CHAPTER 3

RESEARCH METHODOLOGY

3.1 Initial Conceptual Framework of This Research

For an overview of the research concept, the conceptual framework is illustrated here in figure 3.1, and details follow.
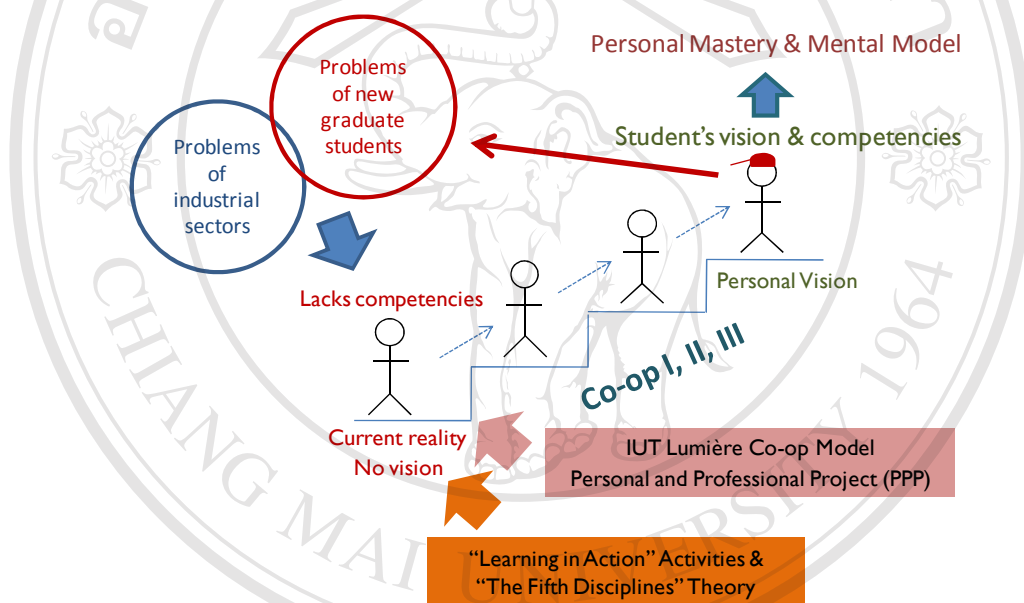

Figure 3.1 The initial conceptual framework of this research

Problems affecting the northern industrial estate of Thailand include: social problems of teenagers, new university graduates not meeting industrial requirements, a shortage of engineers and computer scientists, the lack of a research center to improve production, and a lack of personnel who have ability to deal with the international context (refer to part 1.2.2 and 2.2.1). These factors impacted on foreign investors' decision making to relocate their factories. One essential strategy to prevent relocation is human resources development. Unfortunately, there are still some

problems with the development process, especially with the university graduates. Many studies have shown that most Thai university students lack the necessary competencies to work (refer to part 1.2.2 and 2.2.4) such as patience, responsibility, adaptability, and maturity (behavioral competencies). In other words, they lack professional behavior (personal mastery) and have some problems with mental attitude (mental model). To affect this requires time and various processes to be developed.

This research proposes a new co-op framework to use as a main strategy to help students improve their competencies. It not only aims to improve behavioral (mastery and mental attitude) and work performance competencies but also allows the student to gain work experience within the international context. The co-op model of IUT Lumière France was used as a prototype to leverage Thai students' training systems. The IUT Lumière co-op model was used in the MMIT curriculum to conduct and control the co-op programs such as the assessment system, the student follow-up system, the methodology to manage with companies and mentors etc. Also, the PPP concepts of IUT Lumière were combined with "Learning in Action" (Garvin, 2000) and "The Fifth discipline" (Senge, 1990) theory to be used as core principles to help students improve/increase their competencies, mainly in mastery and mental attitude. Students trained in this co-op system needed to clarify their personal vision (what they desire to be in the future) that affects their attitudes and behavior. At the same time, various activities from the 3 principles/theories above were conducted to train students to continue improving their competencies, both behavioral and work (see details in chapter 4 part 4.1). The final target of this research is to produce students with sufficient competencies and clear future goals. This will also affect their personal mastery and mental attitude. Moreover, these kinds of students will play an important role in helping to prevent factory relocation.

