

CHAPTER 2

LITERATURE REVIEWS

This chapter provides literature reviews related to the research, including competency, cooperative education, Activation of the Vocational and Personal Development (ADVP), Learning Organization (LO), action research, and grounded theory. These publications were reviewed from different perspectives and disciplines, and give various points of view of the subject that are necessary for this research. Details follow.

2.1 The Competency Context

Due to intensified competition, shorter product life cycle, and rapid changes, organizations were forced to do cost management and downsizing in order to maintain the same or higher productivity with fewer people (Lucia and Lepsinger, 1999). As a consequence, the competency concept that emphasized human capability played an important role in human resources management. Competencies-Based Management (CBM) can help organizations identify skills, knowledge, behaviors, and the capabilities needed to meet current and future personnel selection needs consistent with different strategies and organizational priorities. They also can focus on individual and group development plans to eliminate the gap between the required competencies of a project, job role, or enterprise strategy and the existing situation (Draganidis and Mentzas, 2006). This concept can be applied to many organization functions such as performance appraisal, succession planning, career development and compensation.

2.1.1 The Competency Definition

The definition of competency is still under discussion (Rouvrais et al., 2006). Many experts in the Human Resources field give a variety of definitions as shown below.

McClelland is the person who introduced the word “competency”. He wrote the academic paper “Testing for Competence Rather than for Intelligence” in the American Psychologist journal. The main objective of this paper proposed that we should emphasize human capability more than human intelligence when assessing performance (McClelland, 1973). However, the paper didn’t give a clear definition of competency. Nevertheless, many researchers interested in his work tried to define competency as “basic personal characteristics that are determining factors for acting successfully in a job or a situation” (Bergenhengouwen et al., 1997).

Boyatzis is known as the person who applied the competency concept to the human resource field. His best-known work is the book “The competent manager” published in 1982. He gave the meaning of competency as “an underlying characteristic of a person which results in effective and/or superior performance in a job” (cited in Moore et al., 2002). This implies that competency involves motives, traits, skills, self-image or social role, and individual knowledge (Vathanophas and Thai-ngam, 2007).

Similarly, Spencer and Spencer describe competency as “an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation” (Spencer and Spencer, 1993). Competency in this content consist of five characteristics; motives, traits, self-concept, knowledge and skills. (See figure 2.2)

Moreover, there are many definitions of competency given by a variety of researchers such as “competencies may be characterized as dispositions to self-organization, comprising different psycho-social components, existing in a context-overlapping manner, and realizing themselves context-specifically” (Barth et al., 2007). They may be acquired gradually in different stages, and they are reflected in successful actions. Leplat (1991) describes competency as a system of different types knowledge which allows people to act according to the requirements of various tasks. Competencies in specific situations are based on the use of different types knowledge and oriented towards a specific goal. Hoffmann separates the definition of

competency into 3 parts: “observable performance”, “the standard or quality of the outcome of the person's performance”, and “the underlying attributes of a person” (Hoffmann, 1999). Depending on the situation, a different part of the definition is used. In sociology competency is not uniformly defined because there are several different definitions according to the people, the institution, etc. That’s why in sociology competency is an object of debate. Different people or institutions try to define it in their own view, and struggle with other people to impose their own definition (Stoobants, 1994, 1998). Also, some academic papers define competence and competency differently. Competence is a skill which describes the standard of performance reached, while competency is the behavior by which it is achieved. In other words, competence describes what people can do while the competency focuses on how they do it (Rowe, 1995). Some papers separate competency into input and output. Input is the group of human behaviors that cause the output. Output is human capability that comes from input. Competency is also related to personal characteristics including knowledge, skills and attitude that effect work in a specific context (Coll et al., 2002).

From all these concepts and meanings of competency, it can be concluded that “Competency” is the personal characteristic and group of behaviors that consist of motives, traits, skills, self-image or social role, and a body of knowledge. It contributes to personal superior performance and success in life.

2.1.2 The Competency Model

This part will illustrate four competency models that will be used as a basis to set up a competency model in this research.

Richard E. Boyatzis’s Model

In figure 2.1 the competency model of Boyatzis consists of the job demands, the organizational environment, and the individual’s competencies.

Job demands identify what a person should/must do and why. The organizational environment includes policies, procedures and conditions of the

organization which should be consistent. The individual's competencies refers to the personal capability necessary to use in tasks for which they are responsible. These three components must be consistent to produce an effective performance (Vathanophas and Thai-ngam, 2007). According to this model, the person with effective performance will exhibit the special behaviors or actions called "specific action" (Vechayanon, 2006).

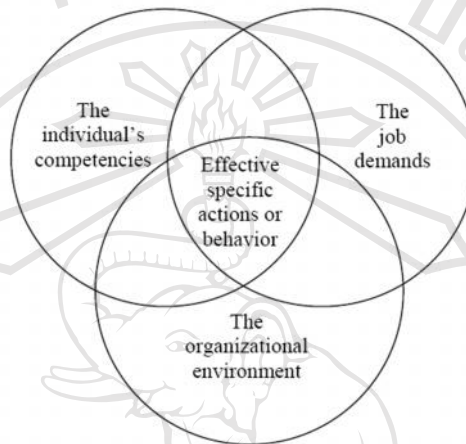


Figure 2.1 A Model of Effective Job Performance (Boyatzis, 1982)
Cited in: Vathanophas and Thai-ngam, 2007

Lyle M. Spencer Jr. and Signe M. Spencer's Model

The competency model of Spencer and Spencer in figure 2.2 shows the underlying characteristics that combine together to be competencies. Each characteristic is explained in the following (Spencer and Spencer, 1993).

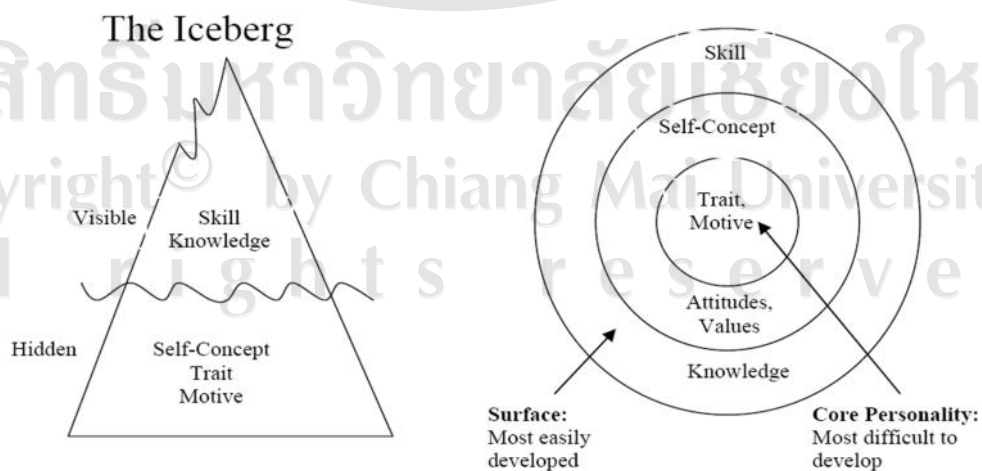


Figure 2.2 The Iceberg Model and Central and Surface competencies
Source: Spencer and Spencer, 1993, p.11

Motives are produced from the things a person consistently thinks about or wants that cause action. They will drive, direct, and select behavior toward certain actions or goals and away from others. Traits are physical characteristics and consistent responses to situations or information. Self-Concept is a person's attitudes, values, or self-image. Knowledge is information a person has in specific content areas. Skill is the ability to perform a certain physical or mental task.

These underlying characteristics have different properties as shown in figure 2.2. The iceberg picture on the left side illustrates that skill and knowledge are the human characteristics which can be observed or measured easily. In contrast, self concept, traits and motives are not obvious and are difficult to measure. The concentric circles picture on the right side explain competency by separating into surface and core personality. The surface includes knowledge and skills easy to develop by training, while core personality consists of traits and motives difficult to improve and develop. Self-concept, attitudes and values are mid-way characteristics between surface and core personality, and can be developed by training, psychotherapy and positive development experience, but can be difficult.

United Nations Industrial Development Organization's Model (UNIDO)

UNIDO defines competency as “mastery in a job that can be easily transferred to another job” (United Nations Industrial Development Organization, 2002). UNIDO separates competency into 3 categories that have an effect on performing tasks or activities, including related knowledge, attributes, and a set of skills. Related knowledge refers to the information and cognitive domain that a person will use to do the job. Attributes relates to qualitative aspects, characteristics or traits of the competency. Set of skills relates to the ability to do, and the physical domain. The model is illustrated in figure 2.3.

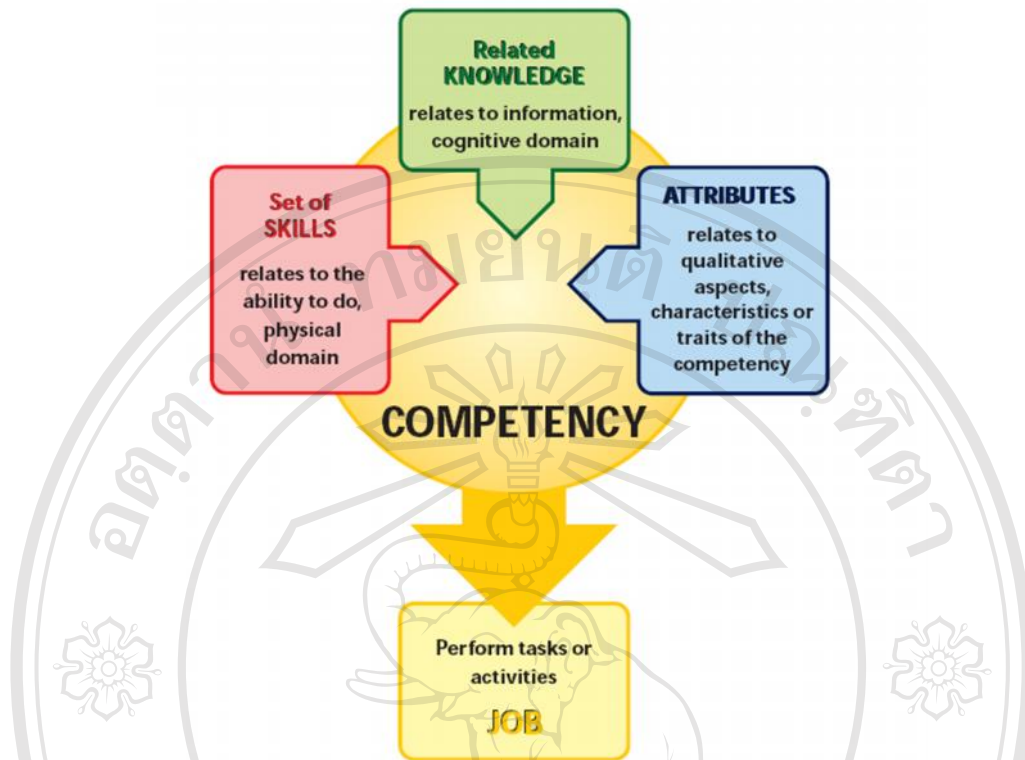


Figure 2.3 Competency graphic displays
Source: United Nations Industrial Development Organization, 2002, p. 9

The Three Dimensions of Skills and Their Formation

This model will be used as the main prototype to set up categories in the initial competency model in this research. The model considers the skills that employers use to consider when they recruit new employees into the company (Mounier, 2008). The model defines skills as “individual and collective abilities to produce”. It separates skills into cognitive, technical and behavioral skills, as shows in figure 2.4.

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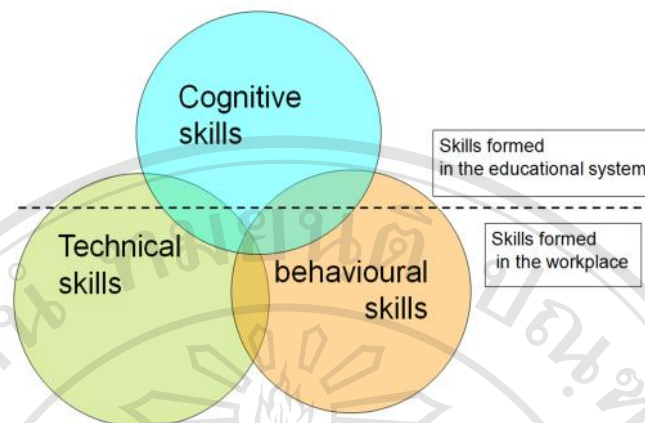


Figure 2.4 The three dimensions of skills and their formation
Source: Mournier, 2008

Figure 2.4 separates skills into three components which have meaning as follows (Mounier, 2008). Cognitive skills are “individual abilities to understand, to reason, to give meanings and the capacity to learn more by oneself based on individual knowledge in particular fields of scholarship”. Technical and behavioural skills are “individual and collective capacities to operate a technology (productive process) and behaviours (organisation) in a given work process”.

2.1.3 The Competency Model in This Research

This part explains the background of the competency model to be established in this research. There are two parts; the first part is about the initial model that uses competency gap analysis in the initial study. The second part is about the model that adjusted some competency categories to enable student assessment after the gap analysis. Details of the initial model follow.

The Initial Competency Model

The objective in constructing the initial competency model for this research is to identify which competencies employers emphasizes and need to develop urgently in new graduates. The research uses the three dimensions of skills develop by Mounier (Mounier, 2008) to categorize the group of competencies. Information was gathered from interviewed Human Resources managers/assistants experienced in

recruiting and training new graduates in some companies and was combined with curriculum analysis plus some related literature reviews and used to establish the initial competency model. After that, the model was used as a guideline to create a questionnaire for competency gap analysis of new graduates. The details of this initial study will be explained more in part 2.2.4.

Initially the definition of competency was “the group of knowledge, skills, and behaviors that influence performance”. This was separated into three categories; cognitive, technical and behavior perspectives. The cognitive perspective is the group of competencies related to knowledge that can be acquired or occur in classroom teaching/studying. The technical perspective is the group of competencies that can be developed or occurs by practice in real activity or work, and the behavioral perspective is the group of competencies that can evolve or develop by confronting real situations. After the gap analysis of the initial study the prototype model was adapted further (see details in 2.2.4.5).

2.2 An Initial Study of New Graduates’ Competencies

In this research there are 4 main initial studies/projects to identify the competencies necessary to work in the industrial sector.

2.2.1 How Human Resources Management can Improve the Industrial Sector Situation in Lumphun Province

In 2006 the College of Arts, Media and Technology (CAMT) of Chiang Mai University (CMU) collaborated with the Lumphun provincial government office and the Office of the National Economic and Social Development Board to study how to use human resources management to improve the industrial sector in Lumphun. The project was titled “The Rapid Producing of Graduates for Industrial and Social Communities of Thailand’s Upper Northern Region”. This project revealed that the Lumphun industrial sector faced several problems, namely: some teenagers that worked in factories had social problems (drug addiction), new university graduates

were not meeting industrial requirements, shortages of engineers and computer scientists, and the lack of a research center to improve production. One solution to solve these problems was to develop their human resources rapidly. The following is a list of what was required.

- Continuing education (especially for teenagers who do not have a bachelor degree)
- Supervisor training (for specific positions)
- Develop human resources to have research capabilities (to improve and/or develop their work)
- Increase their knowledge and skills of English and information technology

From these needs, a plan was developed to produce supervisors at the university level who had knowledge to help solve social problems, use technology to improve work (research), and had moderate English skills for work.

As a result, CAMT, CMU played an important role in designing a curriculum to respond to those requirements. CAMT established a Modern Management and Information Technology (MMIT) curriculum in 2006. The main objective was to develop human resources (according to industrial needs) with the goal of preventing factory relocation (especially foreign investors) in the long run. MMIT consisted of 3 main programs for training students: Human Resources Management (HRM), Quality Management (QM), and Information Technology Management (IM). Practical skills were developed through the Cooperative Education (co-op) program (see MMIT curriculum detail in part 2.3.6).

2.2.2 The Required Knowledge/Skills of Factories/Organizations in Lumphun Province to Improve their Work Systems

After establishing the MMIT curriculum, a survey of those factories / organizations interested in joining the co-op program was conducted in 2007 (Pongsanit et al., 2007). The data were collected through questionnaires and

interviews from 48 factories/organizations. One part of this study focused on the knowledge/skills of factories/organizations required to improve their work systems. The results are described in three categories as follows.

- *Human Resources Management*; most factories/organizations gave priorities on organization safety, performance appraisal, bonus given, and overtime management respectively. There was little emphasis on supporting further employee studies and conducting company celebrations of events/festivals. However, they wanted the university to help them to provide training courses to their employees to improve both knowledge and practical skills.

- *Quality Management*; most factories/organizations gave priorities on quality control, 5s activity, ISO9001, and quality control circle (QCC) activity respectively. There were few requests for TIS18000 and Six Sigma. However, they still needed their employees to improve knowledge/skills in Total Quality Management (TQM), 5s, and quality control respectively.

- *Information Technology Management*; most factories/organizations gave priority to using IT for accounting, quality inspection, human resources management, and material requirement planning respectively. There were few requests for using IT for supply chain management and product distribution. However, they still needed to improve knowledge/skills in using IT more in human resources management, quality inspection, and purchasing respectively.

