CHAPTER III

METHODOLOGY

The methodology described in this chapter is divided into 2 phases; course development and conducting experimental study as shown in Figure 3.1.
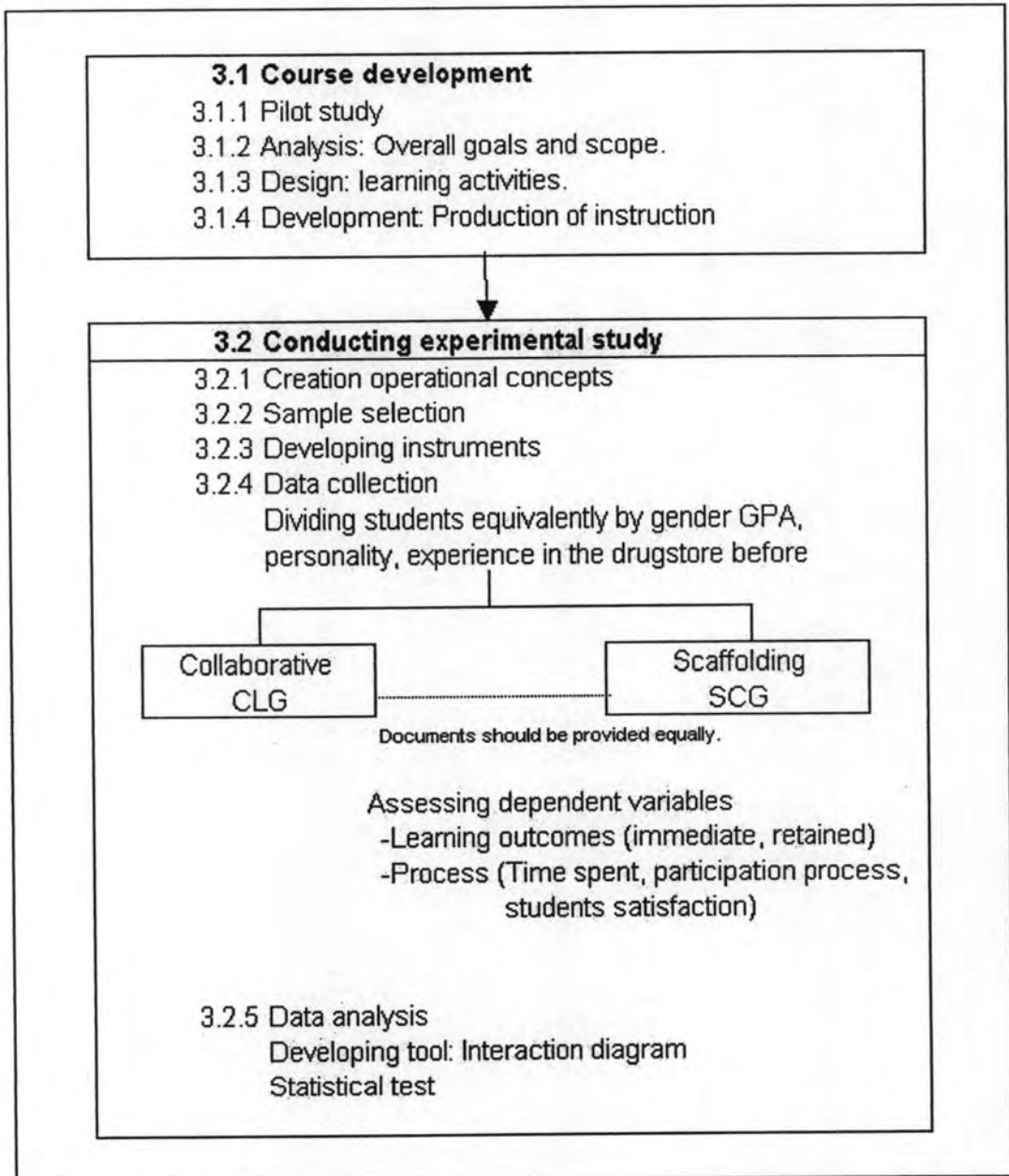
3.1 Course development
3.1.1 Pilot study
3.1.2 Analysis: Overall goals and scope.
3.1.3 Design: learning activities.
3.1.4 Development: Production of instruction

3.2 Conducting experimental study
3.2.1 Creation operational concepts
3.2.2 Sample selection
3.2.3 Developing instruments
3.2.4 Data collection
Dividing students equivalently by gender GPA, personality, experience in the drugstore before

Collaborative CLG	Scaffolding SCG

Documents should be provided equally.

