A MOOC system with self-directed learning in a digital university

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ABSTRACT: A massive open on-line course (MOOC) system with self-directed learning (SDL) is the focus of this article. It is considered as a tool to promote learning in the digital age based on the application of new ideas and innovations that can respond to and accommodate the current world situations. Combined with SDL, the system is expected to bring about direct learning experiences, leading to the creation of learning society in digital universities. It enables learners to learn anywhere and anytime with limitless access to education through digital technology. In addition, the system encourages learners to develop digital literacy skills, including the ability to set up learning plans and to self-assess their learning outcomes. This can be achieved with the aid of instructional activities that can promote learning and enable learner interactions through social networks. In this article, the author presents the MOOC system with SDL recently implemented at a Thai university, discusses the post-implementation results and highlights the significant concepts that can be used as guidelines for further study.

Keywords: Massive open on-line courses, MOOCs, self-directed learning, digital university, learning in digital age, digital technology, digital literacy skills

INTRODUCTION

The main goal of education development in Thailand designated in the National Education Plan B.E. 2560-2574 is to create a quality and efficient education system as the main mechanism for developing human potential, so supporting education and responding to challenges in the 21st Century is a priority [1]. In reference to the education system, learners are encouraged to pursue knowledge on their own, take actions, focus on the development of skills and have positive attitudes toward lifelong learning. Thereby, learners are required to be involved in the planning of learning management, learning assessment, exchange of knowledge, interactions through social networks [2], and they are afforded unlimited access to information based on innovation and digital technology.

Teaching innovations in digital universities are important for the instructors who should monitor and apply them to promote self-directed learning (SDL) in compliance with the current world situation. These innovations can enhance the quality of products and services, especially in the field of education. The exchange of knowledge and interaction with through social networks have assisted Thai people in unlimited access to information. The instructional management and lifelong learning processes need to be continuously adjusted on the basis of innovation and digital technology, enabling access to learning materials with no limitation of time and place for everyone across the society [3]. Ultimately, this will lead to the creation of learning society through digital universities.

Digital literacy skills are associated with the understanding and application of digital technology that encourage learners to develop lifelong learning. The lifelong users of continuously changing information technology create a new learning society. Without these skills, learners would not be able to progress in the 21st Century. The creation of new knowledge is at the core of all basic literacies. Likewise, generating digitally new information by designing, inventing, authoring, adapting or applying information is at the core of digital literacy [4]. Digital literacy or digital learning refers to the ability to create a variety of contents with the use of related but different digital tools. The digital literacy ability refers to three functions: use, understand and create. Digital literacy covers diverse, interrelated skills, including: media literacy, technology literacy, information literacy, visual literacy, communication literacy and social literacy.

Massive open on-line courses (MOOCs) are embedded in on-line education, higher education, open education and distance education. Their name clearly captures the MOOCs' characteristics, such as on-line availability, openness and massiveness; and there is evidence that educators currently pay increasingly more attention to the application of MOOCs in higher education [5]. The MOOC learning platform is the basic information system supporting on-line

teaching and learning activities, which not only stores the learning resource files of a given course, but also holds a large amount of learning activity data. The data include: the basic personal information of learners, click and browse behaviour of learners when dealing with learning resources, assessment and examination data, information from user forums, and so on [6].

Self-directed learning is widely promoted these days, because information technology plays a vital role in learning among the new generation of learners who focus on active learning through various on-line media and attain learning experiences though self-direction [7]. The objective of SDL is to encourage learners as much as possible to help themselves from the beginning to the end of the learning process. This will allow learners to become well equipped with skills and competency to set up their own learning plans, implement these plans, search for learning resources and conduct, self-evaluation - all of that with the aid of instructional activities to promote such learning. Therefore, SDL is often considered one of the indispensable skills in today's fast-changing society [8]. Self-directed learners are able to manage their own learning and knowledge acquisition continuously over time.

Considering the aforementioned background information, the author of this article has resolved to develop a MOOC system with SDL to be applied as a tool to promote learning in the digital age. The application of new ideas and solutions that can respond to and accommodate the current situations in the world is at the core of this development. The system is meant to encourage learners to initiate self-directed learning by optimally utilising the latest digital technology. This will enable them to acquire digital literacy skills and create a learning society based on these skills.

