Journal of Hospitality, Leisure, Sport & Tourism Education 26 (2020) 100243

Contents lists available at ScienceDirect

Journal of Hospitality, Leisure, Sport & Tourism Education

journal homepage: www.elsevier.com/locate/jhlste

Applying structured computer-assisted collaborative concept mapping to flipped classroom for hospitality accounting

Chei-Chang Chiou[a], Li-Chu Tien[b,*], Yu-Cheng Tang[a]

[a] Department of Accounting, National Changhua University of Education, No.2, Shi-Da Road, Changhua, 500, Taiwan, ROC
[b] Department of International Trade, Overseas Chinese University , No.100, Chiao Kwang Rd , Taichung 40721 , Taiwan, ROC

ARTICLE INFO

Keywords:
Active learning
Flipped classroom
Learning motivation
Hospitality accounting
Structured computer-assisted collaborative concept mapping

ABSTRACT

This research investigates the effect of structured computer-assisted collaborative concept mapping (SCACCM) on student learning performance and motivation when it is used as an in-class auxiliary tool for flipped classroom teaching (FCT). This study adopts a quasi-experimental design. The teaching experiment is 3 h per week for 6 weeks, 114 students from a private university's hospitality management department in Taiwan. The experiment results show FCT strategy is helpful for enhancing students' learning motivation and academic achievements; using SCACCM as an auxiliary strategy for FCT is more effective in enhancing student learning motivation and achievements compared to a traditional exercise and discussion strategy.

1. Introduction

Currently most students from the department of hospitality management have negative responses to the hospitality accounting course, including that it is too fast for class progress, has too much content and is not easy to understanding, which result in an obstacle to learning and low motivation (Chen, Sue-Ching, Chen, & Cho, 2003). On the other hand, other students feel the teaching speed is too low and the content is too easy, and they hope the difficulty can be increased. This is the portrayal of traditional “teacher centered” teaching environment in which teachers follow a course schedule to conduct teaching activity, and ignores differences in student learning levels, resulting in a teaching environment that can not satisfy the needs of all students. Therefore, as a teacher of hospitality accounting, it is extremely important to design and create a teaching environment that is both “student centered” and “active learning strategy”. That is, give the initiative of learning to students, allow them to study according to their own ability and time, plan their own study progress by themselves, which can increase their learning motivation and most importantly not discourage them from learning. Kim and Davies (2014) pointed out that tourism and hospitality teachers have been encouraged to implement various student-centered teaching practices beyond conventional teacher-directed approaches. The goal of flipped classroom teaching is to solve the above issues.

The flipped classroom is gaining acceptance in higher education as an alternative to traditional teaching methods (Steen-Utheim & Foldnes, 2018). The flipped classroom is based on constructivism and social learning theory (Moraros, Islam, Yu, Banow, & Schindelka, 2015). Its ideology is to give learning initiative to students and its class design is a type of blended learning which allows students to actively and interactively learn. Its activities are to allow students to watch online video tutorials at home as a preview of lessons, and in the classroom, teachers play the role of guide or facilitator, leading students to perform cooperative learning, answering doubts, guiding thinking, conducting dialogues and discussing together.

* Corresponding author.
E-mail addresses: ccchiou@cc.ncue.edu.tw (C.-C. Chiou), lichu@ocu.edu.tw (L.-C. Tien), loistang888@gmail.com (Y.-C. Tang).

https://doi.org/10.1016/j.jhlste.2020.100243
Received 7 August 2019; Received in revised form 1 February 2020; Accepted 18 February 2020

The prevalence of flipped classroom is due to the advancement of (mobile) network technology; most students owns laptops, tablets, and smartphones, giving them access to Facebook, Youtube, and many more internet resources. Giving them the opportunity to learn from teaching videos at their own pace before class, and replay them if necessary. Teachers can also add instant feedback quizzes in the videos, helping students examine their absorbance. Research done by the Graduate School of Education at Stanford found that when students watch lesson videos before formal classroom teaching, and then go through the process of self discovering and interactive learning with their classmates, learning motivation is easier to trigger, and learning performance is better, than traditional teaching. Therefore, the flipped classroom is commonly viewed as the best teaching method (Akinoglu & Tandogan, 2006; E-school, 2013; O'Dowd & Aguilar-Roca, 2009; Sams & Bergmann, 2012).

Although many scholars and papers proved flipped classroom is helpful with learning performance and motivation, it is not an elixir; a few critical factors would negatively impact its effectiveness. Scholars (Strayer, 2007, 2012) have indicated three weaknesses impacting the learning effects of flipped classroom: 1. Flipped classroom teaching lacks completeness and structure. 2. Flipped classroom teaching lacks independent thinking and gets poor learning performance. 3. Flipped classroom teaching cannot satisfy all subjects and lessons. Especially, hospitality accounting is a subject with high structure and completeness (Chiou, 2008), it needs teachers to build up a scaffolding for students to allow them to construct their personal knowledge automatically. To overcome these shortcomings, this research attempts to use structured computer-assisted collaborative concept mapping as a teaching strategy to aid flipped classroom teaching, and explore whether it can improve its shortcomings.

Structured concept mapping is a structured and visual learning tool with advance organizer, subsumption learning, superordinate learning, progressive differentiation, and integration (Novak & Gowin, 1984; Roessger, Daley, & Hafez, 2018). It can improve the mentioned weaknesses of flipped classroom: 1. Using the 5 features of structured concept mapping, it can allow students to integrate, assort, and rank video clips that are scattered in relation, making learning more complete and structured (Huang et al., 2012). 2. Through the construction of structured computer-assisted concept maps, students can integrate the content of the curriculum to construct a personal learning cognitive map, which can improve the lack of independent thinking and poor learning performance (Chiou, 2008, 2009; Chiou et al., 2018; Huang et al., 2012). 3. A teacher can be informed about all students' progress and understanding levels through computer-assisted drawing of concept maps cooperatively between classmates, which enables teachers to plan the course schedule accordingly and solve problems students may have on the spot (Heinze-Fry & Novak, 1990; Novak, 1980; Stewart, Van, & Rowell, 1979). This can make up for the shortcomings of the flipping teaching effectiveness that cannot be achieved due to the difference of disciplines and curriculum attributes and the deficiency of teaching ability. Many articles in the past have also shown that structured computer-assisted concept mapping helps students engage in adaptive learning and improve their learning motivation and effectiveness (Adeopoe, Cavagnetto, & Hunsu, 2016; Akcay, 2017; Chiou, 2008, 2009; Dias, Dolianiti, Hadjileontiadou, Diniz, & Hadjileontiadis, 2019; Huang et al., 2012; Liu, Chen, & Chang, 2010; Novak & Gowin, 1984). Engelmann and Hesse (2010) pointed out it is very important to get what the collaborators know when collaborative learning, and verified that using the digital concept map method to obtain the knowledge structure and information of the collaborator can help solve the problem more quickly and more frequently.

Flipped classroom has solemnly become a prevalent innovative teaching method in 21st century. However, there is a common problem existing in flipped teaching. That is, many flipped teaching teachers do not know how to conduct teaching in class. Hence, how teachers reach a balance between 'learning' and 'teaching', and how to scaffold an efficient, meaningful, and structured teaching and learning strategy to aid flipped classroom teaching, are highly critical for the successfulness of flipped classroom teaching. Structured concept mapping, a meaningful learning strategy, may be as a good strategy. Therefore, this research attempts to use structured computer-assisted collaborative concept mapping as a teaching and learning strategy to aid flipped classroom teaching. Specifically, there are two purposes for this research as the following:

(1) Comparing whether there is significant difference between the use of structured computer-assisted collaborative concept mapping as a tool for assisting flipped classroom teaching and the use of traditional flipped classroom teaching for students' learning motivation in learning a hospitality accounting course.
(2) Comparing whether there is significant difference between the use of structured computer-assisted collaborative concept mapping as a tool for assisting flipped classroom teaching and the use of traditional flipped classroom teaching for students' learning achievements in learning a hospitality accounting course.