Assessing dependent variables
-Learning outcomes (immediate, retained)
-Process (Time spent, participation process, students satisfaction)

3.2.5 Data analysis
Developing tool: Interaction diagram
Statistical test

Figure 3.1 The brief sequences of methods used in this study.

3.1 Course development

3.1.1 Pilot study

A pilot course development was carried out on the online introductory module of pharmacy professional practice in pharmaceutical marketing and business courses at the faculty of pharmacy, Chulalongkorn university in the year 2004. The suitability of instrument and activities were tested.

The pilot course was organized including various activities to scaffold students to accomplish the planned knowledge. Course Management System (CMS) named "Moodle" was used as a communication tool, whilst instructors acted as a course facilitators. The Constructivist Online Learning Environment Survey (COLLES) was used to assess the social constructivism and instructor developed course evaluation questionnaires to assess satisfaction of this online module at the end of the course.

Thirty pharmacy students of Chulalongkorn University were all voluntarily recruited as samplers of the pilot course. The result from Constructivist On-Line Learning Environment Survey (COLLES) illustrated that the course could promote online interaction as shown in Table 3.1. The students perceived that the average total social constructivist environment score = 3.82 ± 0.28. As the score of The Constructivist On-Line Learning Environment Survey (COLLES) were represented to the student perceived how often each aspect of an online learning environment existed. (1= almost never, 2= seldom, 3= sometimes, 4= often and 5= almost always). Then it could be inferred that the social constructivist environment in this course was perceived as nearly often to exist. After mean social constructivist environment score of the pilot course was compared between the score of preferred and actual form, the score student expectation(preferred) was not significantly different from the score student perceived. The results revealed that the student expectation of social constructivist learning environment was nearly fulfilled. (Table 3.1)

Table 3.1 Mean PSCE score in each aspect of COLLES of online introductory module (pilot course)

	Preferred		Actual		Paired Samples Statistics df=19
	Mean	SD	Mean	SD	Sig. (2-tailed)
Relevance	4.18	0.49	4.08	0.45	0.338
Reflection	3.86	0.53	3.68	0.41	0.160
Interaction	3.66	0.49	3.56	0.49	0.494
Tutor Support	3.95	0.60	4.05	0.43	0.456
Peer Support	3.68	0.37	3.59	0.47	0.399
Interpretation	4.16	0.51	3.96	0.36	0.123
Total social constructivist learning environment	3.91	0.37	3.82	0.28	0.185

The developed questionnaire was applied to assess how much student had positive perception and satisfaction of each activity of the course. The 5 point Likert scale was used. (1= least, 2= less, 3= much, 4= more and 5= most). The results from the developed questionnaire were shown in Table 3.2 - 3.3.

Table 3.2 Student satisfaction of the online activities of the introductory module (pilot course)

Positive perception and satisfaction of each activity	Mean	SD
Activities		
Authentic task by visiting the real sites	4.65	0.51
Course orientation and online technical skills practice	4.02	0.54
Explanation of the reason for picking up student's choice for further assignment	3.79	0.58
Ask-facilitator Forum	3.75	0.68
Online Problem based learning	3.73	0.64
Reflective thought	3.66	0.63
Assignment from authentic tasks	3.64	0.66
Think Aloud	3.46	0.65
Student satisfaction with all activities in this online course	3.67	0.57

Table 3.3 Student perception on online learning outcomes of online introductory module (pilot course)

Positive perception and satisfaction of each activity	Mean	SD
Overall perception of the course		
Student learned from activities in this online course	3.81	0.63
Overall course activities were appropriate	3.86	0.52
Students liked this kind of learning method (compared with the traditional one)	3.89	0.63
All online activities in this course were beneficial	3.90	0.60
Students had knowledge gained after this online course	4.32	0.55

Students in this introductory module (pilot course) had the average score of positive perception and satisfaction of overall course quite high (nearly 4 which represented to more satisfied). The result from the course evaluation questionnaires reported that students learned with no negative impression on minimal face-to-face interaction with instructors and peers. Overall satisfaction with the course was also perceived.

Based on the pilot study, minor modifications were made for the main study course (online community pharmacy course) according to the difference of contents.

The process to develop the online community pharmacy course consisted of 3 steps. Those were analysis, design and development step.

3.1.2 Analysis: Overall goals and scope.

In this step, the overall goals the course tried to achieve, the overall knowledge, skills, attitudes, and behaviors that needed to be taught and the amount and level of content needed were gathered and summarized.

