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The Mapping of On-Line Learning to Flipped Classroom: Small Private Online Course

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Abstract: This study uses an integrated pedagogical tool for knowledge learning as an on-line tool for flipped classroom activities and as an off-line capability training tool. Theoretically, the Experiential Learning Cycle (ELC) plays a critical role in promoting students learning effectiveness and performance. However, a dearth of research has applied M-learning and flipped classroom in combination with the ELC stages such as concrete experience, reflective observation, abstract conceptualization, and active experimentation to examine the knowledge and ability learning outcomes for students. This study integrates the On line to Off line (O2O) classroom development and usage derived from the four stages of ELC based on on-line knowledge learning and off-line ability training in Microeconomics courses. The results revealed significant improvements in students learning outcomes after O2O mode was implemented. In comparison with traditional teaching methods, not only does O2O teaching significantly improve the students' learning result of professional knowledge, but O2O teaching also significantly enhanced the capabilities of the students. Furthermore, this study reports the findings from major activities of each ELC stage in O2O classroom practice along with the mapping of on-line learning and off-line training included in the aforementioned stages. Finally, the study provides pedagogical implications and future research directions.

Keywords: M-learning; flipped classroom; O2O classroom; experiential learning cycle; learning performance

1. Introduction

Massive Open Online Course (MOOC) is an emerging form of online learning based on network and mobile intelligence technology. After the advent of the "MOOC year" in 2012, MOOC has set off an irresistible upsurge in the world.

In January 2018, the Ministry of Education in China held a press conference to announce the formal launching of 490 "National Excellent Online Courses". It is the first time in the world, that full support from a national State power was provided towards launching a new online education mode, and the quantity of China's MOOC has topped the global list ever since.

The large-scale application of MOOC introduced a new low-cost and equitable educational model. MOOC removes the limitation of time and space on educational resources so that students can enroll in courses in top universities at home, thus gaining the flexibility to allocate their learning time and energy according to personal needs. As of September 2015, over 1300 courses in more than 200 universities

around the world have been launched, and more than ten million people from all over the world have taken MOOC courses. However, with the number of platforms, courses and registered students rising sharply, the quality of learning is taking a rapid downswing. MOOC, with its typical features of openness, sharability and large-scale, have generated huge market value; yet in the meantime, presented an embarrassing contradiction between high registration rate and low course completion rate. Also, people find that many MOOC online courses are still dominated by the cognitive mode of classes, and that there is almost no interaction between teachers and students, let alone cultivating the students' learning habits of behaviorism and constructivism. Such phenomenon goes against the concept of MOOC. MOOC presents potential negative effects in at least three aspects: that is, hindering the goal of improving the individualized teaching quality, impairing the intrinsic educational value of the technology itself, and affecting the essential function of university education [1].

Under this consideration, a compact but adequate course model—SPOC (Small Private Online Course) gains popularity. SPOC is a teaching model of school-oriented Online-to-Offline (O2O) classroom (a system integrating school features) developed on the basis of MOOC. Unlike MOOC, which aims at large-scale teaching, SPOC often has a certain restriction on the number of attendants, so is more suitable for courses provided by colleges to their students. SPOC enables teachers to adopt the teaching method of "Flipped Classroom", which consists of two parts: group-based interactive learning in class, and computer-based individualized learning after class [2]. The integration of online video teaching and offline classroom teaching breaks through the closed, fixed and one-way traditional teaching mode centered on teachers, and truly realizes the student-centered individualized learning advocated by MOOC.

At present, the research on O2O classroom in the world mostly focuses on the design and optimization of flipped classroom under the SPOC mode, and concentrates upon the way and method of O2O classroom teaching mode. Gerstein [3] proposed a mode of flipping classroom teaching by dividing the course into four stages: the stage of experiencing learning stage, the stage of exploring the definitions, the stage of constructing meaning and the stage of showing the applications. Bergmann and Sams [4] advocated that the teachers should make a video for every teaching theme, the length of which should be condensed in less than 14 min, and that the common video's length should be kept within 10 min.