RESEARCH OBJECTIVES

The objectives of this research are as follows:

- To synthesise the conceptual framework of the MOOC system with SDL;
- To design and develop it at a Thai university according to the conceptual framework;
- To evaluate the post-implementation results at the Thai university.

METHODOLOGY

Population

The population for this research is comprised of two groups:

1) 14 experts from different higher education institutions, all of whom with experience in Web-based instructional design and development, computer science, and information and communication technology for education;
2) 50 subjects of the sample group selected by means of purposive sampling, including five instructors, three staff members, 32 second-year students from the Department of Electronics Engineering Technology at King Mongkut's University of Technology North Bangkok, Thailand, and 10 subjects from the general public.

Courses Included in this Research

For the experiment in the use of the MOOC system with SDL in a digital university, the researcher designed and developed three courses including:

1) Digital Circuit and Logic Design;
2) Television and Video Control;
3) Multimedia and Animation Technology.

Data Collection and Analysis

The tools and data for analysis included:

1) the MOOC system with SDL;
2) three courses, i.e. Digital Circuit and Logic Design; Television and Video Control; and Multimedia and Animation Technology;
3) evaluation forms about the quality and efficiency of the developed MOOC system with SDL;
4) evaluation forms about the perception on the suitability of the MOOC system with SDL for developing the learner's digital literacy skills.

The typical statistical measures of mean and standard deviation were used in this research.

Design and Methodology

The design of this research has been based on the concepts of the ADDIE model, which is an instructional systems design framework including the following phases: analysis, design, development, implementation and evaluation [9]. Also, the relevant theories have been consulted and incorporated into the design. The methodology can be summarised and presented in three stages as shown in Figure 1.
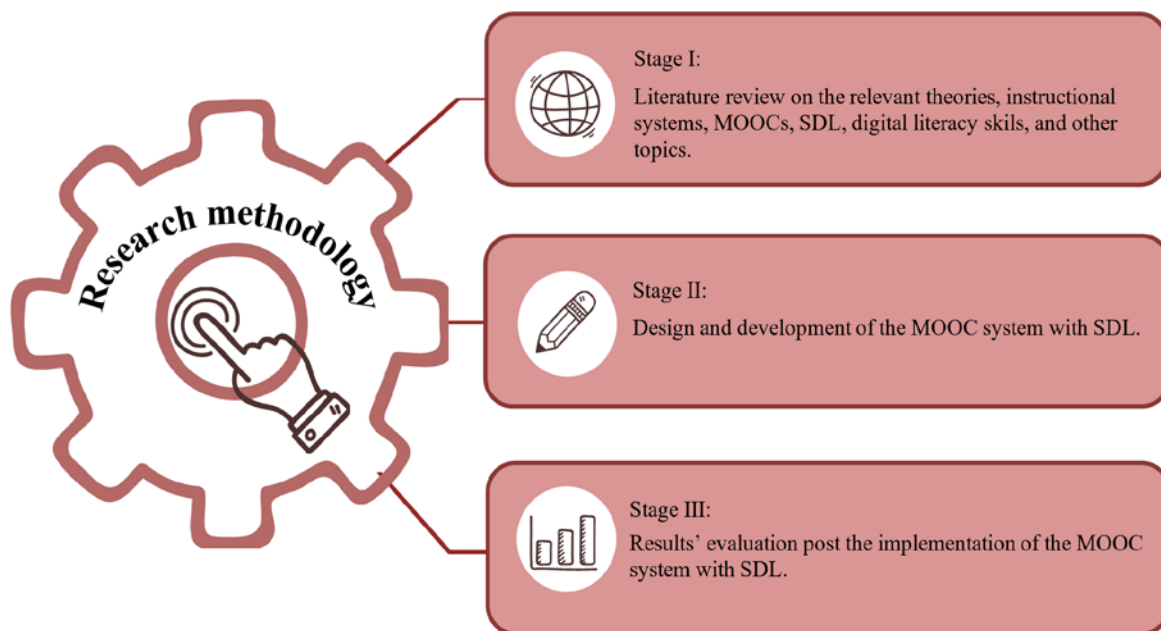
Figure 1: Research methodology.

