CHAPTER IV

RESULTS

The study results were presented in four phases which the first three phases were the results of competency needs identification; competency needs analysis, and competency needs solution. The last phase was proposed Pharm.D. curriculum. In the first phase, identification of competency expectations was summarized. Furthermore, the results of needs assessments survey from the two evaluators, the pharmacy preceptors and the pharmacy students, were presented. In the second phase, needs analysis, the results of competency needs from needs assessment survey were confirmed by other study. The third phase was the results of pharmacy curriculum design using quality function deployment approach. Finally, the proposed Pharm.D. curriculum was presented.

Phase I: Competency Needs Identification

1. Identification of Competency Expectation

The pharmacy competency standard was written by the faculty members based on Pharmacy Practice Activity Classification (PPAC), professionalism concepts and general pharmacy abilities. After that, the pharmacy competency standard was adjusted by the view points of pharmacy practitioners using focus group technique. The class of pharmacy competency standard was divided into 3 levels, which were:

1. Primary level: A competency domain or field of activity, which is the required qualification of entry level, generalist pharmacists, divided into 6 domains which were; first, ensuring appropriate therapy and outcomes; second, selection and dispensing medications and devices; third, health promotion and disease prevention; fourth, health systems management; fifth, professionalism and sixth, general ability

2. Secondary level: A competency level or classes of activities is a sub-class of Class one. This competency activities distributing into sub-activities/steps is a division by knowledge, skills, or attitudes in each different categories, which can be divided into 24 classes of activities.

3. Tertiary level: Activities or Interventions is a sub-class of Class 2. Labels for sets of specific behaviors that, based on their professional knowledge and clinical judgment, pharmacists engage in as a part of their professional practice to enhance patient care and outcomes. This class is classified into 118 activities. The detailed of pharmacy competency standard were presented in Appendix E.

Example of pharmacy competency standard

Domain 1; Ensuring Appropriate Therapy and Outcomes

Competency 1.1; Competency to gather the information for patient's medication use

Activities;

1.1.1 Ability to interview the patient or patient's representative

1.1.2 Ability to read the patients' medication history

1.1.3 Ability to read and interpret the basic lab result for the preliminary physical examination

2. <u>Needs Assessment Survey</u>

Survey research by questionnaire was used in this phase. The questionnaire was developed in order to identify the expectation level and the actual performance of undergraduate pharmacy competency. This phase used Priority Needs Index (PNI) to evaluate the gaps between the expectation competency and actual performance and weighted by expectation competency as presented in the PNI formula. In other words, PNI is the measurement of the statistic index ranking from the highest important needs to the lowest important needs. The higher PNI score, the lower ability level.

The PNI formula was:

$$PNI = (I - D) \times I$$

Where; I = Importance (The expectation level of each pharmacy activity)

D = Degree of success (The actual performance of each pharmacy activity)

In this study, the researcher set the cut-off scores at the mean score of the PNI of each competency domain.

Pharmacy competency was grouped into two types which were; functional competency and core competency.

1. Functional/Professional competency means specialized qualification as pharmacists which graduates in other areas do not possess or may possess some similar qualifications but not all. For pharmacist, functional competency consisted of 4 domains which are:(1) ensuring appropriate therapy and outcomes; (2) selection and dispensing medication and health products; (3) health promotion and disease prevention; and (4) health system management;

2. Core competency means basic qualification in regular management which helps promote more efficiency in functional competency. It consisted of two domains which were: professionalism and general ability.

The components of new pharmacy competency standard were briefly presented in Table 4.1

Table 4.1 The Components of Pharmacy Competency Standard

Domain	Activity items
Functional competency	**102**
1. Ensuring appropriate therapy and outcomes	34
2. Selection and dispensing medications and health product	43
3. Health promotion and disease prevention	10
4. Health systems management	15
Core competency	**16**
5. Professionalism	3
6. General ability	13
Total	**118**

This phase consisted of three parts; first and second, survey of needs from pharmacy preceptors' assessment, and the fifth year of clinical pharmacy students' self-assessment; third, the importance level of each pharmacy competency domain from needs assessment survey. These three parts were as follows.

2.1. Pharmacy Preceptor Needs Assessment Survey

2.1.1 Respond Rate and Characteristics of Pharmacy Preceptor

Sixty questionnaires were distributed to 23 hospitals. Because one pharmacy preceptor could assessed the undergraduate competency more than one pharmacy undergraduates thus 45 (75%) questionnaires were returned from 19 hospitals with 26 pharmacy preceptors. Of the 26 pharmacists, more than half of them were female (84.6%). Forty-nine percent of them were less than 31 years old, and eighty-one percent of them had a master degree. The results were presented in Table 4.2.

Table 4.2 Characteristics of responded pharmacy preceptors

Variables	N	%
Gender		
Male	4	84.62
Female	22	15.38
Education level		
Bachelor degree	6	23.10
Doctoral degree	20	76.90
Age		
Less than 31 years old	11	42.31
31 to 40 years old	10	38.45
41 to 50 years old	5	19.23
More than 51 years old	-	-

2.1.2. Overall needs results of six competency domains from PNI and Matrix Analysis

2.1.2.1 PNI across Six Competency Domains

Overall needs of undergraduate pharmacy competency were summarized in Table 4.3. The results showed that among all four domains of functional competency group, the PNI of pharmacy competency in Domain 1(Ensuring appropriate therapy and outcomes) was 2.86. It was the highest PNI among four domains. The second and third priory ranks were the pharmacy competency Domain 2 (selection and dispensing medications and health product) and Domain 4 (Health systems management. Their PNI were 2.70 and 1.53, respectively. For core competency, it showed that there was not a difference of PNI for both domain competencies. Their PNI were 2.64 and 2.63, respectively.

Table 4.3 Needs results of undergraduate pharmacy competencies across six domains from pharmacy preceptor assessment

No	Pharmacy competency Domain	Actual Performance		Expected Level		Needs Assessment
		Mean	SD	Mean	SD	PNI
Functional Competency						
1	Ensuring appropriate therapy and outcomes	3.38	0.67	4.08	0.59	2.86
2	Selection and dispensing medications and health products	3.34	0.75	4.01	0.71	2.70
3	Health promotion and disease prevention	3.41	0.80	3.70	0.60	1.08
4	Health system management	3.12	0.85	3.55	0.73	1.53
Core Competency						
5	Professionalism	3.61	0.81	4.23	0.53	2.64
6	General Ability	3.75	0.75	4.35	0.64	2.63

2.1.2.2 Matrix Analysis across Six Competency Domains

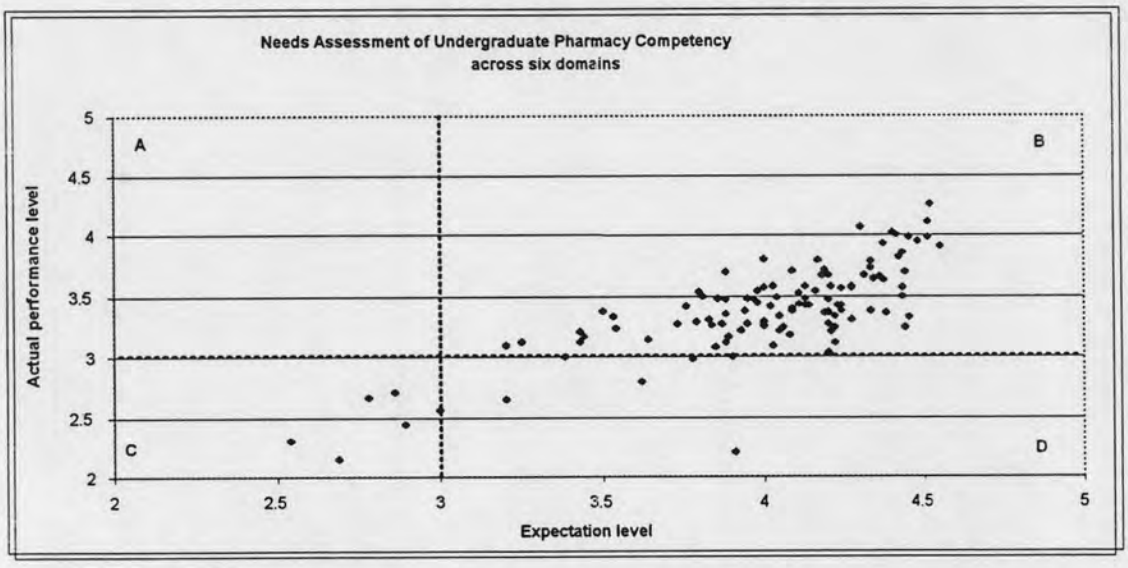


Figure 4.1 The pharmacy expectation and performance of students' competency across six domains.

Figure 4.1 summarized the preceptors' evaluation of student actual performance and students' expectation of competency across six domains which were;

Quadrant A: The upper left quadrant indicated low level of expectation and high actual performance.

There was no competency activity in quadrant A. Therefore, every competency in the case was stakeholder needed.

Quadrant B: The upper right quadrant indicated high level of expectation with over-determined performance.

105 pharmacy competency activities were placed in the Quadrant B. It meant that those competency activities were the strength of undergraduate pharmacy competency. Therefore, the pharmacy school should have a curriculum or special strategy to maintain, improve, and monitor these pharmacy competencies.

Quadrant C: The lower right quadrant indicated high level of expectation with under-determined performance.

This quadrant was the weaknesses of the undergraduate pharmacy competency. The pharmacy preceptor had high expectation toward the undergraduate pharmacy competency. But the students had lower level of the competencies than expected in the reality. As deeply considering the competencies, results indicated as the following:

- Dimension 1(Ensuring appropriate therapy and outcome). Form 34 numbers of pharmacy competency activities, there were 2 numbers in this quadrant which were competency activity statement number 1.2.4.3 (ability to recommend or send the patient to any public health provider that was suitable and appropriate with the condition of patient and situation) and competency activity statement number 1.2.1.4 (ability to identify additional examine the patient and follow up the medication use and the state of disease)
- Dimension 2 (Selecting and dispensing medications and health products). From 43 numbers of pharmacy competency activities, there were 2 numbers in this quadrant which were competency activity statement number 2.3.10.2 dispensing error and competency activity statement number 2.1.1.2 (read and interpret the result of health product analysis)
- Dimension 3 (Health promotion and disease prevention). From 10 numbers of pharmacy competency activities, there was none of those activities in this quadrant.
- Dimension 4 (Health system management). From 15 numbers of pharmacy competency activities, there were 3 numbers in this quadrant which were competency

activity statement number 4.3.1.2 (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), competency activity statement number 4.3.2.1 (ability to apply the Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects) and competency activity statement number 4.1.1.3 (ability to evaluate drug utilization)

- Dimension 5 (Professionalism) and dimension. 6 (General abilities). From 16 numbers of pharmacy competency activities, there was none of those activity level in this quadrant

In conclusion, it was found that there were 7 numbers of pharmacy competency activities which were placed in the quadrant C. The educational institute should revise the curriculum in order to improve the graduate qualification. It was found that the contents which needed improvement were as follow;

- Dimension 1 was the clinical pharmacy content in which relevant to patient-related activity.
- Dimension 2 was the knowledge of patient-related activity and pharmacokinetics.
- Dimension 4 was knowledge of law and drug use review.

Quadrant D: The lower left quadrant indicated low level low level of expectation with under-determined performance.

Pharmacy practitioner had low expectation of these competency activities and the actual performances of the pharmacy competencies of undergraduates were low. It meant that the competency activities were not good performance but not much concerned by the pharmacy practitioners. However, the educational institute should be interested and be careful with these competency activities.

- Dimension 2, Selection and dispensing medication and health product; there were 2 numbers from 43 activities were in this quadrant which were competency activity statement number 2.1.1.1.6 (evaluate pharmaceutical cosmetics using knowledge related to cosmetics) and competency activity statement number 2.1.1.4 (evaluate herb product using knowledge related to pharmacognosy)
- Dimension 4, Health system management; there were 4 numbers from 15 activities in this quadrant which were competency activity statement number 4.1.2.1(Ability to indicate the external and internal factors that impact medication

system), competency activity statement number 4.1.2.2(ability to analyze and evaluate the external and internal factors that impact medication system), competency activity statement number 4.2.1.1(ability to analyze, evaluate the problems that impact medication system in community), competency activity statement number 4.2.1.2 (Ability to present goals ways or activities that used for developing the medication system in all levels (community, hospitals and national) including drug selection, procurement, distribution and drug usage). The practitioners had high expectation in this competency. Most content in this levels were knowledge in social and pharmacy administrative, for example, drug system and pharmacoeconomics.

- Dimension 1 (Ensuring appropriate therapy and outcome), Dimension 3 (Health promotion and disease prevention), Dimension 4(Health system management) and Dimension 5&6 (Professionalism and General ability) were found that none of those activities competency level in this stage.

2.1.3. Within Domain Results

2.1.3.1. Needs Results of Competency Domain 1 (Ensuring Appropriate Therapy and Outcomes)

2.1.3.1.1. Matrix Analysis of Competency Domain 1

In order to know which competency activities should be improved in the whole picture, matrix analysis was used for data analysis. The matrix analysis is an analytical tool designed to cluster and classify stakeholder needs based on the expectation level of pharmacy competency and the actual performance level of pharmacy competency. There are four quadrants which were;

Quadrant A: The stakeholder did not expect with these pharmacy activities but got them anyway.

Quadrant B: The stakeholder expected with these pharmacy activities and student got them.

Quadrant C: The stakeholder expected with these pharmacy activities but did not get them.

Quadrant D: The stakeholder did not expect with these pharmacy activities and did not get them.

