CHAPTER V

DISCUSSIONS AND CONCLUSION

This study aimed to design pharmacy curriculum by identifying the competency needs and using quality function deployment approach. This study was conducted in three phases based on complete needs assessment process which were; competency needs identification; competency needs analysis; competency needs solution.

Therefore, this chapter described discussions and conclusions of the study. The sum up section then began with summarized and discussed about the competency needs identification: (1) pharmacy competency standard, and (2) competency needs assessment survey. The next part had briefly presented and discussed the results of competency needs analysis. In the last, it was summarized the results of QFD approach in pharmacy curriculum design and also were presented discussions of the process of QFD as well. Moreover, some recommendations were suggested for further studies.

Phase I. Pharmacy Competency Needs Identification

1. Pharmacy Competency Standard

1.1. Summary of Pharmacy Competency Standard

Pharmacy Competency Standard consisted of two types which were functional competency and core competency. The functional competency consisted of four competency domains; ensuring appropriate therapy and outcomes, selection and dispensing medications and health product; health promotion and disease prevention; health systems management. On the other hand, two competency domains had described core competency; professionalism and general ability

1.2. Discussion of Pharmacy Competency Standard

The pharmacy competency standards were developed based on the PPAC, professionalism concepts and general pharmacy abilities from the staff of faculties' point of view. As well as, they were designed regarding to the CU contexts. However, applying these standards to other institutions, it should be used with the more carefulness of suitability adjustment of the standards

2. Needs Assessment Survey

2.1 Summary of Pharmacy Preceptors Assessment.

2.1.1. The Level of Actual Pharmacy Competency

There were two types of pharmacy competency which were: (1) functional competency and (2) core competency. From the pharmacy preceptor assessment, it was found that the highest actual competency among all four domains of functional competency were the competency domain 3 (Health promotion and disease prevention), followed by the competency domain 1 (Ensuring appropriate therapy and outcomes) and competency domain 2 (Selection and dispensing medications and health product), respectively. .

Regarding to the core competency, it was found that the pharmacy preceptors rated the competency domain 6 (General ability) higher than the competency domain 5 (Professionalism).

When considering within functional competency, for competency domain 1 (Ensuring appropriate therapy and outcomes), it was found that the top three actual performances were 1) ability to search the documentation and research related to the patients' care, 2) ability to establish the relationship between the patients and the care givers, and 3) ability to work as a team, correspondingly.

For competency domain 2 (Selection and dispensing medications and health product), the actual performances of 1) ability to prepare ancillary labels or cautionary or advisory statements for patients, 2) ability to apply labeling to the product to optimize its stability and correct storage and use, and 3) ability to demonstrate

administrative technique for commonly used medicines were orderly the highest three ranks.

For competency domain 3 (Health promotion and disease prevention), the top three actual performances were 1) ability to search epidemiologic data of drugs and diseases from available sources, 2)ability to perform and distribute appropriate materials, and 3)ability to perform proposed projects or activities.

For competency domain 4 (Health systems management), the top three actual performances were 1) ability to analyze and assess the problem of performing professional in the ethical aspects, ability to analyze and assess the importance of professional role towards the society in the ethical and moral aspects, and 3) ability to analyze and assess the importance of professional role towards the society in the ethical and moral aspects.

With respect to core competency, competency domain 5 (Professionalism) and competency domain 6 (General abilities)), provided the same result that the top three ranks of the actual performances were 1) ability to listen, speak, read, write and use the computer for communication, 2) having diligence, be patient and generous, and 3) having the skill to present and exchange the ideas, respectively.

2.1.2. Priority Needs Index (PNI) from pharmacy preceptors assessment

In the consideration of functional competency, the 34 pharmacy activities of domain 1(Ensuring appropriate therapy and outcomes), 16 pharmacy activities should be reorganized. The top three ranks of such activities were 1) ability to analyze and assess for identifying the medication use problem, 2) ability to determine the difference of each medication for patient treatment, and 3) ability to select the appropriate medicine by formula and the quality to suit the disease and the state of the patient.

Then 43 pharmacy activities of domain 2 (Selection and dispensing medications and health product), and 23 pharmacy activities in domain 2 should be restructured. The top three ranks of the activities were 1) ability to manage

dispensing error, 2) ability to analyze drug-drug interaction, and ability to manage prescription error.

For competency domain 3 (Health promotion and disease prevention), there were 3 out of 10 competency activities that should be revised. The top three ranks of such activities were 1) ability to deliver health education to public-health personnel, 2) ability to manage knowledge with the health care professional, and 3) ability to use the surveillance information to promote safe medication use and prevent the problems of drug therapy and health product.

It was found that the 15 pharmacy activities in domain 4 (Health systems management), and 7 pharmacy activities should be improved urgently. The top three ranks of pharmacy activities were 1) ability to analyze and apply the Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects and the morality to perform the pharmaceutical profession to protect the consumers, 2) ability to apply the Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects, the activity statement number, and 3) ability to analyze and assess the problem of performing professional in the ethical aspects.

