massive open online course (MOOC) in Thailand. Data analysis was conducted using data-mining techniques on questionnaire responses from 2,230 users. The study obtained the following results. Analysis of learners' basic information and course trends derived from MOOC courses reveal that more than 250 students design a micro credit and alternative credit system, including a credit bank system. In terms of user interface, the results underscore the formats of contents, activities, and learning styles. Lastly, analysis of basic data on the Thai MOOC digital learning platform indicates that further development of the academic credit bank system is required. The study identified the need for a curriculum that focuses on vocational skills to develop work competencies, the accumulation and transfer of credits between universities, and recognition of previous credits and certificates to pursue a master's degree. Thai MOOC users were mainly composed of students (30.04%), government officials (25.65%), and private employees (14.44%). In general, learners sought to upskill (83.41%), apply learning to daily life (68.57%), and conduct interest-based study (68.21%). We observed two patterns of registration in three consecutive courses, namely, (1) Personality, Psychology, and Adjustment; Startup: Pushing your Dream; and Consumer Behavior and Retailing Business in the Digital Age and (2) Startup: Pushing your Dream; Online Store Entrepreneur; and Consumer Behavior and Retail Business in the Digital Era. The top three patterns of registration in two consecutive courses included: (1) English for Communication and English Start Up, (2) English for Communication and Easy English for Everyday Life, and (3) Psychology and Daily Life and English for Communication.

**Keywords:** Thai massive open online course; data mining; credit bank; micro credits; learning style

## 1. INTRODUCTION

The COVID-19 pandemic brought about profound changes in education. As a result, technology became critical in facilitating online learning. Meanwhile, learning adopted a self-paced approach. Against this background, educational digital transformation has mainly focused on the personalization of educational processes based on digital technologies (Kopylova, 2023). An example is massive open online courses (MOOCs), which are mainly utilized at the institutional level (institutional MOOCs) and national level (Office of the Education Council, 2021). MOOCs have contributed to an in-depth understanding of concepts related to online teaching and learning and digital transformation (Langseth et al., 2023). In 2005, the Ministry of Higher Education, Science, Research and Innovation in Thailand launched the Thailand Cyber University (TCU) Project to improve access to e-learning for higher education students and individuals from diverse backgrounds. Utilizing Thailand's Inter-University Network, TCU was intended to enhance accessibility to postsecondary education and foster a knowledge-based society. In 2017, the project launched the *Thai MOOC* platform, which targets higher education learners, instructors, government officials, employees, and entrepreneurs, while promoting lifelong learning among the public. This initiative encourages academic collaboration through open online teaching and resource sharing among tertiary institutions. In 2023, the number of Thai MOOC uses reached approximately 1.7 million, out of whom 673,854 received certificates. The COVID-19 pandemic witnessed an average of 35.5–50 thousand daily users (an increase of 58.7%) (Chunwijitra et al., 2020; Office of the Education Council, 2020; Park et al., 2019; Thai MOOC, 2021; Thammetar et al., 2022; Theeraroungchaisri & Khlaisang, 2019).

Thai MOOC focuses on four key areas: (1) development of a national digital learning platform for distance education, (2) creation of diverse courses to meet the demands of higher education and benefit the public, (3) improvement in the quality of the teaching and learning platform, and (4) expansion of educational networks, in particular among key institutions in the four major regions of Thailand. The objective is to establish a central system for open online education and a comprehensive IT architecture for the country. At present, Thai MOOC offers 569 courses in collaboration with government universities and institutions. The system collects data on students, including study records, academic results, and course credits. Thai MOOC enables the facilitation of cooperation in credit-bearing courses through cross-registration and credit transfers to support lifelong learning (Chunwijitra et al., 2020; Office of the Education Council, 2020; Park et al., 2019; Theeraroungchaisri & Khlaisang, 2019). Despite these developments, Thai MOOC continues to face limitations in relation to accreditation and credit transfer. Although the platform collects student records and enables universities to design credit-bearing courses, no standardized national mechanism ensures that MOOC credits are formally recognized across higher education institutions. The accreditation of Thai MOOC courses remains mainly dependent on the policies of individual universities, which leads to low levels of adoption.

Rizvi et al. (2018) analyzed the factors that affect course completion in MOOCs. The authors found that the design of learning activities, including video viewing, discussions, and test-taking, influenced MOOC-based learning. In addition, a survey on the learning behaviors of students who successfully completed a program demonstrated low levels of engagement in learning and learning tasks compared with testing. A potential underlying reason is that these students may have basic knowledge of a given topic. Sanz-Martínez et al. (2019) grouped learners with similar engagement patterns in MOOCs and applied a cooperative teaching methodology. The results indicated that this approach can help increase course completion rates. Tungpantong (2017) examined the achievement of online learning among Thai Internet users aged 17–36 years, specifically focusing on 300 undergraduate students from King Mongkut's University of Technology Thonburi who participated in Thai MOOC. The study found that quality in terms of system, information, and service positively influenced usage and satisfaction, in which satisfaction was correlated with user achievement.

Research on learner behaviors in the use of MOOCs intends to explore behavioral patterns based on the structural factors of MOOCs such as various support features and engagement in content that align with learner interests. It also focuses on the provision of user feedback to obtain an analytical model that could be used to predict new learners. The current study aims to analyze learning behaviors using a data-mining approach. Data obtained in designing the process can be used to encourage users to succeed in learning. The study covers learning styles, support features that promote learning, and media formats tailored according to learners' behaviors with the objective of improving service quality to maximize benefits.