2. Literature review

2.1. Overview of flipped classroom teaching

The Flipped Class Model (Flipped Class Model) was proposed by Bergmann and Sams (2012). Classroom activities are mainly used to answer doubts, share results, and discuss together, so the classroom becomes a place for interaction between teachers and students. This teaching mode reverses the traditional learning process and breaks the traditional teaching mode of teaching in the classroom by teachers, students listening, and doing practice activities after class, as shown in Fig. 1。.

As early as the early 19th century, General Sylvanus Thayer tried to prepare engineering students to use the relevant materials to prepare for the core content of the classroom lectures before class. Instead of focusing on teachers' lectures in classroom activities, students engage in cooperative learning and critical thinking training in groups, and interactive activities to solve problems in small groups. In the 1990s, Eric Mazur, a professor of physics at Harvard University, felt that students would only prepare to take exams but would not be able to make use of their knowledge. Therefore, students were required to preview their studies before class. Students could engage in speculative discussions and cooperative learning. Lage and Platt (2000) used flipped classroom teaching at the

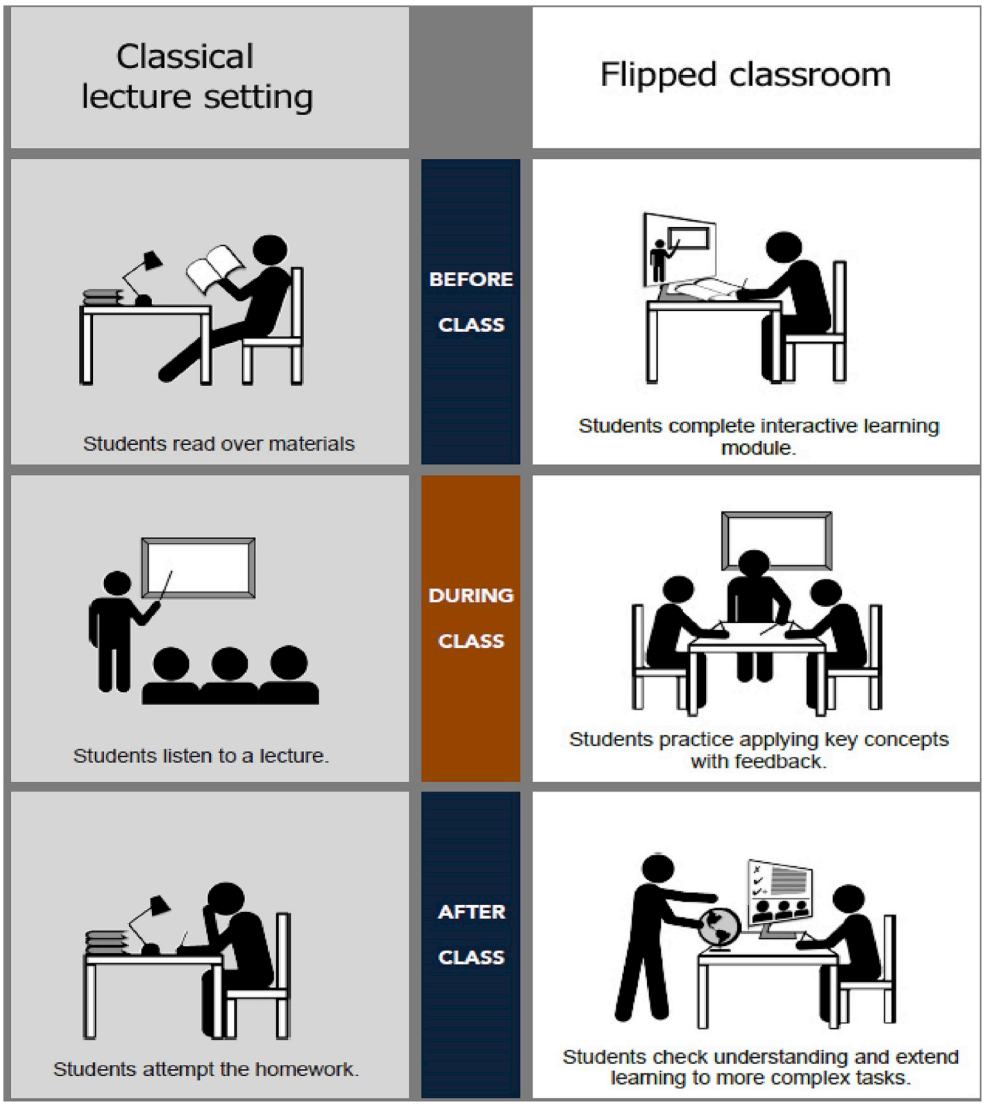

Fig. 1. Comparing traditional learning and flipped classroom learning.

University of Miami Microeconomics course, requiring students to read the exercise booklet before the class, including PPT course recordings with audio recordings or audio; teachers then provide 10 min in the classroom The mini-lectures are guided inquiries and guidance on the books material you watch. The remaining time is used to arrange for students to complete homework, perform experiments or cooperative learning. It was found that compared with traditional classroom teaching, flipped classroom teaching made students like lessons, and their learning effectiveness was also improved. In 2004, the hedge fund analyst of Salman Khan in the United States uploaded a self-recorded teaching commentary to YouTube in order to help his cousin with maths. It was not expected that this would get a friendly review from the learning network and obtain excellent learning results. Studies by many scholars in Taiwan, for example, the Furen University Teacher Development and Teaching Resource Center surveyed 500 teachers in 2012 using a flipped classroom teaching strategy, and sent out a questionnaire to obtain the results: 1.88% of teachers said that after implementing this teaching strategy, they have achieved their own job satisfaction; 46% of them said that job satisfaction was a "very significant improvement"; 2.67% of teachers said that students 'test scores have improved significantly; 80% of teachers said that students' learning motivation had improved significantly; 3.99% of teachers said that they will still use this teaching strategy next year; many teachers said that they will not return to the traditional teaching mode of teaching.

2.2. The current status of using structured concept mapping in teaching accounting

Concept is a common attribute that can be expressed using terms or symbols (Novak, 1981). Concept mapping is an image-based knowledge representation learning map, similar to the network structure context learning method, which puts the more inclusive and

general concepts into the upper layer in a hierarchical way, while the concrete and specific concepts are ranked in the lower layer and utilizes the linking words to link two concepts to form a proposition (Chiou, 2008, 2009; Novak & Gowin, 1984).

The concept map was proposed by Novak and Gowin (1984) based on Ausubel's (1963) cognitive learning assimilation theory as a tool for teaching, learning and evaluation. The structure of concept mapping is similar to the network type. Concepts are connected by line segments. These line segments are marked with appropriate verbs to indicate the meaning of the connection relationship. When learners learn new knowledge and link it with their prior knowledge, they form a meaningful learning (Novak & Gowin, 1984). When a meaningful learning is completed, another new learning is formed. Concept mapping is a well-structured tool that integrates, classifies, and ranks fragmented and scattered relationship of things that students view, into more structured hierarchies, and easily integrate all the concepts in a course through its graphical representation, to help students understand their own learning path and history and help them directly master the core of learning (Heinze-Fry & Novak, 1990; Novak, 1980; Stewart et al., 1979).

The concept map is a well-structured tool with the advantages of superordinate learning, progressive differentiation, and integrative reconciliation, subsumption, and advanced organizer. It can help students establish a network of relationships in memory, and also link old concepts with new concepts. In order to form network structure knowledge, it is necessary to unify the relationship between complex problems and fragments, so that students can understand the connection between complex concepts in each chapter of the course, which is conducive to the improvement of learning effectiveness (Tien, Chiou & Lee, 2018; Tien, Chiou, & Liao, 2018). Therefore, the concept map is a tool that is very suitable for constructing teaching materials at the cognitive level, which can improve the learning effectiveness of teaching strategies. Previous research also confirmed that the concept map has a positive effect on students' learning effectiveness (Chiou, Tien, & Lee, 2015; Huang et al., 2012). It has been used in a variety of teaching areas, such as elementary and secondary schools, science, biology, chemistry, mathematics, medicine.