However, there is little research on the curriculum assessment of the flipped classroom under SPOC mode and on how effective the SPOC is in cultivating students' ability. Moffett and Mil [5] held that, current researches on flip classroom lack objective evaluation on students' performance, and put forward a method of flipped classroom evaluation based on Kirkpatrick model, which accounts of Reaction, Learning, Behavior and Result. Li [6] discussed the evaluation on flipped classroom from specific perspectives such as student satisfaction, and thought that the learning process and learning effect should be considered in the design of indicators for evaluating flipped classroom. Li [7] proposed the basic principles of the flipped classroom teaching and the construction route of the evaluation system based on the evaluation standards of CDIO teaching mode. Zhu and Zhu [8] provided an evaluation system for flipped classroom teaching based on fuzzy analytic hierarchy process, which is the beginning of research on the construction of the evaluation system for flipped classroom. As for how to combine online courses with offline activities, there is little research on curriculum evaluation and ability training of professional basic theoretical courses under the mode of O2O classroom teaching.

Based on the "microeconomics" MOOC course designed by researchers in school, this study explores how to implement O2O classroom teaching mode, to evaluate the effectiveness of implementation and to establish the mapping of on-line learning and off-line training with ELC stages.

2. Literature review

2.1. M-Learning as a Tool to Facilitate Teaching in Educational Institutions

E-learning has advantages in terms of independence over traditional learning modes [9]. There are similar learning programs in Japan and South Korea, i.e., the U-Japan and U-Korea program. Shanghai TV University provides mobile learning and relevant support service in the form of short message interaction [10]. With the development of mobile technology, the interaction and collaboration of mobile learning system is enhanced accordingly. Zheng and Xu [11] suggested that, mobile learning should have at least the following four characteristics: (1) supported by wireless network environment; (2) supported by the tool of mobile communication devices; (3) taking digital learning resources as supporting content; (4) learning whenever and wherever possible in any occasion and situation. Xie, Zhang and Cheng [12] built the evaluation system for flipped classroom teaching based on CIPP model, which can guide educational decision-makers to make comprehensive evaluation on the teaching process of flipped classroom from multiple dimensions. The research on critical thinking in foreign countries began in the early Twentieth Century, and continued to gain attention in the 1960s. In the 1980s, educators began to discuss the application of critical thinking in teaching and made important exploration. Mobile technology makes an important impact on learning, shifting it outside the classroom, penetrating into both real and virtual environment of learners. Mobile technology will create rich links between learning environment, learning resources and learners [13].

2.2. Integrating the M-Learning Tool and Flipped Classroom (FC) Activities for Practical Experience

The mode of O2O flipped classroom teaching has achieved desired results in cultivating students' interest in learning, and improving their autonomous learning ability, practical ability and independent thinking [14]. Mobile learning provides sufficient supplement and technical support to the mode of flipped classroom teaching. The dynamic integration of mobile learning and flipped classroom has the potential to vastly improve the benefits, effectiveness and efficiency of educational teaching [15]. Wang [16] designed a mixed online and offline College English teaching mode, which focuses on the SPOC online learning resources, flipped classroom activities and the design of formative curriculum evaluation system, establishing a mode of college English teaching to improve students' comprehensive application ability. Wu, Pan, and Yuan [17] observed that Information and communication technology (ICT) tools are increasingly utilized in educational institutions. Camacho-Nieto [18] pointed out that Students employed the tools and repositories to improve their teaching-learning processes, immersed in collaborative and mobile learning. Cern-Figueroa et al. [19] designed Instance-based ontology matching model, a new model of pattern classification and an application to align instances from different ontologies in turn related to e-learning educative content in a Knowledge Society context. In general, ontologies are the fundamental tool inherent to Semantic Web. Mobile technology opens the door for a new kind of learning called here and now learning that occurs when learners have access to information anytime and anywhere to perform authentic activities in the context of their learning [20]. Through the use of mobile learning applications, students can learn more than in traditional classroom settings as they can spend more time on extracurricular learning [21]. After long-term follow-up investigations, Wu, Pan and Yuan [17] found that students perceived the ICT tools of collaboration and social media as helpful in learning and in increasing career opportunities. Meanwhile, instructors also found these ICT tools useful. Therefore, by integrating collaboration and social media in teaching and course design, teachers can enhance student participation and link students' learning to their future employment [22]. Ubiquitous mobile computing allows students to take part in learning-related activities wherever they are. They are entitled to use multimedia resources to work on projects, communicate with distant collaborators, and to access information networks anywhere, anytime. They found that wireless computing technologies can potentially enhance social learning and can augment the acquisition of tacit knowledge that is part and parcel of socialization in communities of practice. Baepler, Walker and Driessen [23] stated that statistically, the students

achieved learning outcomes that were in one case superior to, and in the other case equal to that from the traditional classroom when measured by a standardized exam, and their perceptions of their learning environment improved.