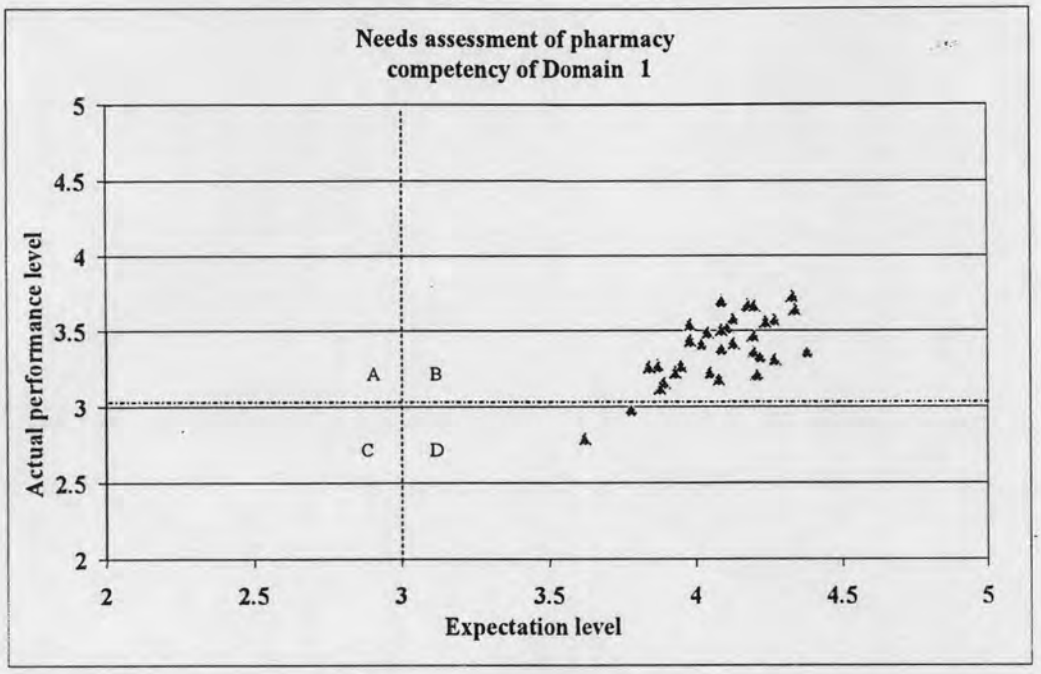


Figure 4.2 The Pharmacy Preceptors' expectation and performance of students' competency with Competency Domain 1

Figure 4.2 showed that there were two competency activities which placed in the quadrant C. The preceptors rated the high expectation with those pharmacy competencies, but the actual performance level was low. Then, those both competency activities had needs to improve. They were the competency activity statement number 1.2.1.4 (ability to identify additional examine the patient and follow up the medication use and the state of disease) and competency activity statement number1.2.4.3 (ability to recommend or send the patient to any public health provider that is suitable and appropriate with the condition of patient and situation)

2.1.3.1.2. Actual Performance, Expectation Level of Pharmacy Competency Activities and PNI in Competency Domain 1

In order to determine which competency activities should be revised, the PNI were very useful because this index was provided data in details as shown in Table 4.4.

From the 34 pharmacy competency activities of domain 1(Ensuring Appropriate Therapy and Outcomes), the mean scores of actual performance activities in domain 1 ranged from 2.79 to 3.73. The highest mean scores of performance activity in this domain was the activity statement number 1.1.4.2 (ability to describe the disease and

medication by using the communication ability and technique of giving an advice). Whereas the lowest mean score of the performance activity was the activity statement number 1.2.4.3 (ability to recommend or send the patient to any public health provider that is suitable and appropriate with the condition of patient and situation).

Expected pharmacy competencies with domain 1(Ensuring Appropriate Therapy and Outcomes) were summarized in Table 4.4. The mean scores of competency activity expectation with domain 1 (Ensuring appropriate therapy and outcomes) ranged from 3.62 to 4.38. Of the 34 pharmacy activities in domain 1, the highest rank was the activity statement number 1.1.3.2 (ability to analyze and assess for identifying the medication use problem). However, the lowest rank was the activity statement number 1.2.4.3 (ability to recommend or send the patient to any public health provider that is suitable and appropriate with the condition of patient and situation).

From the 34 pharmacy competency activities of Domain 1(Ensuring Appropriate Therapy and Outcomes), the PNI of competency activities were ranged from 1.60 to 4.47. The mean score of PNI was 2.86. There were 16 out of 34 pharmacy activities which should be improved. The top three ranks of pharmacy activities in domain 1 were the activities statement number 1.1.32 (ability to analyze and assess for identifying the medication use problem), the activities statement number 1.2.1.1(ability to determine the difference of each medication for patient treatment) and the activities statement number 1.2.1.2 (ability to select the appropriate medicine by formula and the quality to suit the disease and the state of the patient.) Their PNI were 4.47 and 4.21, 4.10, respectively. This finding summarized that the curriculum contents which related to those competency were pharmacology, pharmacotherapy, medicinal chemistry, communication skill in Pharm.D curriculum, Thus, the pharmacy academic should reorganized these contents.

Table 4.4 Mean, Standard deviation and PNI of the expectation level and actual performance of pharmacy competency activities in Domain 1

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
1.1.3.2	Ability to analyze and assess for identifying the medication use problem	3.36	0.609	4.38	0.535	4.47	1
1.2.1.1	Ability to determine the difference of each medication for patient treatment	3.21	0.675	4.21	0.6	4.21	2
1.2.1.2	Ability to select the appropriate medicine by formula and the quality to suit the disease and the state of the patient	3.31	0.557	4.27	0.618	4.10	3
1.2.3.1	Ability to specify the protection plan and the resolution for the medication problem	3.33	0.564	4.22	0.636	3.76	4
1.2.4.2	Ability to describe the disease and medication by using the communication ability and technique of giving an advice	3.33	0.64	4.22	0.56	3.76	4
1.1.4.5	Ability to integrate the evidence-based medicine to evaluate the research paper	3.18	0.457	4.08	0.587	3.67	5
1.1.2.2	Ability to assess the health behavior of patient and any relevant factors	3.36	0.802	4.2	0.588	3.53	6
1.1.4.4	Ability to analyze and define the research outcomes	3.22	0.652	4.05	0.597	3.36	7
1.2.4.1	Ability to consult with and/or counsel the patient and caregivers on the medication and disease.	3.47	0.726	4.2	0.625	3.07	8
1.3.2.3	Ability to answer the drug usage problem by using the database	3.64	0.917	4.34	0.479	3.04	9
1.2.1.4	Ability to identify additional examine the patient and follow up the medication use and the state of disease	2.98	0.724	3.78	0.571	3.02	10
1.2.4.3	Ability to recommend or send the patient to any public health provider that is suitable and appropriate with the condition of patient and situation	**2.79**	0.641	**3.62**	0.817	3.00	11

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
1.1.1.2	Ability to read the patients' medication history	3.57	0.501	4.27	0.66	2.99	12
1.3.2.2	Ability to synthesize and analyze the data of patient's therapy for various benefits	3.12	0.731	3.88	0.544	2.95	13
1.1.1.1	Ability to interview the patient or patient's representative	3.42	0.657	4.13	0.588	2.93	14
1.2.1.3	Ability to use the current resources (the research that published) to develop the patient's therapy	3.38	0.576	4.09	0.633	2.90	15
1.1.4.1	Ability to know the creditworthy data source	3.56	0.785	4.24	0.484	2.88	16
1.2.6.4	Ability to follow up the after care of patient	3.16	0.706	3.89	0.532	2.84	17
1.2.6.2	Drug use evaluation)Ability to assess the problem occurred by the drug usage and the intensity	3.4	0.695	4.09	0.61	2.82	18
1.2.6.3	Ability to determine the form of how to follow up the cure problem	3.22	0.795	3.93	0.495	2.79	19
1.1.3.1	Ability to analyze and assess to identify the preliminary health problem	3.27	0.58	3.95	0.776	2.69	20
1.1.4.2	Ability to search the documentation and research related to the patients' care	3.73	0.618	4.33	0.522	2.60	20
1.1.1.3	Ability to read and interpret the basic lab result for the preliminary physical examination	3.41	0.542	4.02	0.403	2.45	21
1.1.1.4	Ability to ask and record the patient's history	3.52	0.731	4.11	0.573	2.42	22
1.1.2.1	Ability to assess to summarize problem relating to the medication use including the economic, social and cultural problems	3.27	0.688	3.87	0.919	2.32	23
1.3.2.1	Ability to record the history of patients' care and the drug usage in systematic way	3.58	0.583	4.13	0.505	2.27	24
1.2.6.1	Ability to assess the health problem and the intensity	3.26	0.581	3.84	0.615	2.23	25
1.2.5.2	Ability to work as a team	3.67	0.769	4.2	0.588	2.23	25
1.1.4.3	Ability to select the documentation and research and evaluate the fairness and creditworthiness	3.49	0.626	4.04	0.52	2.22	26

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
1.2.5.1	Ability to communicate and enable to give an advice to colleague	3.49	0.727	4.04	0.52	2.22	26
1.2.2.3	Ability to understand the behavior and the personality of the patient	3.44	0.755	3.98	0.543	2.15	27
1.2.2.2	Ability to communicate with the patient and the care givers	3.67	0.798	4.18	0.535	2.13	28
1.3.1.1	Ability to prepare the database of historical information of drug usage and the aftercare systematically	3.54	0.636	3.98	0.651	1.75	29
1.2.2.1	Ability to establish the relationship between the patient and the care givers	3.7	0.765	4.09	0.633	1.60	*30*
	Mean score of 34 competency activities	**3.38**	**0.67**	**4.08**	**0.59**	**2.86**	

2.1.3.2. Needs Assessment Results of Competency Domain 2 (Selection and Dispensing Medications and Health Products)

2.1.3.2.1. Matrix Analysis of Competency Domain 2

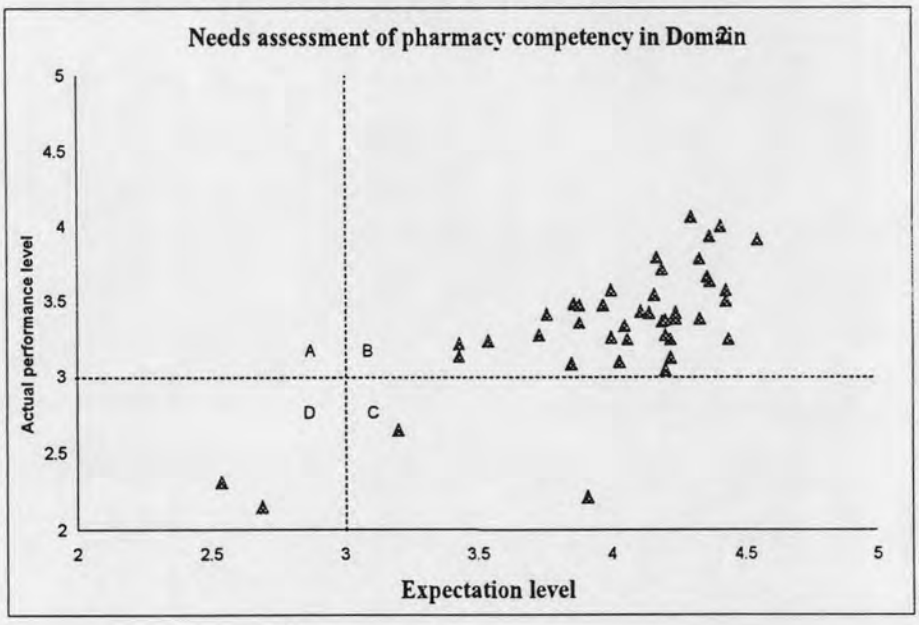


Figure 4.3 Pharmacy preceptors' expectation and performance of students' competency with domain 2

From the Figure 4.3, there were two competency activities that were placed in quadrant C which were the activity statement number 2.3.10.2 (ability to manage

dispensing error) and activity statement number 2.1.1.2(read and interpret the result of health product analysis).

There were two competency activities that were placed in quadrant D which were the activity statement number 2.1.1.6 (ability to evaluate pharmaceutical cosmetics using cosmetic sciences knowledge) and the activity statement number 2.1.1.1.4 (ability to evaluate herb product using pharmacognocy knowledge). However, pharmacy preceptors did not concern of those 2 competency activities. Although those activities had low competency, it is not necessary to improve.

2.1.3.2.2. The Actual Performance, the Expectation Level of Pharmacy Competency Activities and PNI in Competency Domain 2

PNI, Mean, Standard deviation of the actual performance and the expectation level of pharmacy competency activities in domain 2 (Selection and Dispensing Medications and Health Products) were summarized in Table 4.5. The results of each value were presented as following.

From the 43 pharmacy competency activities of domain 2 (Selection and Dispensing Medications and Health products), the mean scores of actual performance in domain 2 ranged from 2.15 to 4.06. The highest mean scores of actual performance were the activity statement number 2.3.5.2(ability to prepare ancillary labels or cautionary or advisory statements for patients). The lowest mean score of actual performance was the activity statement number 2.1.16 (ability to evaluate herb product using pharmacognocy knowledge).

The pharmacy preceptors' expectation with domain 2 (Selection and dispensing medications and health products) included 43 competency activities. The mean scores of pharmacy expectation ranged from 2.54 to 4.55. The highest mean score of the activities statement number 2.3.5.2 (ability to demonstrate accurate handling techniques for dosage form preparation). The lowest mean score of activities statement was the activity number 2.1.16 (ability to evaluate pharmaceutical cosmetics using cosmetic sciences knowledge).

From the 43 pharmacy competency activities of domain 2 (Selection and Dispensing Medications and Health products), the PNI of competency activities were ranged from 0.58 to 6.65. The average of PNI in domain 2 was 2.68. If the researcher set the cut of score at the average of PNI, there were 23 out of 43 pharmacy activities had to be improved. The top five ranks of pharmacy activities of this domain 2 were the activity

statement number 2.3.10.2 (ability to manage dispensing error), the activity statement number 2.2.1.3 (ability to analyze drug-drug interaction), and the activity statement number 2.3.10.1 (ability to manage prescription error), the activity statement number 2.2.1.5 (ability to analyze the off-label drugs), the activity statement number 2.2.2.2 (ability to adjust dose of drugs based on a specific patient). Their PNI were 6.65, 5.33 and 4.87, 4.64, 4.14 respectively. This finding was indicated that the curriculum contents which related to the top five ranks of pharmacy competency were medication error, adverse drug reaction and drug monitor, drug dosage form and pharmacokinetics. Thus, the pharmacy academic should reorganize these contents.