Additionally, all factories/organizations required improved English (and Japanese and Chinese in some places), computerized and human resources management knowledge/skills for their employees. Most of them needed their employees to have more knowledge/skills in communicating, marketing, modern management, and staff supervision. They also expected new university graduates (future employees) would be knowledgeable, proficient in languages, and have appropriate behavioral skills.

2.2.3 The ETHICS-FED Project

In 2009, MMIT started collaboration with EU partners (France and Germany) in the Euro THai Implementation of Cooperative Study - For Economic Development (ETHICS-FED) project (see details in 2.3.6). The project was funded by the European Commission (199,745 EUR), and aimed to help MMIT staff create a model to train mid-level managers in production management. One part of the project application form described the situation of the workforce and new graduates (Thailand-EC Cooperation Facility Grant Application Form, 2008). One reason that companies were reluctant to invest more (especially EU companies) in the Northern Industrial Estate (Lumphun) was because there was an inadequate level of skilled human resources. Low labor costs and the refined skills of Thai workers were less important because of competition from China and Vietnam. It was necessary to leverage the education level so as to offer companies a more qualified labor workforce.

Nowadays, universities and companies do not collaborate enough, particularly at the operational level, and most undergraduate teaching content fails to meet company needs. Moreover, Thai universities have great difficulties in gaining access to international/global trade, where reaction and the ability to manage trade relationships with foreign companies is crucial. In this situation, companies needed more to develop qualified production supervisors. Currently, their supervisors mainly come from manufacturing teams and their qualifications are either based on seniority or a general university degree. These supervisors had difficulties in fulfilling an active role to interface between both the workers and the top management, and also between the local manufacturing context and international constraints. Hence, companies needed to find production supervisors who are able to manage EU norms and standards, commercial habits and cultural practices of the companies, and to communicate with their European departments and customers.

2.2.4 An In-Depth Look at New Graduates' Competencies Problems

Initially, the study looked at graduates with a bachelor degree and identified which competencies employers should focus on to develop new graduates, especially from Chiang Mai University. These competencies were used as a guideline to create the co-op framework that helps students to develop their competencies according to employers' requirements (Janchai et al., 2009). The process consisted of four steps, including: competencies analysis, categorizing competencies, creating the initial competencies model, and competencies gap analysis. Each step is described in the following.

2.2.4.1 Competencies Analysis

Competencies analysis in this initial study involved three main activities; interviewing human resources managers/assistants of industrial companies, curriculum analysis, and literature reviews.

Firstly, human resources managers/assistants of eight industrial companies in Lumphun province (northern part of Thailand, near Chiang Mai University) were asked about their expectations, the challenges, and the competencies required from recent graduates. Below are the guideline questions used in the interview (all questions focused on new graduates with a bachelor degree):

1. What does the company expect of new graduates?
2. What are the main problems that occur with new graduates?
3. What positions are possible for new graduates?
4. What competencies are required to be promoted?

For the first question, companies' expectations can be explained from three perspectives; cognitive, technical, and behavioral (Mounier, 2008). For cognitive perspective, they expect new graduates to adapt their knowledge to the work, have sufficient general knowledge, be precise in their career specialty, and also have a good command of English or other foreign languages such as Japanese. For the technical perspective, they need new graduates to communicate well, to work well

with other, and good at summarizing documentation. The company can improve these kinds of competencies by using their own process and methodology (each company has its own approach to improving an employees' technical competencies). Behavioral perspective is considered vital by companies. The most important behavioral competencies revealed by the interviews of all companies were; patience in the work environment, maturity and responsibility, enthusiasm and willingness to work, and the ability to work under pressure. Companies were also concerned about other behavioral skills, such as expressing opinions, controlling emotions, and the ability to adapt themselves to organization regulations and culture, etc.

Regarding the second question, behavioral competencies seemed to be a big problem for every company. They found that most new graduates lacked the necessary behavioral competencies to do their job, as the observations below indicate.

- 1) *Patience and responsibility*; they give up very easily when confronted by obstacles such as insufficient tools to support their work, the weather too hot (no air conditioner), and when they feel tired and under pressure.
- 2) *Enthusiasm and willingness*; new graduates appeared to be interested in their job at the beginning but are less attentive as time passed.
- 3) *Adaptability and maturity*; they take a long time to adapt to the organization culture, disagree with some company regulations, and present some non-professional behaviors (immature). Moreover, some new graduates apply to a company merely to get experience and then apply for a new job in other places after one or two years.

Also, interview results show that the main problems with new graduates involve cognitive and technical competencies, e.g. they considered only one point of view, lacked planning and goal setting, could not transform theory into practice, and had low presentation skills.

Responses to question three indicated that new graduates are usually assigned work in the factory or the office. Factory staff positions can involve production control, quality control, warehouse and planning staff etc. In the office,

new graduates are usually assigned positions as HR officer, IT officer, marketing officer etc. In both areas, new graduates take major roles and responsibilities by supporting, coordinating, and assisting or managing work so their department or related division runs smoothly, efficiently, and effectively.

The fourth question responses showed that for new graduate to move up in the company they needed to develop their leadership, management (human and work), emotional quotient, holistic/systematic thinking, planning, and decision making competencies. Moreover, time management, creativity, problem solving, coaching and follow-up are also necessary for promotion. The criteria usually considered are job performance, overall capability, experience, and/or sometimes the number of working years.

The curriculum of Modern Management and Information Technology or MMIT is explained in more detail in part 2.3.6 (see the MMIT curriculum in Appendix A). It was analyzed to find the core competencies that students get from the learning program. MMIT students start with general education (GE) subjects such as math/statistics, science, languages (Thai, English) etc. The objective is to make an individual more educated and informed, and hence be able to make a positive contribution to society. After GE, they study in three main specific knowledge areas; first, *information technology*, such as information literacy, computer programming, web programming, and data management, second, *industrial management*, consisting of industrial organization and production management, quality assurance, safety, and environment management, third, *social and business administration*, for example, introduction to law, labor law, accounting, marketing principles, and human resources management. The objective is to help them prepare for their future career. Therefore, normally, students in this programme have basic cognitive knowledge in math, science, and languages and specific cognitive knowledge in information technology, industrial management especially quality systems, and also social and business administration.

Finally, some literature reviews were performed to find additional essential competencies of the new graduate. Coll, Zegwaard, and Hodges (2002) used twenty-

four workplace competencies in ranking the required competencies of new science and technology students from 172 employers by questionnaire. According to science and technology employers, the top competencies required for new science and technology graduates are; ability and willingness to learn, teamwork and cooperation, initiative, and analytical thinking with concern for order, quality and accuracy, computer literacy, and written communication skills. Similarly, Hodges and Burchell (2003) asked 154 employers to rate the importance of new business graduate competencies. The result revealed that the top ten ranked competencies in order from twenty-five competencies were: ability and willingness to learn, energy and passion, teamwork and cooperation, interpersonal communication, customer service orientation, order and quality and accuracy, flexibility, problem solving, achievement orientation, and initiative. These competencies were considered by employers as important for new business graduates to do their job. Moreover, some managerial and generic competencies were considered to prepare students to be good managers in the future. May (1999) suggested five categories of common management competencies relevant to all managers with responsibility for organizational resources. First, the operations management category; consists of managing time effectively, planning and decision making, managing change, and quality management. Second, the people management category; includes team leadership, performance measurement, influencing others, and legal issues of employment. Third, the financial management category, comprising financial control and financial planning. Fourth, the information management category; consists of communications and Marketing. Fifth, the behavioral competencies included entrepreneurship, creative-thinking, management synergy, logical-thinking and analytical ability. Abraham et al. (2001) conducted a survey research on twenty organizations to find a set of managerial competencies currently being used by organizations to describe successful managers. The result revealed 23 competencies are considered descriptive of the successful manager by a majority of organizations. They are (in order); good oral/ written communication skills, problem solver, results oriented, interpersonal skills, leadership skills, customer focus, flexible/adaptable, team worker, dependable, quality focused, technical expertise, business expertise, hard worker, staff developer, safety conscious, imaginative, risk taker, time manager, purposeful, professional dress,

uncompromising, proficiency in foreign language, and previous experience in living and working in a foreign country. Quek (2005) seeks to empirically address the current state of generic competencies considered to be important for successful work performance among Malaysian graduate employees. Questionnaire data were collected from thirty-two graduate employees who work in the fields of banking, engineering, computers, communications and production. All had already completed social competency courses as part of their competency training programme in a local learning institution. The result of this study highlights interpersonal skills, knowledge-acquiring skills, value-improving skills, flexibility, cognitive skills, and practical orientation abilities as being highly important in contributing toward success in work performance.

All of these results acquired from interviewed HR managers/assistants, curriculum analysis and literature reviews will be used to categorize and construct the competency model for undergraduate students or new graduates in next step.

2.2.4.2 Competency Categories

In the initial competencies model, the competencies are categorized according to the three perspectives considered by Mounier (2008) that employers use when hiring new applicants (refer to part 2.1.2 competency model). Each perspective and its sources are illustrated in figure 2.5.

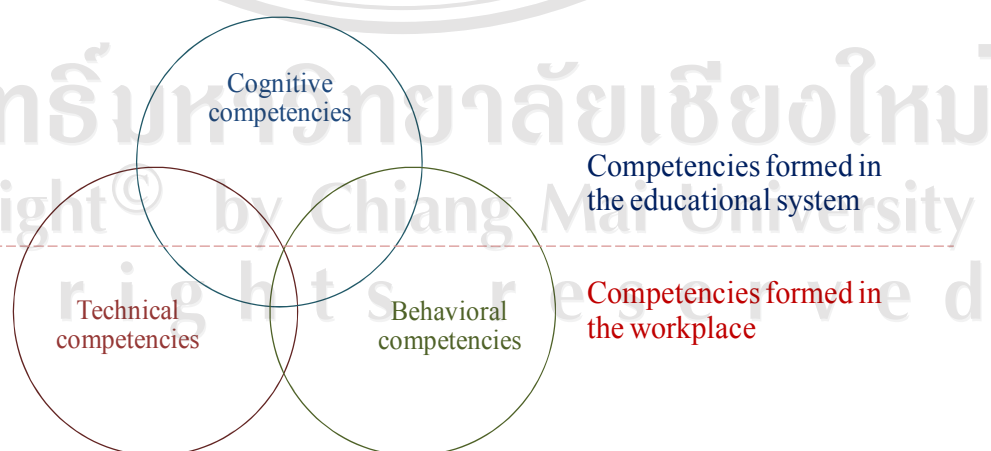


Figure 2.5 The three perspectives of competencies
(Adapted from: Mounier, 2008)

After dividing competencies into three main perspectives, one can separate each perspective into sub-categories. The cognitive perspective can be split into basic knowledge and specific knowledge according to the type and intensity of subjects studied. The technical perspective can be divided into basic general work, basic industrial work, and workplace competencies according to job demands. It is not necessary to divide behavioral perspective into sub-categories at this point. The details of each perspective and sub-category are explained in the next section.

2.2.4.3 Create Initial Competency Model

Table 2.1 Initial MMIT competency model

Perspectives	Categories	Competencies
Cognitive perspective	Basic knowledge	<ul style="list-style-type: none"> • Math • Science • Languages (oral ; written)
	Specific knowledge	<ul style="list-style-type: none"> • Information technology • Quality systems • Human resources management • Business administration
Technical perspective	Basic general work competencies	<ul style="list-style-type: none"> • Technical writing • Presentation • Communication • Inter-Intrapersonal • Teamwork
	Basic industrial work competencies	<ul style="list-style-type: none"> • Productivity improvement • Standard system • Production process • Production support system • Basic industrial accounting • Technology support production
	Workplace competencies	<ul style="list-style-type: none"> • Systematic & Analytic thinking • Creative thinking • Problem solving • Project management
Behavioral perspective	Behavioral competencies	<ul style="list-style-type: none"> • Responsibility • Patience • Enthusiasm • Willingness • Adaptability • Leadership

Referring to part 2.2.4.1, the information from interviewed HR managers / assistants, curriculum analysis, and literature reviews were classified into each competency perspective and sub-categories. The initial competency model for MMIT students or new graduates is illustrated in table 2.1.

This initial model will be used as a guideline to produce a questionnaire (see Appendix B) to analyze the difference between university competencies and the actual level required from new graduates.

2.2.4.4 Competencies Gap Analysis

Ten professionals who had ten or more years of work experience and held management positions in various national industrial companies such as American, Japanese, French, and Thai were asked to complete the questionnaire comparing the competencies that the university provided with the actual level of competencies required from recent graduates; especially students who had just graduated from Chiang Mai University. They were asked to rate the categories of the survey to see which needs are most important. The rating scale was:

0 = none 1 = poor 2 = sufficient 3 = good 4 = excellent

After experts rated the competencies, mean values were calculated for each competency. The competencies gap analysis outcomes of each perspective is shown in tables 2.2, 2.3, and 2.4.

Table 2.2 reveals that the differences between basic knowledge (university developed competencies) and industry needs are negligible except for English where industry needs are much greater (Diff. value = 1.10). In addition, for specific knowledge the largest gap involves industrial needs for greater quality systems knowledge than that developed at the university level (Diff. value = 1.80).

Table 2.2 Cognitive competencies gap analysis ($n = 10$)

University provide					Cognitive competencies		Industry need				
0	1	2	3	4	Categories		0	1	2	3	4
					<i>Basic knowledge</i>	<i>Diff.*</i>					
----- ----- ----- ----- -----					Math	0.20	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Science	0.30	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Language (Thai)	0.40	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Language (English)	1.10	----- ----- ----- ----- -----				
					<i>Specific knowledge</i>	<i>Diff.*</i>					
----- ----- ----- ----- -----					Information Technology	1.00	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Quality Systems	1.80	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					HR management	1.30	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Business administration	1.00	----- ----- ----- ----- -----				

* *Diff.* = Difference of the mean values between what university provides and industry needs

In table 2.3, the basic general work competency reveals that what the experts emphasize is communication, especially with subordinates and with supervisors. This has the widest competencies gap (Diff. value in order = 1.60 and 1.50) in this category. Writing skills, team work, and coordinating both across and within departments are also shown to be important for working in a company.

Workplace competencies reveal the widest gap of all the categories. Experts rated competencies provided by the university as low (mean less the 2.00) and the mean of competencies required by industry as high (mean 3.00 or more). The sub-categories of work process understanding and the ability to put theory into practice had the largest gaps. The next largest gap were the sub-categories involving the ability to identify and solve problems, work overview understanding, job planning and the ability to improve on the job also demonstrated a large gap (Diff. value = 1.50).

Table 2.3 Technical competencies gap analysis ($n = 10$)

University provide					Technical competencies		Industry need						
0	1	2	3	4	Categories		0	1	2	3	4		
					Basic general work		Diff.*						
----- ----- ----- ----- -----					Communication with supervisor	1.50	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Communication with colleagues	1.20	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Communication with subordinates	1.60	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Coordinating across department	1.10	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Coordinating within department	1.10	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Team work	1.20	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Writing paper / report	1.30	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Presentation to supervisor	1.30	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Presentation to colleagues	0.30	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Presentation in public	1.50	----- ----- ----- ----- -----						
					Basic industrial work		Diff.*						
----- ----- ----- ----- -----					5s activity	1.30	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Kaizen activity	1.80	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					QCC activity	1.70	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					ISO9001 procedure	1.50	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					ISO14001 procedure	1.40	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					TIS18000/OHSAS18000	1.40	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Production process	1.40	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Production support system	1.30	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Basic industrial accounting	1.10	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Technology support production	0.90	----- ----- ----- ----- -----						
					Workplace competencies		Diff.*						
----- ----- ----- ----- -----					Work overview understanding	1.50	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Work process understanding	1.70	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Work improvement capability	1.50	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Planning capability	1.50	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Follow plan capability	1.20	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Job assessment capability	1.30	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Identify cause of problem	1.60	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Identify people related problem	0.90	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Problem solving	1.60	----- ----- ----- ----- -----						
----- ----- ----- ----- -----					Theory adaptation	1.70	----- ----- ----- ----- -----						

* **Diff.** = Difference of the mean values between what university provides and industry needs

Table 2.4 Behavioral competencies gap analysis ($n = 10$)

University provide					Behavioral competencies		Industry need				
0	1	2	3	4	Categories		0	1	2	3	4
					<i>Behavioral</i>	<i>Diff.*</i>					
----- ----- ----- ----- -----					Responsibility	1.60	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Enthusiasm	1.80	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Willingness	1.60	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Leadership	1.56	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Dare to propose opinion	1.40	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Punctual	1.40	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Adaptability with company rules	1.40	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Adaptability with colleagues	1.00	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Patience (under pressure)	1.70	----- ----- ----- ----- -----				
----- ----- ----- ----- -----					Patience (working environment)	0.80	----- ----- ----- ----- -----				

* *Diff.* = Difference of the mean values between what university provides and industry needs

As see in table 2.4, when compared with cognitive and technical competencies perspective, the behavioral competencies perspective is the one ranked highest by the experts as required from new graduates. All behavioral competencies have mean value beyond 3.00, especially responsibility, enthusiasm, and willingness with a mean value of 3.70 (almost 4.00). The mean value differences (gaps) are quite high for every competency (Diff. value at least = 1.00) with the exception of patience in the working environment (only 0.80). Clearly, the greatest need of industry involves all sub-categories of behavioral competencies.