Compared with developed countries such as the United States, Canada and Japan, China's thinking education has a late start. At present, thinking courses are either required or considered a key training subject in universities of these countries. The thinking education in Chinese colleges is still in the beginning stage, insufficient in goal-directness, systematic training and effective training methods. Ren et al. [24] concluded that in the mode of O2O flipped classroom teaching under the background of MOOC, students can learn at their school, then take part in flipped classroom learning via MOOC, and get certificates after completing all credits by passing the examination given by course instructors.

2.3. Experiential Learning Cycle (ELC) as a Pedagogical Theoretical Foundation

Dewey [25] proposed some fully developed models of reflection. Kolb [26] then modified these models to propose Experiential Learning Theory (ELT). ELT suggests that a learning cycle involves personal feelings and experience, and emphasizes on experience which plays a key role in the learning process. There are four stages in the theory: Concrete experience (CE); Reflective observation (RO); Active experimentation (AE); and Abstract conceptualization (AC). Cantor [27] noted that experiential learning is a necessary component of formal instruction in colleges and universities. It is important for the college classroom because, too often, academics develop assignments in which "students only learn to write for the academic setting" as described by Trueb [28]. And according to this, many college instructors have adopted a wider range of teaching methods to engage students with real-world learning activities [29,30].

Bonwell and Eison [31] suggested several ways of incorporating active learning into the classroom, such as: (1) pausing in lectures to allow students to consolidate their notes; (2) including brief demonstrations or short and ungraded writing exercises followed by discussion; (3) developing groups. Mcglinn [32] provided some suggestions to make the reflection cycle of the theory more applicable and efficient: on the one hand, teachers should use student reflections to plan future lessons; on the other hand, with time specially assigned for reflection, students' cooperation with teachers can support the reflection cycle. Students need time to reflect privately after the observation. In addition, students need to feel secure when they give their opinions, so a more collaborative relationship between university supervisor, student and teachers is required. To make reflection activities more effective, students should be provided guidelines and techniques such as conceptual mapping to incorporate abstract conceptualization. Manolis et al. [33] transformed the LSI from a type (categorical measure) to a degree (continuous measure) style that is not only more parsimonious but also easier to use than the existing LSI. (pp. 44–52). We combined the theory with modern technology to design the flipped classroom, a new classroom form, hoping to gain higher education effect, as well as to develop the theory, making it more applicable, practical and general.

2.4. MOOC as a Tool to Teach and Learn

MOOC is widely used nowadays. Professionals primarily use MOOC motivated by the following factors: 1. benefits to their current role, 2. future career, 3. casual interest in the topic, 4. simple desire to learn [34,35]. Companies also use information technology tools to model and design an original knowledge map-based web platform to promote organizational learning [36].

At present, some studies of MOOC concentrate mainly on class design. If offline learning is not completed separate from online learning, that is, when the online next semester still allows students to study on cell phones or computers or respond, the students' participation may actually be reduced and distractions may occur [37]. For better MOOC design, students should be prepared to use adequate e-learning tools, and teachers should provide meaningful in-class activities to relieve students' burdens.

MOOC designers should continue to privilege a learner-centered approach, in which autonomy and a personalized trajectory of MOOC learning are supported, to promote student empowerment and engagement [38].

