

Vocational Knowledge Improvement Method on Massive Open Online Course for the Thai Tourism Worker

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ABSTRACT

The adopted of Massive open online courses (MOOC) in the Thailand Tourism sector is aimed at promoting the quality of human resources to reach ASEAN tourism standard. However, traditional vocational education and training do not seem to provide knowledge improvement for many of the workers in the postmodern era since the completion rate of MOOC is very low. Therefore, the aim of this paper is to propose a knowledge improvement method for knowledge workers who are working in the tourism industry.

In this study, the cognitive load theory and interactive media were employed as methods which are able to improve the knowledge workers' learning performance via mobile devices. Two experiments were performed in order to find the optimal length of video lectures and the effectiveness of interactive media in MOOCs. The first experiment was performed on sixty-four tourism industry knowledge workers who were divided into four groups randomly. Each group was loaded with different video lengths and different segmentations. The second experiment was done on the same focus group by separating them into control and experiment groups. The experiment group was assigned to use interactive media (2D learning game) right after watching the learning video. The results show that, by using the same amount of learning time, the group who were using the smaller video lengths performed significantly better due to lower consume of information. Differences in knowledge tests were examined across different conditions of video lengths to measure the learning performance. As a result, the groups which were equipped with interactive media achieved higher test scores than those without it. The evaluation method for the performance test was the same as in the first experiment. The results indicate that the interactive group with shorter of video lengths performed significantly better than the other group exposed to traditional online learning (using longer videos in a non-interactive manner).

Keywords: Vocational Education, Mobile Learning, Massive Online Learning, Knowledge Worker

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1. INTRODUCTION

The ASEAN member countries are going to implement the Mutual Recognition Arrangement (MRA) of Qualifications of Tourism Professionals. It is a framework of competency standards with the aim to promote the equality of human resources in the tourism industry and to facilitate the mobility of worker. Since there are over two million tourism workers in Thailand, an online learning system based on MOOCs was adopted as a tool to re-skill and facilitate their knowledge and performance. This online learning platform is also called "the website of Thailand ACCSTP online learning system". However, the statistics from the Ministry of Tourism and Sport showed that the number of workers who are certified by the ASEAN - MRA on Tourism Committee is very low. The scenario shows a knowledge gap between the Thai knowledge workers' skills and the ASEAN - MRA competency standards. Furthermore, the online provided learning platforms do not seem to facilitate or enhance the learning motivation and performance of learners since the completion rate of MOOCs is only 0.9%.

Previously, the adoption of mobile learning concepts improves the completion rate in MOOCs since it offers the possibility to save time, to allow access to information as needed, and to communication via multiple channels regardless of location. Furthermore, the concept of gamification played a key role in online education. However, it is still question whether such methods are able to improve the effectiveness of learning in MOOCs. Therefore, a new and different knowledge improvement method needs to be added in order to solve the problem of the low completion rate of the Thai ACCSTP online learning system. This is required to reduce the knowledge gap between Thai knowledge workers and ASEAN - MRA competency standards. The aim of this paper is to propose a method which will be more effective learning platform for knowledge workers in the postmodern era.

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The cognitive load theory and interactive media were employed to improve the knowledge workers' learning performance via mobile devices.

2. BACKGROUND AND PROBLEM STATEMENT

The AEC community is going to be established in the next few years, and the knowledge workers in the tourism industry with certified qualifications and certified tourism professional standards will be allowed to travel and work in all ASEAN countries. Thus, the member countries have prepared the ASEAN Common Competency Standards for Tourism Professionals (ACCSTP) which is a framework for tourism professionals, covering 32 positions of the tourism and services sectors. Any knowledge worker in any position, who is willing to achieve the body of knowledge on tourism to meet professional standards of ASEAN, needs to obtain the ASEAN - MRA competencies as follows: Common Core Competencies, Generic Competencies, and Functional Competencies (The Association of Southeast Asian Nations, 2010). According to this scenario, the skilled Thai workers will have the opportunity to move to places where they can earn higher salaries since the free ASEAN community is offering equal opportunities on the labour market. On the other hand, foreign workers can compete in Thailand's tourism sector as well.