## 2. OBJECTIVE AND RESEARCH QUESTIONS

This study examines user behaviors to develop a Thai MOOC that is responsive to users and to provide data as reference for the TCU project in conducting institutional research. The research questions are as follows:

- a. What learner basic information and course trends can be identified using statistics on the teaching management of Thai MOOC courses with more than 250 students for application in designing learning in the form of micro credits, alternative credit systems, and a credit banking system?
- b. What does the analysis of basic data on the user interface of the Thai MOOC platform reveal in terms of formats of content (videos), activities, and learning styles?
- c. What information can be obtained from basic data on the Thai MOOC learning platform for developing a credit bank system?

### 3. LITERATURE REVIEW

#### 3.1 Learning in the form of credit banking, alternative credits, and micro credits

The credit banking system, which was introduced in South Korea in 1998, promotes lifelong learning through the accumulation of credits from various activities such as self-study, personal certifications, and part-time university courses. These credits can be transferred to accredited higher education institutions. Nuffic (2016) described this system as flexible, promoting learning among the public through diverse activities within and outside of the classroom, including training, e-learning, and certified courses. In this system, learners can apply for credit transfers for use in higher education (Choi, 2007; Chunwijitra et al., 2020; Kim & Yun, 2017; The National Institute for Lifelong Education, 2017; Shanghai Open University, 2019). In the ASEAN region, credit transfers enables students to move between higher education institutions domestically and internationally. This system is time- and cost-efficient for courses that permit credit transfers (Heppner et al., 2019; Kim et al., 2014; Share, 2016). A micro-credentialing system enables students to complete brief modules related to their interests, with flexible access to learning resources in terms of time and location. Moreover, students can transfer credits from MOOC courses for career development (Malaysian Qualifications Agency, 2019), which provides them with freedom to set personalized learning objectives and study plans. This approach enhances their experience and promotes the application of knowledge and skills (Lim et al., 2018). The credit bank system in Thai MOOC promotes lifelong learning and is accessible to all. Users can review lessons anytime and anywhere. Study conducted on Thai MOOC can be utilized as follows: (1) as continuing education credits in various professions, (2) as part of a regular course at universities, (3) for use in professional qualification assessments conducted by the Institute of Professional Qualification Development, and (4) for the development of personal knowledge, competency, and general interest.

In Thai settings, the credit bank system has been introduced to link lifelong learning with formal higher education qualifications (Office of the Education Council, 2020). Nevertheless, the incorporation of Thai MOOC into this system remains limited. At present, only a few courses are accredited for transfer, which is dependent of partnerships with specific universities. Learners who complete MOOC courses are typically given certificates, but it does not automatically equate to transferrable academic credits. This scenario creates a gap between the potential of MOOCs as flexible, low-cost alternatives to formal education and their recognition in higher education institutions. Figure 1 shows a sample of the overview page of Thai MOOC.

#### 3.2 User interface design for a national digital learning platform

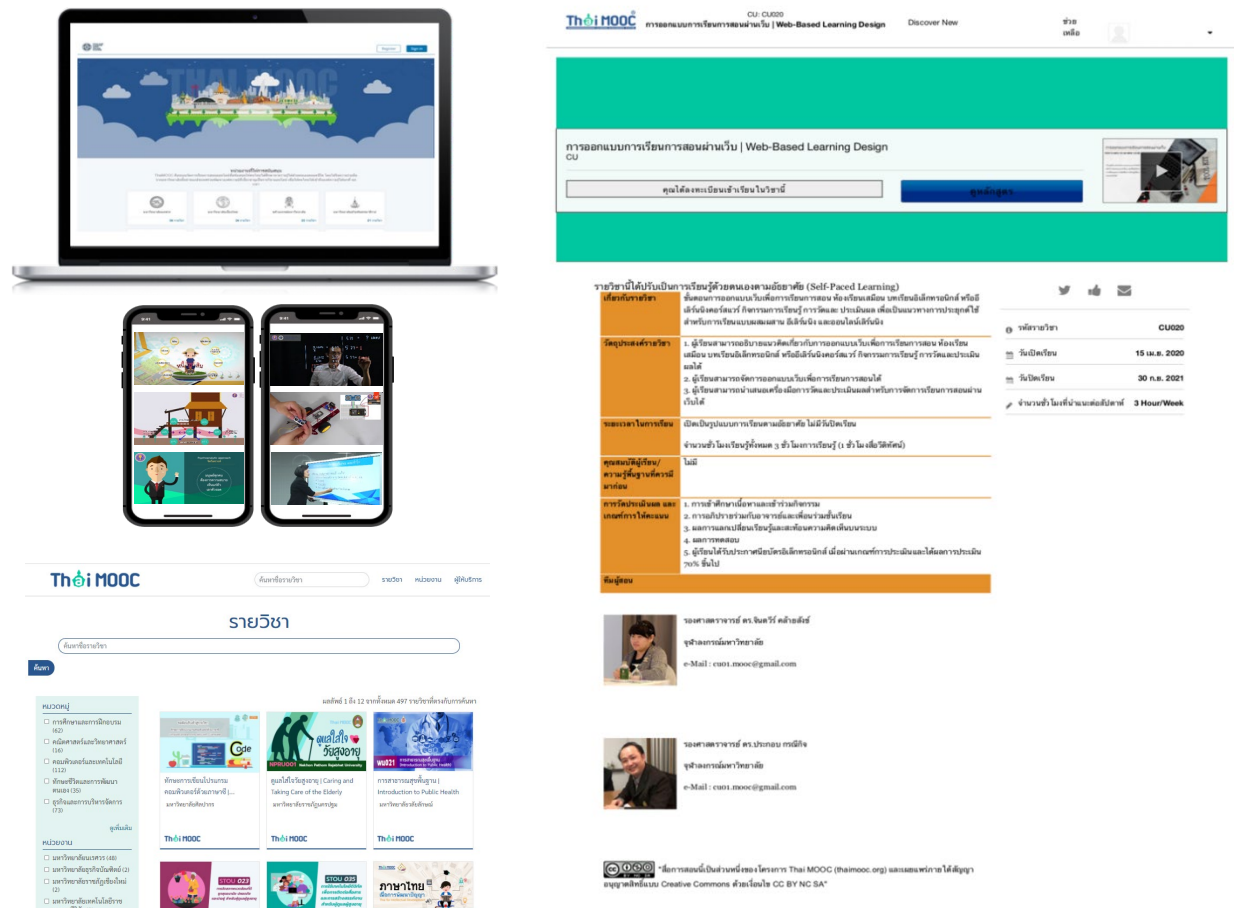
A user interface is a feature that fosters communication and interaction between users and computer software (Faghih et al., 2013). It enables the efficient and easy utilization of the system (Lu et al., 2019; Oppermann, 2002). In educational contexts, the design of the user interface is intended to provide learners with a structured understanding of learning, learning methods, and learning processes. It considers learning needs, learning strategies, ease of use, and learner motivation (Lu et al., 2019; Oppermann, 2002; Park & Song, 2015; Railean, 2016).