Regarding to core competency, results of competency domain 5 (Professionalism) and competency domain 6 (General Abilities) found there were 9 out of 16 competency activities that should be revised. The top three ranks of pharmacy activities were 1) well communicate in Thai and English, 2) identify the topic that would like to learn, and 3)be able to learn on your own effectively.

2.1.3. Matrix Analysis from pharmacy preceptors assessment

It was found that there were 7 numbers of pharmacy competency activities with low performance while the preceptors had high expectation(fell in quadrant). It could be explained that the activity performance was dissatisfied and required an improvement. Examples of these competency activities were "Ability to recommend or send the patient to any public health provider that was suitable and appropriate with the condition of patient and situation.", "Ability to identify additional examine the patient and follow up the medication use and the state of disease", "Ability to analyze and apply the Drug Act, Pharmaceutics Profession Act, the regulations on the

ethical and profession aspects and the morality to perform the pharmaceutical profession to protect the consumers", and "Ability to apply the Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects ."

2.2. Summary of Pharmacy Students Assessment
2.2.1. The Level of Actual Pharmacy Competency

From pharmacy students'self-assessment, the results showed that among four domains of functional competency, the highest level of the actual competency was competency domain 1(Ensuring appropriate therapy and outcomes). The second and third orders were the pharmacy competency domain 2 (Selection and dispensing medications and health product) and competency domain 4 (Health systems management), respectively. The students rated the competency domain 6 (General ability) higher than the competency domain 5 (Professionalism).

When considering within functional competency, it was found that the top three levels of the actual performances were "Ability to establish the relationship between the patient and the care givers", "Ability to communicate with the patient and the care givers", and "Ability to work as a team." "Ability to prepare medication from the prescriptions" "Ability to advice the patients in drug usage", and "Ability to prepare ancillary labels or cautionary or advisory statements for patients." were the highest three orders of the actual performances in competency domain 2 (Selection and dispensing medications and health product).

In competency domain 3 (Health promotion and disease prevention), the top three ranks of the actual performances were " Ability to advise changes for healthy behaviors to drug user and people", " Ability to perform and distribute appropriate materials", and" Ability to search epidemiologic data of drugs and diseases from available sources."

It was found that the top three ranks of the actual performances in competency domain 4 (Health systems management) were "Ability to analyze and assess the importance of professional role towards the society in the ethical and moral aspects", "Ability to analyze the role of graduate toward health problems", and "Ability to

analyze and assess the importance of professional role towards the society in the ethical and moral aspects."

Focusing on core competency, competency domain 5 (Professionalism) and competency domain 6 (General Abilities) had the top three ranks of the actual performances as "Having diligence", "Be patient and generous, and "Search and analyze drug information by him/herself."

2.2.2. PNI from Pharmacy Student Assessment.

When considering within functional competency, in competency domain 1(ensuring appropriate therapy and outcomes), there were 21 out of 34 competency activities that should be improved. The top three levels of competency activities were "Ability to select the appropriate medicine by formula and the quality to suit the disease and the state of the patient", "Ability to integrate the evidence-based medicine to evaluate the research paper", and "Ability to describe the disease and medication by using the communication ability and technique of giving an advice"

Obtained data revealed that the 43 pharmacy activities of Domain 2 (Selection and dispensing medications and health product), 25 pharmacy activities should be improved. The highest three ranks of pharmacy activities were "Ability to prepare or compound pharmaceutical products that meets the individual patient' need.", "Ability to adjust dose of drugs based on a specific patient.", and "Ability to adjust or change the type and dosage form of medication for the purpose of decreasing drug-drug interaction."

There were 5 out of 10 health promotion and disease prevention competencies (Domain 3) should be restructured were "Ability to plan and collect the community information regarding issues of economics, society and public health", "Ability to analyze health problems in community", and "Ability to select methods for reporting the surveillance information of drug therapy and health product problems of community" were the first three priorities of pharmacy activities

It was found that of 15 competency activities in domain 4 and11 competency activities should be improved urgently. The most important three orders of pharmacy

activities were "Ability to analyze and evaluate the external and internal factors that impact medication system", "Ability to provide consumer protection", and "Ability to manage medication system in health care institutes."

When considering within core competency, there were 9 out of 16 competency activities of both competency domain 5 (Professionalism) and competency domain 6 (General Ability) should be revised. The top three ranks of pharmacy activities was "Have conceptual thinking", "Well communicate in Thai and English", and "Ability to apply chemical reaction theory into the work related to pharmaceutical products"

2.2.3. Matrix Analysis from Pharmacy Student Assessment.

From needs assessment results, it was found that the clinical pharmacy students had rather high expectation from all 4 competency domains. When they evaluated themselves, the results had low level, so many competencies needed improvement.

Discussion of Competency Needs Assessment Survey

The results of the competency needs from pharmacy preceptors' view point indicated that competencies in domain 1 (Ensuring appropriate pharmacotherapy vs. outcome) and domain 2 (Selection and dispensing medications vs. health products), related to patient-oriented, and needed an improvement in order to meet the stakeholders' needs. This result was supported by Kapol's study which evaluated curricula contents in Thailand. She summarized Thai pharmacy schools should revise their curricula. Moreover, it may be useful to decrease the product-oriented content and expand patient-oriented material.