Previously, the statistics from the Ministry of Tourism and Sport showed that the number of workers who are certified by the ASEAN - MRA Committee of Tourism is very low. The ministry expects to increase the number of certified workers in Thailand to 600 in 2018 by encouraging their workers to re-skill themselves and achieve the ASEAN - MRA competencies. However, only 330 workers are certified by the national committees. As mentioned, only half of the workers have managed to obtain the certification. The scenario shows a knowledge gap between Thai knowledge workers and the ASEAN - MRA competency standards. Therefore, it is necessary to prepare for the performance improvement of Thai professionals to meet the ASEAN standards. Recently, the Thai government has already implemented many projects in an attempt to encourage the development of the Thai workers' performance to reach the standards. Initiatives have been carried out including the training plans across the whole country, media for learning and training, evaluation system development, and offering online learning system development or E-learning. The E-learning program aims to provide education for Thai tourism workers allowing them to be well informed about ASEAN - MRA competency standards in each position (Ministry of Tourism and Sport, 2015). As regards E-learning, the system developer teams have currently generated, configured, and transferred the content of the ASEAN - MRA competency course materials from

paper into digital based content. Materials of various forms such as video lectures, storytelling short films, and interactive games have been adopted as learning media in the E-learning system. These learning materials have been developed in cooperation with expert teams from both the academic and tourism domains (i.e. lecturers from the tourism departments, programmers, game designers, hotel managers, bell boys and housekeepers). The E-learning is also based on the concept of MOOCs since it is designed for a large number of users and the course can be accessed by anyone, anywhere, anytime without any required qualifications via an online environment (Yuan, L and Powell, S. 2013). This E-learning is also called "the website of Thailand ACCSTP online learning system" (See figure 1).

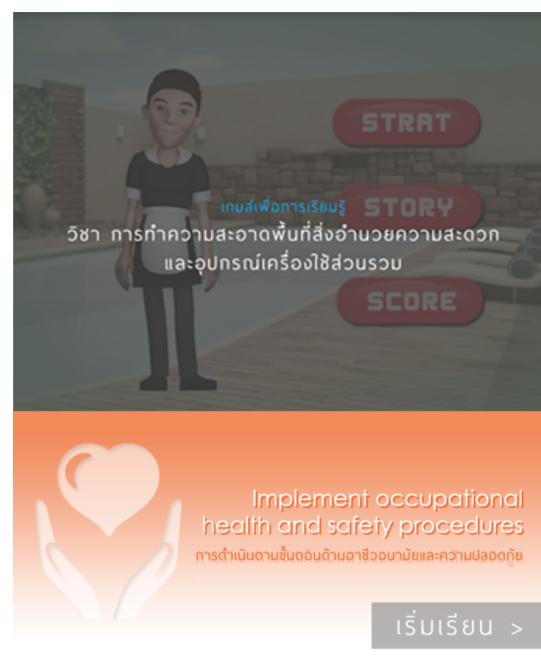


Fig.1: Example of the learning media for the online learning system of the ASEAN - MRA competency course.

The overall features in the website of the Thailand ACCSTP online learning system are similar to other MOOC platforms (see table.1). The teaching guides feature, however, is not provided on our platform since the instruction note already exists in the video lecture. The forum feature is also missing since the budget was too small. The interactive media and game are added in exercise features making our platform different.

However, the provided E-learning platforms do not seem to facilitate or enhance the learning motivation and performance of users. Table 2 presents the last two years' statistics on the users of the website Thailand ACCSTP. The rate of registered users is 100% while the rate of users who enrolled in the online course is 32.6%. Only 8.2% of the users were offered

Table 1: The comparison of the Thailand ACCSTP online learning system to other MOOC platforms.

Features	Coursera	edX	Udacity	Thailand ACCSTP online learning system
Video lecture	✓	✓	✓	✓
Teaching guides	✓	✓	✓	✗
Forums	✓	✓	✓	✗
Exercise	✓	✓	✓	✓
Evaluation /quiz	✓	✓	✓	✓

an online examination and only 0.9% of the users actually passed the test and completed the course. Completion rate actually refers to users who obtained the certificate at the end of course.

Table 2: Website statistics of the Thailand ACCSTP online learning system.

Registration	Enrolment	Examination	Complete
100%	32.6%	8.2%	0.9%

As mentioned, the completion rate of the Thai ACCSTP online learning system is very low compared to other MOOCs where the average of the completion rate is less than 7% (See Table 3). The low completion rate of MOOCs has been considered a significant issue since the statistics of users in other popular MOOCs show that many online learners lost their interest only after a few weeks of course progress (The Maturing of the MOOC, 2013). The following table presents the average completion rate of other MOOCs:

The reasons for failures in MOOCs can be analysed from many perspectives. Failures can be caused by dysfunctions at any levels including the content level (learning materials), the system level (technical platform), or the learner level (user's characteristics). Thus, our research aims to propose a method for the learner which has the ability to improve the learners' knowledge level and motivation in order to increase the completion rate of MOOCs.