2.5. Factors That Affect the Performance of Students in Flip Classroom

Previous research shows that many factors can influence the teaching effect of flipped classroom. Chen, Yang and Hsiao [39] find that there are three factors from the perspective of students' attitude towards the classroom: self-developed perception measures, situational interest contained feeling, value and topic interest. From the perspective of teaching satisfaction, there are four factors: course design, system quality, course arrangement and online assessment. But after analyzing the results of the class, it is found that there was no difference in the learning effect between genders. Females and males might have different topic interest in the course but they performed equally well. Milošević et al. [40] pointed out that expected performance and personal innovative capability have the most influence on the intended behavior of students. At the same time, Littlejohn et al. [41] linked students' performance with their self-discipline degree. Students who performed at higher levels have higher self-discipline ability, not only do they evaluate their learning in a function to their current professional context and needs but they are more likely to connect their learning to their future needs. Students with poor self-discipline ability tended to be more concerned with gaining a certificate of completion and were consequently more focused on completing all the activities and assessments. Gay et al. [22] emphasized the importance of learning for practice. In his opinion, students learn best when given the opportunity to learn skills and theories in the context where the skills and theories can be put into practice.

2.6. Suggestions for How to Improve the Flip-Classroom Model

Various suggestions were brought forward in order to help students learn and perform better in flipped classroom settings. From the perspective of the teacher's preliminary curriculum design, Hao [42] suggested that teachers should determine if they are indeed aware of their own students' learning needs and if they are willing to change for students' sake. Hwang and Chang [43] thought that in order to guarantee the learning effect, the web-based formative assessment has been recognized as an effective way to enable learners to be familiar with the learning content during course design. In the classroom completed, Frydenberg [44] argued that quizzes could motivate students to watch the videos because each quiz accounts for small amount of the final grades, and could help students check their understanding of key concepts. At the same time, Lai and Hwang [45] developed a self-regulated flipped classroom approach for assisting students' the extracurricular learning and for improving lecture quality. In order to improve classroom satisfaction, Yilmaz [46] found that the teaching program should consider sub factors such as computer self-efficacy, Internet self-efficacy, online communication self-efficacy, self-directed learning, learner control and motivation towards e-learning. These are predictors of student satisfaction and motivation.

Metwally and Wang [47] found that engagement in self-assessment and self-reflection activities have a significant direct effect on engagement in online studies and social interaction. In terms of online resource design, Long, Logan and Waugh [48] emphasized the importance of video before class, and conducted a questionnaire survey for students after class. Results indicated that the students want the videos to be shorter and that, in their opinion, 20 to 30 min was the ideal length. The students showed high interest in YouTube videos from National Geographic and Discovery. Metwally and Wang [47], Kong [49] suggested that preparing rich online resources and providing online interaction activities were prerequisites for the success of promotion engagement. But online course design goes beyond video, and teachers can design more interactive activities. Abdullah Konak and Clark [50] used structural equation modeling for data statistics and found that peer interaction is an important factor in student learning experiences, Metwally and Wang [47] also pointed out that the problem-solving model design of the task for the students' classroom performance are of great help for the improvement

of the function. The design of attractive and progressive problem-solving activities is essential for an effective flipped classroom. At the same time, teachers should also pay more attention to innovation.

The previous researches mainly include two aspects: the integration of critical thinking into the teaching of flipped classroom, and the use of mind mapping to better organize the knowledge points. Kong [49] pointed out critical thinking skills could infuse critical thinking skills development into the process of domain knowledge learning; deploy appropriate pedagogy to mobilize learners to engage in learning process; and use appropriate technology to facilitate this learning process. By this theory, teachers should put effort into designing learning materials in which the questions articulate the domain-specific problem scenarios and are formatted as critical thinking tasks for students to critically think about the related domain-specific knowledge to plot the answer. Hwang [43] also stated that mind mapping was a tool to help students organize their observations in the field, and that the mobile learning performance could be disappointing. He created interactive concept map mechanism, which he found out could assist students in re-organizing their observations in the field by evaluating the concept maps developed by the students and giving instant hints or learning guidance. In recent years, more and more new modes of flipped classroom appear in the introduction of relevant literature. According to Blau and Inbal [51], the re-designed model places a special emphasis on technology-enhanced embedded assessment, which combines individual reflection with peer feedback, on collaboration, and on co-creation of course content and of learning outcomes by students in order to develop regulation strategies in both individual learning (i.e., self-regulation) and teamwork (i.e., coregulation and shared regulation). Chen, Wang and Chen [52] design a new teaching model FLIPPED by adding Progressive Activities, Engaging Experiences, and Diversified Platforms, which is implemented in a "Holistic Flipped Classroom" environment and evaluated based on student survey, interviews, and an analysis of computer system logs; the program's model was proved effective; students reported that they were satisfied with the course, their attendance improved, and their study efforts increased.