As determining the needs assessment survey process, some discussions had provided below;

1. The results of the competency needs rated by pharmacy preceptors were the level of the actual and expected competencies and gaps between them. Gaps could be indicated which contents were insufficient and should be further revised. .

2. Because of the use of two Likert-type scales with each representing one of two conditions (the expectation level of each pharmacy activity and the actual performance of each pharmacy activity) in competency needs assessment survey. It was obvious that the double-scaled formats were more complicated and were possible to lead to difficulties in data collection and analysis. Furthermore, there were many items in the questionnaire might led to a small return rate. So, that the use of alternative forms with fewer scales than the original survey seemed to be a reasonable strategy, one that eased response burden and might increase return rate (Lee, Altschuld, and White, 2007).

2.4. Importance Level of Pharmacy Competency Domains

From the finding of the weighted factor of the competency domain, using AHP during the phase 3 study and was evaluated by the faculty members, it was found that the order of the weighted factor's results is in line with the survey from the phase 1 study by the pharmacy preceptor and the fifth-year pharmacy students. It was summarized that the most-rated weighted factor is the competency domain number 1 (Ensuring appropriate therapy and outcomes), subsequently the competency domain number 2 (Selection and dispensing medications and health products) and the competency domain number 4 (Health system management); excluding the pharmacy students who had different opinions regarding the third and forth weighted factor's order, i.e. regarded the competency domain number 3 (Health promotion and disease prevention) more important than the competency domain number 4 (Selection and dispensing medications and health products). The above study is in accordance with a study conducted by Plaza, Draugaris, Slack , et.al (2007) who has applied the curriculum mapping technique to assess the Pharm.D curriculum at the University of Arizona College of Pharmacy (UACOP) during the 2004-2005 academic year. Their outcomes expected document composes of 5 domains which are domain 1(Ensuring appropriate therapy and outcome); domain 2 (Dispensing medication and devices); domain 3(Health promotion and disease prevention); domain 4 (Health system management); and domain 5(Professionalism). The evaluation of each course was found that the contents of PharmD curriculum emphasizes more on domain 1(Ensuring appropriate therapy and outcome), domain 2 (Dispensing medication and

devices), and domain 4(Professionalism), whereas the domain with least relationship between the contents and the subject is domain 3 (Health promotion and disease prevention).

Phase II Needs Analysis

2.1. Summary of Needs Analysis

The results of the competency needs in phase 1 indicated that the modification of contents related to the pharmacy competency in domain 1(Ensuring appropriate pharmacotherapy vs. outcome) and domain 2 (Selection vs. dispensing medications vs. health products), which were patient-oriented, had highly suggested to meet the stakeholders' needs. These results were in accordance with the study of Nattiya Kapol (2006), which concluded that the pharmacy curriculum should decrease the product-oriented content and expand to patient-oriented content.

2.2 Discussions of Needs Analysis

To identify factors associated with competency needs, the competency needs assumption in this presenting study was thoroughly specified as resulting from inefficient of study contents. By this reason, competency needs were likely to base on the curriculum. As well as, the competency needs should confirmed by the other study. The competency needs results in the presenting study were then compared with the results from Kapol's study. The Kapol's study differently used course syllabi and surveyed course coordinators for data collection. However, this was a limitation of her study because data were collected from a broad range of coordinators, and the accuracy of their assessment of curriculum content might varied, ie, some coordinators may sit through all the course material with their students and be more knowledgeable about details of the course contents, while other coordinators may only attend some lectures in the courses. This presenting study, on the other hand, was a survey research using dual-response format questionnaire. The questionnaire was developed based on PPAC which had more details about the pharmacy activities. Furthermore, if insufficient competencies had recognized, identification of related course contents would be likewise achieved.

Phase III Needs Solution

3.1. Summary of Needs solution

The new course contents had interpreted and developed from functional competency. Pharmacy competencies priority ranking by the faculty members were the competency domain 1 (Ensuring appropriate therapy and outcomes), domain 2 (Selection and dispensing medications and health product), domain 4 (Health systems management), and domain 3 (Health promotion and disease prevention), correspondingly.

After finished all processed of QFD approach, the analysis of the HOQ was conducted and then proposed the Pharm.D curriculum model. Subsequent to the HOQ analysis, the following "courses" were found to be the most important and need to be considered on the curriculum design which were pharmacotherapy, pharmacy practice and pharmacology.

3.2. Discussion of QFD

This study is a development of the Doctor of Pharmacy curriculum employing needs assessment (NA) technique together with Quality function deployment (QFD) approach, which is the first time such technique has been applied in the curriculum development for 6-year Bachelor in Pharmacy program with 233 total credit hours. From previous study, it was found that QFD has been applied in the curriculum design of Bachelor of Engineering, Chulalongkorn University by being used in the design of Industrial Engineering courses or in the short-term 2-to-3-year curriculum (Pukcarnon, 2003), for instance, supply chain management curriculum (Gonzalez, Quesada, Gourdin, 2008), management information system curriculum, or in the biostatistics course. However, QFD is a new technique and a few have been applied in the education field, as well as it involves many working steps. Therefore, three main aspects of this curriculum design should be taken into consideration – Input for curriculum design, process of curriculum design, and output for curriculum design.