User interface design in educational contexts should consider the (1) design of the screen display, including font size, font style, color, and style of buttons and icons in terms of appropriateness for content presentation, (2) use of audio narration, medium of communication, tone of voice, and sound effects in learning, (3) interaction between users and the screen, (4) navigation, which may include the form of animation and avatar to assist learners during activities, and (5) general user information, including age, learning objectives, motivation, goals, learning strategies, and learner experiences (Dhir & Alsumait, 2013; Faghih et al., 2013; Korableva et al., 2019).

#### 3.3 Guideline for MOOC instructional design

Several studies on learning behaviors related to MOOCs were conducted to identify the factors that influenced completion rates. Areas of study included video viewing behavior, clickstream (Lemay & Doleck, 2020), learning time and motivation (Chen et al., 2020), and exercise- or task-completion behavior (Qu et al., 2019). The results were used as a guideline in designing MOOCs to decrease dropout rates and increase learning success.

The design of courses in Thai MOOC establishes details of courses and course lessons. A course must contain video materials that comprise approximately 35% of learning hours and other teaching and learning activities, which should be no less than 65%. The components of a course in Thai MOOC consists of (1) course information, including, for example, course description, behavioral objectives, content structure, learner qualification, and criteria for passing the course, (2) course assessment, which includes pre- and post-tests, exercises, and criteria for obtaining a certificate after passing course requirements, (3) discussion, which includes open spaces in which students can exchange ideas, and (4) additional resources, including documentary files for reading, recommended books, and websites.



**Figure 1:** Sample of the overview page of Thai MOOC (thaimooc.org), including a course and overview page, a main page, and video media content

## 4. METHOD

### 4.1 Instrument and procedure

The study used data mining to present basic information on Thai MOOC usage, which will serve as reference for developing a credit bank system. The following steps were taken:

- (1) Review of related literature on MOOCs and credit systems: This includes literature related to MOOCs, conditions, and general information of the system at the domestic and international levels;
- (2) Extraction and analysis of learner behavior derived from the Thai MOOC database: Data mining analysis was used in this step. Data were divided into four areas: (a) credit system, (b) learning effort (number of interactions with lessons and time spent by students on learning on Thai MOOC, (c) learning flexibility in using the Thai MOOC, which is expected to be straightforward and provide easy access to various information. These data are determined using the number of interactions between learners and the user interface, and (d) learning motivation. Using Thai MOOC, learners set goals in learning and exhibit specific behaviors to achieve them. These behaviors are determined through the learning management of instructors in Thai MOOC and

learner motivation such as upskilling (upgrading of skills) and reskilling (learning new skills to change their line of work).

- (3) Development of strategies for increasing course completion. This step involves posing recommendations for methods of increasing course completion rates.

#### 4.2 Data analysis

Secondary data were obtained from the central database of Thai MOOC, which includes records of learner enrolment, course activities, time logs, and interaction patterns. The dataset included 564,322 user registrations between January 2018 and June 2020, out of which the study selected a sample of 2,230 active learners who responded to a survey conducted by Thai MOOC for detailed analysis. Sampling was conducted using a voluntary response method, as which learners opted to participate in the survey and provided consent for data usage in the Thai MOOC platform.

Python was used to process data for analysis. The study used cluster analysis to identify learner groups, association rule mining to examine patterns of course enrolment, and classification analysis to predict learner outcomes. Data cleaning and preprocessing steps included omitting duplicate entries, handling missing values, and normalizing interaction frequency and time-spent features.

Table 1 presents the literature review and related research on learning design in micro credits, alternative credits, and credit bank systems, along with basic information on user interfaces, instructor profiles, and platform features according to category.