3.2 Research Design

The objective of this research is to create and implement a co-op framework to solve problems occurring in the northern industrial estate and with new university graduates. This research was motivated by a real practical problem. It took 2 years and 2 months for implementation using two batches of co-op students (2 cycles of implementation). Hence, action research was used as the main methodology to design and implement the research. The method has four basic steps which are part of the action research concept: plan, act, observe, and reflect, *or* diagnosis, planning, acting, and evaluating (refer to chapter 2 part 2.5.1). This research applied the action research concept and is described in the following (see figure 3.2).
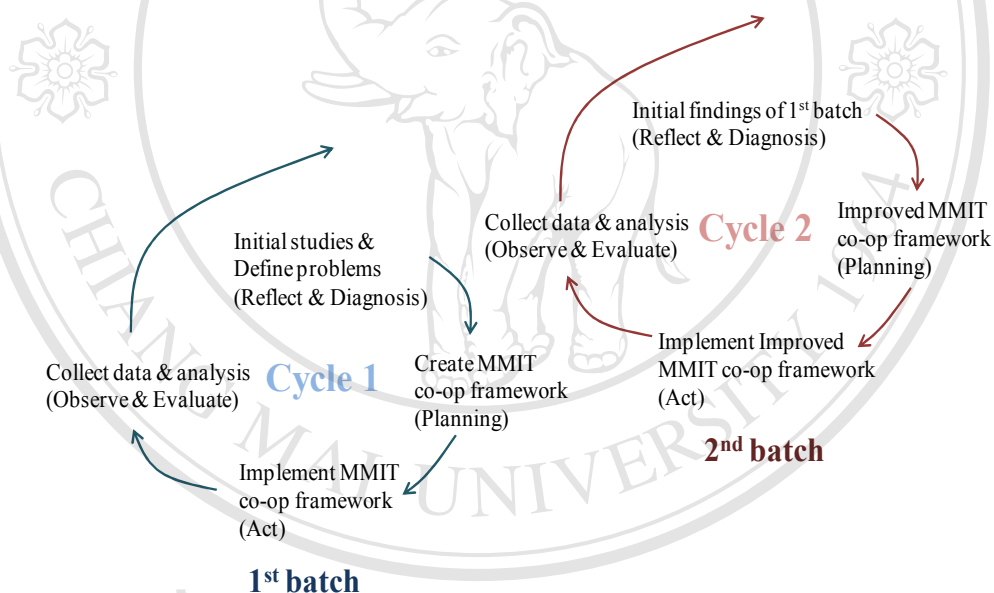

Figure 3.2 The action research of this research
(Applied from Coghlan and Brannick, 2001)

The research started with cycle 1. Initial studies were conducted to define the problems that occurred within the northern industrial estate and university graduates. Then the MMIT co-op framework was established to help to solve the problems. After creating a framework, it was used with the 1st batch of MMIT co-op students. Next, the results were collected for evaluation. In cycle 2, the initial findings

found from the 1st batch were used as important in-put information to improve the co-op framework of the 2nd batch. This improved framework was implemented for the 2nd batch. Then, the results were collected and evaluated.

In addition, for the data analysis of this research, grounded theory was used as the main methodology to analyze the qualitative data. This is because various information needed to be analyzed into categories and their interrelationships explained (refer to chapter 2 part 2.5.2). Details of the analysis process were explained in part 3.5.

This explains the methodology concepts of this research. More details of this research process are described in the next section.