3. LITERATURE REVIEW

3.1 The Concept of Vocational Education In The Industrial And Postmodern Era

Recently, dramatic changes have been taking place in the industry, in the labor market, at work, and in work organizations. The traditional fundamentals of knowledge and skills, the nature of learning and the structure of work are being shaken as a result of the impact of technology and globalization (Watts A G 1996). Consequently, unemployment rates among adult population have soared since the Great Reces-

Table 3: The average of MOOCs complete rate.

Source	Avg.	Reference
Open University doctoral students	7%	The Maturing of the MOOC: Literature Review of Massive Open Online Courses and other Forms of Online and Distance Learning. (September 2013).
local news articles, university documents, presentations and other information source	6.8%	C. Parr. (May 2013). MOOC Completion Rates “below 7%”, Times Higher Education.
Harvard and the Massachusetts Institute of Technology	5%	J. de Bruyn. (August 2014). Wake Tech Beats Harvard/MIT in MOOC Completion Percentage
The EdX courses	8%	Jordan, K. (2013). MOOC Completion Rates: The Data, Available at: http://www.katyjordan.com/MOOCproject.html
Coursera	6%	
MITx 2012	4.6%	
MITx 2013	6.5%	Lewin, T. (2012). One Course, 150,000 Students, Available at: http://www.nytimes.com/2012/07/20/education/edlife/anan-t-agarwal-discusses-free-online-courses-offered-by-a-harvard-mit-partnership.html?ref=education

sion of 2008 in many developed and developing countries. In response with to the sluggish labor market, many young people try to compensate by continuing tertiary education, while others tend to withdraw from education, training and employment. The share of youths (aged 18 to 24) neither in employment nor in education (NEET) in 2011 ranges from 4 percent (the Netherlands) to up to 20 percent (Italy and Greece) in Europe, 12 percent in Australia and New Zealand, and 15 percent in the US (OECD. 2012). Existing evidence from developing countries suggests that rates are even higher, with an average 20 percent of youths in NEET in Latin America (ILO, 2010) and 25 percent in African countries (OECD. 2012).

As a result of the impact of new technology and globalization, the characteristics of the nature and structure of work and career is changing. This reflects a move from the industrial era to what has been termed as Post Industrial or Post-Modern era wherein our concept of vocation or career guidance also needs to change (Patton, Wendy, 2005). Patton and McMahon mentioned the change in the nature of the relationship between organizations and workers. Traditionally, it was based on tenure and loyalty, but now it is being economically driven with short-term contracts. This change has affected the psychological contract in which the worker and the employer

need to constantly renegotiate and enact their own career building process. Therefore, the definition of security at the workplace is now defined in terms of the individual's employability, not in terms of tenured employment.

A new definition of career in the postmodern era has emerged. Workers are expected to act as free agents, developing personal enterprises and personal marketing skills. As mentioned, Watts describes this situation as "the individual's lifelong progression in learning and in work". Furthermore, McMahon, Patton and Tatham (2003) noted that "the term 'life/career' has become widely used and what clearly needs to be acknowledged is the active role the individual needs to take in his or her ongoing career development" (p.4). We are standing in an era of "do-it-yourself career management" where individuals are being challenged to play a greater role in constructing their own career development (Patton W & McMahon M, 1999). Therefore, individuals increasingly need to focus on employability rather than job security. They must learn the skills which will assist them in taking responsibility for the direction and evolution of their own careers. What needs to be created as secure is the individual, and the individual's knowledge and skill currency, not the job.

The widespread changes which are outlined above are having a significant effect on vocational education, the learning requirements of tourism workers, and for the pedagogy to facilitate that learning. Furthermore, the knowledge worker in the present era shows dynamic and complex characteristics (Drucker, P.F. 1999). Thus, an appropriate learning method needs to be created with the ability to facilitate and improve the performance of the knowledge worker in the postmodern era so he or she capable of continuous learning and defining his or her own vocation and career development.