A. Inputs for curriculum design

1. Pharmacy competency standard

In this study, the researcher has applied QFD approach in the design of PharmD curriculum at the stage of specifying the stakeholder' s needs. To modify this concept in the curriculum design, the research has replaced the search for stakeholder's needs with the pharmacy competency standard, in which pharmacy competency standard has been developed from the stakeholder's expectation from the graduates. Nevertheless, the application of this pharmacy competency standard has certain limitations as follows:

1.1. The indirect relationship between the pharmacy competency and contents element of biomedical sciences.

The newly developed pharmacy competency was based on PPAC (Pharmacy Practice Activity classification) which is in accordance with a research done by Draugalis, Slack, Sauer, et.al (2002) who wrote the pharmacy competency for Doctor of Pharmacy curriculum basing on PPAC as well. From the research on Draugalis's research, his created competencies were cited as follows: "this competency standard does not include knowledge of the basic science or general abilities that are required to perform competency. However, faculty member should be able to relate basic sciences knowledge to specific competencies." which is also in accordance with our research. This is because when considering the house of quality for biomedical sciences and clinical sciences, it was found that the biomedical sciences knowledge received low score in the importance of knowledge. Since the relationship score between the knowledge and competency was at the low level (score = 1), the cause should arise from the fact that the content of the biomedical sciences course did not directly create the pharmacy competency. The relationship between the competency and contents of the biomedical sciences could only tell that the connection exists, whereas the clinical sciences or pharmacy practice knowledge was a directly related content that creates the pharmacy competency, hence resulted in high relationship between the contents and competency (score = 2, and 4).

To build the house of quality, this study has combined the biomedical sciences and clinical sciences knowledge into the same house of quality matrix, to assist in the search for the relationship between the basic contents and the clinical sciences

contents. In addition, it also enables the coordinator of the biomedical sciences course to see the link to which pharmacy competency the course taught was aimed. In the case to calculate it into credit hours, we need to build another secondary house of quality matrix having the direct pharmacy competency in biomedical sciences.

1.2. New pharmacy competency were directly to patient-oriented topic only

The design of the pharmacy contents will take the competency into account at the activity-level, which is a sub-level presenting the detailed roles of pharmacy profession, thus results in a large number of pharmacy competencies. The pharmacy competencies used to build the pharmacy contents are PPAC-based competencies, which focus on pharmaceutical care especially in health care setting in hospital and drug store whereas other health care setting such as in pharmaceutical industry, public health, and academic are not yet covered in the PPAC. These pharmacy competencies emphasize only on domain 1 (Ensuring appropriate therapy and outcomes), which were developed by referring to the framework described by Cipolle, Strand, and Morley for pharmaceutical care (Cipolle, Strand, and Morley, 1998). When transferring the contents of new pharmacy competency standard, the importance score of the clinical course is high. In contrast to the social and administrative pharmacy-oriented topic, the importance score of social and administrative pharmacy courses is low because the topic contents are relatively abstract. Conducting activities in this pharmaceutical field require various knowledge and skills, therefore, it is difficult to cover all social and administrative pharmacy-oriented activities for the Bachelor Degree and since it was not detailed adequately for the transform of the social and administrative pharmacy contents, its important score is thus lower than it should be. Even the current Bachelor in Pharmacy program also faces the problem regarding the graduate's ability in social and administrative pharmacy, having inadequate knowledge about social and administrative pharmacy to work in practice settings (Panucharus and Chalongsak, 2005).

1.3. Pharmacy competency statement is subjective

It is difficult to develop the pharmacy competency in patient care practice because each patient has different disease and thus different analyzing context. The

scope and the depth of the contents are also difficult to judge and some competencies may be insufficiently clear. Problems faced are, for example the understanding of the staff of faculty team about the meaning of each competency is inconsistent, as well as the proper scope of teaching is different from teaching the product-oriented pharmacy competency, which is objectively processed and the required knowledge is obvious.

2. Understanding and acceptance problem of QFD team

Since the application of QFD to design the curriculum is a new approach to the staffs of faculty, this will take times for understanding the concept and how to apply it. In addition, the curriculum design process includes many small meetings and some will require longer times for brainstorming and the attendants are not specified, therefore, consistency can be a problem.

3. Visio-QFD program

This research uses Visio-QFD program in the integrating process to build the house of quality matrix. Given that the program has already specified the input data of each stage and the program's working steps, the researcher had to collect the data that is in line with the Visio-QFD program (Yoshida, 2008). For instance, the competency weight factor of each pharmacy domain is assigned by the program to input only one set of numbers. The AHP calculation program, which is a rather complicated questionnaire, makes the researcher to recollect the data from the staffs of faculty instead of using the data collected from the needs assessment questionnaire in phase 2 of this study. Moreover, the calculation of the relationship score between the contents and competency, which is the consecutive set of numbers, the researcher had to transform the numbers into code to input them into the program.