**Table 1:** Learning categories and features in Thai MOOC

Category	Feature
<b>General information</b>	
1. Basic information of learners	Occupation* Learning goal Background and experience Learning style
2. Credit bank system	Number of courses learned within the credit bank system* Number of courses that awards certificates to learners after course completion* Number of learners who applied the credit bank system for transfer of experience* Number of universities or educational institutions that support the credit bank system and transfer of experience*
<b>User interface</b>	
3. Screen interaction	Frequency of adjusting the display screen according to learner preferences. Frequency of pressing a screen button to access lessons and other related menus*
4. Interaction with videos and lessons	Time allocation for watching video tutorials Frequencies of pausing a video and exiting a lesson Frequency of increasing video speed Frequency of decreasing video speed Frequency of consulting an agent for advice during lessons
5. Learning resources	Frequency of using additional external learning resources
6. Student attendance	Duration of time a learner spends for each lesson Frequency of submitting assignments
7. Learning path	Frequency of choosing a topic (quick stream of content and exercises)* Time allocation for learning tasks* Frequency of canceling or changing learning topics* Order of topics learners choose to study (in the case that they are allowed to do so) Frequency of viewing learning progress Continuity of learning in each topic (login, duration of each login)*
8. Interaction with other learners	Frequencies of discussing and exchanging ideas with other learners Frequency of discussing with instructors

**Table 1:** Learning categories and features in Thai MOOC (continued)

Category	Feature
<b>Instructor information on learning management in MOOC</b>	
9. Basic information on instructors	Experience Voice and teaching personality
10. Teaching method design	Length of instructional videos Frequency of assigning workloads to students (discussion related to assignments and success in exercises and quizzes) Number of teaching methods used such as lectures, demonstrations, and inquiry-based instruction
11. Teacher interaction	Frequency of giving feedback to learners* Frequency of giving instruction to learners* Frequency of encouraging or motivating learners to complete activities*

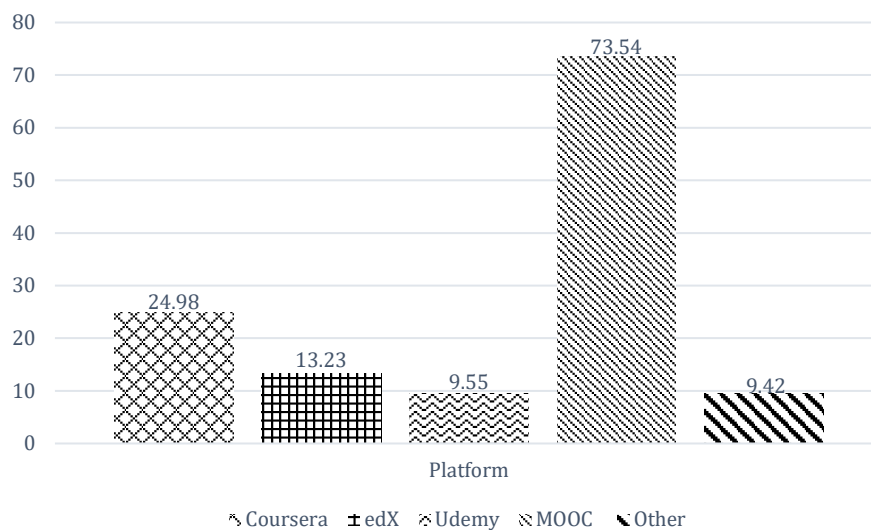
Note: These data were not available in the system. Therefore, results were not analyzed or reported. However, the features in this category are important. For this reason, the study presents them as a guideline for future data collection.

## 5. RESULTS

### 5.1 Learner behavior while using the Thai MOOC system

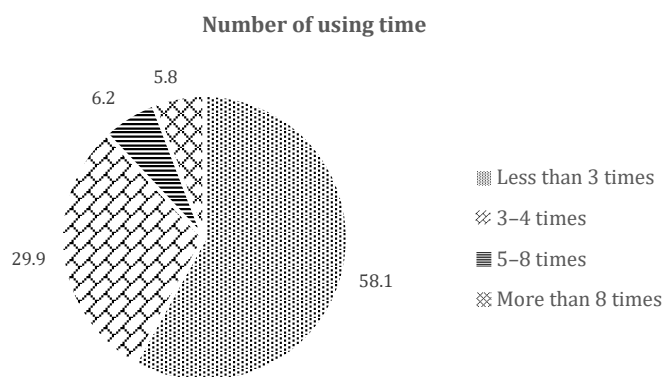
#### 5.1.1 General information of the users

The study found that the majority of learners (30.04%) were students followed by government officers (25.65%) and private employees (14.44%). The majority of users were aged more than 30 years (50.54%). In addition to learning on Thai MOOC, other online learning platforms used were MOOCs of educational institutions (73.54%) followed by Coursera (24.98%) and edX (13.23%) (Figure 2).