Stage 1: Synthesis of the conceptual framework of the MOOC system with SDL. This stage refers to the literature review on the relevant theories, theories instructional systems [9-11], MOOCs [5][6][12], SDL [7][8][13], digital literacy skills [4], digital university [14], achievement and satisfaction, as shown in Figure 2.
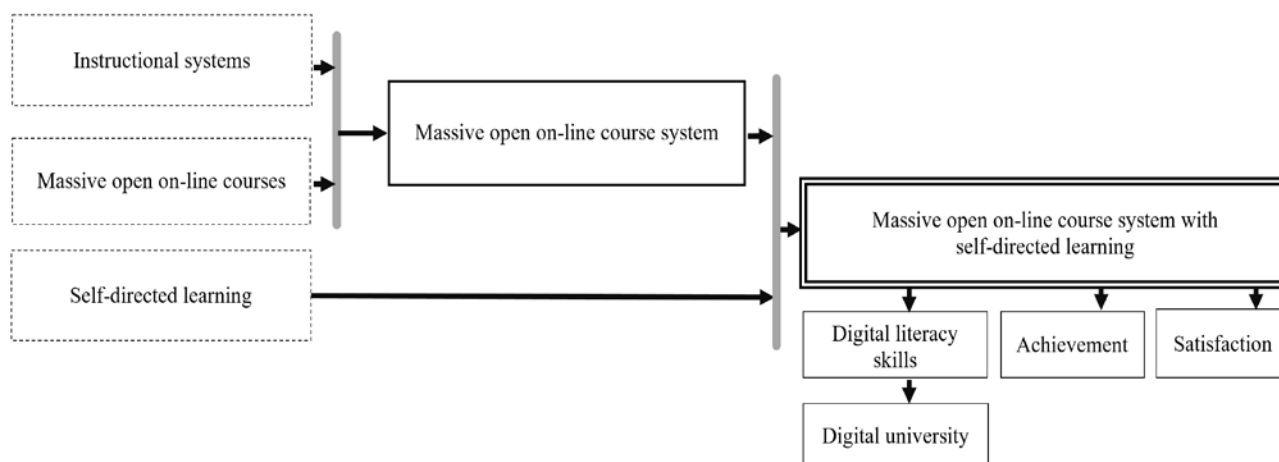

Figure 2: The conceptual framework of the MOOC system with SDL.

Stage 2: Design and development of the MOOC system with SDL. In this stage, the conceptual framework was used as a guideline to analyse and design the structure of the MOOC system with SDL. After that, the tools derived from the analysis and design, i.e. the use case diagram and the overall structure plan, were applied to further develop the MOOC system with SDL.

Stage 3: Post-implementation results analysis and evaluation. The analysed results were derived from the system's use by the above-mentioned groups, i.e. 14 experts from different higher education institutes, and 50 users including five instructors, three staff members, 32 second-year students and 10 subjects from the general public.

MASSIVE OPEN ON-LINE COURSE SYSTEM WITH SELF-DIRECTED LEARNING

As indicated earlier, the MOOC system with SDL is considered as a tool that can promote self-learning in the digital age. So, one of the main aims of the developed system is to encourage learners to use it as much as possible. The instructors are responsible for organising the on-line environment and creating appropriate teaching materials accessible to users anywhere and anytime by means of digital technology. The development of the MOOC system with SDL can be summarised as shown below:

Results of the Analysis and Design of the MOOC System with SDL

After the analysis and design stages, the use case diagram and the overall structure plan were generated as shown in Figure 3 and Figure 4, respectively. The two items were used as a guideline for further development of the system.
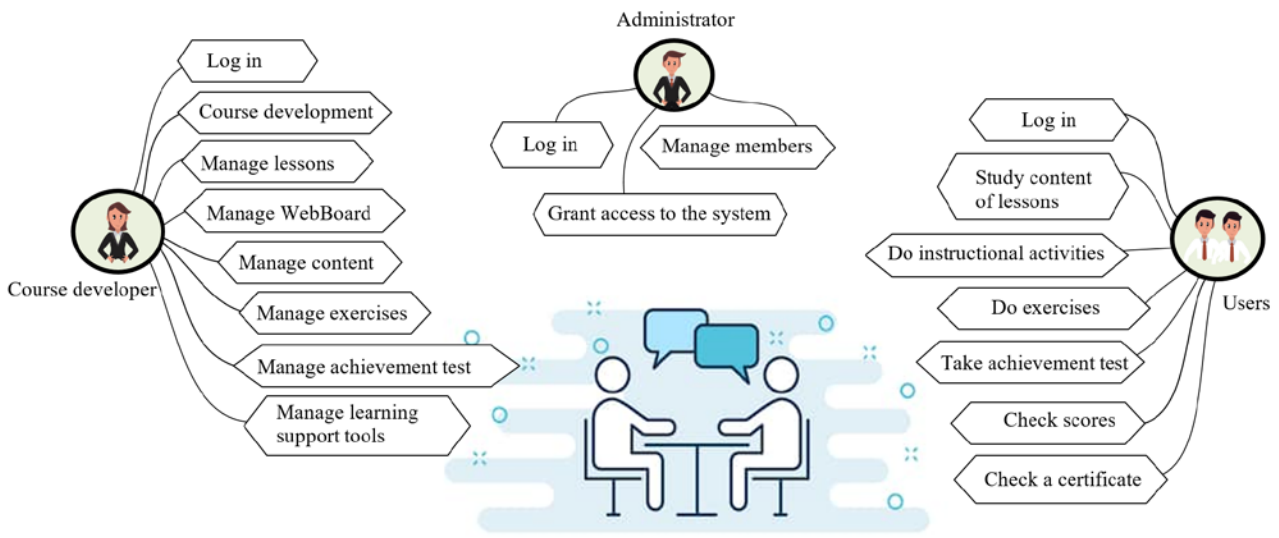
Figure 3: Use case diagram of the MOOC system with SDL.

The researcher analysed and synthesised the system's users and their needs, and established that the stakeholders could be grouped as follows:

1) administrator, who has a key role in assigning rules or roles to the members of this system, such as course developers and users;
2) course developers, who play an important role in course development, management of lessons, WebBoard interactions, content creation, exercises, achievement tests and learning support tools;
3) users, who are able to choose a course of interest, access the study content, do exercises and instructional activities, take achievement tests, check their scores and certificates after the evaluation process as specified by the course developers.
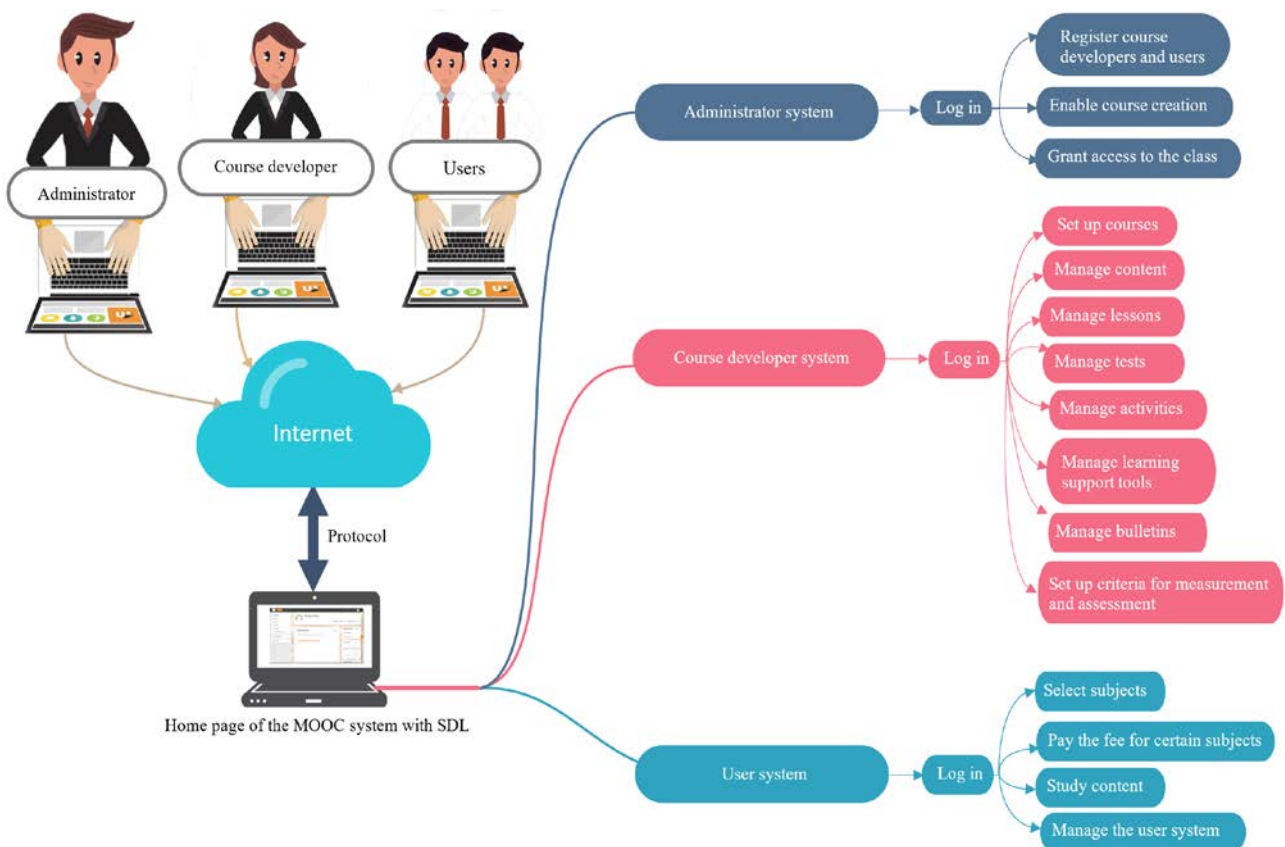