Structured concept mapping is to connect and extend vertically or horizontally the relationship between concept cluster and concept cluster, so as to construct a concept map with depth or breadth. Teachers can understand their learning situation and misconceptions from the concept maps constructed by students, and use the concept maps as the basis for students' learning and understanding of accounting knowledge (Chiou, 2008, 2009; Huang et al., 2012). However, the study of structured concept mapping usage in the restaurant and hospitality accounting course is rare. Some literature explored the application of concept mapping in general accounting teaching. Chen et al. (2003) explored the effectiveness of this structured knowledge map for accounting teaching and student learning. The results showed that concept mapping can effectively promote students' high-level cognitive learning and help students integrate accounting concepts. Chiou (2008) proved that concept mapping can be used to help students to improve their learning achievement and interests in an advanced accounting course. Chiou et al. (2015) and Tien et al. (2018) showed that teaching materials combining multimedia animation and multidimensional concept maps can reduce accounting student cognitive load and improve accounting student learning achievement, retention, and satisfaction. However, these documents are all aimed at accounting students, and explore the help of concept mapping in accounting learning. For hospitality management students, the restaurant and hospitality accounting is a difficult minor course. To date, there is still no literature that explores whether concept mapping can be an effective tool to help these students learn, and whether it is helpful for flipped classroom teaching. Therefore, this study attempts to explore whether concept mapping is helpful for flipped classroom teaching in a restaurant and hospitality accounting.

2.3. Structured concept map as a classroom teaching tool and student learning effectiveness

Flipping the classroom, students can choose reading tools to watch the course content according to their level and time, without any time and space restrictions, and arrange the learning progress. If they have any questions, they can watch the video repeatedly. Students feel that this is novel and interesting, and are willing to take the initiative to learn. However, with the complexity of the course content and the relationship between large professional terms and concept clusters, students cannot integrate and classify the fragmented knowledge received in instructional videos to complete the structural accounting knowledge, and students can't get clear and correct answers to the doubts or myths about accounting knowledge from watching videos or group cooperation activities, so they feel frustrated with learning. In particular, students studying accounting often adopt rote memory methods to cope with the exams to obtain piecemeal knowledge of memories, failing to accurately grasp the full picture of knowledge, resulting in poor learning and learning effects of students (Tien et al., 2018). The flipped class can use video so that abstract and difficult accounting concepts are easy to understand and easy to learn with images and movements. However, the successful teaching of flipped class is not a panacea. It still depends on good teaching tools or teaching strategies. The key to the success of flipping the classroom, especially for the highly structured subject of accounting, which requires teachers to use good teaching tools or teaching strategies to help build the scaffold, so that students can complete the entire course of information reception, digestion and absorption, as well as the use and testing of human cognitive learning (Tien, 2020).

Ausubel (1968) stated that the human cognitive process must be guided by superordinate learning, progressive differentiation, and integrative reconciliation, subsumption, and advanced organizer. These five learning processes need to establish a "relationship network" in the cognitive network structure. New concepts are concatenated to form network structure knowledge, which is also regarded by cognitive psychologists as an effective way for learners to learn knowledge (Novak, Gowin, & Johansen, 1983). The above learning process is a characteristic advantage of the five major learning of structured concept mapping (Chiou, 2006). Structured concept mapping is presented in the form of graphical representations. Students can easily integrate all the knowledge in the course in a systematic and organized presentation in the concept map (Chiou, 2008, 2009), which can help students establish network of relationship in memory. The formation of network structure knowledge can help improve learning effectiveness (Novak, 1990; Tien et al., 2018). Previous research has also confirmed that the concept map materials have a positive effect on students' learning effectiveness (Huang et al., 2012; Tien et al., 2018).

Using structured concept mapping as a teaching aid in a flipped classroom teaching environment, students can integrate fragmented relationships of things into conceptual clusters through structured concept maps and conceptual clusters enable students to better understand the complex relationships between the various chapters in the course, and use hierarchical relationships to integrate, classify and sort into more organized hierarchies. Students can use graphical representations to easily integrate all concepts in the course, understand their own learning path and course, and directly grasp the core of learning to achieve learning goals (Heinze-Fry & Novak, 1990; Novak, 1980; Stewart et al., 1979). Teachers can understand the learning situation and identify wrong concepts from the concept map, and use this concept map as the basis for students' learning and understanding of accounting knowledge (Chiou 2008, 2009; Huang et al., 2012).

2.4. Structured concept maps as a classroom teaching tool and student motivation

College students often feel boring, difficult, abstract and incomprehensible when they learn accounting courses. In order to cope with the exam, they adopt rote memory to obtain piecemeal knowledge of memories, and it is impossible to accurately grasp the full picture of knowledge, resulting in low learning motivation and poor learning outcomes in the learning process (Tien et al., 2018). Pintrich, Marx, and Boyle (1993) pointed out that motivation is an internal state that initiates, guides, and maintains behavior, which means to cause individual activities and maintain the activities that have been caused. Zhang (2004) believes that learning motivation can cause students' learning activities, and make this learning activity continue to lead to the learning activity goals arranged by teachers. Teachers who want to improve the teaching effect must, in specific activities or learning situations, cause students to start learning activities, continue activities, and be able to overcome obstacles and maintain learning to move forward toward goals. Amabile (1997) divides motivation into intrinsic motivation and external motivation (McCown, Driscoll, & Roop, 1996). Students' learning is based on intrinsic motivations, which tend to use learning goals; external motivations tend to use performance goals (Ames, 1992). From the above, teachers need to use teaching strategies in planning teaching activities to help students overcome learning obstacles and participate in learning activities in order to arouse students' learning motivation.

In traditional teaching methods, teachers adopt one-way lectures. Students cannot participate in classroom activities during the learning process. Teachers cannot understand students' learning levels in classroom activities. Students who have lost learning and cognition errors cannot be discovered by teachers. Doubts often are not to be found until the exam. Structured concept mapping is used as learning tool for flipping classrooms. Students can choose reading tools to watch the course content according to their own level and time, without any time and space restrictions, and arrange their own learning progress. If they have any questions, they can watch the video repeatedly. For such a learning environment, students will feel it to be new and will be interesting, and are willing to take the initiative to learn. As the content of the course is complex, teachers use structured concept mapping as a teaching aid to allow students to participate in curriculum activities, group concept mapping cooperatively, and personal concept mapping. Students can understand your own learning losses and doubts, integrate complex and huge accounting knowledge messages, and build personal knowledge; teachers can also use this to adjust teaching activities and improve student learning motivation.

3. Research method

3.1. The establishment of flipped classroom teaching

The accounting textbook for this study is based on the three units of “Hospitality Industry Income”, “Hospitality Industry Expenses” and “Hospitality Industry Inventory and Purchase” in the book “Hospitality Management Accounting Practice” by Lin (2013). The teaching experiment textbook divides the three major units into small units individually, and each small unit has a study form to be practiced by the students. The instructional video for pre-teaching preparation is implemented in a video classroom with two cameras. The teacher completes the recording of the lecture content and the explanation process, and provides it to the students to watch before the formal class.