To conclude the competencies gap analysis, the mean of each competency's sub-category including the cognitive, technical, and behavioral perspectives was calculated. The result is illustrated in table 2.5.

Table 2.5 Overall competencies gap analysis ($n = 10$)

University provide	Overall competencies	Industry need
0 1 2 3 4	Categories	0 1 2 3 4
	<i>Cognitive competencies</i>	<i>Diff.*</i>
----- ----- ----- ----- -----	Basic knowledge	----- ----- ----- ----- -----
----- ----- ----- ----- -----	Specific knowledge	----- ----- ----- ----- -----
	<i>Technical competencies</i>	<i>Diff.*</i>
----- ----- ----- ----- -----	Basic general work	----- ----- ----- ----- -----
----- ----- ----- ----- -----	Basic industrial work	----- ----- ----- ----- -----
----- ----- ----- ----- -----	Workplace competencies	----- ----- ----- ----- -----
	<i>Behavioral competencies</i>	<i>Diff.*</i>
----- ----- ----- ----- -----	Behavioral competencies	----- ----- ----- ----- -----

* *Diff.* = Difference of the mean values between what university provides and industry needs

The gap analysis information in tables 2.2, 2.3, 2.4, and conclusions of overall competencies gap analysis in table 2.5, reveal that most competency categories have a wide gap between university education and industry needs. All competencies in cognitive, technical, and behavioral perspectives urgently need to be improved at the university except the basic knowledge cognitive competencies (overall Diff. value = 0.50). However, as seen in table 2.5, the competencies that require rapid improvement at university are the workplace competencies (overall Diff. value = 1.45) and behavioral competencies (overall Diff. value = 1.43). Industry demands for a high level of behavioral competencies (overall mean value = 3.45) is consistent with the interview results from HR managers/assistants in part 2.2.4.1 which showed that behavioral competencies is a major problem for new graduates.

2.2.4.5 The Adjusted Competency Categories After Gap Analysis

The initial competency model used to analyze the gaps separated competency into three perspectives; cognitive, technical, and behavioral. The cognitive perspective refers to the theoretical knowledge a student gets from the university. It was found to be too difficult to assess this in the real workplace. As a result, the competencies considered by some researchers were reduced to cognitive and behavioral (Birkett, 1993 cited in Coll et al., 2002). Cognitive in this sense is the

combination of technical skills, analytical skills and appreciative skills (similar to the combination of cognitive and technical perspective in the initial model). Coll et al. (2002) gave the meaning of technical skills as “the ability to apply technical knowledge with some expertise”, analytical and constructive skills are “concerned with problem identification and the development of solutions”, and appreciative skills refer to “the ability to evaluate complicated situations and make creative and complex judgments”.

The new cognitive perspective is called “work performance competencies”. It will be used to assess the work performance level of the student during their apprenticeship. The behavioral perspective still retains the same meaning and concept as the initial competency model, namely “behavioral competencies” that measure behavior level in the workplace. The behavioral and work performance competencies are listed in table 2.6.

Table 2.6 The competencies list (after adjusting the categories)

No.	Behavioral perspective	Work performance perspective
1	Enthusiasm	Learning & Understanding
2	Sense of responsibility	Planning & Managing
3	Adaptability	Knowledge application
4	Manner	Creativity
5	Communication	Problem solving
6	Leadership	Follows work instruction
7	Patience	Handles emerging problems

These competencies will be used to assess the MMIT co-op students in the workplace.

2.3 The Cooperative Education Context

Cooperative Education (co-op) is one kind of work-based learning. It is a learning strategy that involves collaboration of the student, company, and university. The student alternates between university and the company throughout the program. Co-op has different formats in each country, but there are common characteristics

such as paid by employers, long duration, and related directly to a student's major. This learning format creates a strong relationship within the three parties. The details of this learning strategy are explained in the following.

2.3.1 Discussion About Pedagogical Models Used in VET Systems to Develop Competencies

This part will illustrate the pedagogical models used regularly in vocational training systems to develop students' competencies. The two main places for students to learn and develop their competencies are school and the workplace.

2.3.1.1 School-Based Learning

As we know, schools have an important role and responsibility to educate students to be knowledgeable, responsible, socially skilled, healthy, caring, and contributing citizens (Greenberg et al., 2003). The schools teach students to be competent in reading, writing, math, and science and also to have a good understanding about history, literature, arts, foreign languages, and diverse cultures. Learning at school is a formal learning (Adam, 2007) that occurs in an organized and structured environment and is explicitly designated as learning (in terms of objectives, time or resources).

Vocational Education and Training (VET) systems involve learning in school and the workplace, and have a long history. In the 12th century, craft guilds in Europe grew up in medieval towns and cities and determined the outward form of the class-based socialization process through their generally uncoded customary rights (Greinert, 2005). People in that era learned working skills from a "master" step by step from apprentice via journeyman to master, finally becoming a full member of the guild. After that, between 1750 and 1850, the shift from an agricultural and craft-based economy to one determined by industrial and machine-based manufacturing occurred. In Great Britain it was called the "Industrial Revolution". This revolution affected not only trade and technology, but also the structure of society, social relations, life style, the political system, types of settlement and even the landscape. As time went on the system changed to school-based learning.

In recent decades the world has moved towards a “*knowledge based economy*” (European Commission, 2002). The notion that preparation for the world of work was best given on the job rather than in formal education has been very influential in the educational realm. Consequently vocational schools that taught only class-based training in schools or colleges started to decline (CEDEFOP, 2002).

2.3.1.2 Work-Based Learning (WBL) / Work-Integrated Learning (WIL)

The transformation between school-based learning and WBL/WIL is becoming popular with students, government, employers, and universities (Abeysekera, 2006). It is becoming increasingly important as a vehicle to enable individuals to achieve academic credit and qualifications through developing their personal and professional collection of skills and knowledge, and also as a mechanism to improve organizational practice/change (Rhodes and Shiel, 2007). WBL/WIL is desirable because it offers the opportunity to teach “employability”, not only as knowledge and skills, but competence development takes place through “real social and communicative requirements” (Hartmann et al., 2009). This matches well with the present trend whereby students expect a payoff from their investment in education (Abeysekera, 2006). In the WBL/WIL context, this means the students can develop themselves continuously throughout the workplace community.

The Developing European Work-Based Learning Approaches and Methods (DEWBLAM) defines Work-Based learning as (Adam, 2007):

Work-based learning is an educational and training approach in which competence development is given a central position, and in which prior and experiential learning, formal learning, informal learning and non-formal learning complement each other in the progress toward formal recognized and accredited qualification by the higher education and training (HET) institution.

WBL/WIL is a category of university programmes (Boud and Solomon, 2003 cited in Miao et al., 2009) that bring together the universities and work

organizations to create special learning opportunities in workplaces. Hamilton and Hamilton (1997) separated WBL/WIL into eight major types. Each one can be explained briefly as follows.

First, *field trips* are limited observation, and ordinarily the purpose is exploration. Normally it is a group activity.

Second, *job shadowing* is described as closely observing an experienced worker by following him or her around on the job. It lasts longer than field trips, is individualized and not a group activity.

Third, *youth-run enterprise* is the concept that young people run their own enterprise as owners and managers, not employees. The purpose of this effort is to teach technical competence, and the activities involving planning, performing, and evaluating complex tasks.

Fourth, *service learning* is usually considered education for citizenship, young people participating in voluntary action such as making Thanksgiving tray favors for a local nursing home, national service and conservation corps programs. This kind of work provides planning and decision making skills for students.

Fifth, *youth jobs* are paid jobs that can improve a student's personal and social competence which includes: punctuality, reliability, responsiveness to supervision and customer relations. Classic youth jobs include working in fast-food restaurants and grocery stores.

Sixth, *subsidized employment training programs* are like youth jobs but are subsidized by public or private ventures.

Seventh, *cooperative education* is integrated learning between classroom and workplace with pay. The students practice work in related and interested field. The training plans are critical for identifying goals, guiding training and evaluation, and maintaining communication among all partners.

Eighth, *youth apprenticeships* are very much like cooperative education. The students begin as helpers, performing unskilled tasks and observing a master at work, and then begin to assume responsibilities requiring more skill and more duty until able to perform highly skilled tasks without supervision.

Additional, Gibson et al. (2002) gave nine WBL/WIL models that have different characteristics as shown in table 2.7.

Table 2.7 WBL/WIL models and their characteristics

Model	Characteristics	Examples
Pre-course experience	Work experience as a pre-requisite for entry.	Farm work for agriculture classes
Sandwich course	Periods of work experience between years of a course, usually complete a 12 month 'thick' sandwich or two 6 month 'thin' sandwiches.	Engineering courses
Co-operative programs	Periods of work experience that may be integrated into the overall curriculum, designed both to integrate theory and practice and improve graduate employment.	Business, science and engineering courses
Cognitive apprenticeship or Job shadowing	Emphasis on observation and absorption of organizational culture of the workplace.	Law and political science courses
Joint industry-university courses	Courses jointly developed with and funded by an enterprise. Uses enterprise staff as teachers/assessors.	Engineering, business, many VET courses
New traineeships and apprenticeships	Flexible arrangements based on a registered training agreement and structured on-the-job or off-the job training.	Many VET courses
Placement or practicum	Extended periods in work settings to learn skills and gain experience of requirements of future work.	Medical, nursing and education

Table 2.7 (continued)

Model	Characteristics	Examples
Fieldwork	Short periods (e.g. one day a week) of fieldwork in an agency to observe and learn about the organizational culture of the workplace.	Social work, science, geography courses
Post-course internship	Work experience after completion of the course	Medicine and law

Source: Gibson et al., 2002, p.4

This research focuses on one kind of WBL/WIL that is cooperative education. It will be described in more detail in the next section.

2.3.2 The Co-op Definition

Cooperative education is one kind of WBL/WIL. There are many definitions of co-op. This research will show some of those definitions:

Law (Law, 1973) describes cooperative education as “generally associated with a school and work program in which student-learners receive supervised payroll experience as part of the school curriculum”. He explained the common elements of this program are:

- The systematic progression of skills and techniques through a definite pattern of learning experiences on the job.
- Occupational orientation and job counseling, together with related technical instruction in school.
- Coordination of school and work activities through job visitations by school personnel.
- Cooperative school and employer development of appropriate classroom work and job experiences.
- School credit for combined employment training and related schoolwork.

Barbeau (1973) described co-op as “that system of education in which students alternate periods of academic study with periods of related work experience”.

Eames and Bell (2005) used the definition “A strategy of education that includes a requirement for successful completion of both formal classroom work and work placements in order to gain a qualification”.

Hoffart et al. (2006) regard co-op as “An educational model in which students alternate periods of academic study with periods of paid employment related to their academic major or personal interests”.

The meaning of co-op from The National Commission for Cooperative Education is “a structured educational strategy integrating classroom studies with learning through productive work experiences in a field related to a student's academic or career goals. It provides progressive experiences in integrating theory and practice. Co-op is a partnership among students, educational institutions and employers, with specified responsibilities for each party”. (National Commission for Cooperative Education, 2010)

From these definitions, it is clear that “co-op” is a cooperative learning strategy between student, company and university where the student studying at the university works in a related field at a company to gain practical knowledge and real work experience.

The different forms of co-op depend on the fundamental education structure and/or occupation feature of each country. However, the main characteristics of most co-op models are; integrated into the academic curriculum (no add-ons), long duration (at least four months), paid by employers, and related directly to a student's major or field of study. The different co-op models of many countries are presented in part 2.3.4.

2.3.3 Advantages of Co-op Education

In the new educational era of knowledge based societies, new employees should have employability, flexibility, and lifelong learning characteristics. As we know, learning occurs everywhere, not just in school. Students must learn in a proper context that encourages them to develop their competencies. Formal education teaches students about citizenship, formal rationality and general knowledge, while training in the workplace develops specific knowledge, socialization, and responsibility (Jorgensen, and Aarkrog, 2008).

There is much research supporting the idea that learning in the workplace helps students to have experience, adapt themselves into the community and develop some skills and competencies. Some research that shows the benefits of training in the workplace and cooperative education follows.

Weirich et al. (1996) showed that cooperative education encourages students to prepare themselves for their future job so they can plan and implement their work autonomously. They develop quality consciousness, professional characteristics, responsibility, creativity, team work, and overall thinking. Some of these competencies are difficult to form in the class room. Garvan and Murphy (2001) argued that cooperative education allows students to acquire practical skills through exposure to the real world. It helps students to improve themselves in many respects, such as enhance student self-confidence, self-concept and improved social skills, enhancement of practical knowledge and skills, enhanced employment opportunities, attainment of necessary skills to supplement theoretical training, and enhancement of the employment process when the student joins the labor market. Similarly, Aleisa and Alabdulahfez (2001) explained that the Riyadh College of Technology, Saudi Arabia, adopted a co-op model. The purpose was to offer students an opportunity to adapt to a real work environment where they are likely to work upon graduation, to enable students to apply their skills and knowledge in particular fields in order to be fully prepared professionally, technically, and psychologically, and to offer students an opportunity to explore the nature of possible future employment opportunities.

Apart from the advantages from the student point of view, the employer sector and educational institutes also benefit from this kind of training. Kato (2005) shows that co-op can raise the quality of education in Japan through a combination between theory and practice. In the cooperative education model of Berufsakademie Karlsruhe, Germany (Gohringer, 2002) shows that employers employed Berufsakademie Karlsruhe graduates for two main reasons; the advantage of professional practice, and the program provided them with qualified junior staff. In his paper he concluded that the Berufsakademie co-op model provided an efficient way of producing graduates of value to employers in high technology areas and helped companies to recruit new graduates who are familiar with the company and able to hold responsible positions without a settling-in period. Lee (2009) showed that the training system in Africa involved 60% time spent at training institutions for theoretical education and 40% in the industrial field for practical training. They used this training system as a strategy to develop partnerships with industry in Technical and vocational education and training (TVET). This system not only increased trainees' adaptability to industrial work after finishing their training and education but also helped to reduce skills shortages and gaps. This is of great value to industry.

As we see above, co-op is an alternative way for many institutions to allow students to develop their potential and enhance their skill in linking theory and practice. It provides not only work skills but also social skills that are very advantageous for students who graduate and are able to satisfy employer needs for practical experience. Moreover, employer sectors can use this methodology to train their future employees with reduced cost.

2.3.4 The Variety of Co-op Models

2.3.4.1 Co-op in North America

1) Co-op in the United States of America

In 1906, at the University of Cincinnati (UC) in the United States of America, the first cooperative education program was established by Dr. Herman Schneider who was dean of engineering. The objective of this program was to bridge

the gap between theory in the classroom and practice in the field (Fifolt, 2006). He decided to establish this program because he found that most of young engineering graduates “...were ill-equipped to function as engineers in the field” (Barbeau, 1973). In the first year (1906), University of Cincinnati received 60 student applications for the cooperative education program, 45 students were accepted and 28 students participated in the program after enduring an intensive preparation in a freshman year. Nowadays, the University of Cincinnati has approximately 3,600 students annually (University of Cincinnati, 2011) enroll into its co-op program. At the University of Cincinnati, the Division of Professional Practice (PP) has responsibility to administrate all co-op programs in four colleges, including: Applied Science (a mandatory co-op program); Business (an optional co-op program); Design, Architecture, Art, and Planning (a mandatory co-op program); and Engineering (a mandatory co-op program). The co-op model of University of Cincinnati based upon full-time, alternating quarters of study and co-op beginning in the sophomore year and extending over three years. Students in this program spend five years to take a bachelor degree. Normally students will spend six co-op quarters (3 months each semester) in a company, which means they accumulate 18 months of co-op experience. A typical alternating University of Cincinnati co-op curriculum is shown in figure 2.6.

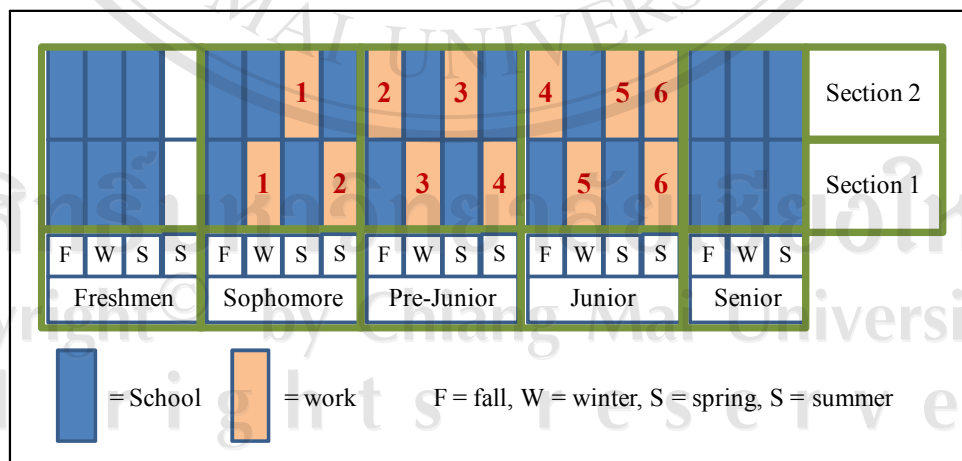


Figure 2.6 Structure of a typical University of Cincinnati Co-op Curriculum
 Source: University of Cincinnati, 2011

From figure 2.6, the students start co-op work in second year (sophomore) and finish in fourth year (Junior). They work a total of six semesters switching with study at the university. During the co-op work quarter, the student is evaluated by three parties including the employer, a faculty member and the student themselves. This encourages the student to progress with their skills and abilities development. Employers are also able to assign students to fit in meaningful positions or suitable job function.