Figure 4: Overall structure of the MOOC system with SDL.

As illustrated above, the MOOC system with SDL consists of three component systems:

- An administrator system, which is designated for learning management by course developers and users. The administrator has the right to grant access to the system for course developers and users, and enable the creation of subjects or courses in the system, with the following steps:

1) log in;
2) register course developers and users;
3) enable course creation;
4) grant access to the class.

- A course developer system, the function of which is to create and manage on-line courses, as well as to locate and suggest the appropriate learning support tools to the users, has the following steps:

  1) log in;
  2) manage all elements in the instructional system including setting up courses, managing content, lessons, tests, activities, learning support tools and bulletins;
  3) set up criteria for measurement and assessment.

- A user system, which learners can access in order to study the courses they select and do activities, has the following steps:

  1) log in;
  2) select subjects;
  3) pay the fee for certain subjects;
  4) study content on the Web site according to the SDL principles;
  5) manage the user system.

Results of the Development of the MOOC System with SDL

In the development of the MOOC system with SDL, the instructional management has to be fully aligned with the concepts and principles of this type of learning. In this way, learners are encouraged and aided by the appropriate technology to develop digital literacy skills. They are also in control of their learning plans, which they have set up, and are able to evaluate their outcomes by themselves. In addition, they can interact with one another through social networks and the developed open on-line learning system, as shown in Figure 5.
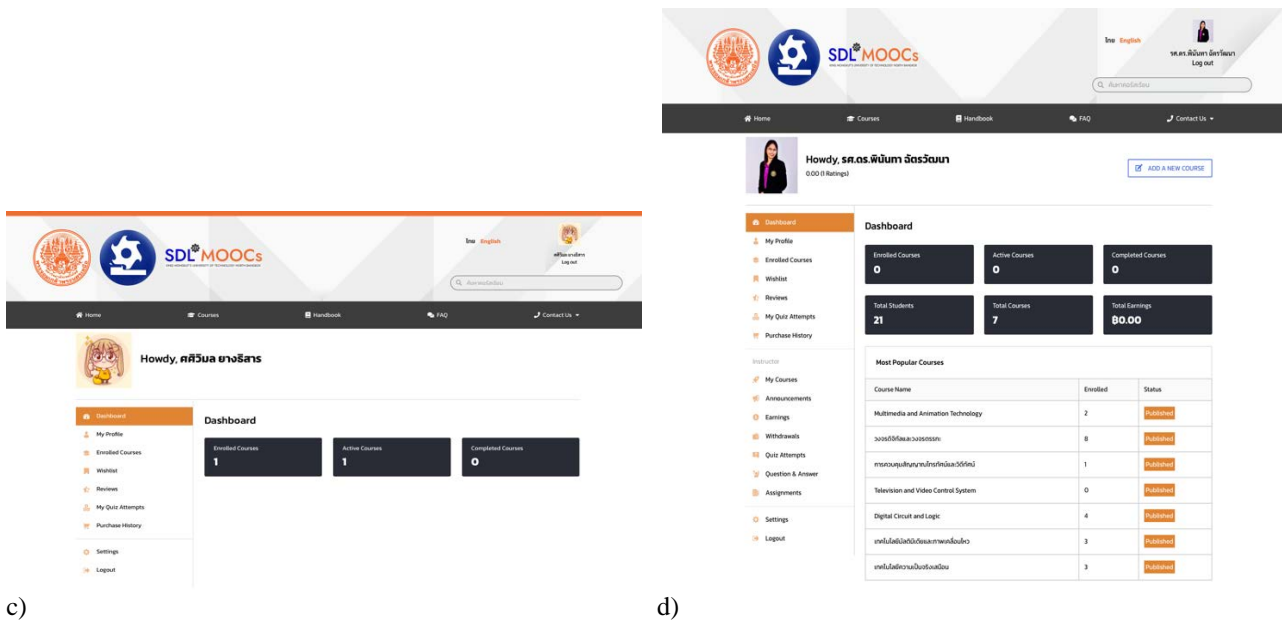