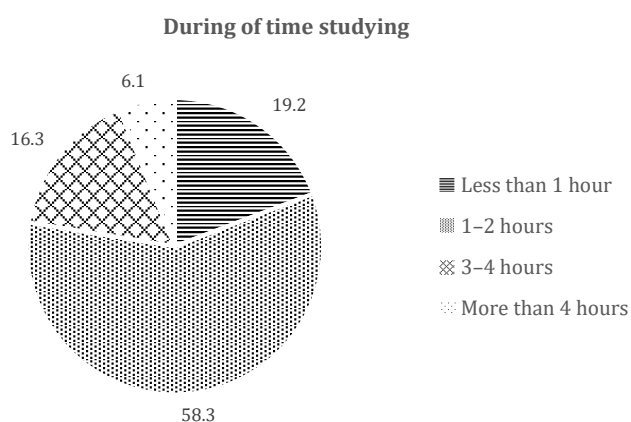
**Figure 2:** Other online learning platforms used

#### 5.1.2 Learner efforts

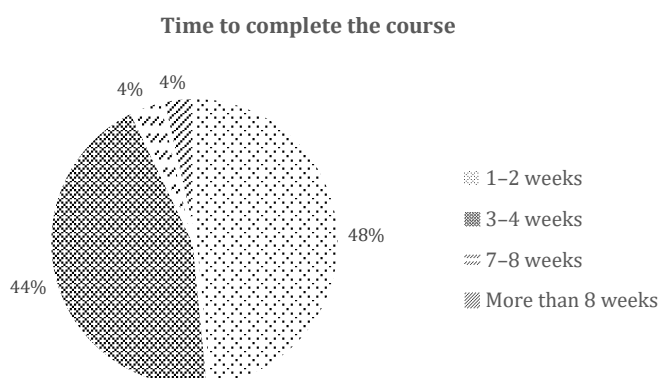
Learning effort denotes the number of interactions with lessons and time learners spent studying on Thai MOOC. In terms of frequency (Figure 3), the majority used Thai MOOC for studying less than three times per month (58.1%) followed by 3–4 times (29.9%) and 5–8 times (6.2%). The majority also spent 1–2 h per session (58.3%) followed by less than 1 h (19.2%) and 3–4 h (16.3%) (Figure 4). In addition, course completion lasted for 1–2 weeks (35.3%), 3–4 weeks (32.4%), and variable times, depending on the nature of the course (19.8%) (Figure 5) (Koraneekij & Kao-lean, 2020).



**Figure 3: Frequency of use**



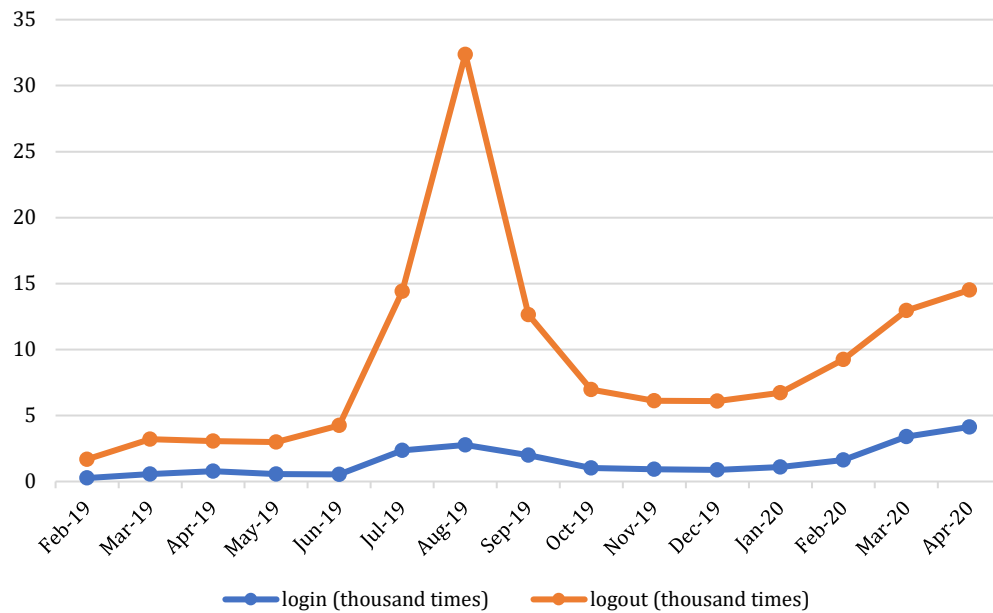
**Figure 4: Duration of study time**



**Figure 5: Time spent in completing the course**

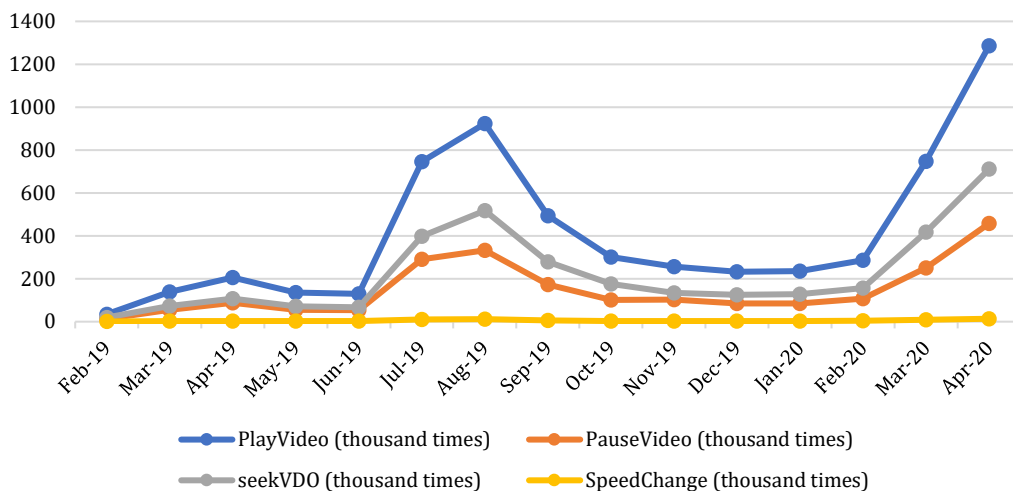
Frequencies of logins and logouts (Figure 6), which were determined using user activity data according to month of MOOC use from February 4, 2019, to April 20, 2020, produced a total of 131,406,968 entries (Kao-lean & Koraneekij, 2020). The study found that the highest frequencies of student login occurred in August 2019 (32.37%), April 2020 (14.51%), and July 2019 (14.42%).