This is the usual co-op pattern of the first co-op university in the world. They started from the endeavor to bridge the gap between theory in the classroom and practice. Now, the co-op still is a key element in many programs at the University of Cincinnati and it seems to be an enduring learning strategy for developing their students.

2) Co-op in Canada

In Canada, the University of Waterloo (UW) is the university that operates the largest post-secondary school co-op program in the world with almost 16,000 students (around 56% of the full time undergraduate population at the University) enrolled over three semesters (University of Waterloo, 2011). Their center of operation is called Co-operative Education & Career Services (CECS). There are many faculties that apply co-op programs: Faculty of Applied Health Sciences, Faculty of Arts, Faculty of Engineering, Faculty of Environment, Faculty of Mathematics, and Faculty of Science. They alternate between study and work, and each year has three terms each four months long. The three most common study/work sequences of co-op programs at University of Waterloo are seen in figure 2.7.

1 st Year			2 nd Year			3 rd Year			4 th Year			5 th Year			Total work term
F	W	S	F	W	S	F	W	S	F	W	S	F	W	S	
1A	1B	*	2A	*	2B	*	3A	*	3B	*	4A	*	4B		24 months
1A	*	1B	*	2A	*	2B	*	3A	*	3B	*	4A	4B		24 months
1A	1B	Off	2A	*	2B	*	3A	*	3B	*	4A	*	4B		20 months

* = work term (4 months), F = Sep.-Dec., W = Jan.-Apr., S = May-Aug.

Figure 2.7 Three of the most common study/work sequences of co-op program at the University of Waterloo, Canada
Source: University of Waterloo, 2011

From figure 2.7, the accumulated working time for University of Waterloo students is 20 – 24 months. This means co-op students graduate by not only having the same number of study/academic terms as a non-co-op student but also up to two years of work experience that they received from a real workplace.

This is the common co-op pattern that the biggest co-op university in Canada uses to develop both academic and professional strength in their students.

2.3.4.2 Co-op in Europe

As already explained in part 2.3.1, the apprenticeship story of Europe started with craftsman who learned and practiced their work skills with a master in the middle ages (12th century). The Vocational Education and Training (VET) in Europe involves three classical training models of three countries: France, Germany and Britain. This research will focus on some interesting co-op models that deal with higher education or university.

1) Co-op in France

Vocational training in France is seen as “The state-regulated bureaucratic model” (CEDEFOP, 2002). This kind of model uses a new educational subsystem to create a political, power-based relationship between capital and labor. As a result, the vocational training model in France contains the risk that vocational training institutions may be too strongly influenced by the logical structures of the general educational system and degenerate to a subordinate branch of it. The major characteristics of this French model are: the quantitative relations between training

demand and concrete vocational training are determined by state bodies or bureaucrats, the types of occupational qualifications are less dependent on their immediate application in companies, school training models are usually characterized by a clear differentiation of individual training course types, and vocational training in schools is financed by the state budget.

These features affected the direction of the vocational training model and several educational institutes tried to set up their own way to create a vocational training system to encourage their students to have both strong academic knowledge and work experienced before graduating. One of these is Institut Universitaire de Technologie (IUT). They have 115 IUTs distributed in different areas of the country. The IUT idea began in 1966 due to social and economic needs for training mid-level engineers and managers (Veillard, 2009). An IUT institute is part of the University and has autonomy to manage its own training courses. IUT delivers two types of degree: first, the University diploma of technology (DUT) after the students study two years, second, the Vocational bachelor after students spend one more year. The DUT has 24 national specialties with a national curriculum, with 16 specialties for the industrial sector and 9 for the services sector. The Vocational bachelor has 600 different specialties.

This research will illustrate the cooperative education system in France by using one IUT, the Institut Universitaire de Technologie Lumière (IUT Lumière), University Lumière, Lyon2, as a representative model. This institute is the only one in France where all the training courses are organized in a cooperative way (mainly by using the apprenticeship method) and uses cooperative education for all students (100%). IUT Lumière began in 1991. Its objective is to train mid-level managers (bachelor degree) by means of training programs combining classroom studies with professional work experience (apprenticeship system). It has five major departments for training students to be mid-level managers, namely;

1. Human resources management/accounts/administrative and financial operations
2. Logistics, goods and passenger transportation

3. Quality and production management/industrial project management
4. Statistics studies and database management
5. Hygiene and safety at work, Environmental management

At this time, IUT Lumière has around 600 students. The process of cooperative education in IUT Lumière has many steps including recruitment, academic courses, preparation for cooperative education, and apprenticeship in a company. The process is described next.

Students' Recruitment Process

Students who need to join the DUT program at IUT Lumière must have a “*Baccalaureate*”. Some work experience and social activities is an advantage. The aim of the selection process is to detect not only good academic students but also those with good personal and reflective skills. The application form of IUT Lumière has three parts: academic results, professional and social experience, and outlining a professional project. Each application form is examined by an IUT teacher using an assessment grid. The most promising students were selected by a board of teachers to be interviewed. In the interview, the committee consists of two IUT teachers and two representatives from some companies. Each student takes around twenty minutes to introduce themselves, the committee asks questions and they look at four different various criteria: behavior during the interview, capacity to work as a team, clearness of the project, and overall impression. After the interview, the final board, consisting of teachers and company professionals decide together which are the best students to select.

The Overview of Learning during IUT

This research will focus on the first 2 years of cooperative education. In the first year students attend academic courses and a preparation program for cooperative education called “*Personal and Professional project (PPP)*”. In the second year, students study further in parallel with PPP and alternate with working in a company

(apprenticeship). The main objectives of PPP are to prepare the students to make choices by themselves. PPP will be discussed further in part 2.4.1.

Academic Courses

There are many different diplomas. However, there is a general study pattern. First year, students study basic scientific and technical knowledge, for example: basic knowledge in technology, introduction in production management, introduction in quality control and management, English, etc. In the second year, students study more advanced technical knowledge vocational skills such as technical communication, industrial flow management, vocational English language, and so on. Academic courses combine different pedagogical approaches, including lessons, practical words, serious business games, case studies, simulations, visiting companies and individual or peer or group work.

Apprenticeship

The students' apprenticeship starts in the second year. The time frame for learning in university and working in a company is 15 days and 15 days respectively (for some diplomas it is 3 days and then 2 days each week). The company will pay students' wages during this time. Each student has two tutors: one from the IUT and another from the company. During the apprenticeship the student, the IUT teacher, and company tutor will meet five times. The objectives of each meeting are:

1st meeting: to define the tasks or missions for all year.

2nd meeting: to assess student's activity; oral presentation, achievements, behavior (18 criteria), and to define the aims for the 2nd period.

3rd meeting: to assess student's activity; oral presentation, achievements, behavior, and to define the aims for the 3rd period.

4th meeting: to assess student's activity; oral presentation, achievements, behavior, to define the aims for the 4th period, and to determine a project for the final report.

5th meeting: to assess the final report (two company tutors + one IUT teacher), and to assess student's activity; achievements, behavior.

Two key factors determining success in the IUT cooperative education are the company tutor and IUT teacher. The company tutor is an employee of the company. He/she must be highly qualified and must attend a tutor training session conducted by IUT. The goals for the cooperative education program are: to help the apprentice fit into the company, give them some work missions or tasks interesting from a learning point of view, check and assess the apprentice work, give some advice on how to improve, and to facilitate information access inside the company. At the same time, the IUT teacher (advisor) must check that the work given by the company is compatible with the main goals of the training course, inform the company tutor about the teaching content and process, help the apprentice to use and apply knowledge learned at school, and manage the assessment meetings.

This is done to help those students who lack some competencies and need follow-up to develop autonomously. Hence, one can consider this model for use in the case of those students who lack some competencies and need more preparation before going to the workplace.

2) *Co-op in Germany*

In Germany "The dual-corporatist model" is the term for their vocational training model. This model uses a relatively independent vocational training subsystem as a means of communication between labor, capital and state (CEDEFOP, 2002). This dual vocational training system is largely isolated from the general education sector. They have their own organizational structure and training regulations as they are mainly run privately. Companies are the primary learning location for students in this 'cooperative' system. Students must sign a private training contract with the company as employees with special trainee status and get

salary. Training methods and content are chiefly determined by the company or by internal interest groups. Moreover, employers, trade unions and state bodies jointly decide on career profiles and training ordinances in a regulated process. These are the common characteristics of the Germany vocational training model.

As we see above, the vocational training system in Germany is set up by the federal government and driven by the private sector (social, communities, and employers). The main reason is because the private sector needs educational institutes to produce employees (graduates) that meet their demands. Thus, the vocational training model in Germany is a strong collaboration between government and the private sector.

The first co-op program at the university level in Germany began in Fachhochschule or University of Applied Science in the 1960s (Mann, 2009a). The structure was similar to traditional universities with priority on teaching but it had curriculum content geared to the demands of the employment sector. It took seven semesters study to get a bachelor degree, which also required a company internship. This learning format was very popular at that time (1960s). Then, in the 1970s, Fachhochschule changed teaching style emphasizing theory-based learning like a mini-university. This was a dramatic change from the original concept. Moreover, young people in this era gradually moved towards general education with further study in university. This trend led to an increased unemployment rate in Germany. Hence, first Berufsakademie or now Duale-Hochschule Baden-Wuerttemberg (University of Cooperative Education) was founded in 1972 to solve this problem and be a new alternative for young people and companies. Some details of this educational institute follow.

In 1972, three big world-class companies including Bosch, Daimler Benz (now Daimler Chrysler), and Elektrik Lorenz (SEL) developed a vocational training system called “Dual System” at the university level in business and engineering in collaboration with the Baden Wurttemberg Chamber of Commerce and the Academy of Business and Administration (VWA) (Gohringer, 2002). In 1974, Berufsakademie (BA) (The University of Cooperative Education) developed a model of cooperative

education which emphasized the fields of business administration, engineering and social work.

In this model, the employment and educational sectors both have a 50:50 participation in the curriculum. The company shares authority and responsibility with the educational institution including determining the structure of the system, developing and revising the curriculum, providing training that is linked and matched with the academic course work for which they get 50% of the time budget, and sit on examination panels (Mann, 2009b). The dual system is shown in figure 2.8.

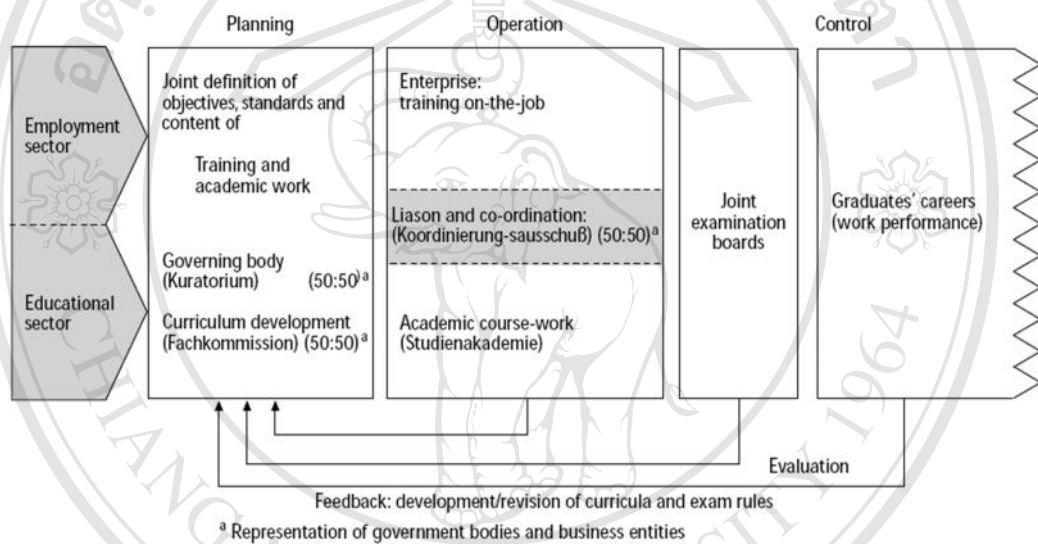


Figure 2.8 Vocational Academy: dual education in the tertiary sector
Source: Wehrich et al., 1996

The applicant who applies to the BA must satisfy two pre-requisites; a full university entry qualification called an “*Abitur*” and a training contract with the company. Companies select students through their recruitment process and pay their salary during their BA study. While studying they are both student and employee. During the three years of the undergraduate program students study for six semesters and apply their skills at the company for an additional six semesters. The students spend three months in the university and another three months in the company until they finish the program. The process is illustrated in figure 2.9.

A Berufsakademie’s student studies in two phases. The first phase is the 1st and 2nd year. The student will learn and do an apprenticeship in the fundamentals of

business administration, engineering or social work and receive their first degree after two years (Reinhard, 2006). In the second phase, the student will learn and do the apprenticeship in their disciplinary field such as banking, business information systems, electrical engineering, social management and tourism, etc. After one year they finish this phase and are granted a BA-Diploma. We see from the BA model that during the company training period there is no assessment in the workplace. However, the student must write reports on work-related topics. At the end of each work period a work-related seminar is organized to assess job performance and discuss student experiences with BA lecturers and company trainers (Weihrich et al., 1996).

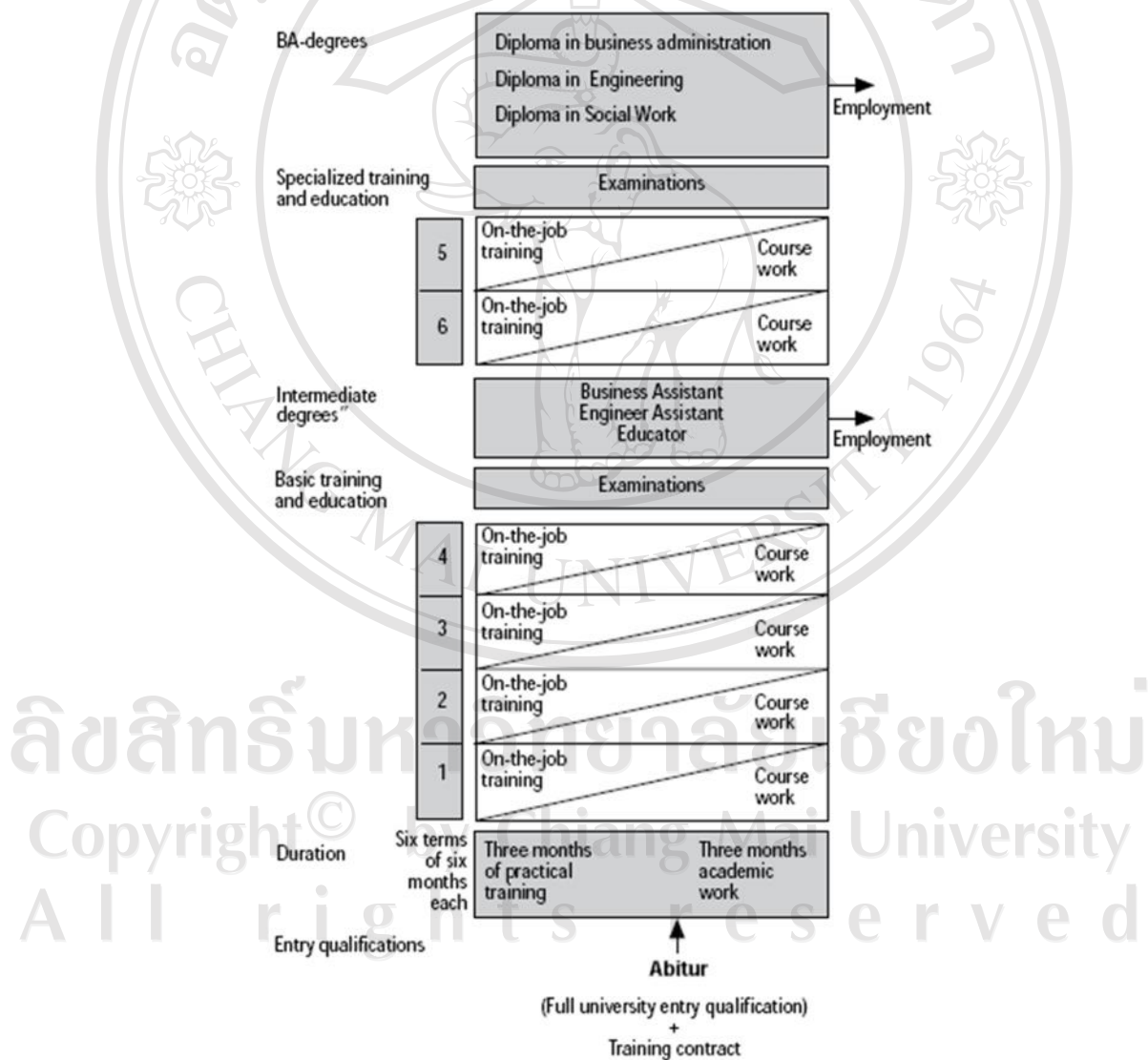


Figure 2.9 Vocational Academy Baden-Württemberg: a new model of cooperative education in Germany
 Source: Weihrich et al., 1996

This is the one of the major co-op patterns in Germany that develops student knowledge and practical skills. Clearly, a strong collaborative structure is important to conduct cooperative education within their country. This model may not be effective to use in other places where there is less collaboration from the employer side.