Table 4.5 Mean, standard deviation of the expectation level and the actual performance of pharmacy competency activities and PNI in domain 2

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
2.3.10.2	Ability to manage dispensing error	2.21	1.726	3.91	0.996	6.65	1
2.2.1.3	Ability to analyze drug-drug interaction	3.24	0.908	4.44	0.624	5.33	2
2.3.10.1	Ability to manage prescription error	3.04	0.539	4.2	0.645	4.87	3
2.2.1.5	Ability to analyze the off-label drugs	3.12	0.714	4.22	0.725	4.64	4
2.2.2.2	Ability to adjust dose of drugs based on a specific patient	3.24	0.802	4.22	0.704	4.14	5
2.3.10.4	Ability to evaluate patients' drug usages.	3.5	0.762	4.43	0.625	4.12	6
2.2.1.2	Ability to analyze the appropriate dose of drug for a specific patient	3.38	0.834	4.33	0.739	4.11	7
2.2.2.3	Ability to adjust or change the type and dosage form of medication for the purpose of decreasing drug-drug interaction.	3.27	0.807	4.2	0.715	3.91	8
2.3.8.3	Ability to counsel with patients on adherence	3.57	0.625	4.43	0.545	3.81	9
2.3.5.1	Ability to prepare medication from the prescriptions	3.09	0.723	4.03	0.684	3.79	10
2.2.1.4	Ability to analyze unnecessary medication	3.38	0.777	4.24	0.712	3.65	11
2.3.10.3	Ability to manage patient self-administration	3.37	0.598	4.2	0.584	3.49	12
2.3.6.1	Ability to check error due to prepare medication before	3.36	0.762	4.19	0.822	3.48	13

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
	dispensing						
2.2.1.6	Ability to analyze untreated indication	3.42	0.753	4.24	0.712	3.48	14
2.3.8.4	Ability to give advice about the relationship between dosage forms and pharmacological actions.	3.24	0.781	4.06	0.886	3.33	15
2.2.1.1	Ability to read the prescription accurately	3.63	0.725	4.37	0.618	3.23	16
2.3.8.2	Ability to advice the patients in drug usage.	3.66	0.776	4.36	0.532	3.05	17
2.3.1.2	Ability to select ingredients (form and strength) and equipment (bottles, syringes) that match the description on the drug formulation	3.25	0.707	4	0.535	3.00	18
2.3.4.2	Ability to recommend drug of choices for physician	3.42	0.692	4.14	0.543	2.98	19
2.3.2.2	Ability to demonstrate the knowledge about the analysis on quality of any type of pharmaceutics	3.08	0.494	3.85	0.689	2.96	20
2.2.2.1	Ability to select the appropriate type and dose of drugs in accordance with the patients' diseases, symptom, and social factors.	3.33	0.747	4.05	0.754	2.92	21
2.3.1.1	Ability to demonstrate accurate handling techniques for dosage form preparation	3.91	0.944	4.55	0.688	2.91	22
2.3.7.1	Ability to dispense medications to patients	3.43	0.698	4.11	0.758	2.79	23
2.3.8.5	Ability to advice about health promotion and prevention to relief symptoms without drug.	3.54	0.605	4.16	0.553	2.58	24
2.3.1.4	Ability to understand the final storage containers that may compromise product efficacy.	3.78	0.801	4.33	0.555	2.38	25
2.1.1.1	Ability to evaluate medication and health product. 2.1.1.1.1 Ability to evaluate medication using physical and chemical knowledge.	3.35	0.562	3.88	0.653	2.06	26
2.3.1.6	Ability to identify beyond use date	3.71	0.845	4.19	0.68	2.01	27
2.3.8.1	Ability to identify characteristics of patients for drug counseling	3.47	0.567	3.97	0.647	1.99	28

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
2.3.9.1	Ability to demonstrate administrative technique for commonly used medicines, including inhalers, eye ointments, and eye, ear and nose drop	3.93	0.704	4.37	0.691	1.92	29
2.3.1.5	Ability to apply labeling to the product to optimize its stability and correct storage and use.	4	0.816	4.41	0.557	1.81	30
2.1.1.2	Ability to read and interpret the result of health product analysis.	2.65	0.885	3.2	1.261	1.76	31
2.3.1.3	Ability to select equipment accurately for product preparation.	3.57	0.787	4	0.577	1.72	32
	2.1.1.1.3. Ability to evaluate medication using knowledge related to social and administrative field.	3.27	0.456	3.73	0.631	1.72	33
2.3.3.2	Ability to select the appropriate containers that match the type and dosage form of pharmaceutical products.	3.47	0.514	3.88	0.6	1.59	34
2.3.4.1	Ability to select the appropriate treatment options or disease prevention for medication user.	3.79	0.588	4.17	0.702	1.58	35
	2.1.1.1.2 Ability to evaluate medication using biopharmaceutical knowledge	3.48	0.512	3.86	0.573	1.47	36
	2.1.1.1.4 Ability to evaluate herb product using pharmacog knowledge.	2.15	1.068	2.69	1.494	1.45	37
2.3.2.1	Ability to demonstrate the knowledge about the regulations on the quality of any type of pharmaceutics.	3.41	0.87	3.76	0.752	1.32	38
2.3.3.1	Ability to prepare or compound pharmaceutical products that meets the individual patient' need.	3.23	0.439	3.54	0.519	1.10	39
2.3.5.2	Ability to prepare ancillary labels or cautionary or advisory statements for patients.	4.06	0.827	4.3	0.585	1.03	40
	2.1.1.1.5 Ability to evaluate medical food and health food using chemical of food and nutrition knowledge.	3.13	0.694	3.43	0.788	1.03	41
2.3.7.2	Ability to manage effective dispensing procedure.	3.21	0.579	3.43	0.514	0.75	42

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
	2.1.1.1.6 Ability to evaluate pharmaceutical cosmetics using cosmetic sciences knowledge.	2.31	1.109	2.54	1.506	0.58	43
	Mean score of 43 competency activities	**3.34**	**0.75**	**4.01**	**0.71**	**2.70**	

2.1.3.3. Needs Assessment Results of Competency Domain 3 (Health Promotion and Disease Prevention)

2.1.3.3.1. Matrix Analysis of Competency Domain 3

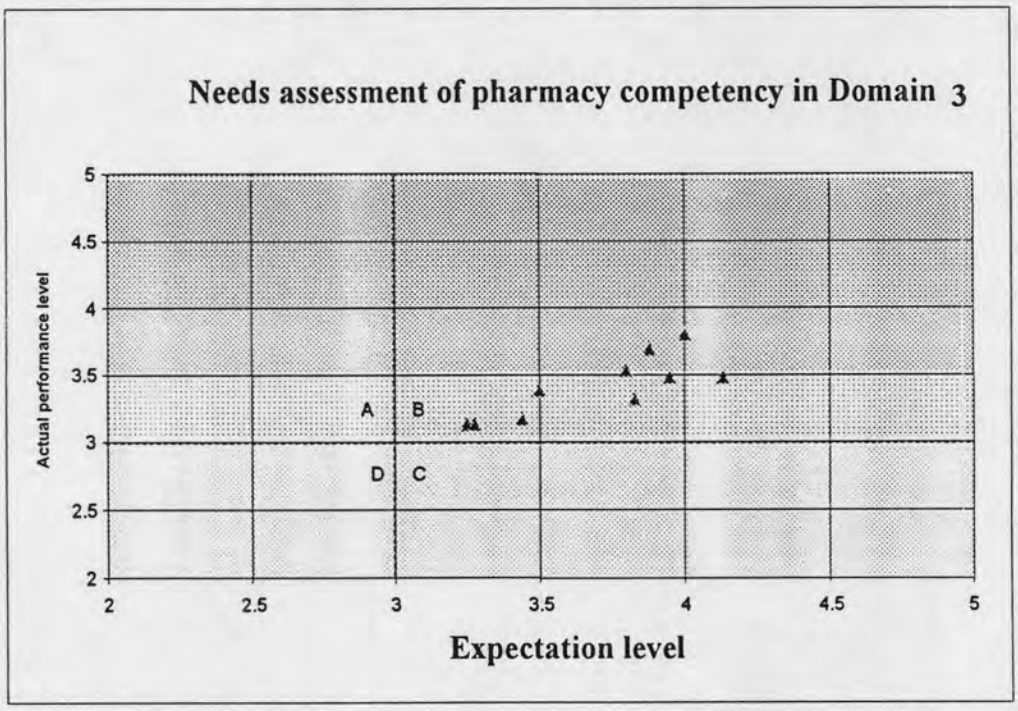


Figure 4.4 Pharmacy preceptors' expectation and performance of students' competency with Domain 3

The expectation and performance of pharmacy students' competency with competency domain 3 (Health Promotion and Disease Prevention) were shown in Figure 4.4. The results showed that there was no pharmacy activity in this domain that should be improved. All activities were in the accepted level.

2.1.3.3.2. Actual Performance, Expectation Level of Pharmacy Competency Activities and PNI in Competency Domain 3

PNI, Mean, Standard deviation of the actual performance and the expectation level of pharmacy competency activities in domain 3 (Health Promotion and Disease Prevention) were summarized in Table 4.6. The results of each value were presented as following.

Results on health promotion and disease prevention showed that the mean scores of actual performance of competency domain 3 (Health Promotion and Disease Prevention) ranged from 3.13 to 3.80. The highest means score of actual performance in this domain was the activity statement number 3.1.1.1 (ability to search epidemiologic data of drugs and diseases from available sources). The lowest mean score of actual performance was the activity statement number 3.2.1.1 (ability to select the appropriate methods for health promotion in community).

The expectation mean scores of domain 3 (Health Promotion and Disease Prevention) ranged from 3.25 to 4.13. The highest rank was the activity statement number 3.1.1.1 (ability to search epidemiologic data of drugs and diseases from available sources). The lowest rank was the activity statement number 3.2.1.1 (ability to select the appropriate methods for health promotion in community) and the activity statement number 3.3.1.3 (ability to deliver health education to public-health personnel).

For pharmacy preceptors assessment of domain 3 (Health Promotion and Disease Prevention), The PNI of domain 3 ranged from 0.39 to 2.68. The average of PNI in domain 3 was 1.08. There were 3 out of 10 competency activities that should be improved. The top three ranks of competency activities in this domain was the activity statement number 3.3.1.3 (ability to deliver health education to public-health personnel), the activity statement number 3.3.2.1 (ability to manage knowledge with the health care professional), the activity statement number 3.2.2.2 (ability to use the surveillance information to promote safe medication use and prevent the problems of drug therapy and health product). Their PNI was 2.68, 1.99, and 1.86, respectively. From this finding, it was concluded that the curriculum contents which related to the competency domain 3 were communication and public education, data analysis. Thus, the pharmacy academic should reorganize those contents.

Table 4.6 Mean, standard deviation and PNI of the expectation level and the actual performance of pharmacy competency activities in domain 3

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
3.3.1.3	Ability to deliver health education to public-health personnel.	3.48	0.716	4.13	0.686	2.68	1
3.3.2.1	Ability to manage knowledge with the health care professional	3.31	0.856	3.83	0.775	1.99	2
3.2.2.2	Ability to use the surveillance information to promote safe medication use and prevent the problems of drug therapy and health product.	3.48	0.814	3.95	0.498	1.86	3
3.2.3.1	Ability to perform proposed projects/ activities.	3.53	1.125	3.8	0.775	1.03	4
3.2.2.1	Ability to select methods for reporting the surveillance information of drug therapy and health product problems of community.	3.17	0.786	3.44	0.511	0.93	5
3.1.1.1	Ability to search epidemiologic data of drugs and diseases from available sources.	3.8	0.714	4	0.587	0.80	6
3.2.1.4	Ability to perform and distribute appropriate materials.	3.69	0.838	3.88	0.711	0.74	7
3.1.1.2	Ability to plan and collect the community information regarding issues of economics, society and public health.	3.38	0.518	3.5	0.535	0.42	8
3.1.2.1	Ability to analyze health problems in community.	3.13	0.835	3.25	0.463	0.39	9
3.2.1.1	Ability to select the appropriate methods for health promotion in community.	3.13	0.835	3.25	0.463	0.39	9
	Mean score of 10 competency activities	**3.41**	**0.80**	**3.70**	**0.60**	**1.08**	

2.1.3.4. Needs Assessment Results of Competency Domain 4 (Health Systems Management)

2.1.3.4.1. Matrix Analysis of Competency Domain 4

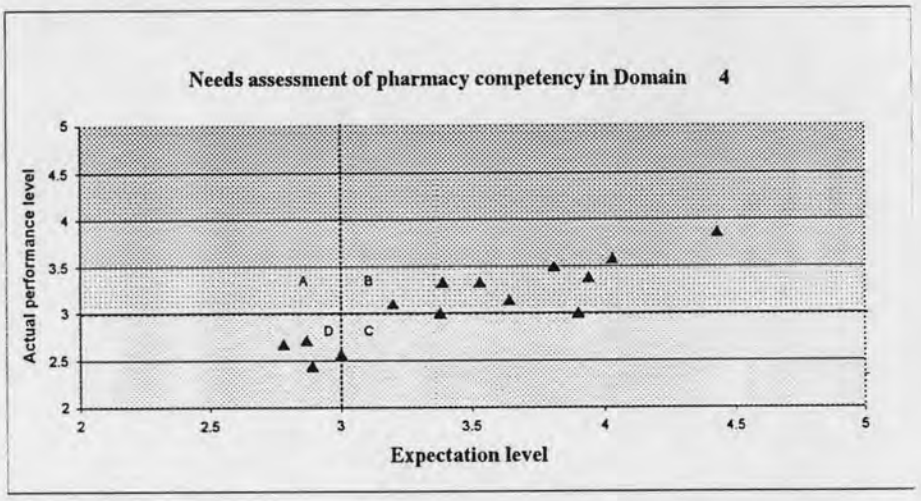


Figure 4.5 Pharmacy preceptors' expectation and performance of students' competency with domain 4

Figure 4.5 summarized the pharmacy preceptors' expectation and actual performance of students' competency with domain 4. From the matrix analysis, it showed that of the 15 pharmacy activities, four were in the quadrant D, and two were in the quadrant C. The activities in quadrant C were the activity statement number 4.3.1.2 (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), the activity statement number 4.3.2.1(apply the Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects), and the activity statement number 4.1.1.3(ability to evaluate drug utilization). It meant that those three pharmacy activities should be improved. However, some activities had low competency but no need to improve as seen in quadrant C. Those competency activities were the activity statement number 4.1.2.1(ability to indicate the external and internal factors that impact medication system), the activity statement number 4.1.2.2(ability to analyze and evaluate the external and internal factors that impact medication system), the activity statement number 4.2.1.1(ability to analyze, evaluate the problems that impact medication system in community), the activity statement number 4.2.1.2(ability to present goals ways or activities that use for developing the medication

system in all levels (community, hospitals and national) including drug selection, procurement, distribution and drug usage).