3.2 Mobile Learning

As mentioned earlier the impact of new technology and globalization on knowledge, skill, and on the nature of work, in conjunction with the evolution of handheld portable devices and wireless technology, has resulted in radical changes in the social and economic lifestyles of modern people. Advanced mobile devices such as "smart" cellular telephones are very popular among people, primarily because they are wireless and portable (El-Hussein, M. O. M., & Cronje, J. C. (2010). The concept of mobile learning defines such tiny technology devices as enabling different styles of learning. The type of learning that could be formal (within the classroom), or informal (outside the classroom). The learner has the choice to choose when and what to learn (Kukulska-Hulme & Shield, 2007). The characteristics of mobile learning mainly focus on the learners' mobility, allowing learning virtually anywhere and anytime, via mobile

devices. Therefore, many scholars have explored the delivery, methodology and feasibility of mobile device usage in various domains such as in educational contexts, technical support, the building of information technology (IT) infrastructure, and other resources (Samsiah Bidin, Azidah Abu Ziden). Previously, there were studies which focused on mobile learning conducted both inside and outside of the school such as in museums and temples (Hung, et al, 2010). So far, most of the studies on mobile learning have shown mainly positive results. As mentioned, these technologies provide opportunities for the knowledge workers to improve their working practices, collaboration processes, their productivity, and performance [9]. The people who come to study can learn, can have a review, and can interact with various competencies of the ASEAN - MRA through the online learning system allow them access to the content from anywhere at any time.

This trend also provides opportunities for the learners to share their knowledge and improve their learning performance (Northrup, P, 2001). The improvement of personal learning performance occurs when technology offers the possibility to save time, free access to information and allows communication via multiple channels regardless of location (Goodman, P. S. & Darr, E. D., 1998). Consequently, online learning systems could deliver benefits for knowledge workers in tourism since it provides them the opportunity to study and to develop their knowledge and skills in compliance with the ASEAN- MRA competency standards. Furthermore, new functionality devices like tablets, smart phones, and phablets also provide richer social connectivity and more engaging face-to-face interaction. As mentioned before, the advantages of mobile technology represent a chance to make a great impact on the learning performance, since it supports the mobile culture and lifestyle of today's knowledge workers.

3.3 Massive Open Online Courses

Massive Open Online Courses (MOOCs) have received worldwide attention as a new model for delivery of online learning for students. Many academic institutions have invested considerable effort in developing, promoting and delivering their courses. Therefore, the number of MOOC registrations have grown dramatically (Laxmisha Rai & Deng Chunrao, 2016). The main reason behind this success is that MOOCs are able to solve many educational problems. For example, the participation in MOOCs is free and easily accessible via Internet. One can take more than one course and all of the content is open for the course taker. Furthermore, the learners in remote areas and even in developing countries are enabled to access the content via Internet (Yuan, L and Powell, S. 2013). The Thailand ACCSTP online learning system under the concept of MOOCs has many features such

as video lectures, interactive scenario games, e-books, and social media. Chernbumroong et al. (2017) also supported that video lecture and game for education is suitable for Thai tourism worker's learning style. These features aim to reach user engagement in an online learning environment and to encourage all Thai tourism workers to reach the ACCSTP standards. However, it has been unclear why learners choose MOOCs and what the reason behind that choice. Furthermore, it has been noted that the success rate in this kind of MOOC is less than 7% on average (Laxmisha Rai & Deng Chunrao, 2016).

The reasons for the failures in MOOCs can be examined from many perspectives. For example, users who intend to complete the course may fail to do because they are unable to devote the necessary time to study (Conole, G. (2013). Also, some users found that the level of the course is too difficult for them and they lack the necessary background (Belanger, Y. (2013). Furthermore, some MOOC users found that they faced a variety of bad experiences such as having a barrier to continued participation, poor quality and incorrect learning materials or technical problems in the MOOC platforms (Boyatt, R., Joy, M., Rocks, C., and Sinclair, J. (2013). According to some opinions, the learners in online learning courses do not intend to complete the course since it lacks clear goals and motivators of achievement. Thus, it is not motivational for them (Cross, S. (2013). The motivation factor becomes an important factor since it leads to successful online learners.