3.1.3 Design: learning activities.

This step was to design what activities media/resources were used in the instruction. It focused on putting the theories to bed and create concrete manifestations and also to develop the whole contents along with activities beneath time. From pilot study, the mean perceived score of SCLE was 3.82 ± 0.28. The mean score of student perception of knowledge gained was 4.32 ± 0.55 from the 5 points of Likert questionnaire. Therefore, activities from the pilot study were included in this study since they can promote social constructivist learning environment and student learning achievement. Some activities were added to make it suitable for acquiring more individual cognitive development such as concept mapping and quiz (pre-post reading test).
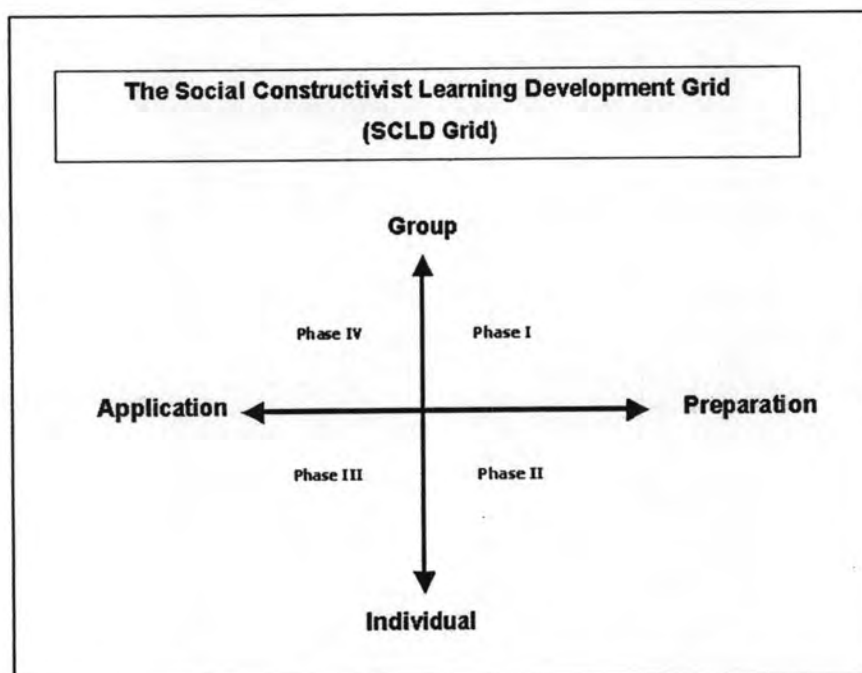

Figure 3.2 The Social Constructivist Learning Development Grid (SCLD Grid)

Figure 3.2, "Social Constructivist Learning Development Grid (SCLD Grid)" was synthesized to be the model for developing the SCLE of the online learning course. The grid was based on 2 variables interaction on process and objective of the process. Is it group or individual? Is it for preparation or application? Whenever the online course to promote SCLE is created, SCLD Grid can be applied as guidance. Since students have to be well prepared for the next step of online learning by sharing, then the overall course orientation and technical skills are provided in the preparation part (Phase I-II). Phase III is aimed for each student to gain higher individual cognitive development. Phase IV, students have to practice more social interaction; apply their prior knowledge to scaffold their friends in a group (scaffolding by peers). This whole process is to achieve higher cognitive development. The grid also presents the logic of scaffolding by tasks. More complicated tasks and responsibilities are delivered to students according to phases. The details of the application of each quadrant in the SCLD grid were described below.

Phase I As shown in the first quadrant; Group-Preparation

- All students should know that everyone is responsible for other learning by instructor's information.
- Students should get to know one another, Icebreaker activities, which give students a chance to participate in the course before assigning team.

Phase II According to the second quadrant; Individual-Preparation.

- Students should have skills in doing their tasks. Technical and systematic thinking skills are prepared by practicing online communication, Think Aloud, Reflective thought.

Phase III Consistent with the third quadrant; Individual-Application

- Develop individual cognitive development by applying the online skills by Reading web document/other resources, quiz, individual concept mapping, authentic experiences.

Phase IV or Comprehensive Phase: According to the fourth quadrant; Group-Application

- Develop higher cognitive development with social interaction by Think Aloud, Reflective thought, group PBL, shared concept mapping

Figure 3.3 presented the details of SCLD Grid and online community pharmacy course. According to the Social Constructivist Learning Development Grid (SCLD Grid), the course was divided to 4 phases. As the time passed, the student's responsibility would increase. Moreover, it was also to scaffold student to do more complicate tasks. At the last phase student role was to take a whole responsibility to achieve his group goal, whilst instructor role was a facilitated observer. The communication techniques designed for this online course were both face to face and computer mediated communication (CMC) as following.