3.2. The structured computer-assisted collaborative concept mapping design model as an aiding tool to flipped classroom teaching

The flipped classroom teaching design model of this research is referring to Bloom's cognitive theory and Tai Chi circular model (Zhong, Song, & Jiao, 2013) as Fig. 2 shows; the contents are described as the following:

1. Video recording of teaching materials (preparation stage): Teachers prepare the content of the textbook before the start of the school (in summer vacation) in order to achieve the teaching goal. Contents include 5 small units of “Hospitality Industry Income”, 7 small units of “Hospitality Industry Expenses”, and 5 small units of “Hospitality Industry Inventory and Purchase.” Each small unit has a study list of conceptual propositions.
2. Watch instructional videos: Students use the computer, tablet, or smart phone to watch the teaching videos of the course content recorded by the teacher, and practice the learning list by drawing a concept map. Students have a preliminary memory and understanding of the content of the course after completing this stage. For example students can memorize and understand the usage of accounting subjects and the direction of accounting debit and credit.
3. Structured computer-assisted collaborative concept mapping: By implementing self learning activities such as watching lesson videos and homework practices, students have already possessed the prior knowledge. In the classroom, students can cooperate to construct a concept map using ‘*Inspiration*’ computer-assisted software to learn accounting knowledge, utilizing concept mapping

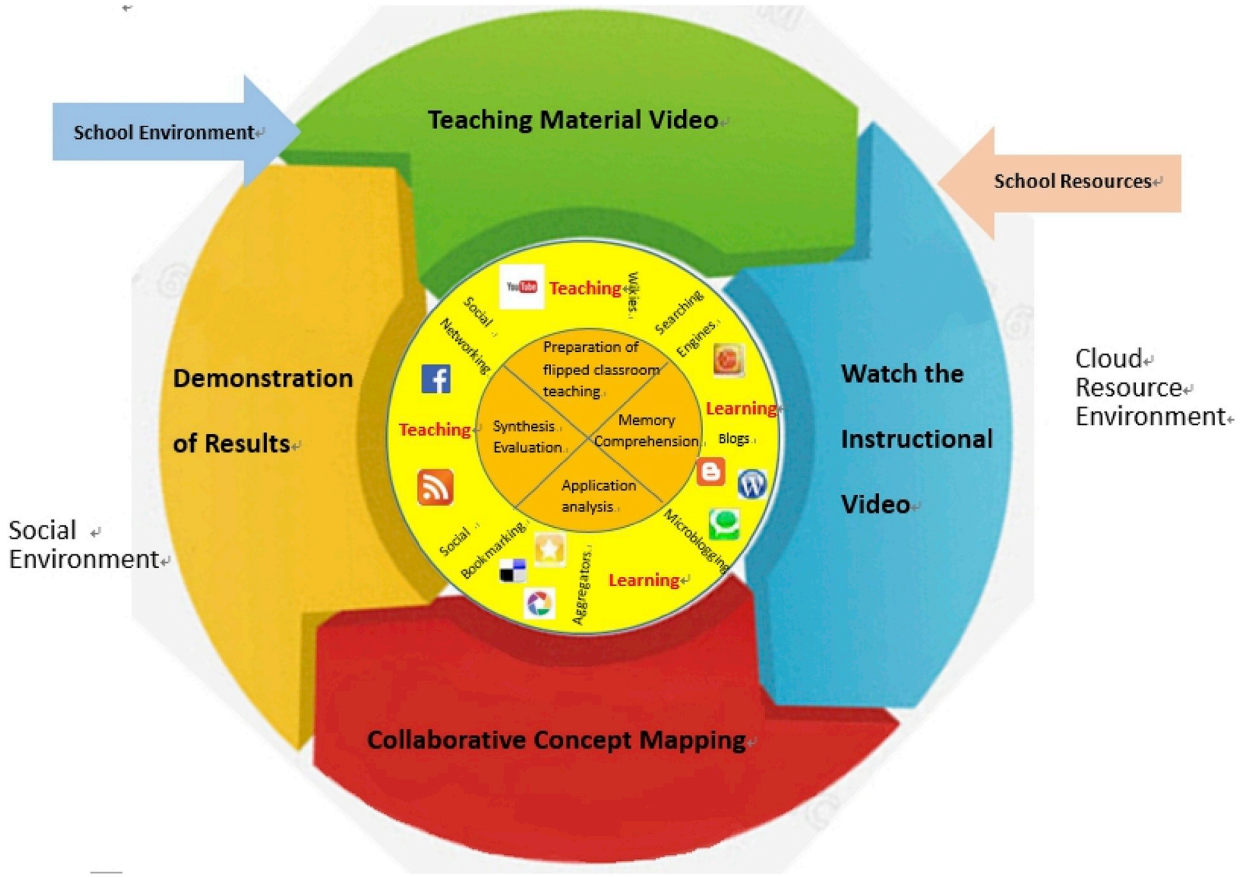

Fig. 2. Teaching model of combining traditional flipped classroom and structured computer-assisted collaborative concept mapping.

features such as subsumption, advance organizer, superordinate learning, integration reconciliation, and progressive differentiation. In computer-assisted collaborative concept mapping activities students can gain clear, intuitive, and easy concepts to clarify misconceptions and complicated concepts.

4. Achievement presentation: Each group shares their concept maps on the stage and discusses with the classmates. In this comprehensive evaluation stage, teachers can evaluate students' understanding, or correct the accounting concept errors and supplement the accounting knowledge.

The core value of structured computer-assisted collaborative concept mapping as a tool for flipping classrooms is “student-centered” and “active learning” (Chiou, 2009; Okebukola, 1992). Students are the main body of learning activities. Teachers are the organizers, participants and promoters of learning activities. The use of good learning methods and strategies to stimulate students' motivation and enthusiasm, lets students become masters of learning, and know how to set goals. Teaching is an interacting activity composed of teachers' teaching and students’ learning; overemphasizing learning and ignoring teaching can go from one extreme to another (Zhong et al., 2013). Therefore, this study constructs a teaching strategy of structural computer-assisted collaborative concept mapping based on the "Tai Chi Circular model" as an aided teaching model for flipping classroom to provide a reference for the design of teaching activities.

3.3. Experiment design

3.3.1. Experiment design and participant

This study used the pretest-posttest control group quasi-experimental design referring to Chiou (2009). The participants were first-year students of the Department of Hospitality Management of a private university in Central Taiwan, ranged in age 18–20 years. Two classes of students were selected. The experimental class used the structured computer-assisted concept mapping as an auxiliary tool for flipping classroom teaching. There were 59 students total and are grouped again based on their midterm grades, with 5–6 students per group. Each group consists of 2 students whose grades are below 60, 2 students 60–80, and 2 students above 80. The control class, which included 55 students, used the traditional exercise and discussion-style flipped classroom teaching method. The number of students in each group and the grouping method were the same as above. In order to be objective, the instructor and the author were different people. The instructor was a senior full-time assistant professor who had taught the hospitality management accounting for more than ten years.

Table 1
The implementation process of research.

Stages	Activity Contents
Stage 1 (Weeks 1–8)	1. The teacher explained the meaning and teaching method designs of flipped classroom. 2. Made and recorded restaurant and hospitality accounting teaching materials (reviewed by senior teachers, students, and professionals) 3. Constructed pretest and posttest questions basing on two-way specification table analysis, and chose a class of 60 students to take the preliminary exam. 4. Prepared the students learning motivation scale, and chose a class of 60 students to take the preliminary exam. 5. Performed the data analysis of the pretest and posttest questions and learning motivation scale. 6. Prepared the formal pretest and posttest questions and learning motivation scale. 7. The teacher taught students the contents of chapter 1–3 using traditional lecture teaching method.
Stage 2 (Week 9)	1. Pre-testing: pre-testing learning outcomes and learning motivation using traditional assessment methods, testing the prior knowledge of the two classes of students. 2. Conducted experiment grouping: group two classes of students, one for the experimental class and one for the control class. 3. Conducted collaborative learning grouping: Group students for experimental and control classes into 10 groups individually (5–6 students per group). 4. Uploaded recorded lesson materials onto e-learning platform.
Stage 3 (Week 10–15)	1. Conducted formal teaching experiment: The control class used traditional flipped classroom teaching; the experimental class used structured computer-assisted collaborative concept mapping as an aiding tool for flipped classroom teaching. 2. Taught and trained students in the experimental class how to use *Inspiration* to draw a concept map.
Stage 4 (Week 16–18)	1. Conducted posttests for both classes after experiment. 2. Conducted learning motivation survey for both classes. 3. Conducted in-depth interviews for randomly selected students. 4. Data analysis.