3. Research Methodology

3.1. Participants

As shown in Table 1, a total of 78 freshmen students in a microeconomics course at a comprehensive university in mainland China form an experiment group, of which 69.7% were female and 30.3% were male. In addition, in the same group of microeconomics courses, 65 students were selected to form a control group, on which traditional teaching mode was employed. They are all between 18 and 20 years of age, none of them had any practical experience in the enterprises, and they have none to little prior knowledge of systematic study of economics.

Table 1. Basic Information of Sample.

Content	Classification	Number		Proportion	
		Test Group	Control Group	Test Group	Control Group
Gender	Male	23	16	30.3%	26.2%
	Female	53	45	69.7%	73.8
Pre-class knowledge background	Never touch	29	28	38.2%	45.9%
	Little understanding	47	32	61.8%	54.1%

Source: This study's questionnaire.

3.2. Online SPOC Class (M-Learning) Teaching Design

Microeconomics is the basic theory course of university economic management, and traditional classroom teaching is difficult to achieve satisfactory teaching effect in this course. Therefore, the "M-learning" online teaching model is adopted and the basic theoretical knowledge is introduced to the Edx platform after modular shooting.

As shown in Figure 1, through a series of teaching design, students can complete the systematic study of theoretical knowledge on the platform. In the first step, students complete a preview of the content of the teaching materials at the time specified. The second step is to assist the reading and preview of the textbook. Students can repeatedly watch the specified open online video, which usually contains 2–4 small fragments, each lasting about 7 min. The third step is to complete the test questions at the end of each lecture, including single topic selection, multiple choice questions and judgment questions, where they need to maintain a score of more than 80% to enter the next lecture. Step 4, students can create discussions from the first 1–3 steps in the online designated discussion area. On the same platform they will be entitled to posting questions, answering questions and sharing learning experiences.

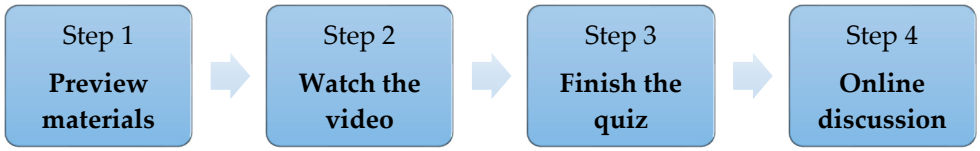

Figure 1. Four steps of M-learning.

3.3. Offline SPOC Class (FC) Teaching Design

M-learning is to assist students learn professional knowledge (knowledge comprehensiveness). Through the four steps of online learning and discussion, students systematically master the theoretical knowledge of specified sections. M-learning is a cost-efficient technique that encourages students to acquire knowledge without traditional education system restrictions [53,54]. In class participation, different forms of flip classroom can be put in place for various purposes such as training students, expanding the application of theoretical knowledge, and cultivating students' team skill and communication, thinking capability, knowledge capability, practical capability, further learning capability and so on.

If there is no online learning platform and system for M-learning, the students' basic theoretical knowledge cannot be effectively completed outside of class. The instructors are limited to using time in classroom environments, participatory teaching does not have allotted time and place, and the experience learning circle can't be discussed. With the M-learning online learning platform, traditional classroom instruction time is reduced, the course utilizes six parts of flip training based on the experience learning, and the system improves the students' knowledge application and practical ability. Figure 2 shows that the flip class of experiential learning and corresponding relation of cultivating the ability of students. Put in comparison with MOOC, SPOC is more capable of designing different offline activities according to content, student learning condition and time. This way the instructor and the institution is able to focus on training specific abilities of students.