2.1.3.4.2 Actual Performance, the Expectation Level of Pharmacy Competency Activities and PNI in Competency Domain 4

PNI, Mean, Standard deviation of the actual performance and the expectation level of pharmacy competency activities in domain 4 (Health Systems Management) were summarized in Table 4.7. The results of each value were presented as following.

The mean scores of actual performance in domain 4 (Health Systems Management) ranged from 2.44 to 3.86. The activity statement number 4.3.2.1 (ability to analyzed and apply the Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects and the morality to perform) was rated the highest score. In the same way, the lowest performance score was the activity number 4.2.1.2 (ability to analyze and evaluate the external and internal factors that impact medication system).

Table 4.7 summarized the pharmacy preceptors' expectation with competency domain 4 (Health Systems Management) competencies. The mean expectation of pharmacy competency was 3.55. The range of pharmacy competency for this domain was 2.78 to 4.43. The activity number 4.3.2.1 (analyze and assess the problem of performing professional in the ethical aspects) was rated the highest score. In the same way, the lowest expectation score was the activity number 4.2.1.2 (ability to analyze and evaluate the external and internal factors that impact medication system).

From the data obtained, it was found that the PNI of domain 4 (Health Systems Management) ranged from 0.31 to 3.51. The average score of PNI in domain 4 was 1.53. The 15 pharmacy activities of domain 4, 7 pharmacy activities should be improved urgently. The top five ranks of pharmacy activities in this domain was the activity statement number 4.4.1.2 (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), the activity statement number 4.4.2.1 (apply the Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects, the activity statement number), the activity statement number 4.3.2.1 (ability to analyze and assess the problem of performing professional in the ethical aspects), the activity statement number 4.4.1.1 (Ability to know the important essence of Drug Act, Pharmaceutics Profession Act, the

regulations on the ethical and profession aspects and the moral). Their PNI were 3.51, 3.51, 2.53, 2.21, and 1.82, respectively. From this finding, it was summarized that pharmacy preceptors focused on the problems related to laws and ethics contents. Thus, the pharmacy academic should reorganize those contents

Table 4.7 Mean, standard deviation and PNI of the expectation level and the actual performance of pharmacy competency activities in domain 4

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
4.4.1.2	Ability to analyze and apply the Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects and the morality to perform	3	0.816	3.9	0.876	3.51	1
4.4.2.1	Apply the Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects	3	0.816	3.9	0.876	3.51	2
4.3.2.1	Ability to analyze and assess the problem of performing professional in the ethical aspects	3.86	0.864	4.43	0.646	2.53	3
4.3.1.3	Ability to analyze the role of graduate toward health problems	3.38	0.5	3.94	0.574	2.21	4
4.4.1.1	Ability to know the important essence of Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects and the moral.	3.14	0.77	3.64	0.745	1.82	5
4.3.1.1	Ability to analyze and assess the importance of professional role towards the society in the ethical and moral aspects.	3.58	0.751	4.03	0.467	1.81	6
4.3.1.2	Ability to analyze and assess the importance of professional role towards the society in the ethical and moral aspects.	3.58	0.708	4.03	0.467	1.81	7
4.2.1.1	Ability to analyze, evaluate the problems that impact medication system in community.	2.56	1.014	3	0.707	1.32	8
4.2.1.2	Ability to present goals ways or activities that use for developing the medication system in all levels (community, hospitals, and national) including drug selection, procurement, distribution and drug usage.	2.44	1.13	2.89	1.167	1.30	9
4.1.1.3	Ability to evaluate drug utilization.	3	0.816	3.38	0.768	1.28	10

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
4.5.1.1	Ability to provide consumer protection	3.5	0.632	3.81	0.655	1.18	11
4.1.1.1	Ability to manage inventory, including purchasing, medication storage, conduct inventory, controlled drug accountability procedures	3.33	0.816	3.53	0.64	0.71	12
4.1.2.1	Ability to indicate the external and internal factors that impact medication system	2.71	1.069	2.86	0.864	0.43	13
4.1.1.2	Ability to manage medication system in health care institutes	3.1	0.994	3.2	0.422	0.32	14
4.1.2.2	Ability to analyze and evaluate the external and internal factors that impact medication system.	2.67	1.118	2.78	1.093	0.31	15
	Mean score of 15 competency activities	**3.12**	**0.85**	**3.55**	**0.73**	**1.53**	

2.1.3.5. Needs Assessment Results of Competency Domain 5 (Professionalism) and Domain 6 (General Abilities)

2.1.3.5.1. Matrix Analysis of Competency Domain 5&6

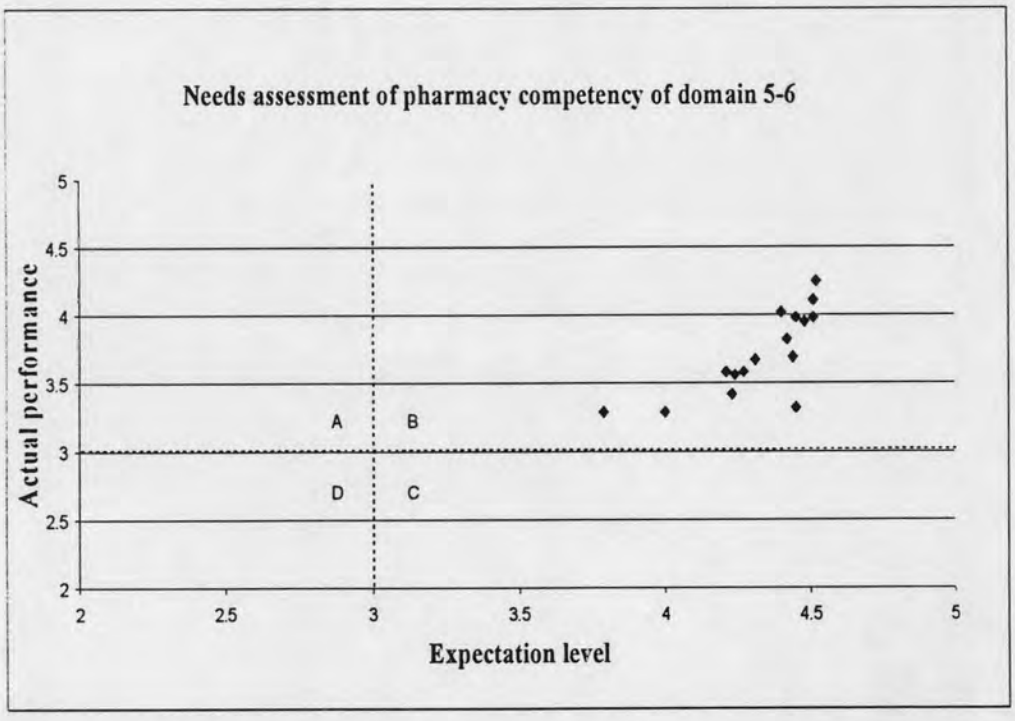


Figure 4.6 The Pharmacy Preceptors' expectation and performance of students' competency with Domain 5 and 6.

From Figure 4.6, of the 16 competency activities, there was no need to improve any competency activities in domain 5 (Professionalism) and domain 6 (General ability).

2.1.3.5.2 The Actual Performance, the Expectation Level of Pharmacy Competency Activities and PNI in Competency Domain 5

PNI, Mean, Standard deviation of the actual performance and the expectation level of pharmacy competency activities in domain 5 (Professionalism) and domain 6 (General Abilities) were summarized in Table 4.8. The results of each value were presented as following.

The mean performance scores of domain 5 (Professionalism) and domain 6 (Personal General Abilities) ranged from 3.29 to 4.25. The highest scores of pharmacy student competency were the statement number 6.4.1(Listen, speak, read, write and use the computer for communication). The activity statement number 6.1.1 (Ability to apply chemical reaction theory into the work related to pharmaceutical products) was rated the lowest mean score of pharmacy competency in this domain.

Results on professionalism and general ability showed that the expectation mean scores of these two domains ranged from 3.79 to 4.52. The highest expectations rank was the statement number 6.4.1(Listen, speak, read, write and use the computer for communication). The lowest expectation rank was the statement number 6.1.1 (Ability to apply chemical reaction theory into the work related to pharmaceutical products) as seen in Table 4.8.

It was found that the PNI of domain 5(Professionalism) andd 6 (General Abilities) ranged from 1.22 to 5.03. The mean of PNI was 2.63. The top rank of competency activity in these two domains was the activity statement number 6.4.2 (Well communicate in Thai and English). Its PNI was 5.03. There were 9 out of 16 competency activities that should be improved. From this finding, it was summarized that pharmacy preceptors concerned about the problems of communication skills both Thai and English and the conceptual thinking.

Table 4.8 Mean, Standard deviation and PNI of the expectation level and the actual performance of pharmacy competency activities in domain 5 and 6

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
6.4.2	Well communicate in Thai and English	3.32	1.171	4.45	0.8	5.0285	1
6.5.2	Identify the topic that would like to learn	3.42	0.763	4.23	0.684	3.4263	2
6.5.3	Be able to learn on your own effectively	3.69	0.925	4.44	0.659	3.33	3
6.6.1	Identify the problem, synthesize to resolve the problem, gather the relevant information for consideration and make a decision	3.58	0.583	4.27	0.618	2.9463	4
6.2.1	Have conceptual thinking	3.56	0.693	4.24	0.645	2.8832	5
5.2.1	Identify target goal of pharmacy profession and pharmacist's responsibility.	**3.29**	0.726	4	0.392	2.84	6
6.3.2	Having the state of leadership and the follower	3.67	0.707	4.31	0.557	2.7584	7
5.2.4	Participate in the pharmacy activities in order to improve professional	3.58	0.881	4.21	0.658	2.6523	8
6.2.2	Ability to use the appropriate rationality	3.82	0.576	4.42	0.583	2.652	9
6.5.1	Having ability to do the research and gather information	3.98	0.657	4.51	0.626	2.3903	10
5.2.2	Search and analyze drug information by his/herself.	3.95	0.815	4.48	0.554	2.3744	11
6.3.1	Can coordinate with the health care professional and other personnel within the organization	3.98	0.792	4.45	0.589	2.0915	12
6.1.1	Ability to apply chemical reaction theory into the work related to pharmaceutical products	**3.29**	0.825	**3.79**	0.802	1.895	13
6.3.3	Having diligence, be patient and generous	4.11	0.647	4.51	0.549	1.804	14
6.4.3	Having the skill to present and exchange the ideas	4.02	0.723	4.4	0.618	1.672	15
6.4.1	Listen, speak, read, write and use the computer for communication	**4.25**	0.719	**4.52**	0.59	1.2204	16
	Mean score of 16 competency activities	**3.72**	**0.76**	**4.33**	**0.62**	**2.63**	

2.2. Pharmacy Student Needs Assessment Survey

2.2.1. Respond Rate and Characteristics of Pharmacy Students

There were 75 questionnaires which distributed to the fifth year of clinical pharmacy students, 73 were returned. Of the 73 pharmacy students, majority were female (82.2%). The mean age of the fifth year of pharmacy students was 22.37 years old and their mean of grade point average was 3.07. The results were shown in Table 4.9.

Table 4.9 Characteristics of clinical pharmacy students

Variables	N	%
Gender		
Male	13.00	17.80
Female	60.00	82.20
Place		
Parents	51.00	70.80
Relatives	3.00	4.20
Private Dormitory	9.00	12.50
Chulalongkorn Dormitory	9.00	12.50
	Mean	**SD**
Age of respondent	22.37	0.74
Grade point average (GPA)	3.07	0.35
Study time (Hours)	1.41	0.84

2.2.2. Overall Needs Results of Six Competency Domains

2.2.2.1 PNI across Six Competency Domains

Table 4.10 Needs results of undergraduate pharmacy competencies across six domains form pharmacy student assessment

No	Pharmacy competency Domain	Actual Performance		Expected Level		Needs Assessment
		Mean	SD	Mean	SD	PNI
Functional Competency						
1	Ensuring appropriate therapy and outcomes	3.01	0.73	4.45	0.56	6.40
2	Selection and dispensing medications and health products	2.90	0.71	4.59	0.55	7.76
3	Health promotion and disease prevention	2.79	0.72	4.24	0.77	6.13
4	Health system management	2.74	0.73	4.25	0.73	6.41
Core Competency						
5	Professionalism	*2.94*	*0.83*	*4.31*	*0.70*	*5.94*
6	General Ability	3.10	0.72	4.49	0.66	6.24

From clinical pharmacy student self-assessment, the overall needs of undergraduate pharmacy competency were summarized in Table 4.10. The results showed that among all four domains of functional competency, the PNI of pharmacy competency in domain 2 (Selection and dispensing medications and health product) was 7.76. It was the highest PNI among four domains. The second and third ranks were the pharmacy competency domain 4 (Health systems management) and domain 1(Ensuring appropriate therapy and outcomes), respectively. Their PNI were 6.41 and 6.40, respectively. It may be explained that the contents characteristics of clinical pharmacy track related to the patient-oriented knowledge which involved with the competency domain 1(Ensuring appropriate therapy and outcomes). Furthermore, the contents of clinical pharmacy track were less emphasized with the product-oriented knowledge which involved with the competency domain 2 (Selection and dispensing medications and health product).