3.3.2. Assessment tool

(1) Learning motivation scale

This study used the Motivated Strategies for Learning Questionnaire (MSLQ) compiled by Pintrich, Smith, and McKeachie (1989) to measure students' learning motivation. In 1991, the development and verification of this scale was carried out for college students, and the construct validity was verified by factor analysis. The values of Cronbach's Alpha reliability were obtained for each dimension (0.52–0.93).

(2) Accounting achievement exam

Hospitality accounting achievement exam was made into two tests, a pretest to examine whether two groups of students had the same amount of accounting knowledge; a post-experiment test was given after the experiment to compare effectiveness of different teaching strategies. All exam questions were from school test bank, difficulty coefficient ranged from 0.2 to 0.8, degree of discrimination above 0.2, and KR-20 coefficient of internal consistency was 0.81.

3.3.3. Research implementation procedure

The experimental procedure of this study refers to the practice of Chiou (2009) as shown in Table 1. The experimental implementation process is as follows:

(1) Pretest stage: Week 1 to week 8 is the pretest stage, works done in this stage include the design of flipped classroom teaching, recording video of hospitality accounting materials, preparation of pretest and posttest questions and learning motivation scale, and performing preliminary exam and analysis. In the first class after the start of the school, the students were given a course introduction. Then the teacher taught the first to third chapters of the textbook for all students using the same traditional lecture teaching method. In order to check whether the pre-accounting knowledge and learning motivation of the two classes of students are similar, so as not to interfere with the experimental processing effect, the pre-test is performed and the learning motivation scale is completed in the ninth week.
(2) Formal experimental stage: Week 9–15 is the formal experimental stage, the experimental course length is 3 h per week for six weeks. Teaching method for two classes refers to the flipped classroom method of Bergmann and Sams (2012). The teacher uploaded lesson materials on e-learning platform one week before class. In this stage, the teaching method of the control class was to watch the teaching video tape before class and accepted the usual test. In the classroom activity, the teacher guided the students to ask questions, learn collaboratively and solve academic confusions, and finally required students to finish assigned homework after class. Students in the experimental class completed the computer-assisted personal concept maps after watching the teaching video tape before class, and then completed the computer-assisted collaborative concept maps with the classmates in the formal classroom. When presenting the outcomes, the teacher and the students asked questions together and found out the misconceptions, and then discussed to clarify the doubts.
(3) The posttest stage: Posttest was performed in the 16th week, the test time was 90 min, the student completed the hospitality accounting achievement test and filled in the learning motivation scale within the specified time. Finally, several students from

the experimental class and the control class were randomly selected to conduct in-depth interviews to understand the students' views on two kinds of aid tools for flipped classroom teaching.

3.3.4. Teaching concept mapping

How students are taught and trained in concept mapping can directly affect the effectiveness of concept mapping strategy and the attitude or willingness of students toward this learning strategy (Chiou, 2006, 2008, 2009; Santhanam, Leach, & Dawson, 1998). Hence this research refers to the recommended standard procedure by Novak and Gowin (1984, p32.-34). The design of teaching process of accounting concept mapping is as follows:

(1) Teach the word "concept". A concept is an object or event that has a general standard of attributes and can be represented by some acceptable symbols or marks. Teach “object” or “event” terms. Students are required to select important concepts from the materials they have studied, such as income, expenses, assets, liabilities, etc. List the concepts chosen by the students on the blackboard.
(2) Teach the word “linking word”. Linking words are used to link concepts in order to construct a meaningful sentence. Ask students to come up with some linking words that can link accounting concepts into meaningful sentences, such as composite, is, include, and so on. List the linking words that students have come up with on the blackboard
(3) Students are required to identify two related concepts and connect them with appropriate linking words to form a "proposition”. For example, the use of "contains" is linked to two related concepts, "income" and "business income", to form a proposition. In this way, many meaningful propositions can be formed and listed on the blackboard.
(4) Teach the “hierarchical attribute” of concept mapping. The hierarchical attribute is the organization of the concept map where the most general or inclusive concept is at the top position of the map and the less general or more specific concept is in the lower position. Students are asked to use the hierarchical attributes to rank a group of concepts on the blackboard. For example, "assets", "current assets", "receivables", "accounts receivable”, etc. are a set of concepts that use hierarchical attributes.
(5) Start constructing concept maps. Use concepts that have been ranked according to hierarchical attributes as a benchmark for building conceptual hierarchies. In the process of constructing a concept map, students are required to help select the linking words of the related concepts and establish the various hierarchies of the concept map. Finally, complete a concept map with hierarchical characteristics.
(6) Teach the term “cross-linking”. Cross-linking refers to the cross-connection between two different conceptual hierarchies. Require students to find cross-linking between different hierarchies in the constructed concept map and give appropriate linking words. For example, “assets” and “expenses” have a cross-linking relation, and the linking word can be “having future economic benefits vs. no future economic benefits”. After the cross-linking is done, the concept map is completed.
(7) Score the completed concept map to let students know how to score. Novak and Gowin’s (1984) scoring method is used. 1 point for every valid proposition; 5 points for every valid hierarchy; 10 points for every valid and important cross-linking, and 2 points for every unimportant or not appropriately marked linking words.
(8) Discuss the scoring criteria and score the above concept map.
(9) Choose another unit in the lesson material and require students to practice drawing concept maps using steps above.
(10) After teacher's grading, present some students concept maps on the blackboard and have discussion. After discussion, students can be asked to redraw a new concept map with the same unit. And let the students compare the old and new concept maps, which shows the change of students' cognitive structure.

3.3.5. Drawing the hospitality accounting concept map as an aiding tool for flipped classroom teaching

According to the above mentioned principles of constructing concept mapping, first a guide of constructing concept mapping was set (the experiment group), as shown in Fig. 3. Secondly, students were required to view the teaching video tape (see Fig. 4) before the class as the prior knowledge of accounting. Each student then used the above-mentioned constructing method to complete personal concept maps to diagnose their doubts and ignorance. As Fig. 5 illustrates, major income of the restaurant accounting unit can be divided into “beverage income”, “banquet income”, and “meal income”. After students understood the basic concepts, they can use the link word "include" to link “income” with "beverage income", "banquet income" and "meal income" into three propositions as a basic concept of learning. The source of the “beverage income” was further explained. The link between the “beverage revenue” and the "juice", "alcohol" and "tea" can be further enhanced through the link word "divided into" as a deeper learning. Again, further explaining “juice” was a “juice income” that was composed from “guava juice,” “orange juice,” and “blueberry juice” incomes, as shown in Fig. 6. These extended concepts were actively discussed by group members, and structured computer-assisted collaborative concept maps were completed collaboratively after debates and discussions, as show in Fig. 7. Finally, students can refer to expert concept maps to make corrections.

3.4. Data analysis method

Because the pretest scores of the experimental class and the control class are different, in order to avoid the difference in the previous levels of the two classes to affect the experimental results, a covariance analysis (ANCOVA) is used to solve this problem. In this study, an ANCOVA is performed using the pretest as the covariate and the posttest as the dependent variable. Before using the ANCOVA, a within-group regression coefficient homogeneity test is first performed to see if it is appropriate to use the statistical method.