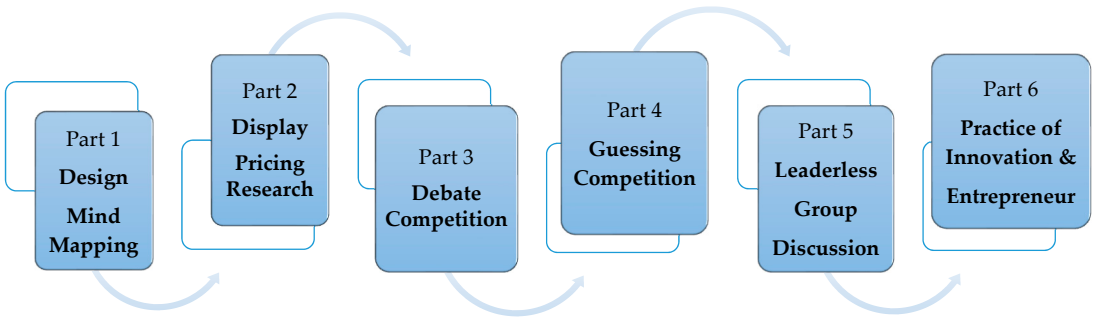

Figure 2. Six Parts of Flip Class.

3.4. Instrument and Data Analysis

The exam and survey method are typically used for quantifiable data, the instrument used in this study were the questionnaires, which discover the demographic information of the participants, including the experiment group and control group, such as gender and age. Moreover, this study compared the test scores after M-learning use as one of student' learning outcomes to that before the new system was introduced. These items were mainly extracted or borrowed from previous studies [54,55], and respondents rated their perceptions of the items using five-point Likert scales, ranking from 1 (for "strongly disagree") to 5 (for "strongly agree").

In this study, we conducted preliminary design based on the combination of on-the-spot investigation on expert and literature research before final design. After questionnaires and interview outlines were designed, we first applied four pretest samples in order to examine the rationality and learned more about this filed. Based on questionnaires and interview outlines collected, we revised them to make them simpler and easier understood. We designed different questionnaires in respond to different interviewee group, including questionnaires for experiment group and control group. 78 participants in experiment group and 65 in control group took the questionnaire survey at the end of the semester. Of the distributed questionnaires, 76 questionnaires for experiment group and 61 questionnaires for control group were collected.

Data analysis is performed and we conducted in-depth interview with part (about 30%) of the students based on the results to confirm if the students' abilities on knowledge application has improved and the activities that effectively enhanced application abilities, and which abilities were involved. For example, if the student states "my critical thinking greatly improved through taking the course", we would ask the student to provide the name of the activity he or she thinks helped the most in enhancing the said ability. If the student gives the opinion "the course helps us improve our abilities to collect information", then we would ask for explanation on the student's method of information collection and how it changed since taking the course.

4. Analysis of Results

4.1. Students' Learning Outcomes before and after M-Learning Use

First, the selection of the experimental group and control group students was conducted by random grouping, Table 2 shows that the mean value of the pre-test scores of the experiment group and control group are 37.356 and 38.126 respectively, the two groups before learning the relevant basic knowledge of no significant difference (T value in statistically significant). Second, Table 2 shows that the mean value of the post-test scores of the experiment group and control group are 82.298 and 76.324, respectively, Although MOCCs are better than traditional teaching methods, there is no significant difference between the two groups after learning (T value is not statistically significant). Table 2 shows that the mean value of pre- and post-test scores of the 76 students are 37.356 and 82.298 respectively. Moreover, the standard deviation (SD) of pre- and post-test scores are 13.234 and 9.385 respectively. Comparing mean values before with those after M-learning use, we found that participants' knowledge learning performance significantly improved. This result is consistent with previous research on M-learning [55,56]. It can be seen from Table 2 that control group with traditional teaching methods can also significantly improve students' knowledge learning performance.

From the results of the follow-up interview, other learning outcomes were also found after M-learning use, such as promoting self-study and self-management capability. For example, S5 stated, "I was a little not accustomed to the teacher's teaching but attending to the edx platform on a regular basis to complete the quiz and discuss with classmates forced myself to learn how to use limited resources to study knowledge and thus I have harvested a lot". S8 demonstrated a similar learning outcome. He said, "compared with other courses of teacher lectures, I prefer the edx platform video teaching, because I can watch for many times, and interact with teachers and classmates through group discussion so that I gain learning initiative. "S1 and S16 also stressed that "other courses don't require

preview before class, and students just go directly to the classroom to listen to the teacher; now that before the class activities, students must use the edx platform resources and fully develop their own ways to learning theory knowledge and gradually gain better self-study ability".