3.3 Research Process

The research work was done with the support of the ETHICS-FED project that was the result of collaboration between Thailand and EU countries (especially France and Germany) to assist Chiang Mai University Staff (MMIT, CAMT) in order to create a framework and adapt a new technical education program (Bachelor degree) to train mid-level managers in production management (see detail in chapter 2). Therefore, many EU experts (see Appendix C) worked together with the researcher (and with MMIT staff) in the planning process, constructing the MMIT co-op framework, and also gave helpful suggestions on how to conduct and follow-up the program. The research process is shown in figure 3.3 and a detailed description follows.
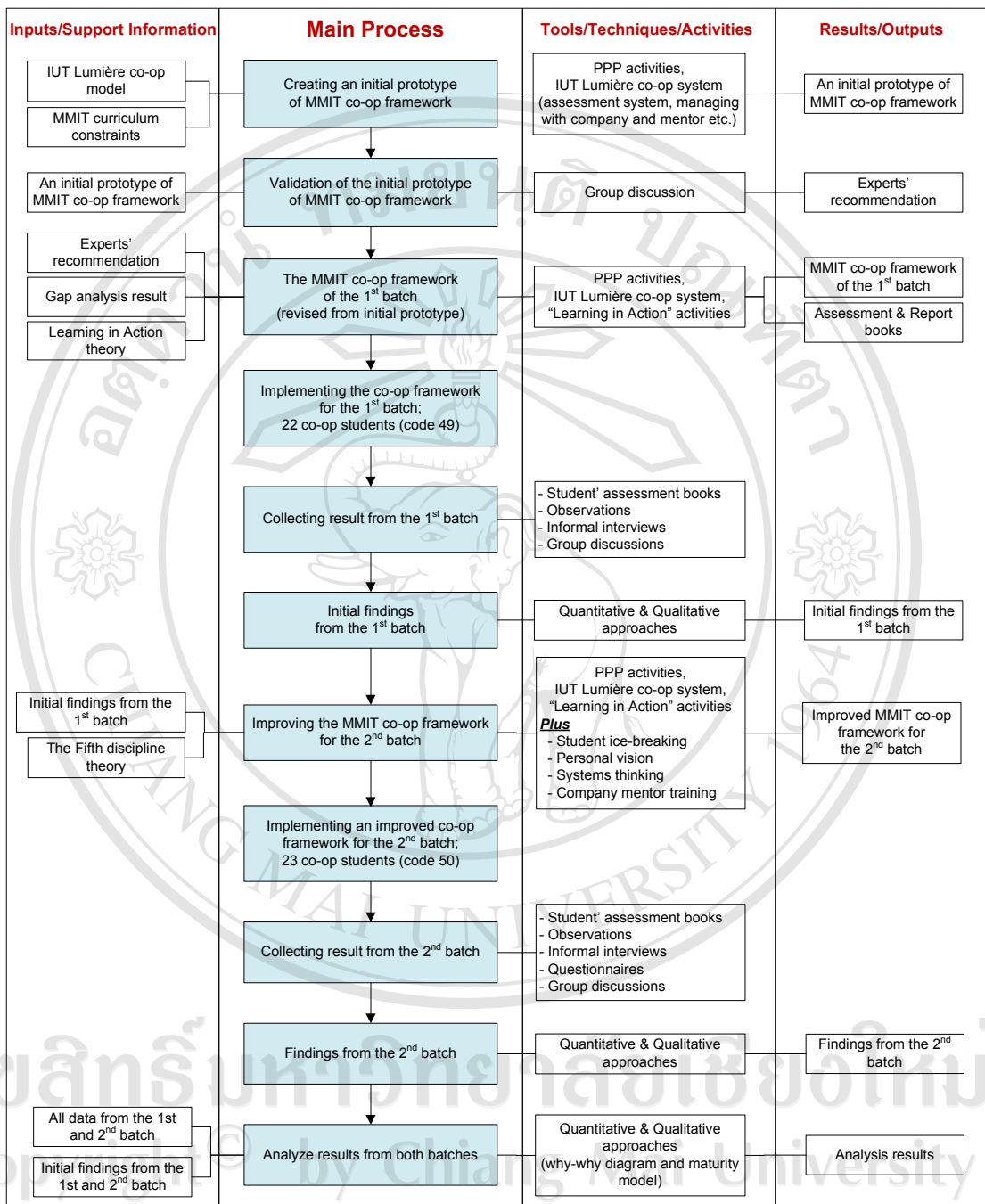
Inputs/Support Information	Main Process	Tools/Techniques/Activities	Results/Outputs
IUT Lumière co-op model / MMIT curriculum constraints	Creating an initial prototype of MMIT co-op framework	PPP activities, IUT Lumière co-op system (assessment system, managing with company and mentor etc.)	An initial prototype of MMIT co-op framework
An initial prototype of MMIT co-op framework	Validation of the initial prototype of MMIT co-op framework	Group discussion	Experts' recommendation
Experts' recommendation / Gap analysis result / Learning in Action theory	The MMIT co-op framework of the 1st batch (revised from initial prototype)	PPP activities, IUT Lumière co-op system, "Learning in Action" activities	MMIT co-op framework of the 1st batch / Assessment & Report books
	Implementing the co-op framework for the 1st batch; 22 co-op students (code 49)		
	Collecting result from the 1st batch	- Student' assessment books / - Observations / - Informal interviews / - Group discussions	
	Initial findings from the 1st batch	Quantitative & Qualitative approaches	Initial findings from the 1st batch
Initial findings from the 1st batch / The Fifth discipline theory	Improving the MMIT co-op framework for the 2nd batch	PPP activities, IUT Lumière co-op system, "Learning in Action" activities **Plus** - Student ice-breaking / - Personal vision / - Systems thinking / - Company mentor training	Improved MMIT co-op framework for the 2nd batch
	Implementing an improved co-op framework for the 2nd batch; 23 co-op students (code 50)		
	Collecting result from the 2nd batch	- Student' assessment books / - Observations / - Informal interviews / - Questionnaires / - Group discussions	
	Findings from the 2nd batch	Quantitative & Qualitative approaches	Findings from the 2nd batch
All data from the 1st and 2nd batch / Initial findings from the 1st and 2nd batch	Analyze results from both batches	Quantitative & Qualitative approaches (why-why diagram and maturity model)	Analysis results