Previously, the gamification concept played a key role in online learning in order to improve motivation and success in online learning contexts. Zichermann and Linder (2010) define the concept of gamification as tools for supplementing and branding which are realized through the application of game elements and mechanics. Gamification has been applied to the online learning context and it turned out that it is able to successfully improve the level of motivation. For example, Chernbumroong et al. (2017) reported that a leaderboard with different goal setting levels could provide positive results. They also provide methods and processes for selecting the gamification elements (Chernbumroong et al. 2019). However, the lack of knowledge improvement is still problematic. For example, Domínguez et al. (2013) developed a gamification plugin for the Blackboard e-learning platform. The results showed that the attention rate and the number of practical assignments was great for the experimental group, but the performance on written assignments and participation was poor. Gasland (2011) developed a collaborative question-and-answer e-learning system called "StudyAid" which was developed for students to learn the course material and study for the final exam. A survey revealed that the system was generally considered as useful and easy to use. However, the gamification elements did not have

a large impact, perhaps due to the nature of the task (studying). Goehle (2013) developed an open source homework application, WeBWorK with a number of gamification elements. The results showed that at least half of the students who completed 90% of the homework put an extra effort to obtain achievements. However, the authors could not conclude what effect, if any, gamification had on the performance of students in the course.

Gamification and mobile learning concepts can be solutions which are able to improve the motivation in MOOCs. However, it is still unclear whether the gamification is able to improve the completion rates in MOOCs or not. Therefore, a knowledge improvement factor needs to be added in order to solve the problem of low completion rates and knowledge gaps in the Thailand ACCSTP online learning system. In the next section we present our applied knowledge improvement method.

3.4 Knowledge Improvement Method

Massive Open Online Courses with mobile technology have an influence on the learning style of tourism knowledge workers through offering them the opportunity of a self-paced learning. However, this technology can also have negative effects on knowledge workers. Knowledge workers are frequently exposed to an overload of partly irrelevant information. Consequently, such a dramatic increase of information flow can confront with the learners' limited cognitive capacities. Nevertheless, online learning systems often lack sufficient control over the content this diminishes the potential learning benefits since MOOCs do not present a sufficient learner-content interaction. Therefore, our research proposes a knowledge improvement method implemented by employing the cognitive theory and interactive media to improve the learning performance of knowledge workers who are working in the tourism industry.

3.4.1 Cognitive Load Theory

The learning media in online learning systems have been developed as mobile learning materials to re-skill knowledge workers in the tourism industry. However, the learners may suffer from information overload. According to the cognitive load theory (Kirschner PA et al. 2011), the human working memory capacity is limited, and overloading working memory hinders learning. Cognitive load theory hypothesizes that the human brain's active memory capacity is limited while the long-term memory capacity of human brain is unlimited. The long-term memory is where knowledge is stored in form of schema (Sweller, J. et al, 1998). In our case, mobile technology has an influence on the learning style of knowledge workers. The dramatic increase of information flow raises the problem of the learner's limited cognitive capacities. Knowledge workers are frequently exposed to an over-

load of partly irrelevant information. Mayer (2005) describes this problem as extraneous load. It occurs when a high load of irrelevant information is processed in the working memory (Mayer, R. E., 2005). He suggests that extraneous cognitive load should be reduced as much as possible.

In our study, we applied the cognitive load theory as a concept to design and test the video lectures in the online learning system with the aim of improving the learning performance of the knowledge workers. The appropriate video length should foster learning since it is considered to be one of the factors that influence the learning performance. According to the cognitive load theory, in order to avoid information overload, the video lectures should be divided into small, meaningful building blocks. Shorter videos will foster the learning performance. The work which is most relevant to our study's objective is the research work by Philip J. Guo, Juho Kim, and Rob Rubin (Guo, P, 2014). They present an empirical study of how video production decisions affect student engagement in online educational videos. The main findings are associated with learner engagement. The result of the experiment indicates that shorter videos are much more engaging while engagement drops sharply after 6 minutes. They conclude that the video creator should plan to segment videos into chunks shorter than 6 minutes in order to foster the leaner engagement. Based on the cognitive load theory and related works, we believe that shorter videos should foster not only engagement, but also the learning performance of the learner. Hence, complexity should be reduced, and the overload of information should be eliminated from teaching videos. Therefore, we hypothesized that video content segmented to shorter than 6-minute videos can best support the learning performance.