B. Process of QFD

1. House of quality is huge and difficult to translate

Due to during the building of the contents, the staffs of faculty has categorized the contents which were translated from the functional competency into 58 courses, resulted in a very large and complex house of quality. One of the problem of QFD process is that there is always a need to input and analyze large amount of subjective

data for which the subsequent HOQ can become very large and complex (Olewnik, 2008; Shahin and Shan, 2006). Crow (1996) recommended that an individual HOQ matrix should not address more than 20 or 30 items on each dimension of the two-dimensional relationship matrixes. If the number of needs or requirement exceeds 20 to 30 items, the matrix should be decomposed into smaller modules or subsystems in order to reduce the number of requirements in the matrix to keep it manageable (Crow, 1996). From the abovementioned limitation of the QFD technique, the researcher has designed the house of quality into 3 smaller houses – house of quality for pharmaceutics sciences, house of quality for clinical sciences and biomedical sciences, and house of quality for social and administrative pharmacy sciences – in order to limit the size of the house. These three houses of quality have been designed from the same pharmacy competency, differing in each field of contents; hence the results obtained from these houses of quality are the importance scores of the course from the three houses and are able to make comparison.

### 2. Problem at the stage of transforming the contents

In this study, the pharmacy competency is classified into two types – the functional competency and the core competency. The research has designed the contents based on the functional competency and the instruction method based on the core competency; this is where the staff of faculty has misunderstood the concept. For example, in pharmacology class, the students have been assigned to search for data and write a report, our study interprets that the instruction method by assigning the research leads to the core competency outputs whereas the contents of Pharmacology class lead the functional competency outputs. At this point the staff of faculty may misunderstand and cause the inaccurate evaluation of the relationship between the course's knowledge and contents.

3. Subjectivity of data

In the translation process from pharmacy competency into the course contents, since the pharmacy contents compose of the biomedical sciences which is the basic sciences, and the clinical sciences which relates to pharmacy practice, the relationship between the contents and the competency therefore has 2 levels of relationship

(1) The contents has direct association with the competency, i.e. the contents yield direct competency output such as pharmacotherapy course

(2) The contents has indirect effect to the competency, i.e. the competency output does not come from the course but the course is a base for the students to learn the practice courses leading to such competencies such as the Pharmacology and Medicinal Chemistry courses as exemplified the competency and the course in the following diagram:

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┌──────────────┐
│ Pharmacology │──────┐
└──────────────┘      │    ┌──────────────────┐      ┌──────────────┐
                      └──► │ Pharmacotherapy  │────► │   Output     │
┌──────────────┐      ┌──► └──────────────────┘      │ (Competency) │
│  Medicinal   │──────┘                              └──────────────┘
│  Chemistry   │
└──────────────┘
```
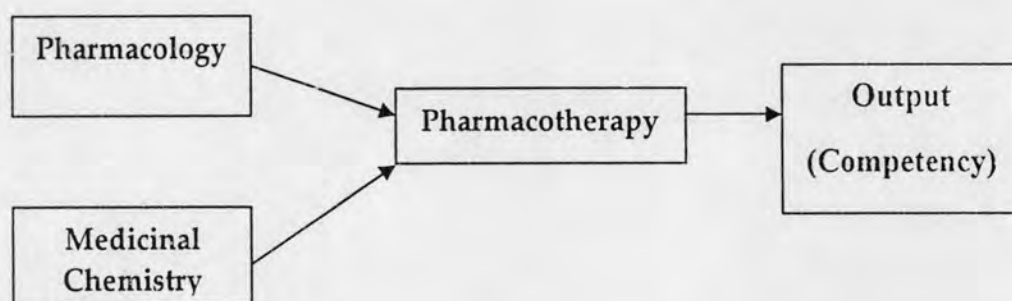
Figure 5.1 Course and competency output relationship

During the process asking the staff of faculty to assess the courses, which competencies relate to which courses, since the aforementioned different kinds of relationship may lead to different opinions and understanding about each competency among the staffs of faculty, the result of relationship between the contents and competency may be displaced.

4. Limitation of the house of quality in providing quantitative information

Because of the limitation of the house of quality in providing quantitative information that may affect the decision in mistakenly designing the products/services, a study by Olewnik, Andrew (2007) summarized that "in the house of quality building process, the limitation may result from the attempt to specify quantitative relationships in the mapping of customer attributes to technical attributes". In addition to the above limitation, there are also other limitations such as ambiguity in the voice of customer, need to input and analyze large amounts of

subjective data (Martin and Aspinwall, 2001; Chan and Wu, 2002). Therefore, other researches studying the QFD techniques are the type that attempts to reduce the limitation of QFD technique by using other techniques together with QFD, for example, fuzzy logic, artificial neural networks, and taguchi method techniques. In this study we have specified the relationship between the pharmacy competency and the contents by using the frequency from the staff of faculty's assessment, to increase the creditability of the detailed and systemized thinking process when transforming the qualitative information into quantitative information. Nevertheless, this approach also has some limitations as follows: 1) some certain course may have more than 1 lecturer, by allowing the course coordinator to make assessment may result in inaccurate data, 2) difference in writing the course's learning objectives, some courses have comprehensive objectives about contents and skills whereas some other courses have only overview objectives. From such kind of data, some knowledge data may be mistaken, even if the experts had already adjusted the codes, it is still the subjectivity data. From this drawback, the researcher suggests that in order to obtain more accurate data, the assessment of the competency and objectives should use brainstorming method by the lecturers or if one course has one lecturer it should be in the form of meeting by relevant experts. The meeting will encourage mutual understanding about the working process and the definitions used by the experts and will consider the relationship between the contents and pharmacy competency using specified codes to indicate the relationship level, thus resulting in more precise information.

C. Output of the QFD Approach

1. House of Quality for pharmacy curriculum

Based on the evaluation of curricula contents by Kapol (2008) some problems were found in the previous 5-year curriculum of the Faculty of Pharmaceutical Sciences, for example, the contents emphasized on product-oriented material, the content ratio of patient to product to social and administrative pharmacy in Bachelor in Pharmacy program was 2:3:1, respectively. However, the content ratio suggested by the Thai pharmacy council was 3:2:1, respectively. Thus, this resulted in the need to increase the clinical program and decrease the credit hours in product-oriented

program (Kapol, 2008). She also recommended that to improve the Pharmacy curriculum, patient-oriented content should be emphasized. The most important content should be emphasized is the competency to provide pharmaceutical care while the product-oriented content should focus on product differentiation, and extemporaneous and general preparation. From such evaluation, in this study the researcher has attempted to adjust the model curriculum by emphasizing on clinical content whereas the product-oriented content will focus on enabling the students to apply their product-oriented knowledge with the patients and not focus on skills in special product preparation. The analysis results of the house of quality matrix regarding the content importance in each field are as follows:

1.1. HOQ of the biomedical science and clinical science content

Because the biomedical science content is foundation of pharmaceutical knowledge and the pharmacy competency was not able to directly transform into basic knowledge, we thus will consider only what competency the biomedical science content is leading to. The result obtained from the QFD process is the importance of course's score and is unable to be calculated into the number of credit hours. This curriculum design will thus use the same number of credit hours as specified by the Pharmacy Council, i.e. 31 credit hours. As for the content of clinical science which is under the same house, the transformation of the pharmacy competency into the clinical science content results in 23 knowledge group and is 74.4% important to all specialized academic knowledge which were: clinical science, pharmaceutical sciences, social and administrative sciences.

1.2. HOQ of the Pharmaceutics sciences content

The transformation of the pharmacy competency into the pharmaceutics sciences' content results in 16 pharmaceutics sciences' knowledge group and is 20.9% important to all specialized academic knowledge.

1.3. HOQ of the social and administrative sciences content

The transformation of the pharmacy competency into the social and administrative sciences' content results in 4 social and administrative pharmacy

sciences' knowledge group and is 4.7% important to all specialized academic knowledge.

When comparing the ratio of the three knowledge group, patient-oriented, product-oriented, and social and administrative pharmacy (SAP)-oriented content, the result is 74.4 : 20.9 : 4.7 or 15:4.5:1. The ratio obtained from the house of quality matrix is not in accordance with this ratio of the three knowledge group, the Pharmacy Council has specified the ratio among the patient-oriented, product-oriented, and social and administrative pharmacy (SAP)-oriented at 3:2:1. This is for the fact that the model curriculum focuses on responding to the needs of the stakeholder, in this study representing 3 groups – pharmacy practitioners, instructors, and clinical pharmacy students. At this point the stakeholder's needs from the curriculum are replaced with the patient-oriented pharmacy competency which is different to the existing pharmacy curriculum design that must consider both the product-oriented and patient-oriented practice. As a result, the designed model curriculum is different to regular pharmacy curriculum.

Comparison of the credit amount from House of Quality, Pharmacy council, and Naplex

The result of the study of HOQ had presented in the ratio of the importance weight of each pharmacy body-of- knowledge (Table 5.1):