a)

b)

c)   d)
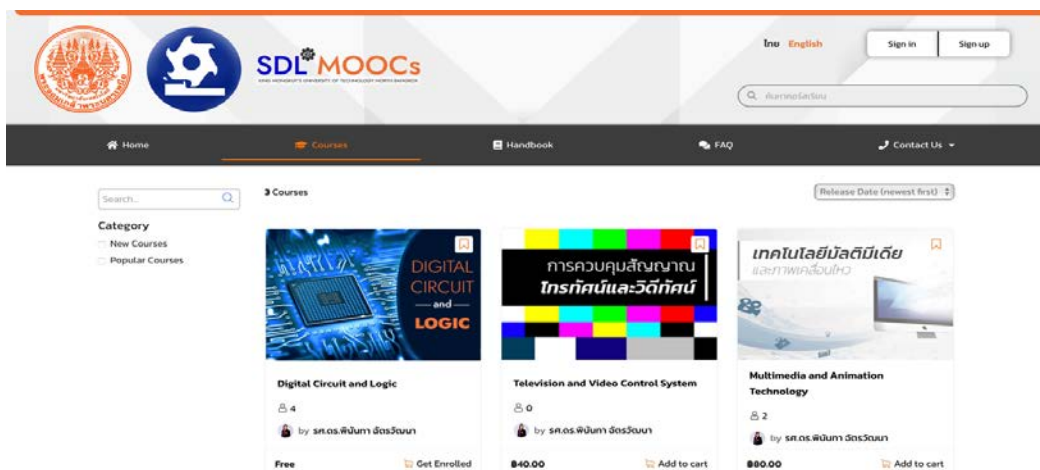
Figure 5: The developed MOOC system with SDL - selected screen captures.

FINDINGS AND DISCUSSION

The results analysed for this article come from the trial use of the MOOC system with SDL developed at King Mongkut's University of Technology North Bangkok, Thailand, in 2021. There were three courses (Digital Circuit and Logic Design; Television and Video Control; and Multimedia and Animation Technology) and two sample groups involved (group 1: 14 experts from different higher education institutes; and group 2: five instructors, three staff members, 32 students and 10 subjects from general public).

The researcher employed the criteria of data analysis and interpretation of Kanasutra [15], as shown in Table 1.

Table 1: Average score range and the interpretation of results.

Average score range	Interpretation of results
4.50 - 5.00	Very high level of suitability
3.50 - 4.49	High level of suitability
2.50 - 3.49	Average level of suitability
1.50 - 2.49	Low level of suitability
1.00 - 1.49	Very low level of suitability

The evaluation results of the quality of the MOOC system with SDL are included in Table 2.

Table 2: Evaluation results of the system's quality.