3.4.2 Interactive Media

Online learning systems provide great learning platforms since they support the mobile nature of knowledge workers. This technology offers the opportunity of self-paced learning for individual learners. However, one of the major weaknesses of some online learning systems is that they do not present sufficient learner-content interaction (Zhang, D., and J. F. Nunamaker., 2004). Normally, interactivity is considered to be a fundamental success factor for teaching and learning in an online environment (Sims, R., G. Dobbs, and T. Hand., 2002). Moore (1989) defined three types of interaction in learning: learner-instructor, learner-learner, and learner-content. In our study, learner-content interaction is defined as any interactive activities between the learner and the instructional content in an online learning environment (Moore, M. G., 1989). Therefore, we have adopted 2D learning games as interactive media tools which aim to provide an interactive environment for

the learner. According to the literature, Northrup mentioned that an online learning environment which provides interactive multimedia instructions can help maximizing the learners' abilities to improve their performance (Northrup, P., 2001). Therefore, in our experiment, we hypothesize that the learners who are involved in an interactive multimedia game-based environment can achieve higher learning performance than those in a non-interactive environment.

3.4.3 Learning Performance and Knowledge Test

Continuous learning is considered as one of the major factors which determine the productivity of knowledge workers. Without learning, knowledge workers tend to lack the appropriate information for solving the problems, for completing the task assignments, and for generating ideas in new situations (DRUCKER, P.F., 1999). Thus, learning technology has been involved with the aim of fostering the learning performance of knowledge workers. Measuring the learning performance of knowledge workers is a crucial part in our study since it can lead to better learning technology improvements. In our study, a knowledge test has been applied for measuring the learning performance of knowledge workers in tourism. The knowledge test consists of three sub-tasks. First, the retention test intends to measure the leaner's memory related to the presented content-corresponding to remembering factual and conceptual knowledge in Bloom's taxonomy. Second, the transfer test intends to measure the learner's understanding of the presented content-corresponding to understanding and applying conceptual knowledge in Bloom's taxonomy. Third, the matching test intends to measure how well the learner was able to build referential connections between corresponding verbal and visual components of the system (Anderson, L et al., W, 2001). According to the knowledge test, we calculated the score of learning performance based on the formula shown in Figure 2.

$$\text{The score of learning performance} = \frac{\text{The score of retention test} + \text{The score of transfer test} + \text{The score of matching test}}{3}$$

Fig.2: The learning performance formula.

4. EXPERIMENT 1

The purpose of experiment 1 was to determine the optimal video length guaranteeing the best learning performance of users in the online learning environment. Based on the cognitive load approach, the group using videos shorter than 6 minutes was expected to have a better learning performance than the other group due to the reduced complexity of tasks in the instructional videos. The hypothesis was formed as follows:

H1 : A length of less than 6 minutes is the optimal length for online video lecture segments.

4.1 Methodology

Sixty-four knowledge workers in front office positions from hotels in Chiang Mai, Thailand, participated in this study. The mean age was 26.5 years and there were 37 women and 27 men. The majority of participant's education background is bachelor's degree (65%) and high school diploma (35.5%). Over 72% of participants had only 0-3 years of work experience. The participants were assigned to obtain the ASEAN- MRA competency standards via video lectures in an online learning system. The videos consisted of PowerPoint lessons on "How to provide room service". The presentations in the video included pictures, diagrams and a narration by the lecturer over 21 individual PowerPoint slides with a total duration of 20 minutes. The slides advanced automatically as the teacher started the lecture. The participants were asked separate into 4 groups (sixteen participants per group) and were randomly assigned learning materials of four different video lengths (Fig: 3).

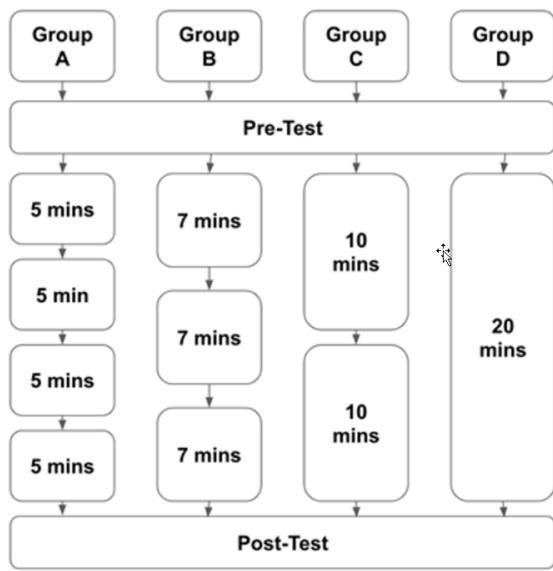


Fig.3: Research Methodology of Experiment 1.