3) *Co-op in Britain (England)*

Britain has a history of craft apprenticeship similar to many countries in Europe (France, Germany, etc.), but there are differences in the vocational education and training system. In England there is great emphasis on economics. They use “The liberal market economy model” of vocational training pattern. It first began in Britain in the 18th and 19th century, and formed a market relationship between the functional subsystems of labor, capital and education emerging from the social evolution process influenced by industrial capitalism. This model has the main following characteristics (CEDEFOP, 2002):

- 1) A quantitative relationship between training supply and training demand, regulated by the market. Those supplying various skills and those demanding them can meet on a voluntary basis in a “free” market (training market not primarily controlled by the state).
- 2) The type of vocational qualifications ultimately depends on their projected application in the labor market and in the actual businesses and authorities.
- 3) Training practices are not particularly standardized. Schooling, in-company training, alternating school and in-company training and organizationally and technically advanced training methods can all be marketed such as distance learning courses or via e-learning. Nevertheless, only some widely accepted certificates exist.
- 4) The cost of training is borne individually, usually by the person requiring training.
- 5) Distinguishes sharply between general vocational education and specific vocational training, both as definitions and within institutions.

Vocational education is always conducted in state schools, vocational training stems from voluntary agreements between market participants.

One characteristic of vocational training in Britain is that on-the-job training is complemented by off-the-job training on a more or less voluntary basis. Industrial training never became successfully institutionalized within the national education system. The character of vocational training in Britain seems to be “learning on the job”, unlike other countries that have comprehensive and intense programs of initial skill formation. The result in Britain is that skills remain job-or firm-specific and therefore difficult to transfer (Deissinger, 2008).

These then are the characteristics of British vocational training. This system does not lend itself to be used as a co-op model. Britain has made improvements in their system, as evidenced in the National Vocational Qualifications (NVQs) in 1986. They combined the notion of “legal freedom” and “company training autonomy” with the idea that training should be linked to more reliable forms of certification or relevant competencies (Deissinger, 2008).

2.3.4.3 Co-op in Thailand

Since the first university (Suranaree University of Technology: SUT), implemented a co-op program in their institute in 1993, people have become increasingly aware of co-op in Thailand. Now, there are numerous curricula based on cooperative education that are being used in the Thai public and private universities.

In 2001, a group of people lead by Prof. Dr. Wichit Srisa-an (The X-President of SUT) established the Thai Association for Cooperative Education (TACE). The objectives of TACE (Thai Association for Cooperative Education, 2011) are:

1. Prepare the students on career development and improve their skills and experience to work in the job market (employability).
2. Enhance students’ academic and professional experience and students’ self-development.

3. Create chances for both private and public organizations to participate in graduate quality improvement.
4. Encourage educational institutes to develop curriculum and teaching to be modern, standardized, and consistent with the job market.
5. Make a good relationship between employer sector and educational sector through co-op students and co-op lecturers.

Now, TACE collaborates closely with the Office of the Higher Education Commission. They work together to set up co-op standard regulations in Thailand. The regulations are intended to be used as a guideline for companies and educational institutes to operate the co-op program, to construct a system and mechanism for control, check, assess the co-op program according to standard regulations, and also to identify the differences between co-op and normal internship (the students do the job in summer, 1-3 months). Some regulations were; students should go out and find a work site to do their work at least for 16 weeks (4 months), students come back to their school during the final weeks of the semester or after finished co-op to report on their work performance. During that period, jobs will be assessed once or twice each term, and the students will have a portfolio to record the outline of their working experience and prospectus (Thai Association for Cooperative Education, 2009). These are an example of the minimum regulations that all universities in co-op education must follow. However, each university can adapt the regulations to their specific situation but must include the TACE requirements. These efforts have spurred development of co-op programs in Thailand. A review of some co-op cases in Thailand gives greater insight to developments follows.

Suranaree University of Technology (SUT)

SUT is the first university in Thailand (Coll et al., 2003) to use cooperative education at the university level. The program was developed in 1993 based on an international model developed from documentary reports, literature, faculty visits to North American universities, and in-depth consultation with overseas institutions. SUT consists of five institutes and schools combined together. Programs include;

Social Technology (General Education, English, Management Technology, and Information Technology),

Engineering (Agricultural, Transportation, Chemical, Mechanical, Computer, Ceramic, Polymer, Electrical, Civil, Metallurgical, Telecommunications, Environmental, Industrial Engineering and Geotechnology),

Agricultural Technology (Animal Production, Crop Production, Food Technologies, and Biotechnology),

Science (Physics, Chemistry, Biology, Mathematics, Remote Sensing and Laser Technology, and Photonics), and

Medicine (Environmental Health, and Occupational Health and Safety)

SUT uses cooperative education as a key learning strategy. Thus a co-op program is compulsory for all SUT students (The Center for Cooperative Education and Career Development, 2011). Those students that cannot join in the co-op program must study special courses simultaneously with other practical subjects according to their major's regulations. SUT has a trimester system (3 terms) with 13 weeks each term. Normally, the students will take four months (16 weeks) for cooperative education in the workplace in 3rd or 4th year after finishing the first part of study in their field. The co-op apprenticeship can start in May or August or January depending on which major has been chosen. Before the student goes to work in a company, SUT conducts orientation activities to prepare them in areas such as writing resumes, application forms, preparing for interviews, academic writing, knowledge for working in company (e.g. safety), etc. During the work period a co-op lecturer or co-op officer of SUT makes one visit. Near the end of the work period the company mentor must check the student's report, assess their work performance, and inform the student. After students finish their co-op apprenticeship, they must submit a report, attend an interview conducted by SUT, and engage in knowledge sharing through seminars with students and co-op advisors. This then is a brief look at the co-op process at SUT.

Because SUT is the Thai university that first included co-op study in their curriculum more than 15 years ago, it has become a prototype of co-op programs for many universities in Thailand. The SUT co-op pattern was also used as a guideline to set the standard regulations of TACE.

King Mongkut's University of Technology North Bangkok (KMUTNB)

KMUTNB is one university that has a co-op program in some curricula. This educational institute has collaborated for some time with Germany to transfer knowledge and technology in teaching Thai students, especially in engineering field. This co-op model has been influenced by the Germany approach. The faculty of engineering of KMUTNB implemented co-op in their curriculum (Chinvorarat, 2001). The program started in 2000. It is an option in the regular curriculum and available only to third year students. The co-op students apprentice in an industrial company for ten months. The apprenticeship schedule separates into three periods: 1st period in the 1st semester of year 3, 2nd period in the summer semester of year 3, and 3rd period in the 2nd semester of year 4. The student also has the option of working in the summer of year 4. This group of students takes five years for a bachelor degree (1 more year than non co-op students). Some students decided not to enter the co-op program because of the extra year involved. Table 2.8 shows the time schedule.

This is also a co-op example in Thailand that attempts to use the co-op to produce highly potential practical engineers and technicians to serve the demands of industry for theoretical and practical engineers in a highly competitive world.

Table 2.8 Cooperative Engineering Schedule at KMUTNB

1 st and 2 nd academic year	3 rd academic year		3 rd summer	4 th academic year		4 th summer	5 th academic year
1 st -4 th semester	5 th semester	6 th semester		7 th semester	8 th semester		9 th -10 th semester
Enrolls as a Regular schedule	Co-op	Enrolls as a Regular schedule	Co-op	Enrolls as a Regular schedule	Co-op	Co-op (Optional)	Enrolls as a Regular schedule & conducts Eng. Project

Source: Chinvorarat, 2001

The two examples of co-op in Thailand have different patterns according to the type of profession and institute constraints. However, the TACE and Office of the Higher Education Commission continue to strive towards setting a minimum standard pattern for Thai co-ops. Co-op is still new in Thailand especially in higher education. It takes more time to consider and make decisions to set a suitable pattern for each institute and each occupational area due to different fundamentals. Thus educational institutes who want to introduce co-op in their curriculum need to become well-informed of the features and attributes of implementing a co-op program.

2.3.5 Further Discussion of Each Model

Although co-ops in North America, Europe and Thai have some different details in practice, they have the same objective of using the co-op to improve student's abilities both in theory and practice to meet employers' demands. Each region/country developed their own co-op model appropriate to their situation, fundamental nature, and constraints. We conclude by discussing some main features of the co-op model in each region/country.

In North America, there are similar co-op characteristics between USA and Canada, for example co-op students must study for 5 years to get a bachelor degree. One disadvantage is that students following a 4 year program can go to the job market earlier. Students in the co-op switch between learning in university and work in a company, and accumulate work experience around 18-24 months (1 and a half - 2 years), and can work immediately after graduation. Normally, students start co-op early (1st or 2nd year of study), but often do not have enough maturity. This can cause some problems to the company, but they can be overcome if a strong recruitment and preparation process is in place. During the co-op time, the student receives wages from the employer which encourages them to feel they are part of the company. Co-ops in North America are very popular as yearly enrollment levels show (3,600 at UC, USA and 16,000 at UW, Canada). This is due to success in producing high quality graduates for the job market and the variety and flexibility of the co-op models, which enables them to adapt to different professions.

In Europe, apprenticeships of a craftsman's guild were common in the middle ages. However, after the industrial revolution different strategies evolved to train engineers, technicians, workers, etc. in different countries. In France, apprenticeships generally tended to be school-based learning rather than work-based learning. Some other countries such as Germany and Switzerland chose to remain the apprenticeship model and added some school training, creating a dual system. Nevertheless this research will discuss each model presented previously in 2.3.4.

In France vocational training is “The state-regulated bureaucratic” model. One characteristic of co-op operations in France is that each educational institute uses the same rules/regulations for apprenticeship set by government, but in practice each one can consider and construct their own pattern for their students. Despite the differences in co-op systems, if anyone can establish a good co-op model, it would be advantageous for their institute. In the case of IUT Lumière, France implemented 100% co-op program (no non co-op students), with many outstanding features:

- 1) A company representative attends the recruitment interview
- 2) Students need to be well prepared to work in the company (using PPP activity that emphasizes self-reliance)

Remark: more will be covered in part 2.4.1

- 3) 5 follow-up and assessment meetings involving the company tutor, the IUT teacher and the student
- 4) Before finishing their company work each student must complete a professional project related to their field of study

This gives students lots of opportunity to improve their skills and abilities both before and during their co-op apprenticeship. In addition, their project process develops their skill in adapting theory and problem solving, which can be helpful to the company. The total apprenticeship time is around 13 months (including the academic period) with sufficient pay to encourage them to improve their working skills before graduation. One advantage of the IUT Lumière co-op program is that the student studies just 3 years (finishes first 2 years, gets a diploma of technology:

DUT). To get a Vocational bachelor requires one more year after DUT. This is sufficient to produce a mid-level manager for work in the industrial sector.

In Germany vocational training is “The dual-corporatist” model. There is strong collaboration between the employment, federal, and educational sectors. The federal government established the regulations to be used for all apprenticeships. Hence, every educational institute in Germany follows the same apprenticeship format. The employer sector shares equal responsibility with the educational sector (50:50) in training students. Recruiting is done only by the company. They both participate in all activities including: training students at the company 50% of the time (around 18 months, half of the 36 month program), sitting on the examination panel, and improving the curriculum. The main reason the Germany employer sector is interested in co-op training is because suitably trained employees help them save time and money. This dual system has been used in Germany for over 30 years. In other countries where the education sector has no strong relationship with the employer sector and there is an inadequate understanding of the co-op model it would be difficult to adapt the system. Students begin co-op in the first year and there is no follow-up or assessment by the company and university. At the end of the work semester they have only to submit a report and discuss their work experience in a seminar setting. This is considered sufficient because most students have previously combined working with study before proceeding to higher education and hence are more mature. The French co-op model also takes 3 years to complete. Both models are efficient in supplying employers with suitable graduates.

In Britain the vocational training model depends on what is called “The liberal market economy” model. The apprenticeship system operates on a volunteer basis, so there is no standard format. It is seen as labor more than learning or practice (Deissinger, 2008). Hence, research has focused on other models.

In Thailand, most universities with co-op programs use the SUT co-op model adapted from North America as a prototype. Consequently, they all have a similar co-op pattern including; students’ preparation (such as job application, document writing, ISO9001, safety, etc.), visiting students in company (normally 1 time), working a total

of 16 weeks (4 months), student assessment via rating by a mentor and a report. The student's faculty/major determines when the work semester is appropriate (it can be in the summer of the 3rd year, or 1st or 2nd semester of the 4th year). During apprenticeship students should receive wages from their employer, but this depends on company policy. In Thailand students normally take 4 years to get their bachelor degree. Most students do not have experience and hence still lack some work competencies. The apprenticeship period in the Thai co-op model is too short (4 months) to allow students to develop sufficient skills if compared with other models (USA, Canada, France, and Germany co-op model). Students develop some basic work competencies that allow them to adapt somewhat, but lack the in-depth understanding and overall skills required. Because of the short period involved companies spend most of it training students with little time left to put their training into practice. Moreover, the Thai model only allows time for 1 visit/assessment, and sometimes none.

In Thailand co-op is a new learning concept for higher education. It is still not clearly understood by many educational institutes and employers. Many Thai universities have adapted co-op in a way most appropriate to their context, but still have not yet decided if it is suitable. Collaboration with the employer sector has been weak because of their understanding of the co-op system. Also, many believe their training system is better than training by an educational institute. However, co-op at the higher education level in Thailand is in the early stages, and now the government and most universities are promoting/using it. This has resulted in increased collaboration with the employer sector. Although co-op is a new way to improve education quality in Thailand, educational institutes who need or are interested to adopt co-op would do well to analyze and assess how to adapt co-op appropriately within their context before implementing it.

Using co-op information collected from the regions/countries listed, a comparison of the main characteristics of each is shown in table 2.9.

Table 2.9 The comparison of co-op model characteristics

	USA	Canada	France	Germany	Thailand
Co-op construction	each institute set up the co-op system	each institute set up the co-op system	each institute sets up the co-op system under the government policy	the federal collaborate with employer sector and educational sector to set up the co-op system	each institute set up the co-op system by consider TACE standard
Co-op students recruitment process	by educational institute	by educational institute	by educational institute with company representative	by company	by educational institute
Study time plan	5 years	5 years	3 years	3 years	4 years
All work time (co-op)	18 months	20-24 months	13 months	18 months	4 months
Start co-op apprenticeship	2 nd year	1 st year	2 nd year	1 st year	3 rd or 4 th year
Students' preparation (before work)	N/A	N/A	Has some preparation	No preparation	Has some preparation
Students' follow-up in company	N/A	N/A	Yes (5 times)	No	Yes (1 time)

As we see in table 2.9, each model has some differences according to the country's fundamentals, nature, and requirements. To select a co-op model that will be successful it is important to consider a country's political, educational system, population characteristics, and economic background (Kato, 2005).

2.3.6 Co-op Model for MMIT, CAMT, CMU

Each university in Thailand has their own educational strengths to produce graduate students. For example, Suranaree University of Technology (SUT) is strong in science and technology, King Mongkut's University of Technology North Bangkok (KMUTNB) in engineering (especially mechanical engineering), and King Mongkut's University of Technology Thonburi (KMUTT) also in engineering (especially chemical engineer). These universities produce students to support all Thai industrial sectors including small and medium sized enterprises. Nowadays, not only specific knowledge and skills are necessary for work, but additional advanced requirements

for the international contexts such as English, modern manufacturing management, and norms and standards to contract with other countries are also required by industrial sectors (refer to part 1.2.2 and 2.2.3). Moreover, according to new graduate problems, students should not only improve their necessary competencies to be ready-to-work before they graduate but also be able to transfer and implement technology to existing systems by using Information Technology in the global manufacturing context. Hence, CMU and CAMT assumed the responsibility to produce these kinds of graduates through a program established at MMIT (funded by Thai government budget especially from the 8 provinces of the upper northern region).

Before explaining the co-op model of MMIT, a brief history of CMU, CAMT, and MMIT is presented.

Chiang Mai University (CMU) was founded in 1964. CMU is the main government university in northern Thailand, has approximate 35,479 students and 11,391 academic staff as March 16, 2011 (source: www.cmu.ac.th). The Thai government proposed Chiang Mai to be the aviation hub for the Greater Mekong Sub-region (GMS) nations including Laos, Burma, China and Cambodia, and has recently declared Chiang Mai as one of three ICT (Information and Communication Technology) cities. Government activities cover the development of e-tourism, e-business for handicraft industry, e-commerce, e-government, e-learning, alternative media, games, animation, mobile, SMEs and large organization e-business application, The city has modern infrastructure for international business investment, and its economy mainly depends on tourism, handicraft, and software businesses. To support development CMU established a new college called College of Arts, Media and Technology (CAMT) in 2003. This college focuses on human resource development and innovation in ICT for tourism, handicraft and software industries in northern Thailand. CAMT offers some undergraduate programs related to software engineering, animation, e-tourism and craft design. At the post-graduate level, CAMT established industrial degree programs for Master and Doctoral studies. Research groups have been setup to support industrial research in the college.