Figure 3.3 Overall research processes

3.3.1 Creating An Initial Prototype of MMIT Co-op Framework

The main components of the IUT Lumière model were the PPP activities derived from ADVP concept (Bujold, 1974). The MMIT co-op model utilized most of the activities from this concept and adjusted some details to be more suitable within Thai context. However, MMIT also transferred other essential elements of the IUT Lumière co-op model to construct an MMIT co-op framework which included methods to cope with companies and mentors, the assessment system (included assessment book and assessment method), and the student follow-up system. Moreover, in the initial co-op framework prototype some constraints and limitations of the MMIT curriculum were also considered as critical criteria, such as credits allotted to co-op courses and the time period for co-op apprenticeship.

3.3.2 Validation of the Initial Prototype of MMIT Co-op Framework

After creating a core co-op structure for the initial prototype, validation by MMIT staff together with 2 French co-op experts and 3 company representatives was conducted to confirm the feasibility of the framework. French experts with many years experience dealing with co-op programs came from IUT Lumière. One was the founder of IUT Lumière. Company experts of various nationalities came from industries in Lumphun province. They include: a Japanese company division manager (this person held the highest position of all Thai people in the company), an American company HR manager (this person also held the position of chairman of the Lumphun HR club), and one from a Thai company in the position of HR manager. All of them had more than 10 years experience. A group discussion was conducted between MMIT staff and all experts. It took about half a day to present the whole MMIT co-op process plan and listen to comments and recommendations from all the experts.