- Phase I Group-Preparation was achieved by Face to Face in the lecture room
- Phase II Individual-Preparation was achieved by Face to Face in the computer laboratory and Computer mediated communication (CMC)
- Phase III The content related activities began. Phase III named "knowledge acquisition phase" was for student to gain knowledge of community pharmacy management. This phase was achieved by CMC
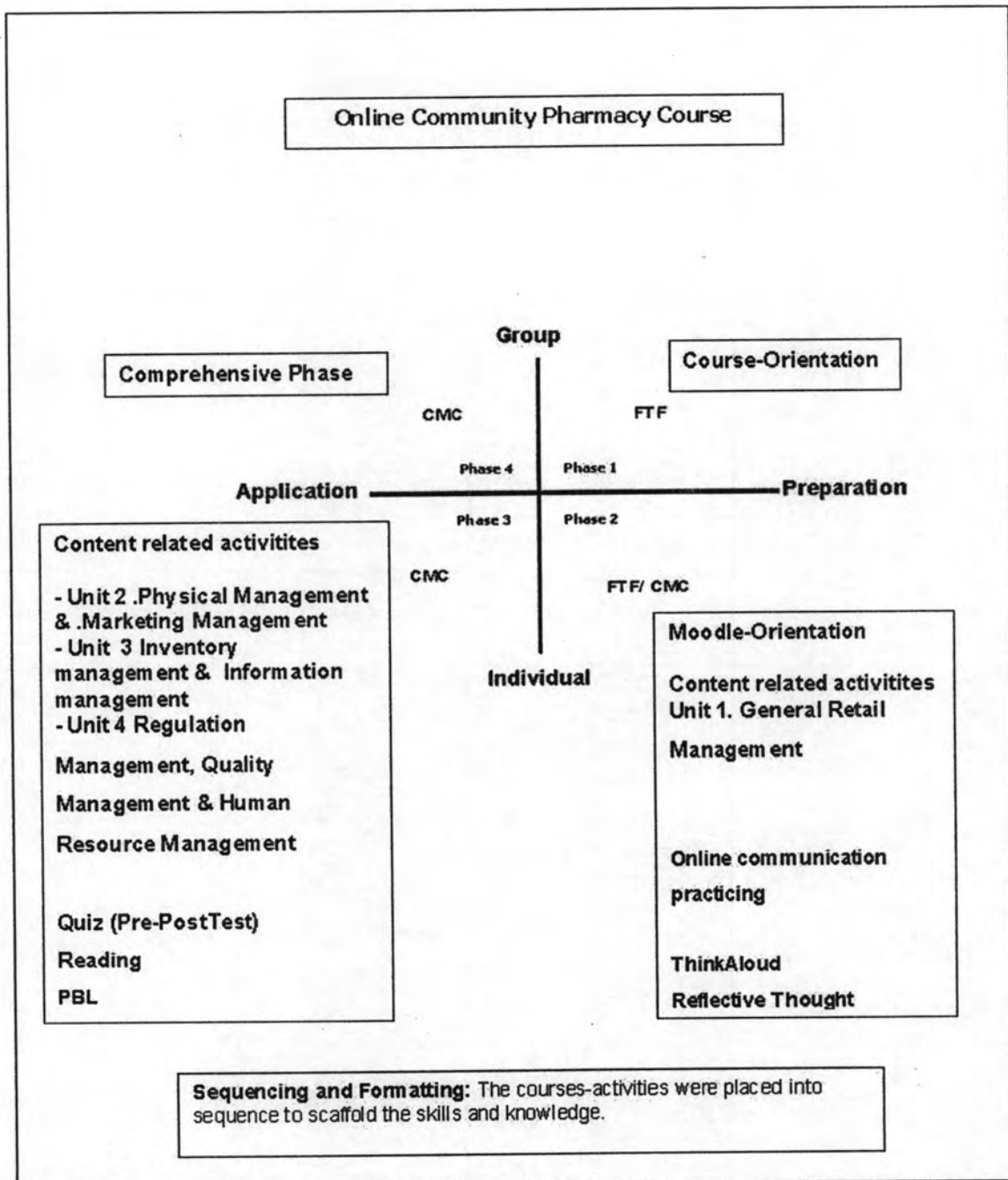- Phase IV or Comprehensive Phase: Group- Application by PBL assignment through CMC

Online Community Pharmacy Course

Group

Comprehensive Phase

Course-Orientation

CMC

FTF

Phase 4   Phase 1

Application ———————————————————— **Preparation**

Phase 3   Phase 2

CMC

FTF/ CMC

Content related activitites

- Unit 2 .Physical Management & .Marketing Management
- Unit 3 Inventory management & Information management
- Unit 4 Regulation

Management, Quality

Management & Human

Resource Management

Quiz (Pre-PostTest)

Reading

PBL

Individual

Moodle-Orientation

Content related activitites
Unit 1. General Retail

Management

Online communication

practicing

ThinkAloud

Reflective Thought

Sequencing and Formatting: The courses-activities were placed into sequence to scaffold the skills and knowledge.