**Figure 6:** Number of logins by month of using Thai MOOC (Koraneekij & Kao-Iean, 2020)

The highest frequencies of video playback were noted for PlayVideo, seekVideo, and PauseVideo. Given behavior related to video use, PlayVideo behavior was consistent with seekVideo behaviour (Figure 7).

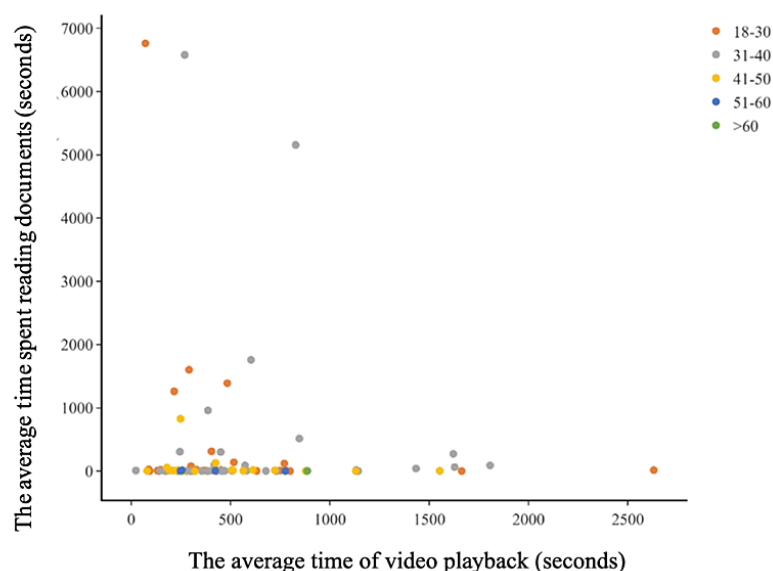


**Figure 7:** Video media usage behavior (Koraneekij & Kao-Iean, 2020)

### 5.1.3 Learning flexibility

Flexibility in learning refers to the various uses of Thai MOOC, which was determined using the number of interactions conducted on the user interface. Learners aged 31–40 years spent the most time reading documents, while those aged 18–30 years spent less time reading documents and more on watching videos. In addition, regarding average test scores and duration of reading documents, the majority spent less time reading documents and taking tests (Figure 8).





**Figure 8:** Average time spent on reading documents and video playback per age group (Koraneekij & Kao-lean, 2020)

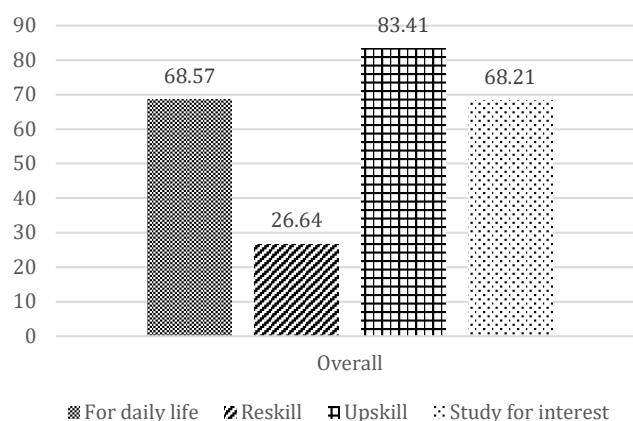
#### 5.1.4 Information on learning motivation

Learning motivation refers to factors that motivate learners to set goals in learning and exhibit continued learning behaviors on Thai MOOC in a manner that is sufficient for achieving their goals. The criteria were learning management of instructors in Thai MOOC and intrinsic motivation of learners such as developing competencies (upskilling) and changing one's line of work (reskilling). Figures 9 and 10 shows the clarification of learning motivation according to gender and background. The majority of male learners prioritized upskilling (83.41%) followed by daily application (69.74%) and interest-based study (68.69%). Meanwhile, the majority of female learners preferred upskilling (83.41%) followed by interest-based study (67.90%) and daily application (67.83%). In terms of profession, the majority were students, who prioritized upskilling (76.27%), followed by daily application (75.97%) and interest-based study (71.34%). The majority of government officials focused on upskilling (86.01%) followed by interest-based study (68.71%) and daily application (67.13%). Thus, upskilling emerged as the primary motivation across occupations.

The examination of learners from different backgrounds in terms of learning motivation indicated that the majority concentrated on upskilling (83.41%), followed by daily application (68.57%) and interest-based study (68.21%).



**Figure 9:** Classification of learning motivation according to gender



**Figure 10:** Learning motivation according to background

### 5.1.5 Learners' enrolment

User registration from January 1, 2018, to June 22, 2020, which reached a total of 564,322 entries, was used to analyze association rules and generalized sequential patterns to identify patterns in course selection among users. Table 2 presents the results.