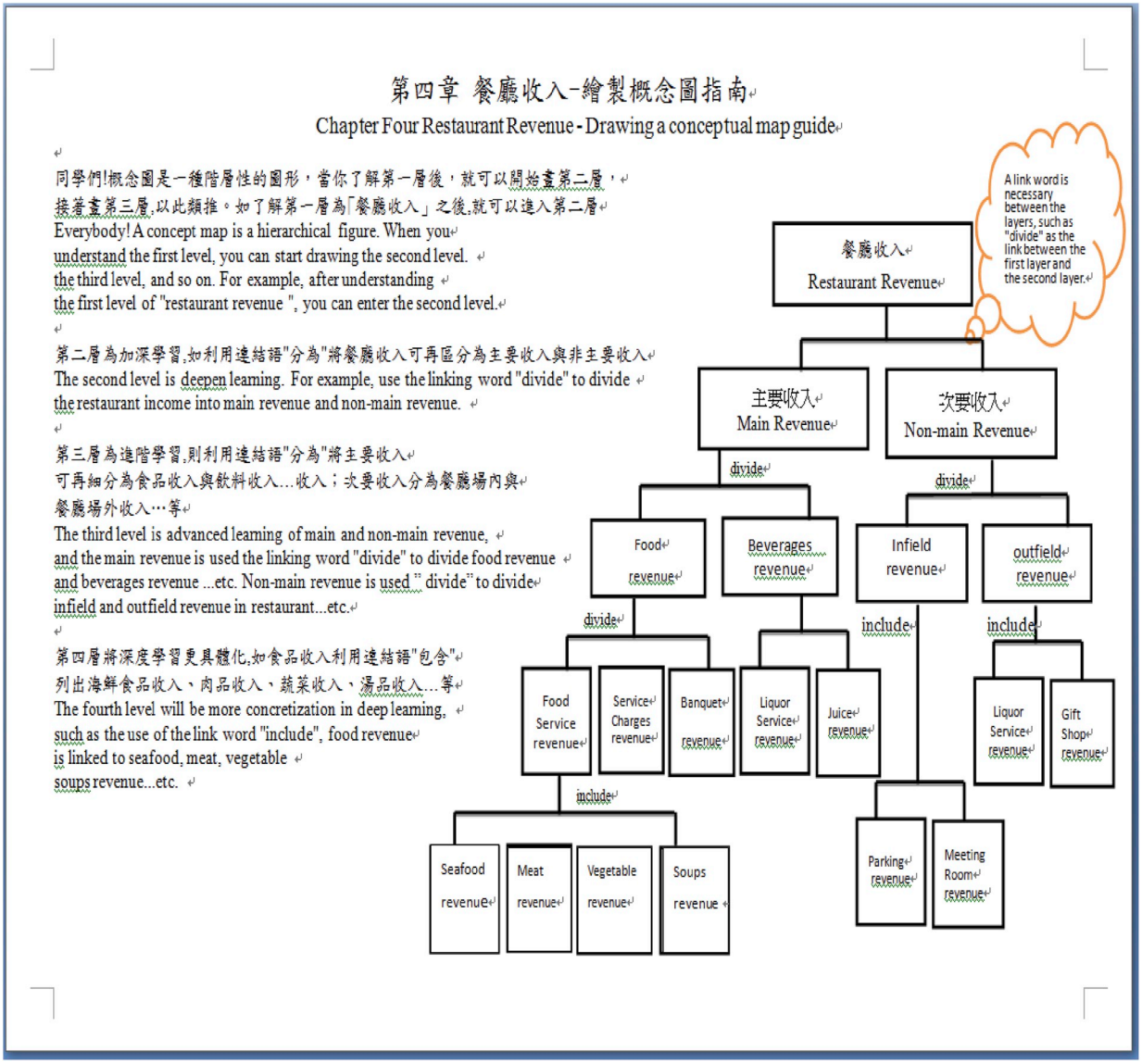

Fig. 3. Concept mapping guide.

4. Result analysis

4.1. The effect of different flipped classroom teaching strategies to learning motivation

The first purpose of this study is to compare whether there is significant difference between the use of structured computer-assisted collaborative concept mapping as a tool for assisting flipped classroom teaching and the use of traditional exercise discussion-style flipped classroom teaching for students' learning motivation. The results in Table 2 showed that the average scores of the students in the experimental class for pretest and posttest were 106.08 and 117.28 respectively; the average scores of the students in the control class were 105.05 and 106.05 respectively. Effect size measures the influence magnitude of the learning method and is computed as the mean score of the post-test minus the mean score of the pre-test, divided by the standard deviation of the pre-test (Cohen, 1988). According to Cohen's (1988) rule, the effect size of the experiment class is 0.62, indicating the use of structured computer-assisted collaborative concept mapping as a tool for assisting flipped classroom teaching has a medium effect on students' learning motivation. While the effect size of the control class is 0.06, indicating the use of traditional exercise discussion-style flipped classroom teaching has no effect on students' learning motivation.

Furthermore, an ANCOVA analysis was performed. First, the homogeneity test result was $F = 2.528$, $p = .115$, which did not reach significant, indicating that the hypothesis was not violated, and an ANCOVA analysis could be used. The results in Table 3 showed, after the influence of the pretest scores of learning motivation was excluded, the F value of the group is 8.604, $p < .05$,

Fig. 4. Hospitality accounting pre-class teaching video.

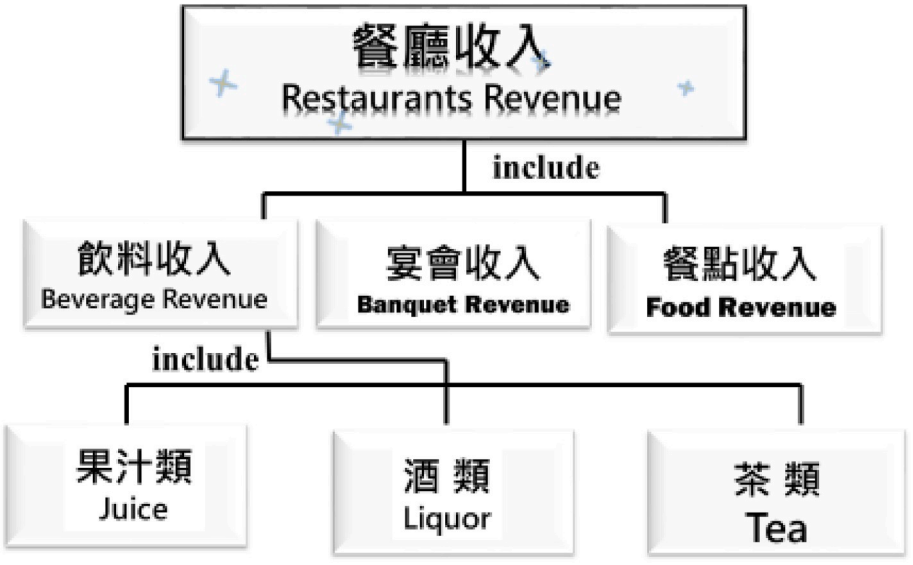

Fig. 5. A concept map of hospitality accounting unit - basic part.

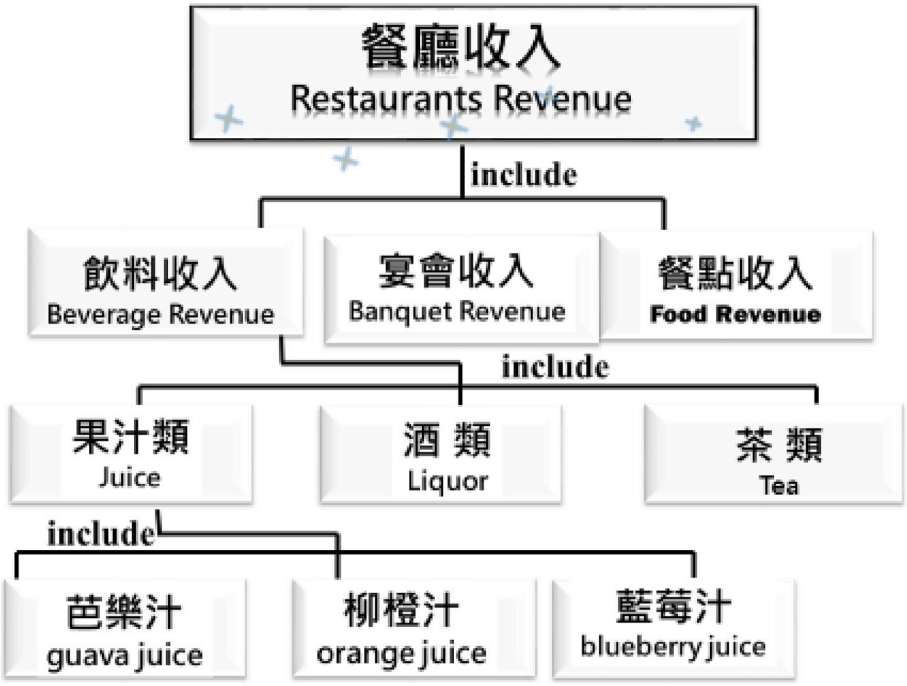

Fig. 6. A concept map of hospitality accounting unit - advanced part.