Figure 3.3   Social Constructivist Learning Development Grid (SCLD Grid) with activities designed for online community pharmacy course.

3.1.4 Development: Production of instruction

To achieve the goal of the course, the web page was produced. Many researches revealed that Moodle provided a support structure, enabled easy access and use, and not high standard hardware facilities are required for servers and clients. Moodle was a web-based further delivered to students by a virtual learning environment in which students and staff can interact remotely and engage in various by software features. The name Moodle stands for Modular Object-Oriented Dynamic Learning Environment. It is an open source e-learning platform. The main benefit lies in the ability to avoid the expensive license costs associated with commercially available alternatives. Moodle benefits from design flexibility, which means that instructors can personalize Moodle system and concentrate on areas important to them. Instructors can build their own individual and collaborative learning activities that reflect and enhance their own teaching preferences. In this study, online community pharmacy course wanted a much richer interaction, support collaborative activities. Moodle can facilitate this kind of function well. . In this study, Moodle courseware was applied as in the pilot study showed that This program was convenient and effective to achieve learning environment and positive learning outcomes.

Moodle includes various interactive features such as discussion online forum, quiz, consultation and providing feedback to assignments. Online discussion in this course was performed asynchronously. Moodle provided other features such as materials online, schedule, updates, assignments, announcement, bulletin, students' and instructors' information.

Instructor who was the facilitator of the course had to learn and understand all Moodle features so the learning content and activities could be delivered with maximum achievements. The learning materials were prepared. Students and instructors were designed to get access password to connect to Moodle web course where they could access the learning materials and interact with others. Since this course required group participation on the web, students had to post and complete assignments in their groups. Moodle was designed to facilitate separated group working web page. Students can build and develop stronger arguments, exchange resources etc in their groups confidentially. Not only the regular structure forums; such as "Problem Solving Forum", instructor designed more to facilitate the social constructivist learning environment such as a free discussion forum called "Free-Talk

Forum", it was the unstructured discussion forum for the students and teacher to communicate leisurely and relaxing among each other's during the course. "The announcement forum" was the one-way communicated board to carry the update information / assignment from instructors to students. "The Ask-Facilitator Forum" was the two ways communication forum between online facilitator and students, especially for students to immediately post any question or incomprehension during the course. This forum was for discussing teaching and learning issues related to this course.

At this final step of the course development, the main web page of the course would be ready for use. Optical media, graphic, resources and accessories by means of appropriate learning activities and contents were all integrated together to the course website. (APPENDIX A)

Online community pharmacy course was finally designed as a weekly structure for the whole semester, which started in June and ended at the end of September.

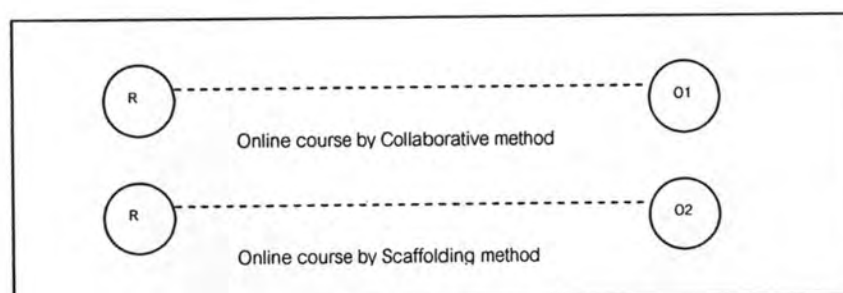## 3.2 Conducting experimental study

Figure 3.4   Posttest Only Design

The quantitative method was designed as experiment research; posttest-only randomized groups design (Figure 3. 4). Samples randomly assigned to two groups, in relation to the two strategies. Collaborative and Scaffolding were two experimental groups. The aim of this study emphasized on the online instructional course developed according to the social constructivist learning theory. Social constructivist learning environment and student's performance would be assessed after those two different online instructional strategies were implemented. The frequency and time students involved in the online course were also measured as the process of students' learning. This study focused on the efficacy of different online strategies in the context of social constructivism.