Modern Management and Information Technology (MMIT) is the one of four majors at CAMT (the other three are Knowledge Management, Software Engineering, and Animation). It was established in 2006. This program was created through the cooperation of Chiang Mai University; the Faculty of Engineering, Faculty of Business Administration and Faculty of Social Sciences. The program focuses on preparing undergraduate students by interdisciplinary programs using modern management and information technology applications aimed at increasing supervisory competencies to make the school-to-work-transition. This program uses co-op as a key learning strategy to help students gain practical work experience and apply theoretical knowledge to quality systems, human resources, and information technology. MMIT curriculum's objective is to have graduates with supervisor qualifications support factory operations in the upper northern region of Thailand, especially the Northern Region Industrial Estate in Lumphun province. The Northern Region Industrial Estate is the main area where many investors from foreign countries such as Japan, Korea, France, Switzerland, etc. built factories (totaling around 70 factories) to produce their products and services. These foreign investors are the major employers and provide approximately half of the total income of the upper northern region. The major products they produce are electronics and machine parts, food, and jewelry. The manufacturing processes make use of cheap labor and produce a high volume of goods. Product design comes from the "Mother Company" country. Secondhand equipment from the mother company or other plant branches is used. These kinds of factories have little need for people with a high level of technical expertise or specific knowledge, such as chemical engineers, mechanical engineers or scientists in petrochemical or automobile industries. In contrast, the production of electronic and machine parts, food, and jewelry requires people with good management and supervisory skills, some work experience, and good attitude (e.g. punctuality, patience, enthusiasm). These types of jobs occur in areas such as routine process, human resources, quality control and using information technology. For this reason, MMIT has taken on the responsibility for producing this kind of human resource to support industrial in the northern regions of Thailand through a co-op approach. This enables the graduate to have both sufficient academic knowledge and practical experience before entering the workforce.

A comprehensive review of the MMIT curriculum follows before presenting the co-op model.

MMIT Curriculum (Year 2006)

MMIT curriculum is the Bachelor of Arts Program in Modern Management and Information Technology, and normally takes four years (8 semesters) to complete. The standard study schedule is shown in table 2.10.

Table 2.10 The standard study schedule of MMIT curriculum

Year	Semester 1	Off	Semester 2	Semester 3 (summer)
	June – September	October	November – February	March – May
1 st year	<i>Study</i>	<i>Off</i>	<i>Study</i>	<i>Off</i>
2 nd year	<i>Study</i>	<i>Off</i>	<i>Study</i>	<i>Off</i>
3 rd year	<i>Study</i>	<i>Off</i>	<i>Study</i>	<i>Off</i>
4 th year	<i>Study</i>	<i>Off</i>	<i>Study (graduate)</i>	-

MMIT students must complete at least 132 credits in total to graduate. They have two plans to choose from; plan 1 Cooperative Education program (Co-op) or plan 2 Independent Studies (IS). Both plans have compulsory courses in General Education (GE) subjects, field of specialization subjects (Core Courses, Required Courses, and Major Electives), and Free Elective subjects. The objectives of each group of subjects and the concept are explained as follows.

The main objective of GE is to give students' knowledge and life skills so they can adapt well in society. Students learn most of the GE subjects in 1st year. GE consists of 4 groups of subjects; Social Sciences, Humanities, Languages and communication, and Sciences and Mathematics. These subjects are compulsory for all students.

Specialization subjects consist of Core Courses, Required Courses, and Major Electives. The objectives of these subjects are to increase student knowledge of their specialty and to prepare students for work in their career path after graduation. Students begin with these subjects in 1st year and continue them in 2nd, 3rd, and 4th year. These subjects can also be separated into three main specific knowledge areas;

Industrial Management, Social Science and Business Administration, and Information Technology. Core and Required Courses are compulsory for all students but for the Major Electives the student can choose to study any subject of interest.

The Free Elective subjects must be chosen outside the MMIT curriculum. They can register in any faculty they desire subject to satisfying prerequisites or special conditions.

A summary of courses and credits for each study plan follows.

Table 2.11 Overall courses and credits of the MMIT curriculum

Courses	Plan 1 (Co-op)	Plan 2 (IS)
General education	33 credits	33 credits
Core course	24 credits	24 credits
Required course	33 credits	24 credits
Major elective	At least 36 credits	At least 45 credits
Free elective	At least 6 credits	At least 6 credits
Total credits	At least 132 credits	At least 132 credits

Remark: see course names and credits in Appendix A

If students select plan 1, they must complete an apprenticeship in a company and a co-op professional project (explained more in chapter 4 part 4.1.3.2). If plan 2 is selected, they must complete an internship (work practice in private/government organization around 1½ - 2 months), and do some research as part of their independent study. Since the research focuses on a co-op model we consider only students who chose plan 1.

The MMIT Co-op Model

From part 2.3.4 we have seen the varieties of co-op model in many regions/countries. There are different formats according to their context but they have the same objective, which is to improve their students' abilities. The co-op framework of MMIT was established by reviewing co-op models. The main concept used to

construct the model came from the Institut Universitaire de Technologie Lumière (IUT Lumière), University Lumière, Lyon 2, France. The model at Duale Hochschule Baden – Wurttemberg (DH-BW) Vellinggen – Schwenningen in Germany was also used as a partial guideline as a result of the Euro THai Implementation of Cooperative Study - For Economic Development (ETHICS-FED) project. This ETHICS-FED project aims to give French and German technical assistance to Chiang Mai University Staff in order to create a framework and adapt a new technical education program (Bachelor degree) to train mid-level managers in production management. The overall objectives of the ETHICS-FED project are (Thailand-EC Cooperation Facility Grant Application Form, 2008):

1. To promote a good understanding of EU technical education systems at the higher education level in the fields of production management and international trade.
2. To exchange ideas, views and knowledge about cooperative education at the university level, both in Europe and Asia.
3. To bring EU technical assistance to CAMT staff in order to structure and adapt a production supervisor training course within a cooperative education system, subject to the cultural, social and economic context of the northern part of Thailand and EU market economic constraints and requirements.

The project ran for 18 months from March, 2009 until August 2010. As a result of this collaboration technical knowledge and know-how on constructing and administering a co-op was passed on to MMIT. After a thorough analysis of the EU co-op model prototypes the French model was selected because it was more suited to the culture and nature of Thai society. There are four main reasons.

Firstly, collaboration between the educational and employer sectors in Germany is very strong when compared with France, where each educational institute works independently to contract with the employer sector. In Thailand and France the employer sector has insufficient understanding of the co-op model and its advantages, so there is not much support for vocational training. Most Thai universities try to

convince the employer sector to make use of the co-op model, but little interest has been shown to date. It will take more time to educate them about the advantages of co-op and MMIT continues to look for ways to establish a strong collaboration with employers.

Secondly, MMIT students still need strong preparation before they go to work and most of them have little or no real work experience. They have difficulty adapting to working under pressure and do not have sufficient basic industrial knowledge they can use in their work. To remedy this, the university organized some special courses to fill this gap. This effort is consistent with the French model which makes use of a Personal and Professional Project (PPP) to prepare students (more detail is in part 2.4.1). In contrast, Germany doesn't have this process because most Germany students are more familiar with the working environment.

Thirdly, according to the MMIT curriculum, students start their co-op apprenticeship when they study in 3rd year (normally semester 2). This is similar to the French model, where 1st year students do classroom study and also the PPP process before their co-op apprenticeship in 2nd year. On the other hand, in Germany students start work in a company in 1st year and alternate with university learning every 12 weeks (3 months) until they finish the program. This program would be difficult to follow in the Thai context due to difference between Thai and German students. Thai students still need more time to gain academic knowledge and mature before going to a real work site. Thus, the preparation process (PPP) of the French model is a necessary procedure for MMIT students, so the co-op apprenticeship must come later in the program.

Finally, the German model does not include any follow-up of a student's company work. They just write a report on a work-related topic and discuss it in a seminar after finishing each working period. In France they have five follow-up meetings to assess the students in each company. This procedure helps students to be more aware of their competencies level, and hence improve themselves continuously. The university lecturer also has a chance to visit the company, establish closer ties, and confirm if it is an appropriate learning environment for the student. This process

is very necessary in the Thai context because students need a follow-up to check their adaptation, help them to keep their job, and to inform them about their competencies level. In addition, because co-op in Thailand is still a new concept, it is advantageous and useful for the university lecturer to visit the company. Other objectives are to check the employer's co-op understanding and firm up the relationship between the company and university.

One aspect of the German model that has been adapted into the MMIT co-op model is having an annual seminar with all students and company mentors to discuss/improve the co-op program. Details of the MMIT co-op model are presented in chapter 4.

2.4 Theories for Developing Students Competencies

This part presents the principle theories used to develop student competencies (especially mastery and mental attitude). This research makes use of two theories. First, ADVP (Activation du Développement Vocationnel et Personnel) or Activation of the Vocational and Personal Development (in English), and second, Learning Organization (LO). Each is explained in the following.

2.4.1 ADVP (Activation of the Vocational and Personal Development)

ADVP (Activation du Développement Vocationnel et Personnel) or Activation of the Vocational and Personal Development is the concept counselors use for adolescent vocational development in Canada (Quebec City Canada). It is based on Guilford's model of intellect (J. P. Guilford, US psychologist) and aims to develop individual intellectual abilities and cognitive attitudes through vocational "developmental tasks" (Bujold, 1974). The developmental tasks consist of 4 steps.

- 1) *Exploration*: this procedure involves an active search for novelty and change, observation and curiosity, the process of trial and error, the elaboration of hypothesis, and risk-taking. This step must use "creative thinking" as the key ability to explore information. It is not necessary for

adolescents to make final decisions here, but in this step they should be able to see all the possible aspects of a situation or all the elements of a problem. Productive exploration depends on the intellectual abilities and cognitive attitudes characteristic of creative thinking.

- 2) *Crystallization*: after the exploration process, adolescents accumulate several experiences (various pieces of information). Some may be confusing to them. They must clarify and organize their perceptions in relation to professional roles. The crystallization process is necessary here. The adolescents then have to eliminate certain possibilities and reduce their field of preferences in order to reach a general preference which embraces a certain number of related activities. Categorical-conceptual thinking is the essential ability required for this step. Adolescents must have the capacity to recognize characteristics common to several occupations, and must be able to identify which of their own attributes match to the requirements of several occupations. In other words, adolescents must be able to think in terms of logically organized systems.
- 3) *Specification*: from crystallization the adolescents specify their preferences in this step. They translate a general or temporary vocational preference to a specific one. This step could be viewed as a point where a person's values intersect with the possibilities provided by his/her environment. One difficulty of this procedure is the determination of a person's priorities with regards to his/her future expectations. They must arrange their hierarchy of values. Hence, the most importance ability used in this step is "evaluation thinking" to differentiate between what is desirable and what is probable.
- 4) *Implementation*: for the last step of developmental tasks, adolescents must commit themselves by enrolling in a program of studies or by finding a job in their chosen occupation by using the result of the previous step. To do this, they must be more involved and committed to their chosen profession. Thus, this step requires the abilities of anticipation, planning and elaboration which could be called "implicative thinking".

As we see here, ADVP can be used as a methodology to determine an adolescent's vocational choice. This approach makes use of intellectual abilities and cognitive attitudes that impacted on adolescent mental development, and skill mastery. ADVP theory was applied to vocational training in France. A detailed description follows.

In 1982 IUT introduced this concept with the help of Robert SOLAZZI (French Orientation consultant and Editor) and Denis PELLETIER (Department of Counseling and Guidance, School of Education, Laval University, Quebec City). IUT focused on adapting this concept to their vocational training system. Some educational institutes used this concept as the key principle for developing their students and implemented it successfully. One of those institutes is the IUT Lumière, which is the co-op prototype in this research.

IUT Lumière adapted ADVP to their vocational training system as a key concept to generate all preparation activities for encouraging students' abilities development and was called "Personal and Professional Project (PPP)". PPP uses the same concept as ADVP which has four major steps, including Exploration, Crystallization, Specification, and Implementation. The theoretical basis of PPP at IUT Lumière (Veillard, 2009) is as follows:

- 1) In a complex and uncertain world, it is more and more difficult to take decisions. The school mission is not only to transmit knowledge but also teach to students how to make personal and professional choices.
- 2) Orientation must be considered as a long-term process rather than a short-term one.
- 3) Frequently, students have wrong impressions about jobs and professional environments, have no clear ideas about their future and have difficulties assessing their capacities, gaps, and potentialities.

PPP at IUT Lumière aims to develop the following:

- 1) the student's sense of responsibilities and intellectual autonomy

- 2) their ability to reflect about themselves and their life experiences
- 3) the ability to find information by themselves and to develop critical views about this information
- 4) student ability to contact and prospect companies
- 5) prepare students to succeed in the school-to-work transition

Normally, IUT Lumière students attend PPP along with the academic courses for the first two years. The PPP process is illustrated in figures 2.10 and 2.11.

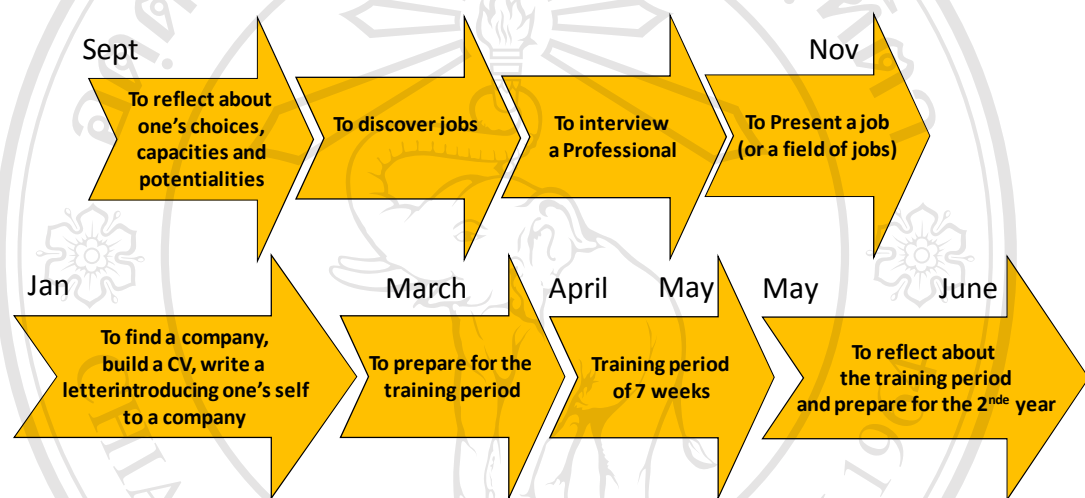


Figure 2.10 The PPP process for 1st year students
Source: Veillard, 2009

Figure 2.10 illustrates the PPP process in the first year. The objectives of each period are to help students in building a personal and professional project, finding a company, and preparing his/her integration into a company. The main PPP activities are arranged to allow the students to do the following:

September – November: the beginning months enable students to reflect about their job choices, their capacities and potentialities, discover potential jobs, interview a professional, and present a job (or field).

January – March: the New Year begins with finding a company, building a Curriculum Vitae (CV) and a letter introducing their qualifications to a company.

March to May: in this period the co-op students go through preparation for the training period. The training period takes 7 weeks and is called the “*Trial Period*”. The objectives of this trial period for the students are to integrate themselves into the company, to discover the organization of the company, and to learn the content of the missions and tasks by doing or observing. At the same time, by this period, the company will test the student before signing an apprenticeship contract and to have a better understanding about the training course.

May to June: this is the period when students reflect about the training period and prepare for the 2nd year.

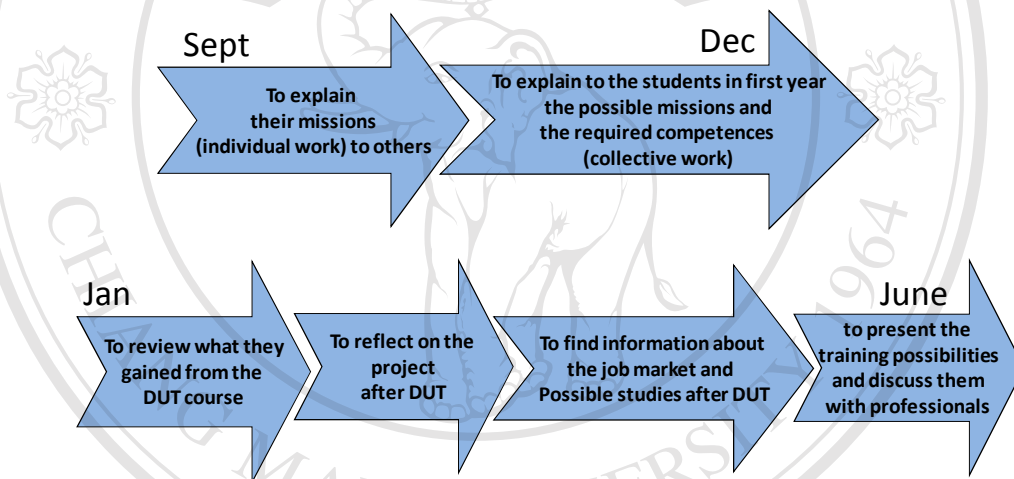


Figure 2.11 The PPP process for 2nd year students
Source: Veillard, 2009

Figure 2.11 shows the PPP process in the second year. The objectives of this period are to provide students the opportunity to reflect and analyze the workplace activity, do a personal and professional project, and prepare themselves after finishing the second year. The activities start from September and end in June. In this timeframe, students are asked to explain their mission. The students are given information about what the possible missions are and the required competencies. In addition, they have to review what was gained from the DUT course, reflect on the project after DUT, and find information about the job market or possible studies after DUT. In the last month, training possibilities are presented and discussed with professionals.