3.3.3 The MMIT co-op framework of the 1st batch

After the validation process, there were some details in the MMIT initial co-op framework that needed some adjustment. Another theory that was also used to

supplement the construction of an MMIT co-op framework was "Learning in Action" (Garvin, 2000), which is one of the learning organization (LO) principles. This theory is used to generate learning activities within a model to help students improve their competencies, especially those that result from the gap analysis of the initial study (see chapter 2 part 2.2.4). The result from this step is the revised co-op framework. The 1st batch of MMIT co-op students followed this program.

3.3.4 Implementing the Co-op Framework for the 1st Batch

After completing the co-op framework, it was implemented with 22 code 49 students (those enrolled in MMIT in 2006 or 2549 B.E.). They were recruited from a total of 90 MMIT students and those not chosen followed an Independent Study program (IS). The recruitment process began in the summer term (March – May) after the students finished their 2nd year of study. Students who passed the recruitment process attended a preparation program before going to apprentice in a company. The apprenticeship period for all 22 co-op students started in 3rd year, semester 2 (beginning of September). For 16 months they alternated between university (1-2 days) and company work (3-4 days) each week. Graduation followed. There were 10 companies from several countries participating in this program, including: Japan, France, U.S.A., Germany, England, and Thailand. The student apprenticeships were distributed among the companies guided by the number of proposed positions (see chapter 4 for details).

3.3.5 Data Collection and Initial Findings of the 1st Batch

Details will be explained in 3.4 and 3.5.

3.3.6 Improving the Co-op Framework for the 2nd Batch

According to the initial analysis and findings from the 1st batch, there were some deficiencies in the co-op framework that needed to be improved (see chapter 4

part 4.1.4). The main framework was similar to the 1st batch. Some activities were added and some were changed. Two main activity categories were:

        1) Activities to directly improve student competencies. They help students to be more efficient and to have greater mastery and mental focus. They include:

- Student-ice breaking activity
- Personal vision activity (Senge et al., 1994)
- Systems thinking activity (Senge, 1990)

        2) Activities indirectly improving student competencies. These make the co-op program more effective. They include:

- Company mentor training activity
- Changed matching process (matching students with companies)
- Reduced number of student assessments
- Reduced apprenticeship time

The details of all activities are described in detail in chapter 4.

3.3.7 Implementing an Improved Co-op Framework for the 2nd Batch

The improved co-op framework was implemented in 2009 with 23 code 50 co-op students (students who enrolled in MMIT in 2007 or 2550 B.E.). They were recruited from a group of 110 MMIT students. Similar to the 1st generation the recruitment process was conducted in the summer term. The students attended a co-op preparation process and were matched with a company which had a program procedure different from the 1st batch (see chapter 4 part 4.1.4.2). The 23 students alternated between a company apprenticeship program and university study for 14 months, from November 2009 to December 2010 (this was 2 months less than the 1st batch). A total of 9 companies participated in this project.

3.3.8 Data Collection of the 2nd Batch, Findings, and Result Analysis

This process is explained detail in parts 3.4 and 3.5.

3.4 Data Collection

Data collections of this research are focused on student competencies progression and factors that impacted on their competencies development. Data was collected mainly from 2 batches of co-op students and their mentors (codes 49 and 50). The main source of data was student assessment books. Moreover, observations, informal interviews, questionnaires, and group discussions were also conducted to collect additional data during the essential activities in the co-op process, such as: the student's company assessment, the company visit (by the researcher), the After Action Reviews (AAR) activities, meetings with co-op students and university advisors, meetings with the company mentors and university advisors, and the co-op seminar. Key words and ideas expressed were recorded during and immediately after each activity.