**Table 2:** Learning patterns in Thai MOOC

No	Main subject	Common subsequent subjects enrolments
1	English for Communication	English Start Up Easy English for Everyday Life English Pronunciation and Basic English Phonetics for English Teachers Psychology and Daily Life English for Office
2	Psychology and Daily Life	Developmental Psychology in Adolescence Personality Psychology and Adjustment Developmental Psychology in Elderly
3	Learning Management Techniques	Educational Research Fun and Practical Active Learning in Classrooms Technology Enhanced Learning for the Digital Era Competency for Teachers in the Digital Age
4	Basic Photography	Photographic Technology for Educational Communication
5	Technology Hardware and System Software	Network Literacy
6	Information Literacy	Knowledge Inquiry for Development of 21st-Century Skills
7	Startups: Pushing your Dream	Consumer Behavior and Retailing Business in the Digital Age

An observation is that most subjects shown in Table 2 exhibit both high popularity in terms of enrolment and a high success rate for certificate attainment.

Analysis also revealed patterns directly related to the design and potential implementation of the credit bank system within Thai MOOC. Two key modes of recognition emerged, namely, credit accumulation through courses that are formally affiliated with higher education institutions and certificate-based accumulation for professional or vocational purposes. Enrolment patterns, particularly those observed in categories of MOOC courses, illustrate that learners value continuity across subjects, which aligns with the principle of stacking micro-credentials for credit accumulation. These findings demonstrate that Thai MOOC functions not only as a flexible learning platform but also as a mechanism for the integration of learning outcomes into a broader academic credit bank system.

## 6. DISCUSSION

### 6.1 Learners' efforts

The number of enrolled learners indicates a continued increased throughout the COVID-19 pandemic, because they tended to study and develop their skills online. Login duration on courses also increased, because many courses on Thai MOOC do not impose time limits, which enables learners to study as long as they need. This finding is consistent with that of Horsley et al. (2016), who designed a program to support lifelong learning with a focus on self-directed learning and a credit system.

Analysis of video viewing behavior demonstrates that learners most frequently engaged in PlayVideo, followed by SeekVideo and PauseVideo. PlayVideo behavior aligned with SeekVideo; this result supports the design of self-paced learning, which enables learners to take control of learning. This finding is consistent with that of Lemay and Doleck (2020), who found that weekly video views predicted learning achievement in MOOCs. Their study emphasized the importance of timely assessments, which implies that learners benefit from taking tests immediately after watching videos. In addition, MOOC teaching styles reflect learner behavior, including reviewing videos to reinforce prior knowledge and facilitate new learning, which depicts self-directed learning.

The results also demonstrated that the majority of learners infrequently paused videos and spent little time on task exercises. Many skipped to the end of videos using SeekVideo to complete exercises quickly and obtain certificates without fully engaging with content. Additionally, given that students can retake exercises, they frequently simply memorized the answers needed to pass tests. Learners who spent more time studying tended to pause videos more frequently but displayed higher dropout rates as a result of the option to re-register, which leads to reduced interaction with course materials and peers. This finding aligns with that of Chen et al. (2020) regarding factors that contribute to dropout in MOOCs, including timing, interface design, access to lessons, and motivation. Many learners dropped out after the coverage of specific topics, as noted by Qu et al. (2019). The authors found that learners spent less than 300 seconds on tasks, which indicates the probability of copying or cheating. Consequently, the credit bank system should focus on evaluating learner performance when awarding certificates and micro credits by potentially requiring students to take examinations at designated centers to assess knowledge retention.

### 6.2 Learning flexibility

Analysis of learner behavior in terms of reading documents and watching videos demonstrated that, overall, learners spent little time on either activity. Doctoral students dedicated the most time to reading; those aged 31–40 years spent more time reading compared with younger learners (aged 18–30 years), who favored watching videos. Additionally, educational background influenced behavior; doctoral students prioritized reading, while younger learners preferred video content. This tendency aligns with the findings of Kahan et al. (2017), who examined learning behaviors exhibited in MOOCs in a biology course on Coursera, including reading, short videos, interactive quizzes, and discussion forums. Murthy et al. (2018) presented a model for teaching and learning on MOOCs and emphasized that various activity designs, such as multiple-choice questions, short-answer questions, file uploads, self-assessments, and peer reviews through the use of rubrics, could be used according to the MOOC platform. González and Morales (2019) examined the factors that influence successful learning in MOOCs by age group, including Baby Boomers, Generation X, and Millennials. The authors observed that Millennials assigned the highest priority to individual factors, including learning methods and time management. Baby Boomers tended to prioritize instructional design, followed by Generation X and Millennials.

Therefore, teaching and learning designs on Thai MOOC should consider the length of videos, which should be relatively short (approximately 10–15 min per subtopic). Lectures should only describe salient points, and videos should be interactive. Learners should be provided with video media and documents for download and divided into three groups, namely, learners that prefer (a) reading documents, (b) watching videos, and (c) both.