For core competency, it showed that the PNI of pharmacy competency in domain 6 (General ability, 6.24) was higher than the PNI of pharmacy competency in domain 5 (Professionalism, 5.94). Their PNI were 6.24 and 5.94, respectively.

2.2.2.2 Matrix Analysis across Six Competency Domains

From needs assessment results, it was found that the clinical pharmacy students have rather high expectation from all 4 competency domains as shown in Figure 4.7. When they evaluated themselves it was found that the results were rather low level made there were many competency numbers needed improvement. In conclusion, there were the competency activities in quadrant C and quadrant D only.

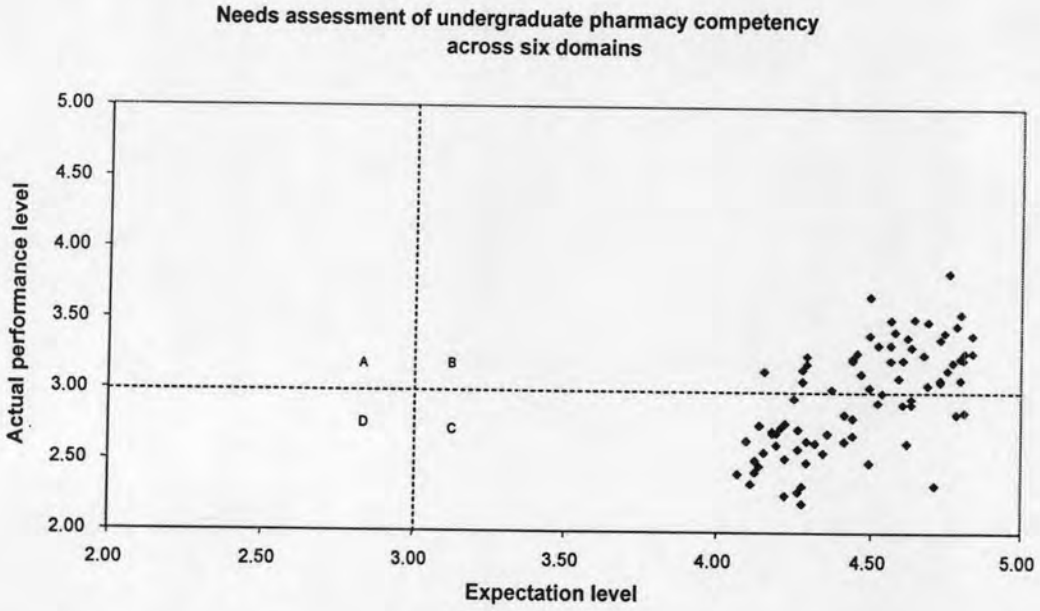


Figure 4.7 clinical pharmacy students' expectation and performance of students' competency across six domains.

Quadrant C The lower right quadrant indicated high level of expectation with under-determined performance.

There were 68 pharmacy competency activities which were placed in quadrant C which were;

Dimension 1: there were 15 from 34 pharmacy competency activities.

Dimension 2: there were 20 from 43 pharmacy competency activities.

Dimension 3: there were 7 from 10 pharmacy competency activities.

Dimension 4: there were 11 from 5 pharmacy competency activities.

Dimension 5 and 6: there were 5 from 16 pharmacy competency activities.

The competency examples were pharmacy competency activities 1.2.1.2 (ability to select the appropriate medicine by formula and the quality to suit the disease and the state of the patient), pharmacy competency activities 1.1.4.5 (Ability to integrate the evidence-based medicine to evaluate the research paper)

Quadrant B The upper right quadrant indicated high level of expectation with over-determined performance.

There were forty-nine pharmacy competency activities were placed in this quadrant. The pharmacy institute should monitor all competency activities which placed here. The examples were as follow; pharmacy competency activities1.2.2.2 (ability to communicate with the patient and the care givers), pharmacy competency activities 1.2.2.3 (ability to understand the behavior and the personality of the patient).

2.2.3. Within Domain Results

2.2.3.1. Needs Assessment Results of Competency Domain 1 (Ensuring Appropriate Therapy and Outcomes)

2.2.3.1.1. Matrix Analysis of Competency Domain 1

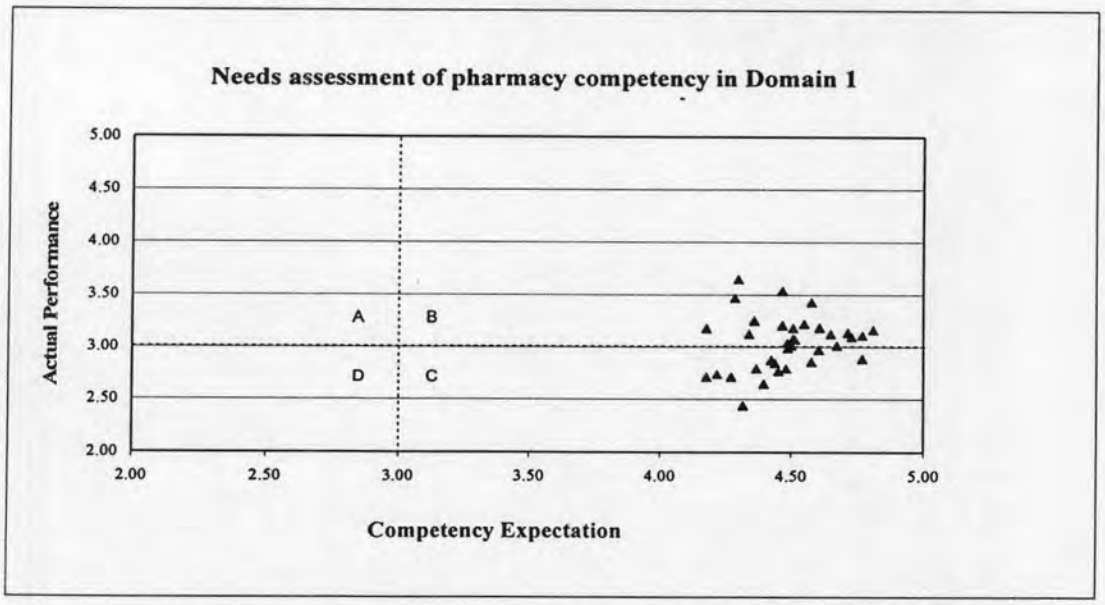


Figure 4.8 Pharmacy students' expectation and performance of students' competency with domain 1

Figure 4.8 showed that there were many competency activities in the quadrant C which meant that the pharmacy students rated the high expectation with competency activities, but the current competency activities were low. The example of competency activities in competency domain 1 which placed in the quadrant C

were the competency activity statement number 1.2.1.2(ability to select the appropriate medicine by formula and the quality to suit the disease and the state of the patient), competency activity 1.2.1.1 (ability to determine the difference of each medication for patient treatment), competency activity 1.2.4.1 (ability to consult with and/or counsel the patient and caregivers on the medication and disease), respectively.

2.2.3.1.2. The Actual Performance, the Expectation Level of Pharmacy Competency Activities and PNI in Competency Domain 1

PNI, mean, standard deviation of the actual performance and the expectation level of pharmacy competency activities in domain 1(Ensuring appropriate therapy and outcomes) were summarized in Table 4.11. The results of each value were presented as following.

For domain 1 (Ensuring appropriate therapy and outcomes), it showed that the mean scores of the actual performance of pharmacy competency in this domain ranged from 2.44 to 3.64. The highest means score of competency activities in this domain was the competency activity statement number 1.2.2.1 (ability to establish the relationship between the patient and the care givers). The lowest rank was the competency activity statement number 1.2.4.3 (ability to recommend or send the patient to any public health provider that is suitable and appropriate with the condition of patient and situation).

Results on ensuring appropriate therapy and outcomes are shown in Table 4.11. The expectation mean scores of competency domain 1 (Ensuring appropriate therapy and outcomes) ranged from 4.18 to 4.81. The highest rank was the activity statement number 1.2.4.2 (ability to describe the disease and medication by using the communication ability and technique of giving an advice). The lowest rank was the competency activity number 1.2.5.1(ability to communicate and enable to give an advice to colleague.)

For pharmacy student self-assessment of competency activities in Domain 1 (Ensuring appropriate therapy and outcomes), The PNI of those competency activities ranged from 2.83 to 8.95. The average of PNI in domain 1 was 6.49. There were 21 out of 34 competency activities that should be improved. The top five ranks of competency activities in this domain were the activity statement number 1.2.1.2 (ability to select the appropriate medicine by formula and the quality to suit the disease and the state of the patient), the activity statement number 1.1.4.5

(ability to integrate the evidence-based medicine to evaluate the research paper), and the activity statement number 1.2.4.2 (ability to describe the disease and medication by using the communication ability and technique of giving an advice), the activity statement number 1.2.3.1(ability to specify the protection plan and the resolution for the medication problem), the activity statement number 1.2.1.1(ability to determine the difference of each medication for patient treatment). Their PNI were 8.95, 8.13, 7.90, 7.90, and 7.84, respectively. This finding was indicated that the curricula contents which related to those competencies were pharmacology, pharmacotherapy, medicinal chemistry, communication skill in Pharm.D. Thus, the pharmacy academic should reorganize those contents.

Table 4.11 Mean, standard deviation of the expectation level and the actual performance of pharmacy competency activities and PNI in domain 1

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
1.2.1.2	Ability to select the appropriate medicine by formula and the quality to suit the disease and the state of the patient	2.89	0.79	4.77	0.43	8.95	1
1.1.4.5	Ability to integrate the evidence-based medicine to evaluate the research paper	2.44	0.73	4.32	0.58	8.13	2
1.2.4.2	Ability to describe the disease and medication by using the communication ability and technique of giving an advice	3.16	0.75	4.81	0.40	7.90	3
1.2.3.1	Ability to specify the protection plan and the resolution for the medication problem	3.11	0.66	4.77	0.43	7.90	4
1.2.1.1	Ability to determine the difference of each medication for patient treatment	2.86	0.77	4.58	0.66	7.84	5
1.1.3.2	Ability to analyze and assess for identifying the medication use problem	3.01	0.74	4.67	0.58	7.74	6
1.1.4.4	Ability to analyze and define the research outcomes	2.64	0.75	4.40	0.52	7.71	7

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
1.2.4.1	Ability to consult with and/or counsel the patient and caregivers on the medication and disease.	3.10	0.78	4.73	0.45	7.70	8
1.2.1.3	Ability to use the current resources (the research that published) to develop the patient's therapy	2.79	0.83	4.48	0.53	7.55	9
1.2.1.4	Ability to identify additional examine the patient and follow up the medication use and the state of disease	2.97	0.74	4.60	0.52	7.50	10
1.3.2.2	Ability to synthesize and analyze the data of patient's therapy for various benefits	2.77	0.86	4.45	0.55	7.50	11
1.2.6.2	Ability to assess the problem occurred by the drug usage and the intensity	3.14	0.65	4.71	0.46	7.42	12
1.1.3.1	Ability to analyze and assess to identify the preliminary health problem	3.13	0.60	4.65	0.54	7.08	13
1.1.4.3	Ability to select the documentation and research and evaluate the fairness and creditworthiness	2.85	0.81	4.44	0.55	7.05	14
1.2.6.3	Ability to determine the form of how to follow up the cure problem	2.79	0.69	4.37	0.63	6.88	15
1.2.4.3	Ability to recommend or send the patient to any public health provider that is suitable and appropriate with the condition of patient and situation	2.88	0.74	4.42	0.60	6.85	16
1.1.1.3	Ability to read and interpret the basic lab result for the preliminary physical examination	2.99	0.79	4.49	0.56	6.73	17
1.1.2.2	Ability to assess the health behavior of patient and any relevant factors	3.01	0.51	4.50	0.56	6.69	18
1.1.2.1	Ability to assess to summarize problem relating to the medication use including the economic, social and cultural problems	2.71	0.68	4.27	0.77	6.67	19
1.2.6.4	Ability to follow up the after care of patient	3.18	0.70	4.61	0.49	6.55	20

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
1.3.2.3	Ability to answer the drug usage problem by using the database	3.07	0.76	4.51	0.58	6.52	21
1.1.1.1	Ability to interview the patient or patient's representative	3.08	0.57	4.51	0.56	6.42	22
1.3.1.1	Ability to prepare the database of historical information of drug usage and the aftercare systematically	2.74	0.82	4.22	0.53	6.24	23
1.1.1.4	Ability to ask and record the patient's history	2.71	0.74	4.18	0.65	6.12	24
1.1.4.2	Ability to search the documentation and research related to the patients' care	3.22	0.73	4.55	0.53	6.04	25
1.2.6.1	Ability to assess the health problem and the intensity	3.18	0.56	4.51	0.56	5.98	26
1.1.1.2	Ability to read the patients' medication history	3.21	0.55	4.47	0.53	5.63	27
1.3.2.1	Ability to record the history of patients' care and the drug usage in systematic way	3.12	0.76	4.34	0.53	5.29	28
1.1.4.1	Ability to know the creditworthy data source	3.42	0.72	4.58	0.58	5.26	29
1.2.2.3	Ability to understand the behavior and the personality of the patient	3.25	0.69	4.36	0.63	4.85	30
1.2.5.1	Ability to communicate and enable to give an advice to colleague	3.18	0.69	4.18	0.54	4.18	31
1.2.2.2	Ability to communicate with the patient and the care givers	3.53	0.75	4.47	0.58	4.16	32
1.2.5.2	Ability to work as a team	3.47	0.78	4.29	0.66	3.52	33
1.2.2.1	Ability to establish the relationship between the patient and the care givers	3.64	0.73	4.30	0.70	**2.83**	34
	Mean score of 34 competency activities	**3.04**	**0.72**	**4.48**	**0.56**	**6.49**	