3.4.1 Data Collection of the 1st Batch

Data was collected from the 22 co-op students of code 49 and their company mentors. The data collection period was from November 2008 to February 2010, and took about 16 months. This research used different data sources of information and several perspectives from participants. Using a variety of data sources helped to ensure the reliability, validity, and generalizability of the research (Creswell, 2009). The tools and methodologies used to collect data included:

1) *Student assessment books*; this is the main tool (see Appendix D) for observing the students' competencies progress. MMIT staff used the IUT Lumière students' assessment book as a guideline, and adjusted the assessments' criteria by using the results of the initial study (competencies gap analysis in chapter 2 part

2.2.4.4). Data collection from the students' assessment books was done every 2 - 3 months during the 16 months of apprenticeship (7 times). The assessment process was conducted in meetings between the student, company mentor, and university advisor. Rating by others (Schunk, 2000) was the main approach to assess students' competencies. The students explain their work and evaluate their own competencies. Then, the company mentor gave the student his/her assessment of the level of behavior and work performance, and assigned a grade. Grades and comments from the company mentors on each student's competencies were recorded in the student's assessment book. The university advisor acted as a facilitator and conducted the assessment process for each competency. Each assessment took 1 - 2 hours. All competencies and criteria were given a grade (detail in chapter 4 part 4.1.5).

      2) *Observations*; students were observed during the contract signing and assessment at the company. This occurred 8 times throughout the apprenticeship period. Each time took 1 - 2 hours. Another participant-observation is the After Action reviews (AAR) of the students. This was conducted at the university 4 times in the first month and once every 1 or 2 months during the remaining 15 months of co-op apprenticeship. Each AAR took about 3 hours.

      3) *Informal interviews*; for students, this technique occurred during the 16 month co-op period when students came back to study at the university. They were interviewed about their jobs, problems on the job, working environment, and also their opinion of the co-op program. Each student interview took 5 -10 minutes. During the researcher's company visit the mentor was interviewed to gather feedback of co-op program (within ETHICS-FED project). Questions were asked about the students' progress, problems, and recommendations. Each interview took 30 to 60 minutes.

      4) *Group discussions*; there were several group discussions to gather feedback about the co-op program, including: twice between students and MMIT lecturers (university advisors) in the fifth and ninth month of the co-op apprenticeship, one time between company mentors and MMIT lecturers in the fifth month, and once in a co-op seminar between three parties (students, company mentors

and MMIT lecturers) in the tenth month. The general topics for discussion were: impressions of the co-op program, student problems, which competencies MMIT should focus on improving, and what we should do next, etc. Each group discussion took 30 to 60 minutes.

3.4.2 Data Collection of 2nd Batch

Data was collected similar to the 1st batch, but there were some changes in detail as described next. The 23 co-op students of code 50 and their mentors were the main sample groups for data collection. The data collection period was from November 2009 to December 2010, and took about 14 months. Tools and methodologies used for collecting data included:

1. *Student assessment book*s; this tool used the same assessment criteria and methodology as the 1st batch but reduced the assessment frequency from 7 to 5 times due to some company constraints (details in chapter 4 part 4.1.4.2). Each assessment lasted 1 - 2 hours.

2. *Observations*; the participant-observation was also similar to the 1st batch. The only change was observation frequency. Observations were conducted a total of 21 times in 5 companies, each lasting 1 - 2 hours. After Action reviews (AAR) were conducted 4 times in the first month and once every 1 or 2 months afterwards. Each AAR took about 3 hours.

3. *Informal interview*s; similar to the 1st batch, students' informal interviews were performed throughout the co-op apprenticeship period (14 months) when students came back to study at the university.

4. *Questionnaires*; this was an additional activity different from the 1st batch. The questionnaires (see Appendix E) were informally created by MMIT staff to ask the opinions of students and company mentors about students' competencies progression and the effectiveness of the co-op program. They were sent and collected during the third month after students began their apprenticeship.