Table 5.1 The comparison for the credit proportion

No.	Pharmacy body-of-knowledge	House of Quality		Pharmacy Council		Naplex	
		Ratio	Credit	Ratio	Credit	Ratio	Credit
1	clinical science	16	71	3	48	5	47
2	Pharmaceutical Sciences	4.5	20	2	32	3	35
3	Social and Administrative Sciences	1	5	1	16	1	14
	Total	20	96	6	96	9	96

The results from HOQ showed that Patient-, product-, and SAP-oriented contents ratios were 16: 4.5: 1 in Pharm.D. curriculum. This study results were different from the Thai pharmacy council criteria (3:2:1) and the NAPLEX criteria (5: 3: 1). It was because the characteristics of Pharm.D. curriculum, which mainly emphasized patient-oriented. Furthermore, the model curriculum focused on responding to the needs of the stakeholder, in this study representing 3 groups – pharmacy practitioners, faculty members, and clinical pharmacy students. At this point the stakeholder's needs from the curriculum were replaced with the patient-oriented pharmacy competency which was different to the existing pharmacy curriculum design that must consider both the product-oriented and patient-oriented practice. As a result, the designed model curriculum was different to regular pharmacy curriculum.

When calculating the amount of credit of the courses in HOQ, it was found that the amount of credit of clinical sciences, pharmaceutical sciences and social and administrative sciences were 71credits, 20 credits and 5 credits, respectively. The results of this study differed from the amount of credit specified by the Thai Pharmacy Council on the course of clinical sciences, pharmaceutical sciences, social and administrative sciences which were 48 credits, 32 credits and 16 credits, respectively.

2. Proposed pharmacy curriculum model

This curriculum model, using the QFD approach, was built for the Pharm.D pharmacy undergraduate. The creation of this QFD curriculum differs from the other traditional way of creating the curriculum. The traditional way is based on the meeting of the faculty members who are expert in each field to set the goal of the curriculum and draft the curriculum structure, after that, the honorable members will further revise the draft. From this traditional way of creating the curriculum, the data is a qualitative data and has no clear-cut working process, thus it is difficult to verify back the quality of the curriculum. On the other hand, the QFD approach has an explicit concept and steps, it also forwards the qualitative data which is the detail of the curriculum and transforms the qualitative data into the quantitative data to assist in the ordering of the subjects in the House of Quality, as well as verifies back the accuracy of the curriculum whether it can respond to the stakeholder's needs (i.e. the pharmacy competency) or not. Nevertheless, to create the curriculum using QFD approach is complicated and consumes both time and patience of the QFD team, thus its advantages and disadvantages should be taken into consideration before use.

The application of QFD approach with the Pharm.D curriculum design yields 2 parts of curriculum which are pre-pharmacy curriculum and professional curriculum. The pre-pharmacy curriculum is an introduction to the learning contents of pharmacology, consisting of the basic courses such as mathematics, sciences, biomedical science. Whereas the content for the professional phase will be profession-related contents, herein the clinical science content is directly related to the Pharm.D. curriculum, the example of important courses are Pharmacotherapy which is an integral of the pathophsiology, pharmacology, medicinal chemistry, therapeutics and is taught using case studies. The students must attempt to use the knowledge learned from the biomedical sciences, pharmaceutics, and clinical sciences to solve the problems in these case studies. As for the pharmacy practice content, the content is based on the concept of pharmaceutical care and several pharmacy clinical skills such as counseling of medicine usage, basic physical examination, reading of the laboratory analysis, and other fundamental disease diagnosis within the pharmacy-profession scope. In addition to the clinical sciences content, the curriculum also

composes of the pharmaceutics sciences content, focusing on the student's ability to apply the pharmaceutics sciences knowledge to help prescribers and patients make the best use of medicines and prevent, identify, and solve drug therapy problems. Social and Administrative Pharmacy content that the students should learn is the law and other administrative pharmacy.

D. Strengths of the study

1. The pharmacy profession is a specialized field having its own knowledge and skills, its curriculum design thus is emphasized as the competency-based curriculum which is appropriate to the pharmaceutical profession. In the curriculum design to develop the pharmacy competency, Lowenthai (1977) suggested the following steps in curriculum development 1) the examination of the pharmacy competency used in the curriculum design 2) the selection of the content based on the competency and specifying it as a course's content 3) the specification of the course's objectives 4) the arrangement of the course's order. Our research method is compliant with these steps in curriculum development, but different in the application of the needs assessment technique with the stage of examining the pharmacy competency used in the curriculum design and application of the QFD technique with the stage of selecting the content.

2. This research has applied the needs assessment technique together with the quality function deployment in curriculum development, in order to minimize the limitation when using the quality function deployment technique at the stage of searching for the stakeholder's needs, which may cause ambiguity and confusion (Bouchereau, and Rowlands, 2000). Since this needs assessment technique requires a systemized process and steps, at the stage of searching for the stakeholder's needs, the researcher has applied the needs assessment technique to specify the pharmacy competency of expected graduates and employed the specification of the pharmacy competency needs in the research. In addition, the researcher employs 2 types of the data analysis technique, which are the PNI calculation and the matrix analysis. The PNI is an index telling the high or low level of importance, thus providing the detailed information of the needs that should be repaired; whereas the matrix analysis provides

the information divided by the data group, which is helpful in planning the improvement.

3. The process of the QFD technique works as a guideline for the curriculum design team to work in a clear sequential step, have the documents and information at each step, and enhance the communication among the staffs of faculty. Furthermore, the information obtained from this QFD process has been used to build the house of quality matrix, which provides quantitative data for the staff of faculty. The data analysis of the house of quality will be needed to validate the curriculum in order to stipulate the strategy for curriculum design to match with the stakeholder's needs and to allocate the resources – time and personnel – efficiently. This QFD technique is also easy to use to revise and update the curriculum by analyzing the house of quality matrix, for instance, when the stakeholder needs more Pharm.D pharmacy's competency in the medicine preparation area, the staff of faculty is able to consider from the house of quality matrix and analyze the information about the courses relevant to this competency area to further plan the curriculum revision.