Evaluation aspects - description	Results		Interpretation
	Mean	SD	
1) Evaluation of the general quality	4.75	0.47	Very high
2) Evaluation on the system's efficiency	4.76	0.43	Very high
3) Evaluation of the practical use of the system	4.86	0.35	Very high
Overall	4.78	0.43	Very high

According to Table 2, the overall quality of the MOOC system with SDL has been assessed as very high (mean = 4.78, SD = 0.43). Therefore, it can be concluded that this system as tested in the trial is efficient and can be applied as a tool to promote self-directed learning in the digital era. This finding is in accordance with the study by Tan et al, who pointed out that MOOCs constitute a new education model that could lead to the reform of higher education and improve the quality of instruction in universities [5]. Moreover, the trial results from King Mongkut's University of Technology North Bangkok also comply with the study by Wajeesiri, who stated that the application of self-directed learning in the design of instructional models can develop the ability of critical thinking and at the same time improve learning achievements [16].

The evaluation of the perception on the suitability of the MOOC system with SDL for developing the learner's digital literacy skills involved a framework with six considerations. The framework has been created from the synthesis of desirable characteristics in regard to digital literacy skills. Also, the assessment indicators have been identified and are included in Table 3.

Table 3: Synthesis of the assessment measures of the perception on the system's suitability for developing the learner's digital literacy skills.

Digital literacy skills	Desirable characteristics	Indicator	Type of measurement
1) Media literacy	The ability of learners to access, analyse and produce media based on the understanding and communication of ideas in an effective manner.	1) Understanding of and access to information	Ability to use digital tools (digital tool skills)
2) Technological literacy	The expertise of using technology in learning and communication environments.	2) Use of digital tools	
3) Information literacy	The ability to search for the required information on-line, to select the appropriate information and to use the retrieved information in a proper way.	1) Information assessment	Information literacy skills
4) Visual literacy	Learners' ability to understand and interpret what they view, including analysis, learning and expressing their opinions.	2) Information management	
5) Communication literacy	The ability to exchange knowledge with others via social media or on-line learning platforms.	1) Communication	Communication literacy skills
6) Social literacy	The ability to work hand in hand with others in order to achieve common goals.	2) Network collaboration 3) Use of network	

In the evaluation of the perception on the suitability of the MOOC system with SDL for developing the learner's digital literacy skills three assessment categories have been formed: i.e. 1) ability to use digital tools; 2) information literacy skills; and 3) communication literacy skills, along with seven indicators within the framework. The evaluation results are summarised in Table 4.

Table 4: Evaluation results of the perception on the system's suitability for developing the learner's digital literacy skills.

Description	Mean	SD	Interpretation
1. Evaluation of the perception on the system's suitability for developing the learner's digital literacy skills: the ability to use digital tools			
1.1. Able to learn the on-line courses available through the MOOC system by themselves.	4.36	0.60	High
1.2. Understands the use of functions available in the MOOC system.	4.30	0.61	High
1.3. Able to learn how to use different functions by themselves.	4.32	0.68	High
1.4. Can access the learning platform of the system in an efficient manner.	4.26	0.75	High
1.5. Able to choose appropriate information that can promote self-learning and communication.	4.42	0.50	High
1.6. Able to solve technical problems occurring in the MOOC system.	4.20	0.70	High
1.7. Able to search for tools and applications that facilitate self-learning.	4.34	0.75	High
1.8. Able to adjust and learn new technology in an effective manner.	4.32	0.65	High
1.9. Understands the ethical issues of using the Internet.	4.30	0.74	High
1.10. Overall ability to use digital tools.	4.36	0.63	High
2. Evaluation of the perception on the system's suitability for developing the learner's digital literacy skills: information			
2.1. Knows the information resources in the MOOC system, which are appropriate to the problems to be addressed.	4.26	0.63	High
2.2. Able to choose the information resources suitable for problem solving.	4.30	0.54	High
2.3. Able to choose the information appropriate for the targeted problems.	4.36	0.69	High
2.4. Able to construct the search to find the required information.	4.26	0.69	High
2.5. The search results are correct, accurate and satisfy the learner's needs.	4.22	0.68	High
2.6. Knows the criteria used for learning evaluation through the MOOC system.	4.44	0.67	High
2.7. Is aware to always assess the reliability of on-line information resources before using them.	4.30	0.68	High
2.8. Always verifies the accuracy of the information before using it.	4.32	0.59	High
2.9. Integrates different kinds of information to create new knowledge.	4.36	0.60	High
2.10. Overall ability in terms of information.	4.44	0.64	High
3. Evaluation of the perception on the system's suitability for developing the learner's digital literacy skills: communication			
3.1. Can exchange knowledge and learn with others through the MOOC system.	4.36	0.63	High
3.2. Collaborates on the network with no need for face-to-face interactions.	4.38	0.78	High
3.3. Chooses appropriate channels for communication and exchange of knowledge.	4.38	0.67	High
3.4. Exchanges knowledge and learns with others, all by themselves, through social media or using on-line learning materials available within the system.	4.30	0.58	High