Table 2. Comparison of Students' Knowledge Learning Outcomes.

Sample	Period	*N*	Mean	SD	*t*-Value
Experiment group	Pre-test	76	37.356	13.234	0.253 **
	Post-test	76	82.298	9.385	
Control group	Pre-test	61	38.126	13.014	0.211 **
	Post-test	61	76.324	10.564	

Notes: ** Standardized beta coefficients are reported at the 5% levels of significance.

4.2. Major Activities and Findings Based on Integrating M-Learning Use and FC Practice

4.2.1. Empowerment of Practical Capability Via FC Practice

Table 3 shows that the mean value of experiment group and control group scores of the participated students are 4.014 and 3.256 respectively. Moreover, the standard deviation (SD) of experiment group and control group scores are 1.302 and 1.732 respectively. Comparing the mean values of experiment group and control group, we found that participants' practical capability significantly improved via FC practice.

Table 3. Comparison of students' capability learning outcomes.

Capability	Sample	*N*	Mean	SD	*t*-Value
Practical capability	Control group	61	3.256	1.732	0.375 ***
	Experiment group	76	4.012	1.302	
Further learning capability	Control group	61	3.423	1.685	0.301 ***
	Experiment group	76	3.953	1.293	
Integrative capability	Control group	61	3.453	1.725	0.241 **
	Experiment group	76	3.841	1.356	
Thinking capability	Control group	61	3.374	1.702	0.224 **
	Experiment group	76	3.725	1.367	

Notes: Standardized beta coefficients are reported at the 1%, 5%levels of significance with ***, **, respectively.

Based on data from the follow-up interview, in the experiment group, over 30 students indicated that they could learn more practical experience through price research and the practice of innovation and entrepreneurship. For example, S35 said that he felt he could solve business problem via FC practice. We know the purpose of practice-based learning for flipped classroom is to help students explore what they have learned in real world situations. With content provision moved outside of the class, in-class time is devoted to other activities, such as active learning, critical thinking, and problem solving (CITL) [57]. Love et al. [58] found that students in a flipped algebra class performed better on course exams, although the final-exam results were no different than their peers in a more traditional format [32]. Given continuous practical activities with the RPC, students will be promoted to a higher level of practical experience [59].

4.2.2. Enhancement of Reflection and Further Learning Capability from FC Practice

For this aspect, participating students yielded mean values scores of the s are 3.953 and 3.423 respectively for experiment and control groups and the standard deviation (SD) for the two groups are 1.293 and 1.685 respectively. Upon comparison it can be observed that participants' reflection and further learning capability also underwent significantly improvement.

Over 20 students from the experiment group indicated in the interview that they know how to effectively engage in reflection and self-learning via the on-line interaction and off-line competitions. For example, S53 said, "I have learned more skills about how to learn effectively". During this learning process, the students can systematically reflect on their own experience and develop their study skills [60].

4.2.3. Integration of Different Knowledge via FC Practice

For the Integration of Different Knowledge Via FC Practice, data shows the two having mean values of 3.841 and 3.453 respectively. Standard deviation (SD) came out to be 1.356 and 1.725 respectively for experiment and control groups. The mean values of the groups showed significant change in integration of different knowledge capability.

Data from the follow-up interview reveals that over 40 students from the experiment group pointed out that they had the knowledge of how to integrate different knowledge via designing mind mapping and competitions. More importantly, the students can reflect on and integrate different knowledge and information in the flipped classroom activities. In contrast, some students learned the basic knowledge well in the control group, but they lacked the ability and the experience to apply this knowledge in practice. The ability to apply different knowledge to practice is important for the learners [61].

4.2.4. Improvement of Thinking Capability Via FC practice

As shown in Table 3, the mean values of 3.725 and 3.374 were plotted for experiment and control groups respectively. As for the standard deviation (SD), the experiment group had an SD of 1.367 opposed to 1.702 from the control group. It is found from the mean values of the groups that participants' thinking capability significantly improved after FC practice was put in place.