3.2.1 Creation operational concepts

3.2.1.1 "Online instructional course" in general composed of a collective of activities both individual activity including direct authentic experiences and interactivity activity. Activities were designed in sequence to scaffold students to do more complicated tasks. To provide a more complex and rich learning environment, instruction based on 'in-group problem based learning' was adopted. The students are required to analyze content, and formulate plans or solutions by themselves. Problem-solving learning can be seen to encourage students to apply their knowledge more deeply than the subject matter that directly covered in lectures.

3.2.1.2 Controlled variables

Personality. Introvert and extrovert type of personality was considered and equivalently divided when groups were formed. This variable has the study supported that it can affect the way the students cooperate with each other. (Sutaratana, 1974). MPI (Maudsley personality inventory) questionnaire was the tool to assess the type of personality in this study. The higher MPI score, the more extrovert student was.

Socio-demographic such as gender, prior experiences in drugstore, computer skills and GPA were also considered before group working started.

3.2.1.3 Experimental variables

The two different strategies of this online instructional course were

I. Collaborative strategy was the strategy to design situations where all of the community pharmacy management contents were designed in sequences and students studied together in-group in all the contents. For example; the teacher provided additional articles for the students to read and analyze, beyond the text, and then assigned the students to work in groups to solve problems. The groups then to achieve the group goal, group members had to exchange their knowledge and discuss their solutions.

II. Scaffolding strategy was the strategy to design situations where students were divided in to subgroups and each subgroup had to study and concentrate on one unit of content in the community pharmacy course to become an expert subgroup. Afterward the experts had to instruct and scaffold their friends in other expert subgroups in order to get everyone in this group know and understand all contents.

3.2.1.4 Dependent variables

Perceived Social Constructivist Learning Environment. Social constructivism is emphasizing on the collaborators' efforts as sources of learning. The learning environment should also be designed to support and challenge the student's interaction. In this study, the social constructivist environment consists of 6 major aspects followed by COLLES (Constructivist Online Learning Environment Survey)

1. **Relevance** - how relevant is online learning to students' professional practices?
2. **Reflection** - does online learning stimulate students' critical reflective thinking?
3. **Interactivity** - to what extent do students engage online in rich educative dialogue?
4. **Tutor Support** - how well do tutors enable students to participate in online learning?
5. **Peer Support** - do fellow students provide sensitive and encouraging support?
6. **Interpretation** - do students and tutors make good sense of each other's communications?

Students' performance. In this study, Students' performance was defined as learning outcomes, which there will be two aspects to be considered.

1. Learning products. In this study, there were immediate and retained learning achievements evaluated as the products of the learning. These were assessed by the instructor-developed examination. The students' perception on learning outcomes and satisfaction of the online activities was also evaluated by instructor-developed questionnaire.

2. Learning process, the other aspect of the learning outcome. To evaluate how student learned via online social constructivist technique, the time and frequency students participated in the online course was examined.

3.2.2 Sample selection

3.2.2.1 Sample size

From $n = \dfrac{(Z_\alpha + Z_\beta)^2 \, 2S_p^2}{D^2}$

For two sided test $Z_\alpha = 1.96$ ($\alpha = 0.05$) $Z_\beta = 1.64$ ($\beta = 0.10$; Power= 90%) D was assumed as 0.30. From pilot study, The students perceived that the average total social constructivist environment score = 3.82 ± 0.28. The calculated sample size was 22 (22.57) for each group.

3.2.2.2 Community Pharmacy was the selected course. This subject was the elective for the fifth year students in the social and pharmacy administration track of Chulalongkorn University. Before the registration period, the students were informed about details of the study. Students could decide by themselves whether they wanted to join this study or not. If they refused to be samplers of this study, they could select other electives.

3.2.2.3 The fifth year pharmacy students at Chulalongkorn University who enrolled in the community pharmacy course were recruited as subjects of this study.

3.2.3 Developed instruments

The instruments and the tools of this study were

1. Student characteristic and type of personality assessment questionnaire.
2. The Constructivist On-Line Learning Environment Survey (COLLES)
3. The developed examination
4. The developed questionnaire for assessing student perception and satisfaction

The validity and reliability of the instruments used in this study were considered.

1. Student characteristic and type of personality assessment questionnaire.

This questionnaire objective was to assess the student's general characteristic and introvert and extrovert type of personality, which were controlled during the study. The questionnaire was developed based on Maudsley Personality Inventory of H.J. Eysenck .