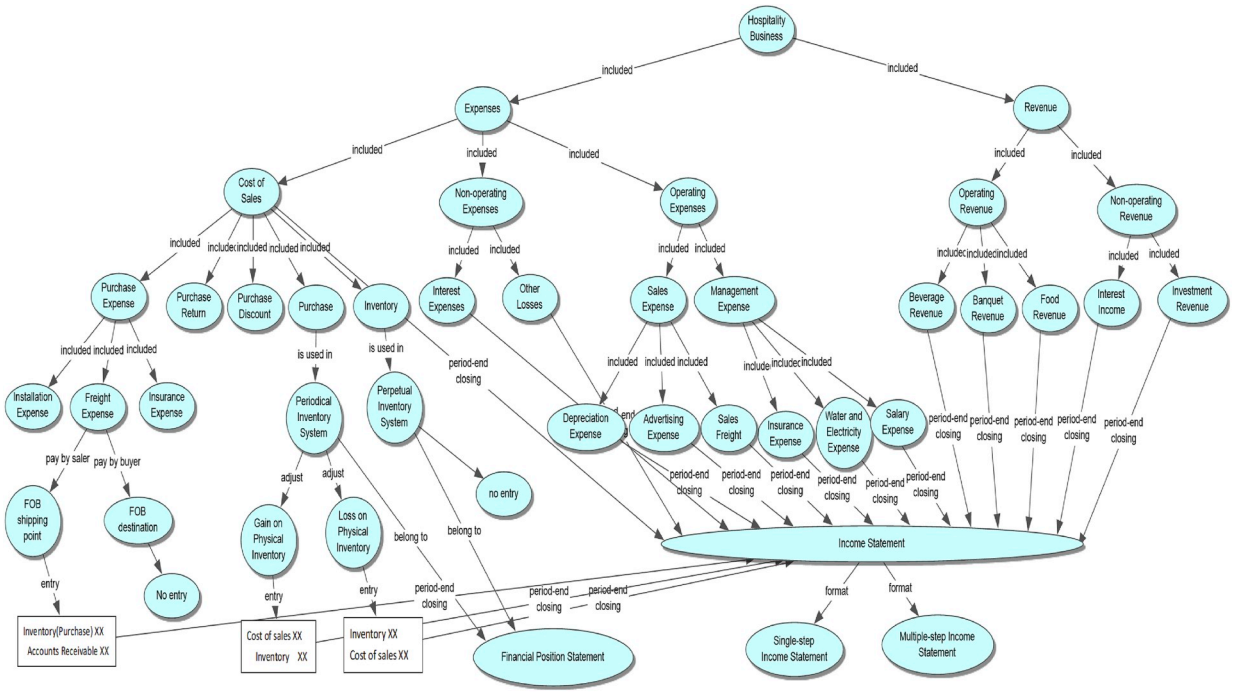

Fig. 7. A concept map of hospitality accounting unit-whole diagram.

indicating that the influence of using different teaching strategies in the flipped classroom on student learning motivation was significantly different.

Therefore, the experimental results showed that students who use structured computer-assisted collaborative concept mapping to assist in flipping classroom teaching have significantly higher learning motivation than students who use traditional exercise discussion-style flipped classroom teaching.

Table 2
Descriptive analysis.

Classes	Experiment class		Control class	
	Mean	S.D.	Mean	S.D.
Pretest scores	106.08	18.18	105.05	18.06
Posttest scores	117.28	20.02	106.05	19.95
Effect size	0.62		0.06	
N	59		55	

Note. Effect size measures the influence of the learning strategy and is computed as the mean score of the post-test minus the mean score of the pre-test, divided by the standard deviation of the pre-test. N indicates the number of student.

Table 3
ANOVA analysis of affecting students' learning motivation by using different teaching strategies in the flipped classroom.

Source	SS	*df*	MS	*F*	*p*
Model	3879.200	2	1939.600	4.921	.009**
Intercept	50305.491	1	50305.491	127.640	.000**
Covariance	557.347	1	557.347	1.414	.237
Groups	3391.040	1	3391.040	8.604	.004**
Errors	43747.300	111	394.120		

**$p < .01$.

4.2. The effect of different flipped classroom teaching strategies to learning achievement

The second purpose of this study is to compare whether there is significant difference between the use of structured computer-assisted collaborative concept mapping as a tool for assisting flipped classroom teaching and the use of traditional exercise discussion-style flipped classroom teaching for students' learning achievement. The results in Table 4 showed that the average scores of the students in the experimental group for pretest and posttest were 45.31 and 66.03 respectively; the average scores of the students in the control group were 37.29 and 46.05 respectively. The effect size of the experiment class is 1.38, indicating the use of structured computer-assisted collaborative concept mapping as a tool for assisting flipped classroom teaching has a large effect on students' learning achievement. While the effect size of the control class is 0.45, indicating the use of traditional exercise discussion-style flipped classroom teaching has a small effect on students' learning achievement.

Furthermore, an ANCOVA analysis was performed. First, the homogeneity test result was F = 0.961, $p = .329$, which did not reach significant, indicating that the hypothesis was not violated, and an ANCOVA analysis could be used. The results in Table 5 showed, after the influence of the pretest scores of learning achievement was excluded, the F value of the group is 12.69, $p < .01$, indicating that the influence of using different teaching strategies in the flipped classroom on student learning achievement was significantly different.

Table 4
Descriptive statistics.

Classes	Experiment class		Control class	
	Mean	S.D.	Mean	S.D.
Pretest scores	45.31	15.06	37.29	19.30
Posttest scores	66.03	21.43	46.05	27.67
Effect size	1.38		0.45	
N	59		55	

Table 5
ANOVA analysis of affecting students' learning achievement by using different teaching strategies in the flipped classroom.

Source	SS	df	MS	F	*p*
Model	20412.954	2	10206.477	19.221	.000**
Intercept	19830.997	1	19830.997	37.347	.000**
Covariance	9050.486	1	9050.486	17.044	.000**
Groups	6735.600	1	6735.600	12.685	.001**
Errors	58940.282	111	530.994		

**$p < .01$.

Therefore, the experimental results showed that students who use structured computer-assisted collaborative concept mapping to assist in flipping classroom teaching gained significantly higher learning achievement than students who use traditional exercise discussion-style flipped classroom teaching.

4.3. Students' views on two kinds of aid tools for flipped classroom teaching

After finishing the experiments, three students from the experimental class and the control class individually were randomly selected to conduct in-depth interviews. Two questions were asked: 1. Can structural computer-assisted collaborative concept mapping (exercise discussion) be used as a teaching aid for flipped classrooms to improve your motivation? 2. Can structural computer-assisted collaborative concept mapping (exercise discussion) be used as a teaching aid for flipped classrooms to make your learning easier?

The students surveyed in the experimental class believe that the use of computer-assisted collaborative concept mapping in the flipped classroom can help them improve their motivation and interest in learning, feel more interested to learn, find it easier to classify accounting concepts, enjoy studying more and take classes more seriously. For example, one student's answer is: "Using the teaching video tape to learn can give me a preliminary concept. When I actually do the problem, I will encounter some difficulties. For example, the main income and the non-main income of the restaurant often confuse me. The process of concept mapping keeps me thinking, so I will find the information which I need to understand the problem, making it more interesting and easier to understand. Especially when I go back to the classroom and draw the concept map with my groupmates collaboratively, I find that some concepts in the concept map of groupmates construction are concepts that I have never thought of before. After that, I will want to prepare more lessons, do more topics, and discuss them with my classmates." Another student's answer is: "Before class, I watch the concept explanation or problem solving process of the hospitality accounting in the teaching video tape, and use the concept map to organize the concepts. When I return to the classroom, I draw the concept map with my groupmates collaboratively. I can discuss this with my groupmates, find information together and work together to complete results. I feel that it is easier to learn and not tiring, so I don't want to sleep, play mobile phones, and play video games."