In the experiment group, over 20 students expressed in the follow-up interview that the competitions and other flipped classroom activities significantly explored their thinking approaches, including critical thinking, systemic thinking, and creative thinking. For example, S62 said, "she is likely to think over the problems partly and superficially because of the lack of knowledge and thinking training". S68 commented, "It is important to look at problems all-round field via the thinking training of the flipped classroom". Rich inspirational classroom questioning can broaden the students' mind, arouse their study enthusiasm and stimulate students' curiosity [62].

4.3. Mapping of M-Learning and FC Activities with ELC Stages

In this study, we adopted the O2O model of online theoretical knowledge learning and offline training, and designed the knowledge application, ability training of online interactive knowledge learning and flipped classroom in six sessions. Based on the process and development of M-learning, FC activities and the theoretical foundation of ELC, Table 4 presents the mapping of M-learning (on-line) and FC (off-line) activities with the four major ELC stages.

Table 4. Mapping of M-learning, Flipped Classroom (FC) activities with Experiential Learning Cycle (ELC) stages.

O2O	Activity	ELC Stage	Key Capability
M-learning	On-line interaction	RO and AC	Reflection and further learning
FC Activities	Designing mind mapping	AC and AE	Integration of different knowledge
	Displaying pricing research	CE and AC	Practice
	Debate competition	RO and AE	Thinking
	Guessing competition	RO and AC	Integration of different knowledge
	Leaderless group discussion	RO and AE	Reflection and further learning
	Practice of innovation and entrepreneurship	CE and AC	Practice

According to the feedbacks of the students in in-depth interviews, students who were in the control group had a deeper impression about teacher performances, whereas those who were in experiment

group focused more on themselves, especially the acquisition of the knowledge and the development of abilities. When giving comments and advice on the course, students in reference class spoke about the style of the teacher and classroom atmosphere; while students in experimental class think that the course is challenging and suggest that the students' pressure and group projects can be reduced with proper measure.

It was observed that though students as well as teachers adapt well to in traditional lecture-based classroom teaching mode, but the effect of knowledge learning and ability training is relatively poor. Meanwhile, although it might be stressful and challenging for students and teachers to perform when O2O teaching mode is introduced, students were able to learn more and develop their ability of knowledge application through online self-study, online discussion as well as offline flipped classroom sessions.

5. Conclusions

In regard to the issue of O2O classroom and the ELC, we found that the integration of O2O classroom, a pedagogical tool for knowledge learning and ability training, and ELC, a learning theoretical foundation, is crucial for promoting students' learning effectiveness. However, few studies have applied O2O classroom with ELC's stages to examine the learning process and learning outcomes for students. This study, based on the survey study and in-depth interviews for the experiment group and control group participants, provides the following valuable findings and insightful suggestions for researchers and educators.

First, regarding the ELC as a pedagogical theoretical foundation, this study extends the application of the academic field to the social science field, allowing it to be applied in engineering or sport or information education [60,63,64]. More importantly, the results present the major activities of the four stages in the ELC with the O2O learning outcomes in real time settings. This study provides a useful illustration of applying the ELC in teaching and learning for integration of M-learning tool and flipped classroom activity.

Second, with respect to the issue of the integration of online platform use and offline flipped classroom design, this study shows that the students maintain superior learning outcomes by using M-learning compared with previous studies. Students may be allowed to use their mobile devices as bilingual dictionaries or use their mobile cameras to capture photographs of PowerPoint presentations [54]. M-learning is a cost-efficient technique that encourages students to gain knowledge without traditional education system restrictions [53,65]. More importantly, compared with the traditional lecture-based courses, the O2O course significantly improved the students' knowledge application capability.

Finally, this study provides suggestions from students for further O2O classroom development. The following questions can be put into consideration for future studies and course planning: (1) how to motivate students to learn professional knowledge and interact online, and how to motivate them to prepare and actively participate in offline activities? (2) how to better match the activities of offline flipped classroom with specific ability training? (3) how to keep track of the knowledge learning results and ability learning outcomes of students in the experimental and control groups?

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