After translated from English to Thai, two students was asked to test if the questionnaire was understandable. If it had any non-understandable phrase, the questionnaire then was edited. Thirty pharmacy students from the fourth year who intended to study community pharmacy course in the future did the pilot study. Internal consistency reliability (Cronbach's alpha) was 0.793. Either positive or negative feeling of each student with 24 statements of the questionnaire was collected. Positive and negative feeling scored 2, and 1 respectively. Zero score represented to undecided feeling. The higher Maudsley personality inventory (MPI) score, the more extrovert student was. Finally, Cronbach's alpha of MPI in students who enrolled in online community pharmacy course was 0.7676 (APPENDIX D)

2. The Constructivist On-Line Learning Environment Survey (COLLES)

The COLLES has been designed to monitor the extent of the interactive capacity of the World Wide Web for engaging students in dynamic learning practices. It was also translated from English to Thai and this Thai version had been applied before in pilot course "the introductory module of pharmacy professional practice in pharmaceutical marketing and business 2004". Cronbach's alpha was 0.8323 and 0.7113 for Preferred and actual form, respectively.

The COLLES (Contructivist Online Learning Environment Survey) is an electronic questionnaire which were developed from the theory of social constructivism (Taylor & Maor, 2000). It can evaluate each student's preferred online learning environment and compare it with her/ his actual experiences. The instrument consists of 24 questions (actual and preferred) arranged into 6 scales:

a. **Relevance** - how relevant is online learning to students' professional practices?

b. **Reflection** - does online learning stimulate students' critical reflective thinking?

c. **Interactivity** - to what extent do students engage online in rich educative dialogue?

d. **Tutor Support** - how well do tutors enable students to participate in online learning?

e. **Peer Support** - do fellow students provide sensitive and encouraging support?

f. **Interpretation** - do students and tutors make good sense of each other's communications?

The COLLES contains a five-point Likert-type response scale:

– Almost Never (1), Seldom (2), Sometimes (3), Often (4), Almost Always (5) –

with scores shown in parentheses. COLLES actual and preferred form was applied in this study.

The actual form was measured students' perceptions of the existence of an online environment that supported them to reconstruct themselves as both reflective and collaborative learners. If the score of this form was higher than 3 that means the online environment in any aspect measured existed more than sometimes.

The preferred form was measured students' expectations of an online environment. When the score of the preferred form was not different from the score of the actual form, that meant the students' expectation was nearly fulfilled, or it could be implied that student was satisfied with the environment.

In this study, the Cronbach's alpha was 0.823 and 0.817 for Preferred and actual form, respectively. (APPENDIX E)

3. The developed examination.

To evaluate the learning achievement after the course, students were tested. The developed examination consisted of 80 multiple-choice questions, covering knowledge relative to the course content. The experts approved this examination, and the quality of the examination was examined KR20 KR21 Discriminant analysis Difficulty Index were tested. The results of Kuder-Richardson reliability statistics were presented as followed. KR20 =0.437, SEM20 = 3.652; KR21 =0.237, SEM21 = 4.251

The examination structure

The structure of the exam was related directly to the content of the course (Unit I- Unit IV). The minority of the exam content was in unit I (5/80; 6.25%), which students studied in Phase II (Moodle orientation). The other units were studied during phase III (Knowledge acquisition phase). The contents of the exam were distributed almost equally (23/80,26/80,26/80; 28.75, 32.5, 32.5% for unit II, III, IV respectively).

According to Bloom's taxonomy, There are six major categories of the cognitive domain involves knowledge and the development of intellectual skills, which are listed in order as; Knowledge (Kn), Comprehension (Cp), Application (Ap), Analysis (An), Synthesis (Ss) and Evaluation (Ev), starting from the simplest behavior to the most complex. The categories can be thought of as degrees of difficulties. That is, the first one must be mastered before the next one can take place.