However, the students surveyed in the control class consider that the use of exercise discussion in the flipped classroom can't help them clarify accounting misconceptions and integrate accounting concepts. Because of the characteristics of numerous accounting professional terminologies and difficult integrating relationship between accounting concepts in the hospitality accounting course, students can't understand accounting terms and how to integrate related accounting concepts through textbook exercises. For example, on student's answer is: "Hospitality accounting is very difficult for me. I have a lot of accounting concepts that I do not understand when I watch videos, and I also have a lot of problems. In the classroom, the teacher only asks us to discuss the exercises collaboratively. It is impossible for me to understand these complicated accounting concepts, and how to integrate and apply these accounting concepts."

5. Discussion and conclusion

The experimental results show that students using structured computer-assisted collaborative concept mapping as a supplementary flipped classroom teaching strategy can enhance students' learning motivation and improve their academic achievement more than traditional exercise discussion-style flipped classroom teaching strategy. At the beginning of the teaching experiment, both groups use the flipped classroom teaching. Students can choose the reading tools such as smart phones, Facebook and YouTube videos according to their own level and time to watch the course content, and not be restricted by time and space to plan their own learning progress, and to repeat videos for confused parts. Bergmann and Sams (2012) indicates that students are interested in this kind of learning environment and are willing to actively learn, and look forward to returning to the classroom to work with classmates to complete learning. However, the result in this study shows that there is no significant improvement of students' learning motivation and only a little improvement for their academic achievement when traditional flipped classroom teaching method is used.

The primary purpose in accounting is to correctly construct financial statements. There are a lot of related and complicated concepts in accounting. A thorough understanding of the relationships among different accounting concepts is essential (Chiou, Lee, Tien, & Wang, 2017). After in-depth interviews with students, there are several possible reasons for the results of this study. Due to the complicating materials, massive accounting professional terminologies and difficult integrating relationship among accounting concepts of hospitality accounting course, students may not be able to learn integrated accounting knowledge by watching the teaching video tapes that only have fragmented and scattered accounting knowledge. Furthermore, students often feel overwhelmed by the misconceptions of accounting in the process of watching the teaching video tapes, and therefore feel frustrated by learning. Additionally, collaborative exercises in the classroom are not very helpful in clarifying accounting misconceptions and integrating accounting concepts. As a result, their motivation for learning is low and their learning achievement is not high.

Conversely, the experimental group students who use computer-assisted collaborative concept mapping as an aided tool in the flipped classroom, making good use of the features of concept connection and concept hierarchies for concept mapping, can integrate deeply and widely fragmented and scattered accounting concepts and knowledge of teaching videos, and use concept mapping to make meaningful learning (Chiou et al., 2015; Huang et al., 2012). Students can also assess their misconceptions and conceptual integration through concept mapping process (Chiou, 2008, 2009). Through this learning process, every student can also know his/her accounting concept mistakes or misconceptions, or the differences from other classmates in understanding accounting concepts, and clarify accounting concept through mutual discussions and collaborative concept mapping learning. Mistakes will be reduced when students completely comprehend the relationships among accounting concepts, which are then manifested as improved

academic achievement (Chen et al., 2017). Schmid and Telaro (1990) argued concept mapping that is created from sharing and discussion is a guiding technology for promoting effective learning.

Although concept mapping can effectively assist students in reorganizing the conceptual structure of learning content and improve their academic achievement, students are burdened with constructing concept maps and are prone to learning anxiety and lack of self-confidence (Chiou, 2006). Many literatures proved that collaborative learning concept mapping can reduce these problems and improve students' learning motivation and achievement (Chiou, 2006; Okebukola & Jegede, 1989; Roth & Roychoudhury, 1992, 1993, 1994). Johnson and Johnson (1999) pointed out that cooperative learning is more likely to trigger students' intrinsic motivation than individual learning, and students are more active in learning. Kagan (1985) indicated that students' communication can enhance students' understanding and memory, and students' dispute resolution can lead to higher level understanding. If teamwork is used to learn concept mapping, students will be able to discover and reduce the misconceptions by communicating the meanings of concept or proposition through open discussion. The learning efficiency and effectiveness are naturally better (Chiou, 2006). Chiou (2006) pointed out that students can cooperate with each other to draw concept maps in the context of collaborative learning concept mapping. Under the lively situation of mutual help and collaborative learning in the flipped classroom, students can overcome the obstacles of students' accounting and improve their motivation for accounting. Therefore, the collaborative concept mapping as a teaching aid for flipped classroom teaching can better improve students' learning motivation and academic achievement than traditional flipped classroom teaching.

For the limitations of using paper and pencil to draw concept maps, Liu et al. (2010) pointed out that a concept map contains many concepts, which will make the concept map too complicated and inconvenient to draw and to use. Combining computer-assistance with concept mapping is a good learning strategy to lead learners to actively use computer software to construct concept maps to achieve positive learning outcomes (Liu et al., 2010). Reader and Hammond (1994) pointed out that computer-aided concept mapping facilitates the revision of notes and links compared to paper-and-pencil concept mapping, making concept maps easier to draw and easier to modify conceptual structures. Chiou et al. (2017) noted that overly complicated paper-and-pencil concept maps may reduce a student's learning motivation. Using *Inspiration* software, allows students collaboratively to easily and rapidly construct concept maps, and receive faster teacher feedback (Chiou et al., 2017; Liu, 2011; Royer & Royer, 2004). Their learning frustration and anxiety are decreased. Consequently, students are more inclined to use concept mapping as a learning method, and they also improve their learning motivation and achievement simultaneously (Chiou et al., 2017; Liu, 2011; Liu et al., 2010).

From the above inferences, the advantage of using structured computer-assisted collaborative concept mapping as a teaching aid for flipped classroom is that it is not only possible to easily relate and integrate all accounting concepts in the course through the concept mapping technology. It can also diagnose students own concept mistakes, help clarify their misconceptions, and help them understand abstract and complex concepts (Chiou, 2008, 2009). Schmid and Telaro (1990) proposed that concept mapping is helpful for students to construct their personal knowledge in cognitive level to promote skills of effective learning. In addition, during the interacting process of solving problem collaboratively in the computer-assisted collaborative concept mapping process, students can create an environment in which learning motivation is stimulated and learning effectiveness promoted. Chiou and Wang (2016) proved that using computers to assist collaborative concept mapping has a significant positive help on improving students' academic achievements. Chiou et al. (2017) also showed that the use of computer-aided concept mapping has a significant positive impact on improving students' academic achievement. Hence using structured computer-assisted collaborative concept mapping as aiding tool to flipped classroom teaching can better improve students' learning motivation and achievement than traditional discussion-type flipped classroom teaching. Teachers who adopt the method of flipped classroom teaching should consider using the additional strategy of structured computer-assisted collaborative concept mapping.

Some limitations are as follows. First, under the existing education system, there is no more class participation, so there is no more complete comparison of different teaching methods (such as individual concept mapping and collaborative concept mapping). Second, under the existing education system, class students cannot be dispersed, so random experiment design cannot be used. Due to the development of the Internet, the popularity of mobile devices and the rise of artificial intelligence, the scope of technology-assisted education has become more extensive. In the future research, the application of structured collaborative concept mapping in the flipped classroom teaching can further integrate mobile device learning and artificial intelligence, making the flipping classroom more flexible and more effective.

CRediT authorship contribution statement

Chei-Chang Chiou: Conceptualization, Project administration, Methodology, Software, Writing - review & editing, Supervision, Validation. **Li-Chu Tien:** Conceptualization, Data curation, Investigation, Methodology, Software, Writing - original draft. **Yu-Cheng Tang:** Visualization, Writing - review & editing, Investigation.

Acknowledgements

This study is supported in part by the Ministry of Science and Technology of the Republic of China under contract numbers MOST 104-2511-S-451-002-.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jhlste.2020.100243.

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