Group A used video segments of 5 minutes. In Group B the video content was broken up into 3 segments, 7 minutes each. Group C used two 10-minute segments and finally group D was provided a 20-minute videos without any segmentation. The participants in groups A, B, and C were allowed to stop or select parts of the videos. However, all of the participants needed to complete the lesson within 25 minutes. Before the lesson, they were assigned to have a Pre-test. The Pre-test questions consisted of 3 parts as follows (5 questions for each part): retention test questions (with a 5-minute time limit), transfer test questions (with a 5 minute-time limit) and

matching test questions (with a 5-minute time limit). After the Pre-test, a tablet PC, Samsung note10.1 with a 10-inch monitor was given to every participant as a learning mobile device. The participants in each group were told that they were going to have a lesson on "Providing room service" via the tablet and then they need to answer some questions (Post-test) based on the material. Following the presentation, all participants took the Post-test which was similar to the Pre-test.

4.2 Results

In order to score the retention test and the transfer test, we generated five multiple choice questions for each test. An example question from the retention test was "Please write down an explanation of room service". Another example of a transfer test questions was "What would you do when the customer asks for room service?" For each question the only one good answer should have been selected from the possible four choices. For the matching test, we generated five pictures which appeared in the presentation and ten possible definitions. The participants had to match the pictures with related definition. Each correct answer was awarded one point, and the points for each question were added up to compute the total score which was used in the analyses. Table 4 presents the mean scores of the four groups on the retention, transfer and matching tests for both Pre- and Post-tests, including the overall score of learning performance and progress.

Table 4: Mean Score of Retention, Transfer, and Matching Test - Experiment 1.

Group Experiment	Knowledge-Test						Total Score		Pro-gress	
	Retention Test		Transfer Test		Matching Test					
	Pre	Post	Pre	Post	Pre	Post	Pre	Post		
A (5 mins)	0.97	2.95	1.26	3.02	1.41	2.91	1.21	2.96	1.75	
B (7 mins)	1.14	2.6	1.31	2.72	1.30	3.10	1.25	2.80	1.55	
C (10 mins)	1.21	2.5	1.28	2.74	1.82	2.82	1.43	2.68	1.25	
D (20 mins)	0.85	1.1	1.30	2.13	1.37	2.85	1.17	2.02	0.85	

As regards the scores of the pre-tests, the participants in group C reached the highest score ($M = 1.43$) and group D ($M = 1.17$) reached the lowest. However, there was no significant difference in the overall scores among the four groups. As far as the back-

ground of the participants is concerned, prior knowledge seemed to be similar since all of them were working in the same position (front office) at local hotels and the topic of ASEAN-MRA competency standards was new for them. For post-tests, the results indicate that the scores of the participants in group A (total score = 2.96) were significantly higher than others in every tests (retention test = 2.95, transfer test = 3.02, and matching test = 2.91) whereas the scores of groups B (total score = 2.80) and C (total score = 2.68) were similar without any significant differences. However, the scores in group D (total score = 2.02) were significantly lower.

The comparison of the progress scores of the four groups shows that the learning performance of participants in group A who were provided the shortest videos (5 min) show significant improvement. According to the cognitive load theory a shorter video length is likely to contribute to a better learning performance since it reduces task complexity and information overload in instructional videos. Thus, the leaner can absorb the information more effectively. We concluded that the results support our hypothesis.

5. EXPERIMENT 2

The purpose of experiment 2 was to test the effect of interactive media on the learning performance of knowledge workers in an online learning environment. According to the applied concept, interactive media instructions in an online learning environment can help maximizing the learners' abilities to improve their performance. Thus, we formed the following hypothesis:

H2: participants involved in a learning group in an interactive multimedia environment can achieve higher learning performance than those in a non-interactive environment.

5.1 Methodology

The second experiment was done on the same group of participants, knowledge workers from the hotel service sector. The participants were assigned to learn about the ASEAN-MRA competency standards via video lectures in an online learning system. The video consisted of a PowerPoint lesson on "Providing food and beverage service". The presentations in the videos included pictures, diagrams and the voiceover of the lecturer via PowerPoint with a total duration of 20 minutes. After the presentation the participants were separated into control and experiment groups (thirty-two participants per group). The experiment group was assigned to use an interactive media (2D learning game) right after watching the learning video. The control group was assigned to use a general learning video (Fig. 4).