4. The curriculum design's process by applying the QFD technique has high flexibility and is not fixedly defined, depending on the objectives and results needed from the research. Thus, the curriculum design can be adjusted according to each curriculum development. In this research at the designing process of the pharmaceutical curriculum, the analysis of sub-activities or the pharmacy-competency operations has been conducted and then translated into a proper learning content. The resulting curriculum therefore is very high detailed; which created a research about the application of QFD technique in the development of pharmacy curriculum that provides more detailed and clearer curriculum.

E. Limitation of the study

When interpreting the results of this study, following limitations should be mentioned.

1. Difficulty in inviting the pharmacy instructor to join the research

Because the development of Pharm.D curriculum requires cooperation from the staffs of faculty in collecting the data and brainstorming to develop the contents and instruction method several times, however, due to the limitation of the staffs of faculty in many ways such as the different ideas about the curriculum development, the misunderstanding of the working process of the QFD, including the limitation in times of the staffs of faculty to attend the meeting, thus, their cooperation to work may be limited.

2. Limitation in time

The Thai Pharmacy Council has issued the regulation regarding the certification of the Pharmacy Degree in 2008 that only the students graduated from the 6-year program and have been trained in pharmaceutical practice not less than 2,000 hours have the right to apply for the test of pharmaceutical profession certificate. Consequently, the faculty of pharmaceutical sciences of Chulalongkorn University had to open the 6-year Pharm.D program in 2009 and the research must be urged to be able to develop the curriculum in time for the study. Therefore, in this curriculum development the researcher chose to design only the contents of the curriculum.

F. Recommendation

The development of the Pharm.D curriculum using both QFD and needs assessment techniques is to develop the curriculum that is able to respond to the needs of the stakeholders, to satisfy the stakeholders the most. The needs assessment technique has been applied during the stage of identifying stakeholder's needs in order to reduce the ambiguity, by applying it into the development of pharmacy competency and searching for the needs to develop the pharmacy graduate's competency. From the experiment results of such curriculum development, recommendations for those who develop the curriculum design approach are as follows:

1. This study had been produced the patient-oriented pharmacy curriculum under the contexts of the Faculty of Pharmaceutical Sciences, Chulalongkorn University. To achieve the highest level of usefulness, applying of this curriculum, should concern of adjusting programs of study to suit with different environments.

2. The curriculum model.

From the curriculum model in the presenting study, the components of curriculum that the researcher designed was scoped only the pharmacy competency and courses. This study did not cover the instructional method and course evaluation. Therefore, to apply this curriculum model in the real academic organization, the consideration of this curriculum with their teaching approach should be further conducted.

3. The application of the QFD technique in curriculum design is different to the application of this technique in product development because the data in curriculum design is more subjective and each area's curriculum may possess different knowledge's nature and complexity, differing from the product design that is more concrete. The modified QFD approach should be conducted. Furthermore, the researcher may develop the curriculum design by using other approaches or techniques to minimize this subjective problem.

4. The curriculum development requires cooperation from several parties; therefore someone should be responsible in assigning the tasks, in order to accelerate the process and obtain the right curriculum as needed. Furthermore, the process should be well planned and foresaw the potential problems and develop a back up plan in the case the plan is failed.

5. The study of pharmaceutical sciences changes over time, the curriculum design team should study and update the curriculum information and linking them with the current curriculum.

G. Further Study

1. This presenting study had primarily designed, using QFD, only the courses responding to the pharmacy competency and the course structure without concerning the design of the contents in details. Therefore, further study should designed course contents in details, in order to accomplish the complete results.

2. Validation of the new curriculum model did not conduct in this study. As a result, further study would remarkably suggested to develop the methodologies for curriculum validation in order to obtain a satisfied curriculum.

3. In this study the researcher has designed, using QFD, only the contents responding to the pharmacy competency yet still lack the design of instruction method to create required competency for the pharmacy students. Therefore, in further study there should consist of the design of instruction method together with the contents, in order to illuminate a picture of connection between the contents and instruction method and the competency.

4. Further study is able to use the content data obtained from this study to plan the next course design. For example, in the development of each course if the researcher requires results from the house of quality to be the detail of elements within the courses such as the contents, instruction method, the multimedia, the learning assessment, the researcher is able to build the curriculum design process for such course. This will be the research paper regarding the use of QFD technique in the development of courses in certain areas.

5. From this study, when building the house of quality for biomedical sciences and clinical sciences, the designed pharmacy competency is unable to be translated into the content for the biomedical sciences course and requires separate competency for biomedical sciences. Thus, for further study this should be taken into account and may design the research for the core courses separating from the specialized courses so that the research is more accountable.

6. This study has applied the QFD technique with the needs assessment in developing the PharmD curriculum, which will benefit the education community to apply both concepts together when developing the curriculum for other areas or the courses that are able to respond to the needs of that area's stakeholder and satisfy them the most. Furthermore, this QFD technique can be used with other techniques such as the taguchi method or neutral network in the curriculum or course development as well.