This is the PPP process at IUT Lumière that was adapted using the ADVP principle as a key concept for generating activities to develop their students' abilities.

In the northern industrial estate of Lumphun, more than half of the 70 factories are Japanese. Less than 20% are EU companies because they still have some difficulties extending their investment. The main reason is the different cultures of Asia and the EU. To trade with the EU market, an essential factor is the knowledge of norms and standards. Hence, they need employees who are able to manage EU norms and standards, commercial habits, and cultural practices (refer to part 2.2.3). These employees meet the technical and legal requirements of EU markets (norms, quality, master of logistics, and manufacturing costs) for manufacturing systems, manage contacts with EU customers, and analyze their specifications. Therefore, the PPP concept of the EU educational context was used as a main methodology in the MMIT co-op to create a new kind of employee that is not only ready-to-work after graduation but also can work at the international level (especially in the EU context).

2.4.2 Learning Organization Theory

Nowadays, the world is more interconnected and communication is global. Business is more complex and dynamic. Organizations cannot survive if they depend on only one individual. Everybody must learn and work together to create extraordinary performance. Thus, due to the trend to globalization an important goal of organizations is to take advantage of human potential. Consequently Learning Organization (LO) theory plays an important role in business today in using human capital as a major force to sustain and develop.

According to the research objective related to competency development of students, especially behavioral perspective, this part will explain two LO theories from two authors that are relevant to the research context. Two interpretations of LO follow.

Senge (1990) explained that a learning organization is “an organization that is continually expanding its capacity to create its future.” He described a learning

organization as the organization “where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free and where people are continually learning how to learn together.”

Gavin (2000) described a learning organization as “an organization skilled at creating, acquiring, interpreting, transferring, and retaining knowledge, and at purposefully modifying its behavior to reflect new knowledge and insights”.

From these two definitions, one can conclude that a Learning Organization emphasizes the contributions of human resources in learning how to learn and develop themselves to become an essential mechanism for organization development. Therefore, this research uses the LO concepts as a guideline to stimulate the students in learning how to learn and master their careers. This research will use two major LO theories which can be applied to help students develop their learning capacity and competencies. The first theory, Learning in Action of Garvin (2000), will be used to generate learning activity in the co-op framework, and the second, the Fifth Discipline of Senge (1990) will be applied to develop student self-discipline so they can master the subject material and have a positive mental attitude. The details of each theory follow.

2.4.2.1 Learning in Action

“Learning in Action” (Garvin, 2000) theory provides guidelines to an organization and helps to create a learning organization. The theory consists of four major components which include three types of learning (intelligence, experience, and experimentation), and a process leading to learning.

1. Intelligence

Companies today could not survive well without precise, up-to-date information from the external environment. Intelligent learning is the collection and interpretation of information that exists outside the organization. The general aims are the selection, collection, interpretation and distribution of information that has

strategic importance. Normally, it focuses on information that is publicly available and can be legally obtained. Information is collected using: search, inquiry, and observation.

Search: normally, public sources or documents such as the internet, annual reports, newspapers, magazine articles, trade shows, and commercial databases are used. For effective searches, companies need to collect information from diverse sources and cross-check their findings to ensure reliability. When information is not self-evident or obvious, companies need a targeted search (follow up) rather than searching by monitoring (routine). How and when information is interpreted affects the decision-making process. The primary skills needed in this search process are careful analysis and research.

Inquiry: when available information is incomplete new information can be elicited directly from users by interviews or questionnaires (survey). This is called the inquiry process. Questionnaires and surveys can give distorted results depending on wording and structure, so careful attention must be paid to minimize any bias. Inquiry has two basic methodologies: descriptive and exploratory. Descriptive methods are the most traditional. They involve precise, focused questions and targeted information collection. The purpose is to determine patterns or frequencies of use when comparing products and services of competitors. There are many advantages, including well-defined procedures, easy result's summarization and interpretation. However, with targeted questions, the descriptive method does not usually generate an unexpected idea or discover something fundamentally new. The exploratory method can give greater insight by using open-ended questions that can extract users' opinions and needs. Unstructured interviews are the key approach to this method. The interviewer should follow up and query tactfully, suspend judgment, keep an open mind, and listen sympathetically. These techniques help to gain insight into what the respondent really thinks. The primary skills needed in the inquiry processes both descriptive and exploratory are framing and asking insightful questions.

Observation: when knowledge is tacit or not articulated, it is difficult to extract information even when questions are well structured. Direct observation is

necessary when seeking this type of information. Observation should be conducted in the real context rather than some artificial setting. Observers must be in the real situation to watch individuals and groups perform their daily work. Observation can be separated into two approaches, passive and participant, distinguished by the degree of involvement or participation required. Passive observation is conducted discreetly without interaction. This process gives ready access to users but does not allow for follow-up questions to enhance understanding. In contrast, when using participant observation, the observer is fully engaged in activities and is recognized as an insider. This approach provides deep, empathetic understanding and insight, and gives an opportunity to observe natural interactions and patterns, but may/may not be useful, and more time is required to collect data. The initial required skills for these observations are political sense and negotiating ability because anonymity and confidentiality are important for sample individuals/groups. The essential skills are suspended judgment, curiosity, and openness but the most important skill of the observer is careful listening to target individuals/groups.

2. Experience

This type of knowledge generally comes only from “truly participation” and “personal involvement”, or in other word it is the accumulation of knowledge through action. Knowledge occurs when people put themselves into unfamiliar situations. Repetition of a process leads to deeper understanding, increased skill, and superior performance. We learn from experience in two different ways: repetition and exposure. Repetition guarantees that the same tasks are efficiently executed over time. The objective is refinement and depth. Skills are sharpened through repeated use. Exposure ensures that a new set of aptitudes is developed. The goal is to increase management skills and expand understanding to new different tasks/environments. Skills are developed through exposure to unfamiliar environments or new tasks/responsibilities. The main tools used to capture experience gained after or during the performance of tasks or activities are *reflection and review*, and *experiential learning program*.

Reflection and review are usually conducted after the fact (after performed tasks). There are two main approaches to reflection and review: single case or comparison reviews, and individual, group, or organizational reviews. Single cases are typically written up as institutional histories. The idea is to tease out insights and practical advice by combining diverse memories and comments. Comparisons consider side-by-side assessments of success and failures or contrasts of superior and average performers. Both single case and comparisons must be conducted immediately, when memories are fresh and data can still be verified. The goal for individual reviews is to refine and distribute the elements of effective practice. Normally they are conducted with skilled managers, engineers, marketers, and salespeople who are very experienced. Group reviews often focus on complex, expensive capital projects. The main objective is to identify critical elements such as the processes and procedures that keep quality high, schedules on track, and costs under control. Reviews are conducted regularly by the participants themselves. Organizational reviews normally take one of two forms: dealing with the ongoing operations or assessing changes in a program. Studies of ongoing operations usually focus on “best practices”. The reflection and review processes help to spread superior performance in one area to other related areas. Reviews of changes in programs focus on critical mistakes or missteps to discover difficulties before they become embedded. An excellent example of the reflection and review process is the After Action Reviews (AARs) of the U.S Army. They incorporate this into all phases of the operation to capture and disseminate critical organizational knowledge. The AARs process may be formal or informal, may involve large or small groups, and may last for minutes, hours, or days. However, the discussion always deals with the same four questions: “What did we set out to do?” “What actually happened?” “Why did it happen?” and “What are we going to do next time?” These questions stimulate all AARs participants to continuously assess themselves, review their assignments, identify successes and failure, and look to improve their performance in the future.

The experiential learning program involves reflections and reviews, and alternates periods of learning and doing by pauses along the way to evaluate progress, share learning, and make midcourse corrections. These experiential learning programs

use problems and actual challenges to ensure active participation. The problems can be real or simulated and can be designed for a specific learning need. Dealing with real and simulated situations requires well-chosen problems, moderate time, good sponsors (from supervisor/manager), and an appropriate team.

3. Experimentation

When unknown concepts or unverified theories are involved, the desired data must be obtained by experimentation. Experimentation is the action of trying different procedures to discover something unknown. It involves the treatment of variables and changing of conditions. Experiments have various forms, and two forms of interest to managers are exploratory experiments and hypothesis-testing. Exploratory experiments are designed for discovery. The goal is to see what happens, collect impressions, and develop a detailed picture of the surrounding world. Those experiments usually involve open-ended research. Experimenters try a new technique or a new approach, then review results, and repeat the process after some adjustments. General examples of experimentation are when businesses demonstrate or test an innovative product, process, or an organization extends the current practice boundaries. Hypothesis-testing experiments are designed to distinguish among alternative explanations and confirm predominate views. The goal is to support a view, not discovery as in exploration. Approaches to hypothesis-testing begin when researchers alter one or more factors, while holding others constant; they record the result and rule out some explanations. This process is repeated until only one possibility remains.

Learning in action theory involves three processes: intelligence, experience, and experimentation. The combination of them works together to give a precise and efficient method to gain new knowledge. Intelligence gathering is aimed at the present; it requires that organizations focus on currently available information, while experiential learning is aimed at the past and ensures that organizations depict lessons from activities that have already taken place. Experimentation is aimed at the future and organizations look forward, trying out new designs or theories to see which is most useful. This comprehensive approach to learning from the present, past, and

future helps an organization to be a “learning organization”. However, these three learning approaches must have organizational support and suitable promoting of the activities. The “leading learning” process following presents a strategy to set up an appropriate learning environment.

4. Leading Learning

Setting up a leading learning environment requires three tasks. Firstly, create opportunities for learning by designing scenarios and events that support the necessary activities. Secondly, cultivate a proper tone to foster desirable norms, behaviors, and rules of engagement. Finally, lead the process of discussion by framing the debate, posing questions, listening attentively and providing feedback and closure. All these activities are necessary to encourage people to learn continually with a proper learning environment.

According to learning in action theory, many learning approaches are used to establish a learning organization. The three processes of intelligence, experience, and experimentation are useful to encourage people and organizations to adopt a learning strategy, especially learning how to learn. This can be applied to both individuals and organizations. For these reasons, this theory will be used as a component to construct a co-op framework for MMIT to help students develop their abilities through “Learning in Action” learning activities.

The theory will be applied to establish learning activities in the MMIT co-op program in parallel with PPP to help students improve their competencies. MMIT designed co-op activities by using intelligence, experience, and experimental learning to stimulate co-op students learning how to learn and continually improve themselves. Intelligence learning is necessary for students when they face new situations (co-op activities such as finding an interesting job, site visit etc.), where they must find new information by search, inquiry, and/or observation. Experience learning is used for learning in an unfamiliar environment. Students need this learning a lot when they start work at company, where they must reflect on and review their work for improvement. MMIT also conducted AARs sessions to help them practice this kind of

learning. For experimental learning, exploratory experiments (or some cases hypothesis-testing experiments) are necessary for students, especially when they do their professional project. Leading learning is important for MMIT to create opportunities, cultivate the proper tone, and lead the process of discussion to establish an appropriate learning environment. We can see that all learning activities of “Learning in Action” theory play an important role to help student to improve their necessary work competencies.

2.4.2.2 The Fifth Discipline

This theory describes the “disciplines of a learning organization” (Senge, 1990). It is composed of five disciplines: team learning, personal mastery, mental models, shared vision, and systems thinking. Each discipline encourages people so they “learn” and continue to enhance their ability to establish a successful learning organization. The next section will describe briefly some essential content of each discipline related to this research work.

1. Systems Thinking

In this discipline the business processes or activities and the human actions or attempts are identified as the systems. These systems are interconnected by unseen structures that take a long time to reveal their influence on each other. Systems thinking is a discipline that considers all to see the interrelationships as an entity and looks at the processes of change at every step. In other words, it considers the “big picture” or “overall view” rather than analyzing each piece separately. To illustrate the systems thinking discipline, the simplest example is “filling a glass of water” (Senge, 1990) as illustrated in figure 2.12. This system consists of five variables: the desired water level, the glass’s current water level, the gap between the two, the faucet position, and the water flow. These variables are drawn in a circle of cause-effect relationships called the “feedback process”. Feedback in this case means any reciprocal flow of influence. We can see that every influence is both cause and effect.

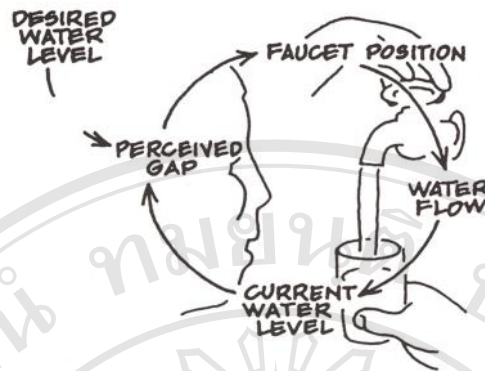


Figure 2.12 Systems thinking “filling a glass of water”

Source: Senge, 1990, p.75

In figure 2.12, from any element in the circle, we can trace arrows that represent the influence of one element on another, and can observe the results. The faucet position (hand’s position) impacts on water flow which changes the water level in the glass. Then, the water level affects the perceived gap (between the current water level and desired water levels). After the perceived gap changes, it commands the hand to adjust the faucet position. In this circle, if we consider the flow of influence, we can see the pattern or story that repeats again and again. This repetition can make the situation better or worse. The main skill used to read this feedback process is the ability to see the story from the diagram (systemic thinking), how the structure creates a pattern of behavior and how that pattern might be influenced. Systems thinking is the cornerstone discipline of learning organizations.

2. Personal Mastery

Personal mastery is the discipline of personal growth and learning. It encourages people to continually expand their ability to create the results in life they truly seek (called “personal vision”), and compare them with their current status (called “current reality”). Practicing Personal Mastery requires energy and patience, and it becomes a lifelong discipline for many people. Personal mastery discipline can be divided into two processes. First, create a “personal vision,” and continually clarify what is important to the individual. Second, define the “current reality”, and observe what stage one is at (self-assessment). The association between vision and current

reality generates “creative tension”. It is a kind of force that tries to bring vision and current reality together. Personal mastery involves learning how to generate and sustain creative tension in people’s lives and use it as a lifelong learning strategy. Hence, personal mastery is an important discipline for LO because it helps people to be active and lifelong learners and, of course, without individual learning, no organizational learning occurs.

3. Mental Model

The mental model is the discipline that involves developing, testing, and improving a person’s internal pictures of how the world works. Mental models are the assumptions, generalizations, and images that influence how people understand the world and how people take action. They affect a person’s behavior and shape their actions. To develop the capacity of an organization to work with mental models necessitates learning new skills and implementing innovations that help to bring these skills into regular practice. The required skills are reflection, developing, and public discussion of mental models. The general processes used to create these skills include: analyzing jumps from observation to generalization (recognizing “leaps of abstraction”), expressing what people normally do not say (exposing the “left hand column”), balancing inquiry and advocacy, and facing up to distinctions between adopted theories (what we say) and theories-in-use (the implied theory in what we do).

4. Shared Vision

Shared vision is one to which many people are truly committed. It is the answer to the question “What we want to create?” This discipline manages to gather enormously diverse people together and share a common identity and sense of destiny. Shared vision emerges from the personal vision of each person. It is the view that all people in an organization share. The first step in building shared visions is to abandon the process to create an organization’s vision by one person or a small group of people at a high executive level. To develop a shared vision, the skill of uncovering shared “pictures of the future” to foster genuine commitment is important. This

should be done on a voluntary basis and not forced. Visions take time to truly share and they evolve from individual visions' interactions. When true sharing takes place people are connected and share a common aspiration.

5. Team Learning

Team learning discipline is the process of aligning and developing the capability of a team. The objective is to produce the results desired by the team's members. This discipline starts with mastering the practices of "dialogue" and "discussion". Dialogue involves listening intently to other people, suspending judgments, communicating freely, regarding one another as colleagues, and facilitating the dialogue. All team members will see the representative and participatory nature of thought. Dialogue helps them to reveal the coherence in their thought and become observers of their own thinking. It leads to a genuine "thinking together", no need for a winner, and is a free exploration that brings the full depth of people's experience and thoughts to the surface. In contrast with dialogue, discussion is a searching process to determine the best view to support decisions. Both dialogue and discussion are necessary for team learning. In dialogue, different views are presented for discovering a new view while in discussion, and then different views are presented and defended to provide a useful analysis of the whole situation. When teams use dialogue and discussion, it is essential to deal creatively with powerful forces called "defensive routine" (habitual ways of interacting that protect us and others from threats or obstacles) that prevent a productive dialogue and discussion. Teams that do not recognize this, inhibit learning, and teams that do can truly accelerate learning. When teams are truly learning, they can produce not only extraordinary results but also help individual members improve more quickly.