5. *Group discussions*; in the 2nd batch, group discussions were conducted formally twice. The first group discussion was between co-op students and MMIT lecturers (university advisors). The 2nd batch of co-op students were asked to discuss and share their opinions on the co-op program, especially about the factors for success or failure in the co-op apprenticeship. This was done in the ninth month after students began their co-op apprenticeship and took about 1 ½ hours. The second group discussion was conducted in a co-op seminar between students, company mentors, and MMIT lecturers in the eleventh month. It took about 30 minutes.

3.5 Data Analysis

After data collection using the methods in the previous section, both quantitative and qualitative approaches were used to analyze the data.

3.5.1 Quantitative Data Analysis

The main data for analysis were the grades given by company mentors. The average value of each competency (7 behavioral and 7 work performance competencies: totaling 14 competencies) was calculated, and plotted in a radar graph pattern according to the categories of behavioral and work performance. This analysis revealed the trend of students' competencies progress throughout the co-op apprenticeship.

3.5.2 Qualitative Data Analysis

This research divided qualitative analysis into 2 parts: initial and in-depth qualitative analysis.

1) Initial qualitative analysis; the data in this initial analysis is comments of company mentors from student's assessment book. The objective is to give examples of company mentors' comments to explain the events/situation that

impacted on students' behavioral and work competencies. Hence, for initial analysis, some basic approaches of qualitative analysis are needed to analyze the data, including gathering raw data, organizing and preparing data for analysis, reading through all data, coding/categorizing, and interpreting data according to their theme (Creswell, 2009). For example, the raw data (comments) about student enthusiasm competency are collected from all co-op student assessment books. All comments of enthusiasm competency are arranged in MS excel and read through to define topics/categories such as student attention, student task follow-up, etc. Next, comments are assigned to appropriate topics/categories and described according to their theme. See result in part 4.2.

2) *In-depth qualitative analysis*; the main data for in-depth analysis were informal interviews, observations, questionnaires, and group discussions. Data analysis was performed according to grounded theory (Creswell, 1998) which is used to generate or discover a theory or an abstract analytical schema of a phenomenon, that relates to a particular situation (refer to chapter 2 part 2.5.2). The analysis was carried out as follows:

2.1) Open coding. The texts including recorded notes and documents from data collections were categorized. All information was examined for instances that represented a category and then followed until the new information obtained did not provide further insight into the category. For this step, data from informal interviews, observations, questionnaires, and group discussions were combined and used to identify various categories, such as "student basic knowledge", "student characteristics", "co-op understanding", and so on. These categories were used as codes to separate data into themes. For example, the company requirements of student behavior fit into the "student characteristics" category.

2.2) Axial coding. This step identifies a single category as the central phenomenon of interest and begins exploring the interrelationship of categories by using a logic diagram. A why-why analysis diagram (sometimes called "why-why chart" or "five whys") can produce a linear set of causal relationships (Gano, 2007)

and was applied to be the logic diagram in this research. For example, the most interesting theme of this research is student success in improving their competencies, therefore it was used as a central phenomenon. Other categories categorized in the open coding step were brought together to explore their interrelationships with the central phenomenon. One example of interrelationship explanation is student competencies improvement derived from student characteristics, knowledge and skills. Student has sufficient knowledge and skills because of the amount and quality of course content and lecturer (see in figure 4.7, why-why diagram).

    2.3) Analysis (selective coding). After axial coding and creating a why-why diagram, the analysis process identified a "story line" and wrote a story that integrated the categories in the axial coding model. This step is the analysis and explanation of each category related to the central phenomenon (the case of student success in improving their competencies). Two examples of an explanation pattern answer the questions "What factors affected student behavior and how were they affected?" and "Why do students who have clear career target and future plans perform well in their job?" The results are described in part 4.4.1. Additionally, a competencies maturity model illustrating the students' competencies progression was also shown in this research analysis. The model presented 3 phases of student's evolution, each phase describing the details of development and identifying the competencies necessary for work at that period. The results are shown in part 4.4.2.