2.2.3.2. Needs Assessment Results of Competency Domain 2 (Selection and Dispensing Medications and Health Products)

2.2.3.2.1. Matrix Analysis of Competency Domain 2

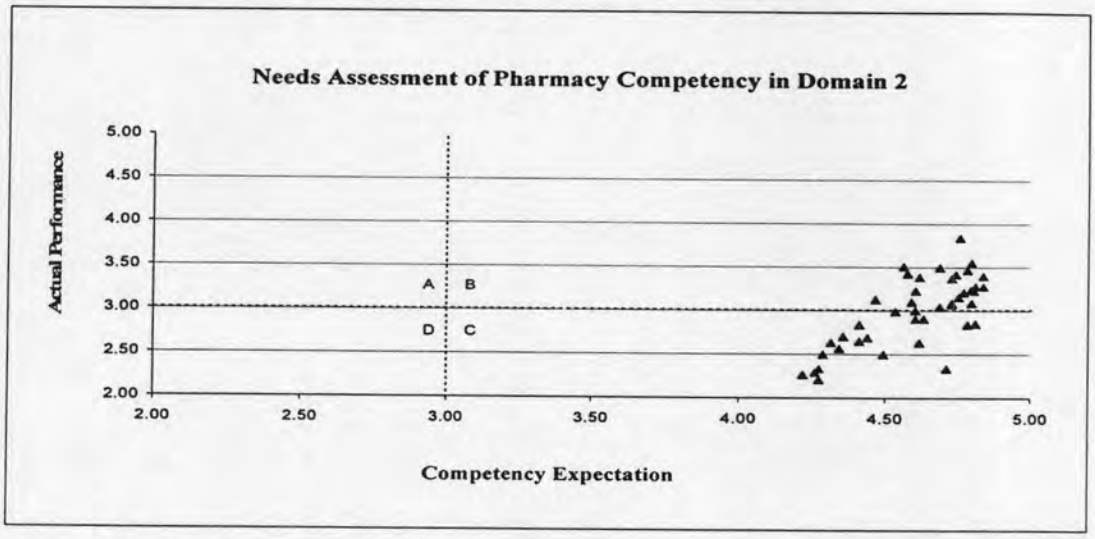


Figure 4.9 Pharmacy students' expectation and performance of students' competency with domain 2

From analysis of this matrix in Figure 4.9, there were many competency activities that were placed in the quadrant C. It meant that those competency activities which were placed in quadrant C should be improved. The example were the activity statement number 2.3.3.1 (ability to prepare or compound pharmaceutical products that meets the individual patient' need.), the activity statement number 2.2.2.2 (ability to adjust dose of drugs based on a specific patient), the activity statement number 2.2.2.3(ability to adjust or change the type and dosage form of medication for the purpose of decreasing drug-drug interaction).

2.2.3.2.2. Actual Performance, Expectation Level of Pharmacy Competency Activities and PNI in Competency Domain 2

PNI, mean, standard deviation of the actual performance and the expectation level of pharmacy competency activities in domain 2 (Selection and dispensing medications and health products) were summarized in Table 4.12. The results of each value were presented as following.

From the data obtained, it was found that the mean scores of actual performance of competency activities in domain 2 (Selection and dispensing medications and health product) ranged from 2.21 to 3.84. The highest mean scores of activity competency was the competency activity statement number 2.3.5.1(ability

to prepare medication from the prescriptions) and the lowest mean scores was the competency activity statement number 2.3.2.2 (ability to demonstrate the knowledge about the analysis on quality of any type of pharmaceutics).

Expected competency activities with domain 2 were summarized in Table 4.12. The expectation mean scores of competency domain 2 (Selection and dispensing medications and health product) ranged from 4.22 to 4.84. Of the 43 competency activities in domain 2, the highest rank was the activity statement number 2.2.1.3 (ability to analyze drug-drug interaction). However, the lowest rank was the activity statement number 2.1.1.4 (ability to evaluate herb product using pharmacognosy knowledge).

From the data obtained, it was found that the PNI of competency activities in domain 2 (Selection and dispensing medications and health product) ranged from 4.36 to 11.18. The average of PNI of competency activities in domain 2 was 7.37. Of the 43 pharmacy activities of domain **2,** 25 pharmacy activities should be improved. The top three ranks of competency activities in this domain were the competency activity statement number 2.3.3.1 (ability to prepare or compound pharmaceutical products that meets the individual patient' need), the competency activity statement number 2.2.2.2 (ability to adjust dose of drugs based on a specific patient), and the competency activity statement number 2.2.2.3 (ability to adjust or change the type and dosage form of medication for the purpose of decreasing drug-drug interaction), respectively, the competency activity statement number 2.1.1.1.1. (ability to evaluate medication using physical and chemical knowledge), the competency activity statement number 2.3.1.1 (ability to demonstrate accurate handling techniques for dosage form preparation) Their PNI were 11.18, 9.42, and 9.30, 9.17, and 8.99, respectively. This finding was concluded that the curricula contents which related to those competencies were focus in drug preparation, dosage form and pharmacokinetics. Thus, the pharmacy academic should reorganize these contents.

Table 4.12 Mean, standard deviation and PNI of the expectation level and the actual performance of pharmacy competency activities in domain 2

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
2.3.3.1	Ability to prepare or compound pharmaceutical products that meets the individual patient' need.	2.33	0.82	4.71	0.52	**11.18**	1
2.2.2.2	Ability to adjust dose of drugs based on a specific patient	2.85	0.79	4.81	0.43	9.42	2
2.2.2.3	Ability to adjust or change the type and dosage form of medication for the purpose of decreasing drug-drug interaction.	2.84	0.78	4.78	0.42	9.30	3
2.1.1.1	Ability to evaluate medication and health product 2.1.1.1.1. Ability to evaluate medication using physical and chemical knowledge	2.63	0.59	4.62	0.52	9.17	4
2.3.1.1	Ability to demonstrate accurate handling techniques for dosage form preparation	2.49	0.77	4.49	0.53	8.99	5
2.3.2.2	Ability to demonstrate the knowledge about the analysis on quality of any type of pharmaceutics	**2.21**	0.73	4.27	0.65	8.84	6
	2.1.1.1.6 Ability to evaluate pharmaceutical cosmetics using cosmetic sciences knowledge.	2.29	0.75	4.26	0.73	8.40	7
2.1.1.2	Read and interpret the result of health product analysis	2.33	0.76	4.27	0.71	8.31	8
	2.1.1.1.4 Ability to evaluate herb product using pharmacognosy knowledge	2.26	0.71	**4.22**	0.69	8.26	9
2.2.1.5	Ability to analyze the off-label drugs	3.08	0.74	4.79	0.41	8.21	10
2.3.4.2	Ability to recommend drug of choices for physicians	2.90	0.75	4.63	0.70	7.99	11
2.3.10.2	Ability to manage dispensing error	3.07	0.67	4.73	0.51	7.83	12
2.3.10.1	Ability to manage prescription error	2.90	0.60	4.60	0.59	7.82	13
	2.1.1.1.5 Ability to evaluate medical food and health food using chemical of food and nutrition knowledge.	2.64	0.79	4.41	0.64	7.79	14

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
	2.1.1.1.2.Ability to evaluate medication using biopharmaceutical knowledge	2.68	0.57	4.44	0.60	7.78	15
2.3.10.4	Ability to evaluate patients' drug usages.	3.08	0.70	4.73	0.53	7.77	16
2.3.2.1	Ability to demonstrate the knowledge about the regulations on the quality of any type of pharmaceutics	2.56	0.69	4.34	0.71	7.73	17
2.3.10.3	Ability to manage patient self-administration	3.04	0.70	4.68	0.52	7.70	18
2.3.1.2	Ability to select ingredients (form and strength) and equipment (bottles, syringes) that match the description on the drug formulation	2.49	0.69	4.29	0.61	7.69	19
2.2.2.1	Ability to select the appropriate type and dose of drugs in accordance with the patients' diseases, symptom, and social factors.	3.15	0.64	4.75	0.44	7.60	20
2.2.1.6	Ability to analyze untreated indication	3.23	0.68	4.80	0.43	7.58	21
2.2.1.3	Ability to analyze drug-drug interaction	3.27	0.67	**4.84**	0.37	7.55	22
2.3.4.1	Ability to select the appropriate treatment options or disease prevention for medication user	3.23	0.64	4.79	0.44	7.47	23
2.2.1.2	Ability to analyze the appropriate dose of drug for a specific patient.	3.21	0.73	4.77	0.59	7.44	24
2.2.1.4	Ability to analyze unnecessary medication	3.27	0.65	4.81	0.40	7.38	25
	2.1.1.1.3. Ability to evaluate medication using knowledge related to social and administrative field.	2.63	0.70	4.32	0.74	7.27	26
2.3.1.3	Ability to select equipment accurately for product preparation	2.70	0.70	4.36	0.59	7.22	27
2.3.8.4	Ability to give advice about the relationship between dosage forms and pharmacological actions.	2.99	0.66	4.53	0.65	7.02	28
2.3.3.2	Ability to select the appropriate containers that match the type and dosage form of pharmaceutical products	2.83	0.82	4.41	0.62	6.96	29

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
2.2.1.1	Ability to read the prescription accurately	3.40	0.66	4.84	0.41	6.96	30
2.3.7.2	Ability to manage effective dispensing procedure	3.10	0.78	4.59	0.68	6.85	31
2.3.8.3	Ability to counsel with patients on adherence	3.37	0.66	4.73	0.51	6.41	32
2.3.8.1	Ability to identify characteristics of patients for drug counseling	3.22	0.63	4.60	0.64	6.35	33
2.3.9.1	Ability to demonstrate administrative technique for commonly used medicines, including inhalers, eye ointments, and eye, ear and nose drop	3.47	0.67	4.78	0.51	6.29	34
2.3.6.1	Ability to check error due to prepare medication before dispensing	3.42	0.76	4.74	0.50	6.27	35
2.3.1.4	Ability to understand the final storage containers that may compromise product efficacy	3.12	0.80	4.47	0.58	6.00	36
2.3.8.2	Ability to advice the patients in drug usage	3.55	0.75	4.79	0.41	5.98	37
2.3.1.6	Ability to identify beyond use date	3.38	0.86	4.62	0.52	5.69	38
2.3.7.1	Ability to dispense medications to patients	3.49	0.67	4.68	0.50	5.58	39
2.3.1.5	Ability to apply labeling to the product to optimize its stability and correct storage and use	3.49	0.71	4.68	0.50	5.58	40
2.3.8.5	Ability to advice about health promotion and prevention to relief symptoms without drug.	3.42	0.72	4.58	0.76	5.26	41
2.3.5.2	Ability to prepare ancillary labels or cautionary or advisory statements for patients	3.51	0.73	4.56	0.62	4.81	42
2.3.5.1	Ability to prepare medication from the prescriptions	**3.84**	0.71	4.75	0.52	**4.36**	43
	Mean score of 43 competency activities	**3.00**	**0.71**	**4.60**	**0.56**	**7.37**	

2.2.3.3. Needs Assessment Results of Competency Domain 3 (Health Promotion and Disease Prevention)

2.2.3.3.1. Matrix Analysis of Competency Domain

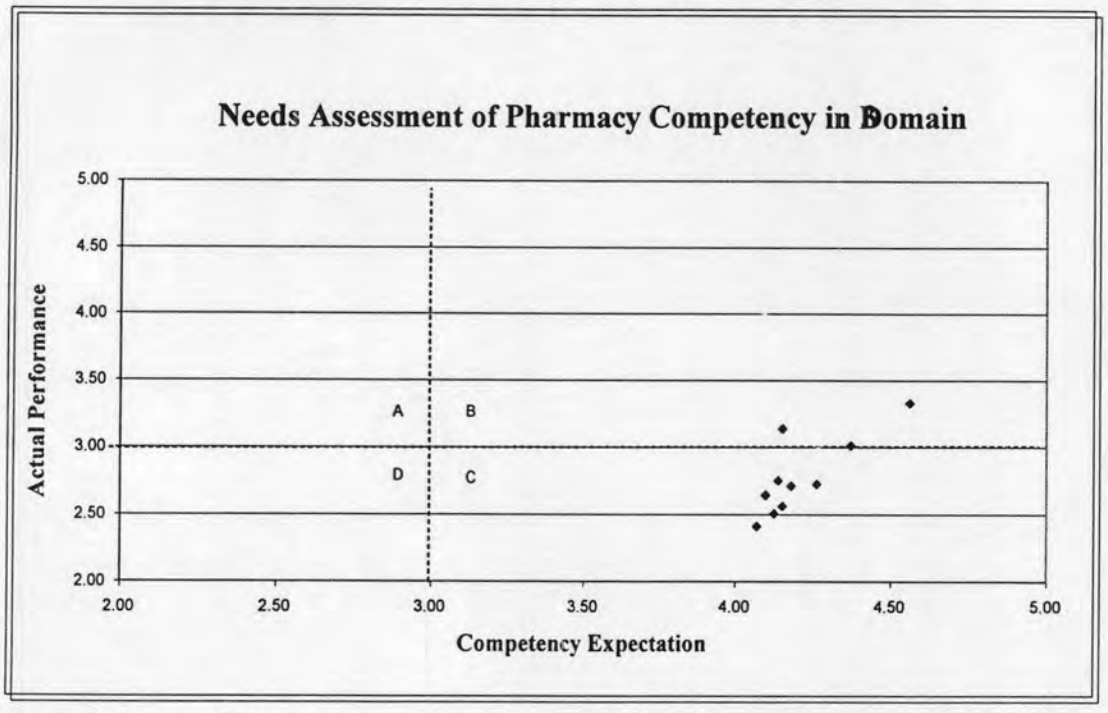


Figure 4.10 The Pharmacy students' expectation and performance of students' competency with Domain 3

Figure 4.10 showed that there were many competency activities were placed in the quadrant C. The examples were the activity statement number 3.1.1.2 (ability to plan and collect the community information regarding issues of economics, society and public health), the activity statement number 3.1.2.1 (ability to analyze health problems in community), and the activity statement number 3.2.2.1 (ability to select methods for reporting the surveillance information of drug therapy and health product problems in community). Their PNI were 6.74, 6.67, and 6.60, respectively.