The questions in the exam were categorized into all six major competencies as shown in Figure 3.3. The question about competency in application was found most (20/80; 25%) while the least was in evaluation level (2/80; 2.5%)
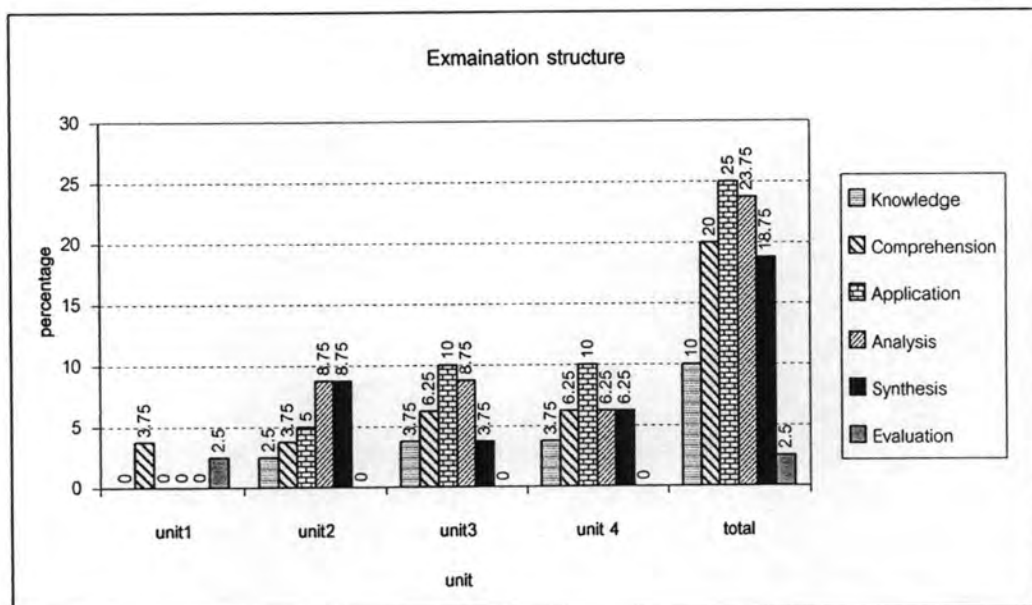
Figure 3.5 Examination structure divided by unit of content and Bloom's Taxonomy

4. The developed questionnaire for assessing student perception and satisfaction

To measure how students perceived the outcomes of the online community pharmacy course, all enrolled students were surveyed. Evaluations were administered after completion of the course by instructor-developed questionnaire. (APPENDIX F) The constructs of this questionnaire were from the expected outcomes as follows.

Part1) Student perception on online learning outcomes

Students responded to 16 questions. Questions were developed to measure how students perceived with the overall image of the online community pharmacy course based on the social constructivist theory. A 10 point- Likert-scaling was applied to each question. Scaling was a bipolar, measuring either positive or negative response to a statement. The more scale selected represented respondents specify more level of agreement to a statement. There were 6 constructs as follows.

Student's perception of knowledge escalated.

Student's perception of learning skills

Student's perception of learning process

Student's perception of learning atmosphere and motivation.

Student's perception of learning development.

Student's affection of the interaction online course

Part 2) Student satisfaction with online learning activities

All activities were asked about how were the benefit or the affection students perceived when the course finished. A 5 point- Likert-scaling was applied to each question. Scaling was a bipolar, measuring either positive or negative response to a statement. The more scale selected represented respondents specify more level of agreement to a statement.

Experts also examined this questionnaire before it was applied. The result of this study showed Cronbach's alpha was 0.972.and 0.963 for part 1) and part 2), respectively.

3.2.4 Data collection

All students who enrolled in the community pharmacy course at Chulalongkorn University were informed to volunteer as the sample of the study. The online community pharmacy course was implemented. Samples randomly assigned to two groups, in relation to the two strategies of online instruction of pharmacy community course created with social constructivist perspective. Collaborative and Scaffolding were two experimental groups. The data of the student's perception of social constructivist learning environment, knowledge achievement and student's satisfaction were collected after the two online instructional strategies were already finished at the end of the semester.

3.2.5 Data analysis

The differences of the student's perception in social constructivist learning environment, learning achievement and the learning process between those two strategies were analyzed.

The qualitative method and data involved the analysis of the online discourse from the discussion forums. Analyzing discussions was to examine the interaction and social process in an online environment. The opened- end evaluating questionnaire was also done at the end of the course.

Tool for analysis: Interaction diagram

To simplify the online interaction patterns during phase III and IV of the course, both CLG and SCG subgroup discussion were monitored and diagrams were created according to learning phase.

Statistical test

Data obtained from the COLLES, the instructor-developed examination and questionnaire. Descriptive analysis considered portraying student's perception of social constructivist learning environment and learning achievement. The time/frequency was considered as to discover how students involved in the process to achieve learning outcomes. The quantitative assessment, the results were compared between two different strategies; collaborative and scaffolding methods by Student T-test, Repeated measures designs were to take measurements on same subject under different conditions. Qualitative analysis was conducted to ensure if the social constructivist-learning environment existed; it also investigated how the learning environment developed by observing the online interaction diagram. Ensuring the confidentiality of data and preservation of the anonymity of participants the number of student was applied instead of their real name.