### 6.3 Learning patterns and motivations

The majority of learners sought upskilling (83.41%), followed by daily application (68.57%) and interest-based study (68.21%). This finding is consistent with the profession of learners on Thai MOOC, who were mainly students and of working age, including people with a bachelor's degree and pursuing career-based competencies and skills. Albelbisi et al. (2018) investigated the factors that influence the success of learning on MOOCs, including interaction and motivation, and credits and certificates that can be used in work. In addition to self-development as a motivation, the design of MOOCs was also important, which indicates that instructors should consider and design courses in response to learner diversity. The reason is that learners at different ages exhibit varied learning styles. Chen et al. (2020) recommended the formulation of a teaching design that

prevents learners from dropping out. Learners should be introduced to the overall course. Thought-provoking questions should be posed at the end of each lesson to keep learners interested in the next lesson.

For patterns of enrolment in Thai MOOC, the current study found that the subsequent courses that learners were enrolled in were related to the first course. In this manner, learners can effectively apply knowledge from earlier subjects. Therefore, in designing the credit bank system and accumulation of micro credits, the continuity and consistency of courses should be considered. Thai MOOC presents its micro credit course design as SeriesMOOC. For example, an engineering course consists of five subjects that learners complete across 8 weeks. Every subject imposes a time limit. Failure to reach objectives within a specified time will prevent learners from accumulating credits. Coursera's credit-accumulating course design was adapted to the MasterTrack format. Learners could accumulate credits to complete a master's degree. Credits could then be transferred, for example, by taking the Instructional Design and MasterTrack Certificate. Learners can transfer eight credits after completing one course to achieve a master's degree. In turn, learners must complete six additional courses or 24 credits to complete a master's degree. For this program, learners are required to study two major courses, namely, (1) Instructional and Training System Design and (2) Learning Technologies.

Similar initiatives in other countries illustrate excellent practices. In South Korea, the academic credit bank system enables learners to accumulate credits through formal and nonformal learning experiences, including MOOCs, workplace training, and self-study, which can then be transferred toward higher education degrees (The National Institute for Lifelong Education, 2017; Park et al., 2019). In Europe, the Open Badge and Digital Credential projects have developed portable, verifiable recognition of learning achievements. These credentials, which are linked to the European Qualifications Framework, enable learners to acquire micro credentials and present them across institutions and national borders (European Commission, 2020; Lim et al., 2018). By comparison, the Korean model is nationally legislated and widely recognized, thus providing greater credibility and flexibility for lifelong learners, while European digital credentials are interoperable and integrated with broader systems of recognition. In contrast, credit transfer in Thai MOOC is primarily arranged through affiliated universities. These international comparisons indicate that although Thai MOOC has laid the foundation for micro credentials and credit accumulation, future development requires stronger policy alignment, broader cross-institutional participation, and increased interoperability with regional and global frameworks such as the ASEAN Qualifications Reference Framework.

## 7. CONCLUSION

Given that Thai MOOC classifies learners into three groups, namely, students working with an affiliated university who pass for credit from a higher education institution or related agency, students in continuing education accumulating credits toward a vocational certificate, and students in informal education and personal education, the model of credit accumulation presented by Thai MOOC could be divided into two types. The first pertains to classroom learning or credit accumulation and transferring credit to the affiliated university. The second refers to online learning courses that provide certificates after taking tests or passing an evaluation in an e-testing center to accumulate credits for transfer to an affiliated university.

The results demonstrated that the Thai MOOC platform provides a functional foundation for an academic credit bank system. Learner behaviors in terms of enrolment and motivation indicate a strong demand for formal recognition of online learning, particularly for credit transfer toward higher degrees and professional certificates. Sequential enrolment patterns highlight the importance of a modular series of MOOC courses, in which multiple, related courses can be aggregated into transferable credits, which is similar to Coursera's MasterTrack model. Importantly, the willingness of learners to use MOOC certificates for professional qualifications underscores the potential of the system to expand from higher education to workforce development.

The study provides the following recommendations for the development of the credit bank system. First, designing continuous courses is vital to enable in-depth engagement among learners with materials while gradually accumulating credits for transfer to higher education. This approach can foster a better understanding and prepare students for advanced studies. Second, collaborating with agencies, organizations, and companies is essential. By developing courses that improve professional skills, these partnerships can provide certificates that enable learners to earn credits, thus increasing the value of their educational experiences. Third, a diverse range of teaching resources can be offered, including videos, downloadable documents, and external materials. Using various teaching strategies can encourage learners to create projects and apply knowledge to real-world contexts, thus effectively serving as a learning tool and an assessment method. Fourth, video contents should focus on interactivity instead of traditional lectures. The incorporation of interactive elements can enhance the engagement of learners with materials, thus enhancing learning experiences. Finally, establishing a robust assessment system is necessary. The current practice of enabling multiple attempts at exercises can lead to

superficial learning, in which students memorize answers instead of truly understanding concepts. Comprehensive assessments should be developed, which may require tests to be taken at designated centers to ensure an accurate measurement of student achievements. By implementing these recommendations, the credit bank system can more effectively support lifelong learning and professional development.

Nonetheless, this study has its limitations. The Thai MOOC dataset contained incomplete and inconsistent indicators, such as limited information on instructor feedback and frequency of learner interaction, which restricted the depth of data mining analysis due to limited access. Moreover, structural and legal barriers to credit transfer persist, given that affiliated universities, instead of a legislated national framework, mediate credit accumulation. Finally, institutional readiness remains unequal; many higher education institutions have yet to fully integrate Thai MOOC into their credit systems, while varying levels of infrastructure and policy alignment hinder large-scale implementation. These limitations highlight the need for future research and policy initiatives to enhance data completeness, strengthen legal frameworks, and expand institutional capacity to realize the full potential of a national credit bank system.

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