For the experiment group, a 2D learning game was provided as an interactive media tool which was ex-

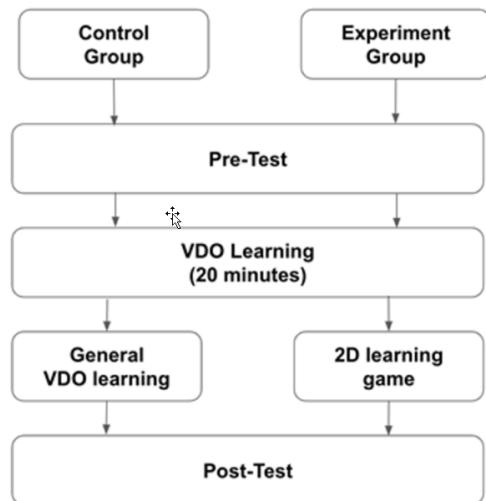


Fig.4: Research Methodology of Experiment 2.

pected to provide an interactive activity between the learner and the instructional content in the online learning environment. The game content was based on the lesson on "Providing food and beverage service" related to the ASEAN-MRA competency standards. The learning game consisted of a 2D animation and a game element (e.g. Matching, Quiz). The game aimed to illustrate the simulated scenario of the lesson content. Thus, the participants could interact with the content via the learning game after they finished the learning video. The control group, on the other hand, was not provided any interactive media. The participants in this group were only allowed to watch the learning video via tablets before doing the tests.

Participants of the control and experiment groups were assigned to take a Pre-test before the video lesson. The Pre-test question structure was similar to that which was used in experiment 1. It consisted of a retention test, a transfer test, and a matching test (5 questions in total with a 5-minute limit to complete each part). After the test, they were given tablet PCs as learning mobile devices. All the participants were told to complete the lesson within 25 minutes and then they had to answer the questions of the Post-test which was similar to the Pre-test.

5.2 Results

A multiple-choice questionnaire was created as an assessment tool for the retention and transfer tests. The matching test consisted of random pictures and a list of possible definitions. The same scoring rule was applied as in Experiment 1. Participants received 1 point for each correct answer, then it was added up to compute the total score which was used in the analyses. The mean scores of the control and experiment groups are presented in table 4, including the overall score and progress.

Table 5: Mean Score of Retention, Transfer, and Matching Tests - Experiment 2.

Group	Knowledge-Test						Total Score	Pro- gress		
	Retention Test		Transfer Test		Matching Test					
	Pre	Post	Pre	Post	Pre	Post				
Control	0.88	2.12	0.96	2.32	1.35	2.62	1.06	2.35		
Experiment	0.94	3.03	1.31	2.52	1.27	2.78	1.17	2.77		
								1.60		

On the Pre-test the experimental group ($M = 1.17$) achieved a slightly higher score than the control group (1.06) on general knowledge. There was no difference in background since the participants were the same as in experiment 1. On the Post-test, however, there was a significant difference in the test results. The experiment group achieved better scores than the control group on every test (transfer test = 2.52, matching test = 2.78), and particularly on the retention test ($M = 3.03$). Hence, the total score ($M = 2.77$) and overall progress ($M = 1.60$) of the experiment group was much higher than that of the control group. Involving interactive media instructions in an online learning environment improved the learning performance of participants, especially on the retention test which focuses on the learner's memory. Therefore, we concluded that the results support our hypothesis.

6. CONCLUSION

In two separate experiments, the concept of cognitive load and interactive multimedia were applied for designing and testing the learning media in the online learning system focusing on the ASEAN-MRA competency standards. The pattern of the results in experiment 1 is consistent with the cognitive load theory. The learning performance of the participants was significantly better when the video was divided into smaller parts (shorter than 6 minutes). Moreover, the learning performance decreased as the video length became longer (7, 10, 20 minutes). Thus, our recommendation for video creators / editors of online learning content is to use video segments shorter than 6 minutes in order to foster the learning performance. The empirical results in experiment 2 are also consistent with the concept of interactive media. A 2D learning game was added to the online content in order to facilitate interaction between the learner and the instructional content as part of the online learning environment. The participants who used interactive media after they finished the video lesson could achieve higher scores and better learning performance than those without any interactive content. Therefore, we recommend developers of online learning systems integrate interactive media into the online learning environment since it leads to better

learning performance.

7. LIMITATIONS AND FUTURE DIRECTIONS

These studies were conducted as short laboratory experiments and the number of participants was quite low. Future work can be oriented to determine the different video production styles in order to find out the preferences of knowledge workers in online learning. Moreover, there are other possible aspects against which online learning systems designed for the knowledge workers of the tourism industry targeting the ASEAN- MRA competency standards could be assessed such as engagement, motivation, and preference.

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