These five disciplines are necessary for building a learning organization. They are all essential disciplines to encourage both individual and organizational to learning. The advantages of these disciplines make this theory an important tool to use in this research to encourage and motivate the students to be lifelong learning students.

Some parts of this theory will be chosen by MMIT to apply to the co-op model. The essential principles that will mainly be used are systems thinking and personal mastery. When students start work in a company, the essential thing is to understand the work systems. Hence, systems thinking is very important at this time to help students understand the overall work systems. Because most industrial jobs/tasks are repeating, if they can understand the cause and effect, and its interrelationship to each activity they will be able to work more effectively/efficiently. This also helps them to have more “systemic thinking”. MMIT has students train on drawing “systems thinking” diagrams to help them to plan their work early in their apprenticeship. For personal mastery, personal vision defining is very important. It motivates students to assess themselves “where are they” and plan for their future goals (especially in their career). This encourages student attendance and willingness to work in their co-op apprenticeship. As a consequence, they have more mastery and a better mental attitude (mental model). MMIT conducted “personal vision” creation sessions for all co-op students to help them find “what they actually want to be/do”.

2.5 Theories for Implementing Research

2.5.1 Action Research

Action research helps the researcher explore a practical problem with an aim towards developing a solution to a problem (Creswell, 2005). It directly addresses the problem of the division between theory and practice and integrates the development of practice with the construction of research knowledge in a cyclical process (Somekh and Lewin, 2006). It was introduced in the 1930s led by Kurt Lewin (Creswell, 2005). In the mid-1940's, he and his associates conducted action research projects in different social settings (Coughlan and Coughlan, 2002). It succeeded for a time in making the notion of collaborative research with stakeholders with a liberating intent a central interest of a broad range of social scientists (Brydon-Miller et al., 2003).

Coughlan and Coughlan (2002) described action research as in the following.

1) Action research focuses on research in action, rather than research about action. The central idea is that action research uses a scientific approach to study the resolution of important social or organizational issues together with those who experience these issues directly. It works using a cyclical four-step process of conscious and deliberate planning, taking action, evaluating the action, and leading to further planning.

2) It is participative. Members of the system which is being studied participate actively in the cyclical process.

3) It is research concurrent with action. The goal is to make that action more effective while simultaneously building up a body of scientific knowledge.

4) It is both a sequence of events and an approach to problem solving. As a sequence of events, it comprises iterative cycles of gathering data, feeding them back to those concerned, analyzing the data, planning action, taking action and evaluating, leading to further data gathering and so on. As an approach to problem solving, it is an application of the scientific method of fact finding and experimentation to practical problems requiring action solutions and involves the collaboration and co-operation of the action researchers and members of the organizational system.

Peter Reason and Hilary Bradbury (cited in Brydon-Miller et al., 2003) explained action research as:

A participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory worldview which we believe is emerging at this historical moment. It seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities.

From these descriptions, we can see action research has several characteristics. Some characteristics of action research can be explained as follows (Creswell, 2005).

1) *A practical focus*; the aim of action research is to address an actual problem in any situation/event. Thus, researchers study practical issues that will have immediate benefits for those situations/events.

2) *The researcher's own practices*; in this sense, researchers engage in participatory or self-reflective research in which they turn the lens on their own practices.

3) *Collaboration*; researchers collaborate with others, often involving co-participants in the research. These co-participants may be individuals within an organization or outside.

4) *A dynamic process*; researchers engage in a dynamic process involving iterations of activities (“spiral” of activities). The main idea is that researchers “spiral” back and forth between reflection about a problem, data collection, and action.

5) *A plan of action*; researchers formulate an action plan in response to the problem. This is used to present to participants, establish a pilot program, start several competing programs, or implement an ongoing research agenda to explore new practices.

The action research steps

The main processes of original action research by Lewin consist of four steps: planning, acting, observing, and reflecting (Creswell, 2005) that are repeated to solve problems or improve any process/situation continuously. Nowadays, researchers apply action research in many fields/scopes. There are many ways in which action research can be practiced in a particular setting. Some action research models are illustrated in the following.

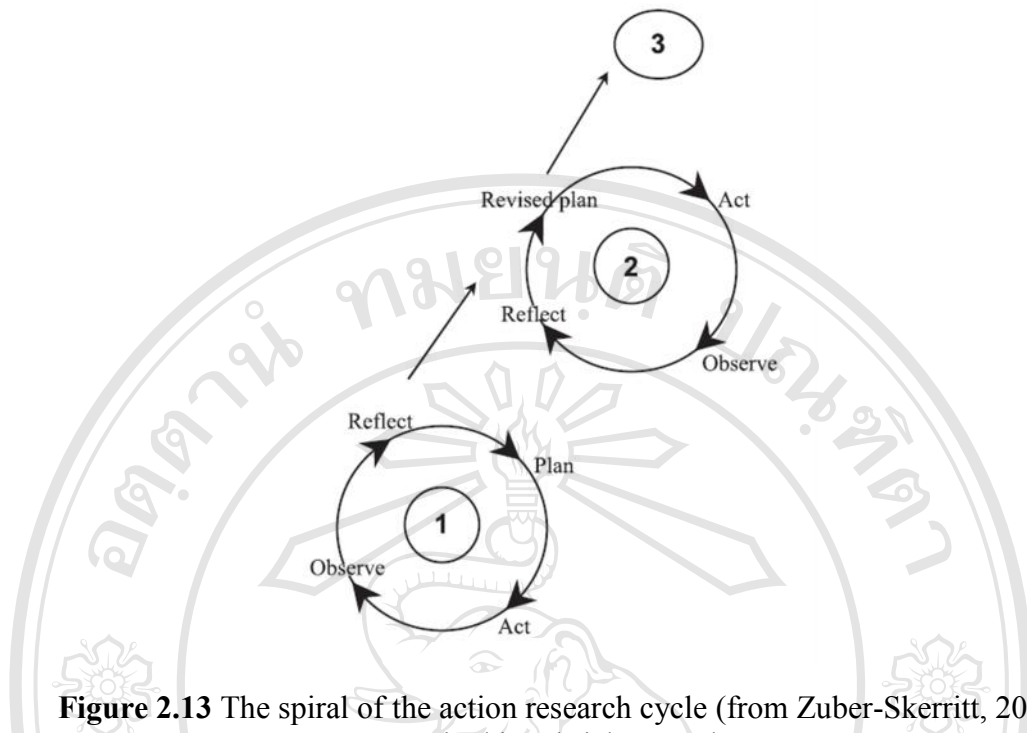


Figure 2.13 The spiral of the action research cycle (from Zuber-Skerritt, 2001)
Source: cited in Altrichter et al., 2002

Figure 2.13 shows a spiral cycles model of action research. This model is based-on Kurt Lewin's work where each spiral consists of four phases: planning, acting, observing, and reflecting. It is a simple, helpful model of a continuous and iterative process. It involves research and development, intellectual inquiry and practical improvement, and reflection and action (Altrichter et al., 2002).

Similarly, figure 2.14 shows a simple model of the cyclical nature of a typical action research process. Each cycle has four steps: plan, act, observe, and reflect. It is a cyclical process that never ends but always provides a conclusion with more ideas to help progress and improve (Yasmeen, 2008).

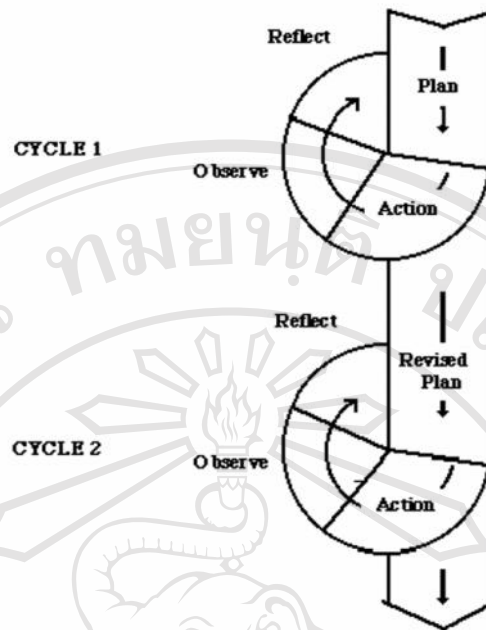


Figure 2.14 Simple action research model (from Dan MacIsaac, 1995)
Source: cited in Yasmeen, 2008

In figure 2.15 also shows spiral cycles of an action research model. It involves four main stages (Rowley, 2003). They are

- 1) *Diagnosis*; concerned with the identification of the issue (the focus for action)
- 2) *Planning action*; the stage that is concerned with planning the intervention
- 3) *Taking action*; the step during which plans are implemented and interventions enacted
- 4) *Evaluating action*; the step that offers the opportunity to focus on the outcomes of the intervention.

The review in evaluating action stage leads into the diagnosis stage of the next cycle of action research.

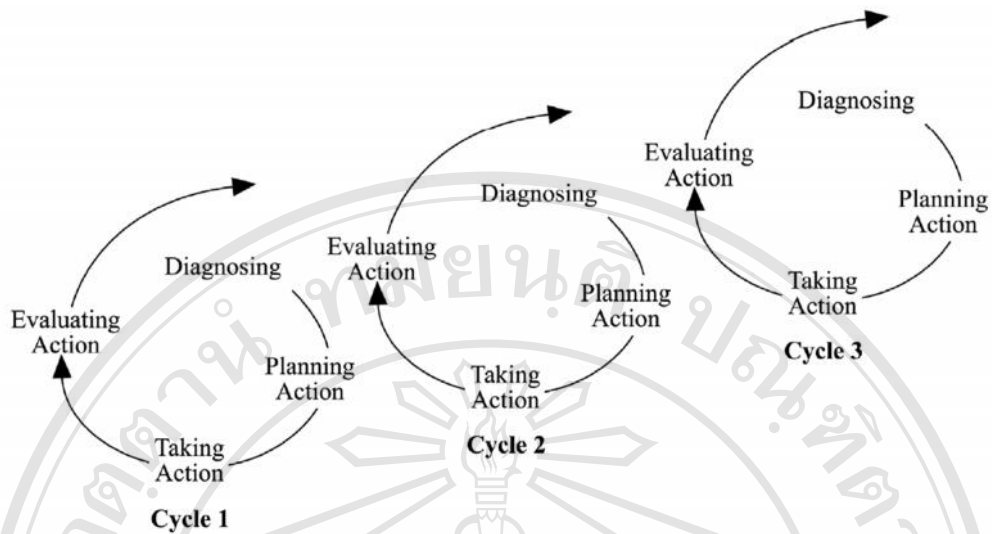


Figure 2.15 Spiral of action research cycle (from Coghlan and Brannick, 2001)
 Source: cited in McPherson and Nunes, 2002

The last model gives a somewhat more elaborate listing shown in figure 2.16. It has five phases conducted within each research cycle. It begins with identifying a problem followed by a collective postulation of several possible solutions, from which a single plan of action emerges and is implemented. Data on the results of the intervention are collected and analyzed, and the findings are interpreted in light of how successful the action has been. At this point, the problem is re-assessed and the process begins another cycle. This process continues until the problem is resolved (Yasmeen, 2008).

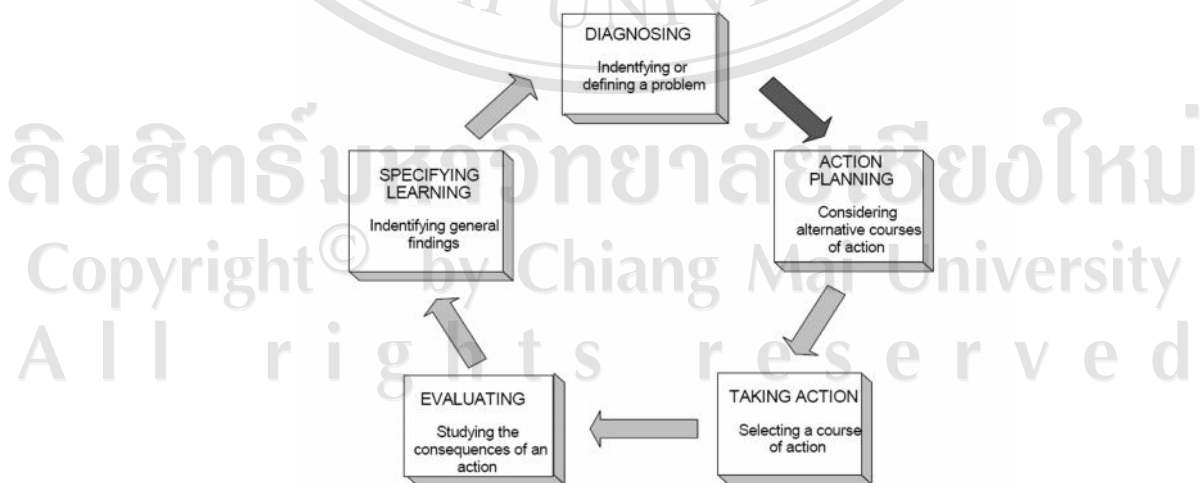


Figure 2.16 Detailed action research model (Adapted from Gerald Susman, 1983)
 Source: cited in Yasmeen, 2008

Although there are different words and processes used in some models, most of them have the same stages to perform the action research: plan, act, observe, and reflect in order to solve/improve problems/situations of interest.

This research will use these main processes of action research as a main principle to design methodology because it aims to solve problems that occurred with students and an industrial estate. It focuses on real practical problems. This kind of problem requires a continuous solving/improvement process. The research is concurrent with real action. Moreover, the researcher is a full participant and has co-participants including students and company mentors in this research. These initial characteristics fit with action research.

2.5.2 Grounded Theory

Grounded theory or “the discovery of theory from data” was first defined by Barney Glaser and Anselm Strauss in 1967 in a book entitled “The Discovery of Grounded Theory”. Some definitions of grounded theory follow.

“... a general methodology of analysis linked with data collection that uses a systematically applied set of methods to generate an inductive theory about a substantive area.” (Glaser, 1992, p.16, cited in Tan, 2010)

“... a qualitative research method that uses a systematic set of procedures to develop an inductively derived grounded theory about a phenomenon.” (Strauss and Corbin, 1990, p.23, cited in Tan, 2010)

It is a methodology used to generate theory where little is already known, or to provide a fresh slant on existing knowledge (Goulding, 1998). In other words, it is a set of methodological rules formulated with focus on the discovery of theory (Selden, 2005). It aims to generate theory by grounding that theory in data rather than verifying theory as traditional quantitative approaches do. The main and unique characteristics of grounded theory different from other qualitative research approaches (i.e., biography and ethnography) can be described in four elements as follows (Tan, 2010).

- 1) Theory is emergent from empirical data rather than from inferences or existing theories
- 2) The constant comparison method enables theory generation during systematic collective and analytic procedures
- 3) Memo writing is the formulation and revision of theory throughout the research process
- 4) The research process is flexible and creative

To performed grounded theory, typically 20-30 interviews were conducted based on several visits to the field to collect data continually until the categories are saturated (no more data can be found). A category is a unit of information composed of events, happenings, and instances (Creswell, 1998). Sometimes, observations and documents are also collected and analyzed. The analysis begins during data collection when the researcher goes out in the field to gather information, analyze the data, return to the field to gather more information, analyze the data, and so on. The constant comparative method of data analysis is used to be a process of taking information from data collection and comparing it to emerging categories. The researcher must ensure constant comparison is an ongoing feature of the process. This is where emerging themes are sorted on the basis of similarities and difference (Goulding, 1998).

The data analysis process of grounded theory research has four major steps described as follows (Creswell, 1998).

- 1) *Open coding*; the researcher forms initial categories of information about the phenomenon being studied by segmenting information. Within each category, the investigator finds several properties, or subcategories, and looks for data to dimensionalize, or show the extreme possibilities of the property on a continuum.
- 2) *Axial coding*; the investigator assembles the data in new ways after open coding. This is presented using a coding paradigm or logic diagram in which the researcher identifies a central phenomenon (i.e., a central category about the phenomenon), explores causal conditions (i.e.,

categories of conditions that influence the phenomenon), specifies strategies (i.e., the actions or interactions that result from the central phenomenon), identifies the context and intervening conditions (i.e., the narrow and broad conditions that influence the strategies), and defines the consequences (i.e., the outcomes of the strategies) for this phenomenon.

- 3) *Selective coding*; the researcher identifies a “story line” and writes a story that integrates the categories in the axial coding model. In this phase, conditional propositions (or hypotheses) are typically presented.
- 4) *Finally*; the researcher may develop and visually portray a conditional matrix that elucidates the social, historical, and economic conditions influencing the central phenomenon. This phase of analysis is not frequently found in grounded theory studies.

The analysis process of grounded theory will be adapted to analyze the qualitative data in this research. The data that were collected from interviews, observations, and group discussions are the main targets for analysis. The objective of this research is to create and study a co-op framework that impacts on students’ competencies. To construct and improve the co-op framework, and study students’ competencies progress, a lot of data needed to be collected and continually analyzed during implementation, such as the requirements of co-op from companies, the co-op students’ assessment results, and co-op feedback from company mentors. The information needed to be categorized in order to analyze and present a complete picture of the co-op program that impacted on students’ competencies. Moreover, the interrelations between each category are explained and some supporting events described. Thus, grounded theory will be the methodology used to analyze the research results.