	Mean	SD	Interpretation
3.5. Uses technology available in the MOOC system to promote self-learning and communication.	4.42	0.64	High
3.6. Is aware of the advantages, disadvantages and impact of using the Internet.	4.04	0.67	High
3.7. Is aware of the dangers that may arise from improper use of the Internet.	4.14	0.78	High
3.8. Respects the privacy of others when using the Internet for communication.	4.44	0.64	High
3.9. Communication is successful in relation to the set goals.	4.32	0.65	High
3.10. Overall ability in terms of communication.	4.38	0.64	High
Overall	4.32	0.66	High

According to Table 4, it is evident that the overall suitability of the system for developing the learner's digital skills is at a high level (mean = 4.32, SD = 0.66). Thus, it can be concluded that the developed MOOC system is capable of stimulating learners to develop digital literacy skills through the use of existing digital technology and social media. This will lead to creating a learning society in digital universities able to optimally use the technology, while responding to the current world situations. This conclusion accords with the research of Andriushchenko et al who stated that digital literacy can be used to effectively communicate, solve problems, and achieve self-realisation in education, work and social life [17].

The results also correspond to the study of Jao who confirmed that MOOCs can enhance learners' achievements, while developing their ability of self-directed learning and their communication skills in the context of work team [18]. Moreover, the findings of the current study comply with the research of Dobricki et al who stated that the application of digital technology can facilitate the learning that can be undertaken anywhere and anytime, creating all-time learning opportunities [19].

The evaluation of the learner's satisfaction of using the MOOC system with SDL has been based on the questionnaire including questions with a five-point rating scale in relation to two aspects: design and performance of this system. The evaluation results are summarised in Table 5.

Table 5: Evaluation results of the learner's satisfaction of using the MOOC system with SDL.

Description	Results		Interpretation
	Mean	SD	
1) Overall satisfaction in regard to the design of the developed MOOC system.	4.36	0.68	High
2) Overall satisfaction in regard to the performance of the MOOC system.	4.38	0.69	High
Overall	4.37	0.68	High

In reference to Table 5, it can be seen that the satisfaction in regard to the use of the developed MOOC system with SDL is at a high level (mean = 4.37, SD = 0.68). From these results, it can be concluded that the system has the appropriate elements, functions and process stages to make learners satisfied with its design and performance, which ultimately leads to enhanced digital literacy skills and higher achievements accomplished in an efficient manner. This finding is in compliance with the study of Nerona who established that collaborative learning and problem solving can help to increase learning achievements and communication skills [20]. Moreover, the results of the present study correspond to the research of Shukor and Abdullah who pointed out that MOOCs can fulfil different needs of diverse learners by making them feel challenged, and then enabling them to have satisfying learning experiences [21].

CONCLUSIONS

The developed MOOC system is considered as a useful tool to promote self-directed learning through digital technology. The system consists of three component systems, i.e. 1) administrator system designated for learning management by course developers and users; 2) course developer system, the function of which is to create and manage the on-line courses, as well as to locate and suggest the appropriate learning support tools to the users; and 3) user system, which learners can access in order to study the courses they select and do activities.

The results of this study clearly indicate that the developed MOOC system with SDL can help learners to attain digital literacy skills needed in the 21st Century workforce. The system users are satisfied with this kind of learning and able to use the existing technology for maximum benefit. This approach to education may lead to the creation of learning society in digital universities.

ACKNOWLEDGEMENTS

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BIOGRAPHY

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