2.2.3.3.2. The Actual Performance, the Expectation Level of Pharmacy Competency Activities and PNI in Competency Domain 3

PNI, mean, standard deviation of the actual performance and the expectation level of pharmacy competency activities in domain 3 (Health promotion and disease prevention) were summarized in Table 4.13. The results of each value were presented as following.

For competency domain 3 (health promotion and disease prevention), the mean score of actual performance of the competency activities ranged from 2.41 to 3.33. The activity statement number 3.3.2.1 (ability to advise changes for healthy behaviors to drug user and people) was rated the highest score. In the same way, the lowest performance score was the activity statement number 3.1.1.2 (ability to plan and collect the community information regarding issues of economics, society and public health).

Table 4.13 summarized the pharmacy students' expectation with domain 3 competencies (Health promotion and disease prevention). The mean expectation score of competency activities was 4.21. The range of competency activities in this domain was 4.07 to 4.56. The activity competency statement number 3.3.2.1 (ability to advise changes for healthy behaviors to drug user and people) was rated the highest score. In the same way, the lowest expectation score was the activity statement number 3.1.1.2 (ability to plan and collect the community information regarding issues of economics, society and public health).

From the data obtained, it was found that the PNI of the competency activities in domain 3 (Health Promotion and Disease Prevention)) ranged from 4.21 to 6.74. The average of PNI of the competency activities in domain 3 was 6.02. Of the 10 competency activities in domain 3 and 5 competency activities should be improved urgently. The top three ranks of competency activities in this domain was the competency activity statement number 3.1.1.2 (ability to plan and collect the community information regarding issues of economics, society and public health), the competency activity statement number 3.1.2.1.(ability to analyze health problems in community), the competency activity statement number 3.2.2.1 (ability to select methods for reporting the surveillance information of drug therapy and health product problems of community). Their PNI were 6.74, 6.67, and 6.60, respectively. This finding was summarized that the curricula contents related to epidemiology and research methodology should be revised.

Table 4.13 Mean, standard deviation and PNI of the expectation level and the actual performance of pharmacy competency activities in domain 3

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
3.1.1.2	Ability to plan and collect the community information regarding issues of economics, society and public health	**2.41**	0.66	**4.07**	0.89	**6.74**	1.00
3.1.2.1	Ability to analyze health problems in community	2.51	0.73	4.12	0.85	6.67	2.00
3.2.2.1	Ability to select methods for reporting the surveillance information of drug therapy and health product problems of community	2.56	0.71	4.15	0.79	6.60	3.00
3.3.1.3	Ability to deliver health education to public-health personnel	2.73	0.73	4.26	0.76	6.54	4.00
3.2.1.1	Ability to select the appropriate methods for health promotion in community.	2.71	0.70	4.18	0.82	6.12	5.00
3.2.3.1	Ability to perform proposed projects/ activities	2.64	0.67	4.10	0.77	5.95	6.00
3.1.1.1	Ability to search epidemiologic data of drugs and diseases from available sources.	3.01	0.82	4.37	0.72	5.93	7.00
3.2.2.2	Ability to use the surveillance information to promote safe medication use and prevent the problems of drug therapy and health product.	2.75	0.70	4.14	0.75	5.72	8.00
3.3.2.1	Ability to advise changes for healthy behaviors to drug user and people	**3.33**	0.73	**4.56**	0.60	5.62	9.00
3.2.1.4	Ability to perform and distribute appropriate materials	3.14	0.77	4.15	0.83	**4.21**	10.00
	Mean score of 10 competency activities	**2.78**	**0.72**	**4.21**	**0.78**	**6.02**	

2.2.3.4. Needs Assessment Results of Competency Domain 4 (Health Systems Management)

2.2.3.4.1. Matrix Analysis of Competency Domain 4

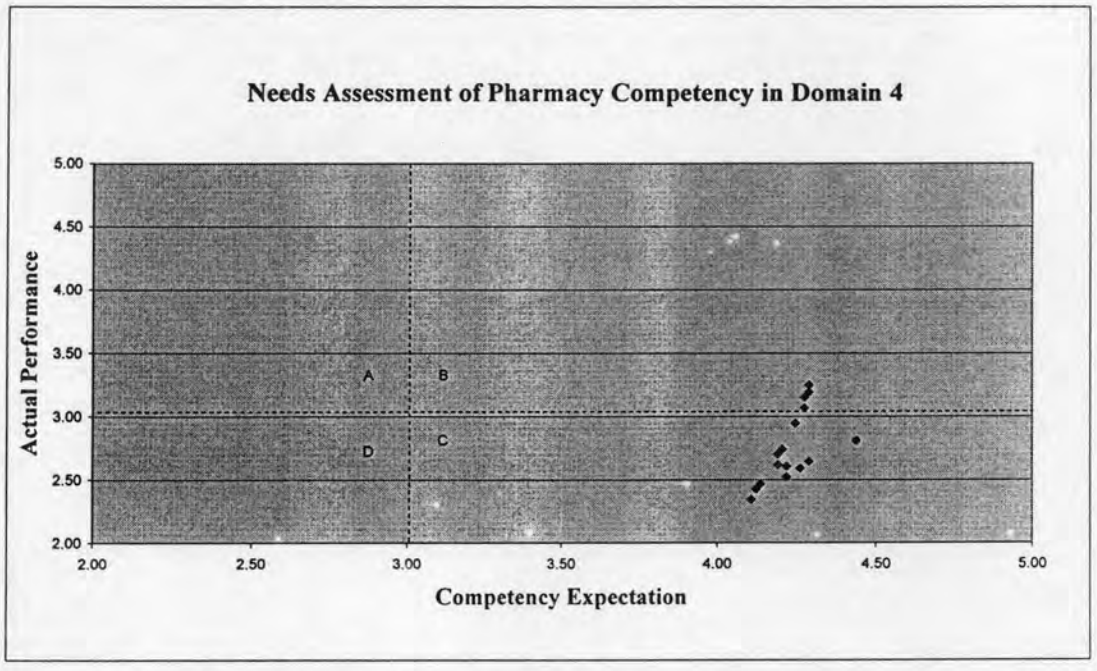


Figure 4.11 Pharmacy students' expectation and performance of students' competency with Domain 4

Figure 4.11 summarized the pharmacy preceptors' expectation and actual performance of students' competency with domain 4. From the matrix analysis, it was showed that there were many pharmacy activities that were placed in the quadrant C. The examples were the competency activity statement number 4.1.2.2 (ability to analyze and evaluate the external and internal factors that impact medication system), the competency activity statement number 4.5.1 (ability to provide consumer protection), and the competency activity statement number 4.1.1.2 (ability to manage medication system in health care institutes).

2.2.3.4.2 Actual Performance, the Expectation Level of Pharmacy Competency Activities and PNI in Competency Domain 4

PNI, mean, standard deviation of the actual performance and the expectation level of pharmacy competency activities in domain 3 (Health promotion and disease prevention) were summarized in Table 4.14. The results of each value were presented as following.

The mean performance scores of competency activities in domain 4 (Health systems management) ranged from 2.34 to 3.25. The competency activity statement number 4.3.1.1 (ability to analyze and assess the importance of professional role towards the society in the ethical and moral aspects) was rated the highest score. In the same way, the lowest performance score was the activity statement number 4.1.2.2 (ability to analyze and evaluate the external and internal factors that impact medication system).

Table 4.14 summarized the pharmacy students' expectation with competency domain 4 (Health systems management). The mean expectation score of competency activities was 3.99. The range of competency activities in this domain was 4.11 to 4.44. The activity statement number 4.1.2.2 (ability to analyze and evaluate the external and internal factors that impact medication system) was rated the highest score. In the same way, the lowest expectation score was the activity statement number 4.5.1 (ability to provide consumer protection).

From the data obtained, it was found that the PNI of competency activities in domain 4 (Health systems management) ranged from 4.46 to 7.26. The average score of PNI in domain 4 was 6.27. Of the 15 competency activities of domain 4 and 11, competency activities should be improved urgently. The top five ranks of competency activities in this domain was the competency activity statement number 4.1.2.2 (ability to analyze and evaluate the external and internal factors that impact medication system), the competency activity statement number 4.5.1.1 (ability to provide consumer protection), the competency activity statement number 4.1.1.2 (ability to manage medication system in health care institutes), the competency activity statement number 4.1.1.1 (ability to manage inventory, including purchasing, medication storage, conduct inventory, controlled drug accountability procedures), the competency activity statement number 4.1.1.3 (ability to evaluate drug utilization). Their PNI were 7.26, 7.24, and 7.17, 7.12, 7.05, respectively. This finding summarized that the clinical pharmacy students had needs to improve many competency activities. Thus, there were many contents in this domain that should be improved, such as managing drug supply, drug system management

Table 4.14 Mean, standard deviation and PNI of the expectation level and the actual performance of pharmacy competency activities in domain 4

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
4.1.2.2	Ability to analyze and evaluate the external and internal factors that impact medication system	**2.34**	0.69	**4.11**	0.79	**7.26**	1
4.5.1.1	Ability to provide consumer protection	2.81	0.66	**4.44**	0.65	7.24	2
4.1.1.2	Ability to manage medication system in health care institutes	2.52	0.69	4.22	0.73	7.17	3
4.1.1.1	Ability to manage inventory, including purchasing, medication storage, conduct inventory, controlled drug accountability procedures	2.59	0.68	4.26	0.76	7.12	4
4.1.1.3	Ability to evaluate drug utilization	2.64	0.69	4.29	0.70	7.05	5
4.2.1.1	Ability to analyze, evaluate the problems that impact medication system in community	2.42	0.76	4.12	0.83	7.00	6
4.2.1.2	Ability to present goals ways or activities that use for developing the medication system in all levels (community, hospitals and national) including drug selection, procurement, distribution and drug usage	2.47	0.73	4.14	0.87	6.91	7
4.4.1.2	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	2.62	0.88	4.19	0.70	6.60	8
4.4.2.1	Apply the Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects	2.70	0.81	4.19	0.68	6.26	9
4.1.2.1	Ability to indicate the external and internal factors that impact medication system	2.74	0.71	4.21	0.83	6.16	10

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
4.4.1.1	Ability to know the important essence of Drug Act, Pharmaceutics Profession Act, the regulations on the ethical and profession aspects and the morality to perform the pharmaceutical profession	2.95	0.90	4.25	0.66	5.53	11
4.3.2.1	Analyze and assess the problem of performing professional in the ethical aspects	3.07	0.63	4.27	0.73	5.15	12
4.3.1.2	Analyze and assess the importance of professional role towards the society in the ethical and moral aspects	3.15	0.76	4.27	0.73	4.80	13
4.3.1.3	Ability to analyze the role of graduate toward health problems	3.19	0.76	4.29	0.74	4.70	14
4.3.1.1	Ability to analyze and assess the importance of professional role towards the society in the ethical and moral aspects	3.25	0.64	4.29	0.70	4.46	15
	Mean score of 15 activity competency	**2.59**	**0.69**	**3.9709**	**0.69**	**5.48**	

2.2.3.5. Needs Assessment Results of Competency Domain 5 (Professionalism) and Domain 6 (General Abilities)

2.2.3.5.1. Matrix Analysis of Competency Domain 5&6

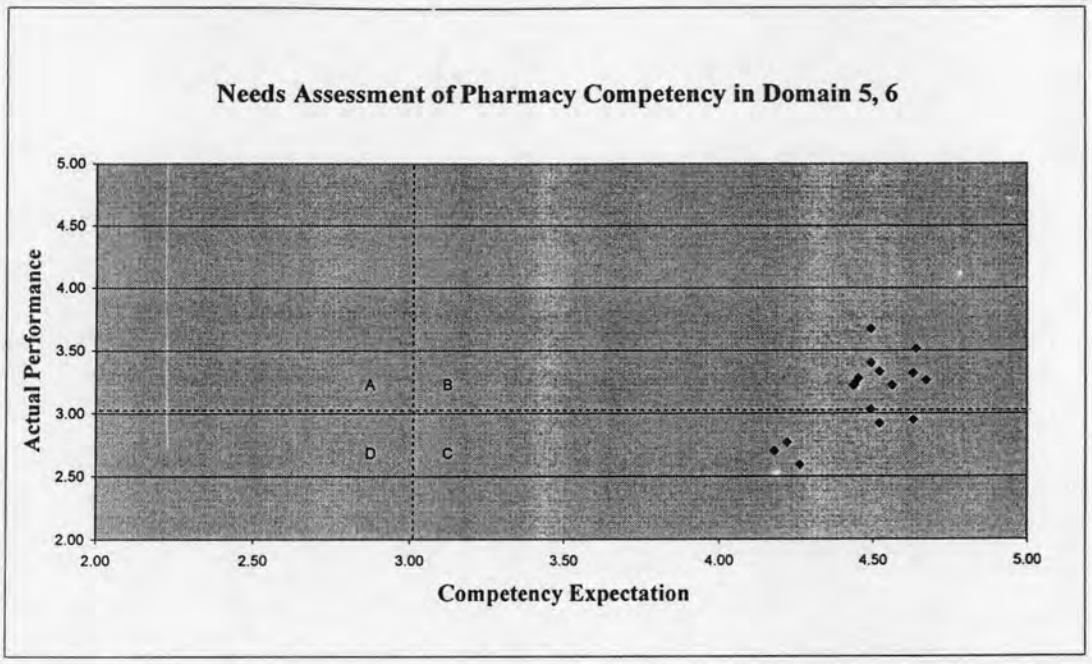


Figure 4.12 Pharmacy students' expectation and performance of students' competency with domain 5 to 6.

From Figure 4.12, of the 16 competency activities, there were five competency activities that should be improved. The examples were the activity statement number 6.2.1 (have conceptual thinking), the activity statement number 6.4.2 (well communicate in Thai and English)

2.2.3.5.2 Actual Performance, Expectation Level of Pharmacy Competency Activities and PNI in Competency Domain 5 and 6

PNI, mean, standard deviation of the actual performance and the expectation level of pharmacy competency activities in domain 4 (Health systems management) were summarized in Table 4.15. The results of each value were presented as following.

The mean performance scores of competency activity in domain 5 (Professionalism) and domain 6 (Personal general abilities) ranged from 2.59 to 3.67. The highest scores of competency activities were the activity statement number 6.3.3 (having diligence, be patient and generous). The activity statement number 6.1.1 (ability to apply chemical reaction theory into the work related to pharmaceutical products) was rated the lowest mean score of competency activity in this domain.

Results on professionalism and general ability showed that the expectation mean scores of these two domains ranged from 4.18 to 4.67. The highest

expectations rank was the statement number 6.2.2 (ability to use the appropriate rationality). The lowest expectation rank was the activity statement number 5.2.It was found that the PNI of domain 5(Professionalism) and domain 6 (General abilities) ranged from 3.69 to 7.80. For domain 5 and domain 6, the average of PNI of competency activity was 5.95. There were 9 out of 16 competency activities that should be improved. The top three ranks of pharmacy activities in these two domains were the activity statement number 6.2.1(have conceptual thinking), the activity statement number 6.4.2 (well communicate in Thai and English), the activity statement number 6.1.1 (ability to apply chemical reaction theory into the work related to pharmaceutical products). Their PNI was 7.80, 7.25, and 7.12, respectively. This finding was indicated that the students should be improved their communicate skills both in Thai and English and their conceptual thinking.

In general competency, both respondents had needs to improved their communicate skills both in Thai and English and have conceptual thinking.

Table 4.15 Mean, standard deviation and PNI of the expectation level and the actual performance of pharmacy competency activities in domain 5&6.

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
6.2.1	Have conceptual thinking	2.95	0.55	4.63	0.54	**7.80**	1
6.4.2	Well communicate in Thai and English	2.92	0.94	4.52	0.71	7.25	2
6.1.1	Ability to apply chemical reaction theory into the work related to pharmaceutical products	**2.59**	0.81	4.26	0.69	7.12	3
6.2.2	Ability to use the appropriate rationality	3.26	0.60	**4.67**	0.53	6.59	4
6.6.1	Identify the problem, synthesize to resolve the problem, gather the relevant information for consideration and make a decision	3.03	0.71	4.49	0.67	6.59	5
5.2.1	Identify target goal of pharmacy profession and pharmacist's responsibility.	2.70	0.78	**4.18**	0.84	6.18	6
5.2.4	Participate in the pharmacy activities in order to improve professional	2.77	0.86	4.22	0.71	6.13	7
6.5.3	Be able to learn on your own effectively	3.22	0.77	4.56	0.65	6.12	8

No.	Pharmacy Ability	Performance Level		Expectation Level		Needs Assessment	
		Mean	SD	Mean	SD	PNI	Priority
6.3.1	Can coordinate with the health care professional and other personnel within the organization	3.32	0.76	4.63	0.61	6.09	9
6.4.3	Having the skill to present and exchange the ideas	3.22	0.69	4.44	0.77	5.40	10
6.3.2	Having the state of leadership and the follower	3.33	0.73	4.52	0.69	5.39	11
6.4.1	Listen, speak, read, write and use the computer for communication	3.23	0.81	4.44	0.71	5.35	12
6.5.2	Identify the topic that would like to learn	3.27	0.67	4.45	0.71	5.24	13
5.2.2	Search and analyze drug information by him/herself.	3.51	0.82	4.64	0.54	5.22	14
6.5.1	Having ability to do the research and gather information	3.40	0.66	4.49	0.71	4.92	15
6.3.3	Having diligence, be patient and generous	**3.67**	0.62	4.49	0.63	**3.69**	16
	Mean score of 16 competency activities	**3.15**	**0.74**	**4.48**	**0.67**	**5.95**	

2.3. Importance Level of Each Pharmacy Competency Domain from the Pharmacy Preceptor and the Pharmacy Students.

The second session of needs survey was an open-ended question. The respondents were asked to rank the importance level of each pharmacy competency domains. In considering the opinion about the importance level of each pharmacy competency concerning the functional competency as surveyed from the pharmacy preceptor and the fifth year of pharmacy students, it was found that both groups give the most weight to the competency domain 1 (Ensuring appropriate therapy and outcomes) following by the competency domain 2 (Selection and dispensing medications and health products) whereas the third is equally weighted by the pharmacy preceptor between the competency domain 3 (Health promotion and disease prevention) and the competency domain 4 (Health system management), while the pharmacy students put more weight on the competency domain 3 (Health promotion and disease prevention) more than the competency domain 4 (Health system management). The results were shown in Table 4.16.

Table 4.16 Importance level of each pharmacy competency domains concerning the functional competency

Competency Domain	Importance level	
	pharmacy preceptor	Pharmacy students(clinic)
No. respondents	26.00	73.00
1. Ensuring Appropriate Therapy and Outcomes	0.44	0.35
2. Selection and Dispensing Medications and Health Products	0.21	0.27
3. Health Promotion and Disease Prevention	0.17	0.23
4. Health Systems Management	0.18	0.14
Total	1	1

Table 4.17 presented the importance level of core competency, the pharmacy preceptor and the clinical pharmacy students give equal weight to professionalism and general Ability.

Table 4.17 Importance level of each pharmacy competency domains concerning the functional competency

Competency Domain	Importance level	
	pharmacy preceptor	Pharmacy students(clinic)
No. respondents	26	73
1. Professionalism	60	60
2. General ability	40	40
Total	100	100

Phase II. Competency Needs Analysis

The aim of this phase was to analyze factors associated with pharmacy competency needs. In the presenting study, it was assumed that the cause of competency needs was the lack of curriculum contents related to those competencies. Therefore, the curriculum was the one factor that associated to competency needs. The results of the competency needs in phase 1 were 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 is patient-oriented, was highly suggested to meet the stakeholders' needs. These results were confirmed by the study of Kapol (2006). Kapol(2006) conducted an evaluation of curricula contents of all core (ie., require) courses from each pharmacy school in Thailand using a written questionnaire that was distributed to course coordinators. Course syllabi were collected from 11 pharmacy schools. A questionnaire was developed based on the Thai pharmacy competency standards. Course coordinators completed the questionnaire assessing the curricula content. The results showed that based on Thai pharmacy competency standards, the curricula of both the BS and Pharm.D. degree programs addressed all 8 competency domain requirements. However, the patient-oriented portion did not meet the Thai pharmacy competency standards, which have a higher emphasis on patient-oriented material. The ratio of patient-oriented, product-oriented, and social and administrative pharmacy-oriented content areas was 2.1:2.9:1.0, which differed from the ratio recommended by the Thai pharmacy competency standard (3:2:1). The predominant content area was product-oriented material for the BS programs. In contrast, the predominant content area in the Pharm.D programs was patient-oriented content. Social and administrative pharmacy-oriented content was the lowest in both the BS and Pharm.D curriculums. As Thai pharmacy schools further revise their curricula, it may be useful to decrease the product-oriented content and expand patient-oriented material. In conclusion, in the presenting study, therefore, was to design the pharmacy curriculum based on patient-oriented approach.

Phase III. Competency Needs Solution

The results of this phase were to design course of curriculum in order to produce the competitive pharmacy graduates. The focus of curriculum was based on patient-oriented approach regarding to the competency needs results of the study in Phase 1.

The results of the study were presented based on the QFD steps. The research methodology for the curriculum design using QFD approach consists of 7 steps which were; step 0. QFD plan for pharmacy curriculum design; step 1: pharmacy competency in curriculum design; step 2: Identifying contents elements (study content) (How's); step 3 Establishing correlations between pharmacy competency and study contents; step 4: Identification of the pre-requisite contents using the correlation matrix; step 5: Competency assessment in quality planning matrix; and step 6: Identify the importance priority of knowledge requirement. After finished all steps, the next phase were proposed the new Pharm.D curriculum. Figure 4.13 shows the six major areas of the house of quality for the design of curriculum. .

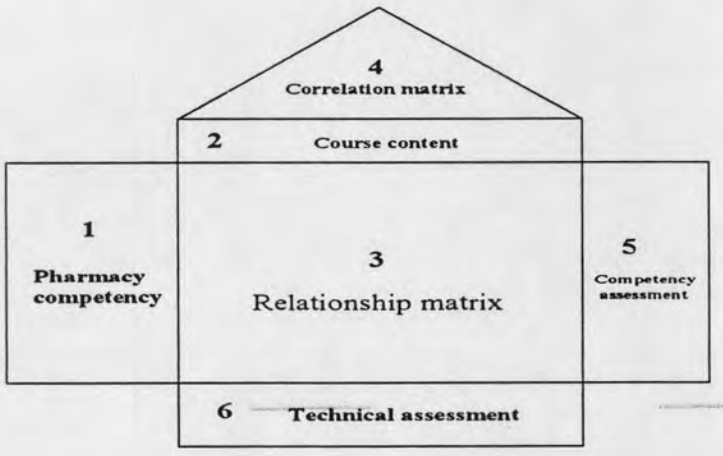


Figure 4.13 Six major areas of the house of quality for the design of curriculum

Step 0: QFD Plan for Pharmacy Curriculum

Before the pharmacy curriculum was designed using quality function deployment (QFD) approach, the planning step was conducted first. The mission statement of pharmacy undergraduates were as follows;

Table 4.18 The mission statement of pharmacy undergraduates

Mission Statement : Pharmacy undergraduate qualification	
Pharmacy undergraduate qualification	The mission of Doctor of Pharmacy Education is to prepare the new Pharm.D. students who are able to provide good quality pharmaceutical care and pass the pharmacy qualifying examination. To achieve this mission, pharmacy students must develop knowledge, skills, and attitudes that enable them to pharmacy competency which had 6 domains. Domain 1: Ensuring Appropriate Therapy and Outcomes Domain 2: Selection and Dispensing Medications and Health Products Domain 3: Health Promotion and Disease Prevention Domain 4: Health Systems Management Domain 5: Professionalism Domain 6: General Ability

Mission Statement : Pharmacy undergraduate qualification	
Curriculum Objectives	The curriculum objective of producing pharmacy undergraduates is to create the pharmacists with morals and ethics who possess knowledge in drug systems and health systems management, with leadership and skills in conducting pharmaceutical care, selection and dispensing health products, giving advices, teaching, demonstrating, and managing the risks in drug usage, promoting health and preventing diseases, and ensuring that people and individual patients in the community or clinics received appropriate medicine treatments and protection, with greatest benefits and in accordance with the need of society and country (CU pharmacy curriculum).
Target Markets	• Drug store • Hospital
Assumption and Constraints	Factors that should be concerned before designing pharmacy curriculum were 1) The qualification of students who entered the faculty of Pharmaceutical Sciences, Chulalongkorn University. 2) Competitive of the pharmacy schools 3) Standard and regulations: Thai Pharmacy competency standard. 4) Resources: Facilities and faculty members
Stakeholders	The stakeholders were defined as two groups of customers; first, external customer -pharmacy preceptors; second, internal customer- clinical pharmacy students and faculty members.

Step 1 Pharmacy Competency Standard

This step was divided into two parts; first, classifying of the pharmacy competency with group discussion and identification of the competency weight factor using AHP (Area 1 of the HOQ).

1. Pharmacy Competency Structure

From phase 1 of this study, the first draft of pharmacy competency standard was evaluated and adjusted to be the final pharmacy competency standard for using in phase 3 of this study to develop pharmacy curriculum. After that, the pharmacy competency standard was classified into three levels using group discussions which were; first, a competency domain or field of activity; second, a competency level or classes of activities; and third, activities or interventions. The details of each class of pharmacy competency were mentioned in the Phase I of this study. Figure 4.14 showed the example of the structure of pharmacy competency standard.

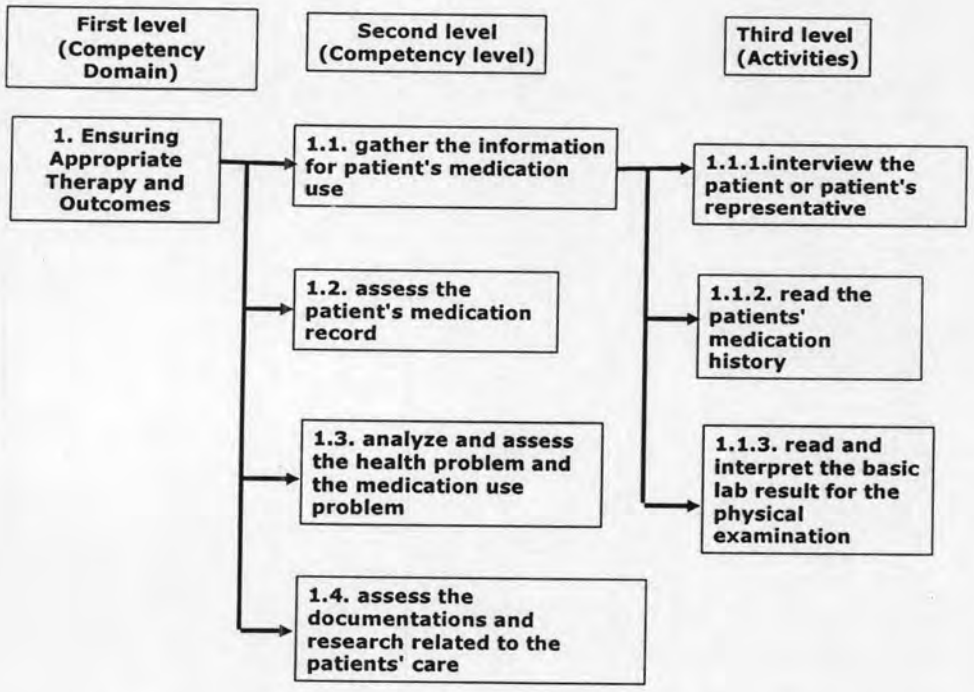


Figure 4.14 example of the structure of pharmacy competency standard

2. The Pharmacy Competency Weight Factors

After classifying the pharmacy competency standard, the researcher determined the competency weight factor of each competency domain. This research applied the VISIO-QFD program in building the house of quality and using the analytic hierarchy process (AHP) of this program to calculate the competency weight factor, by filling out one set of data from the AHP questionnaire. This study, the design content was created from the functional competency which were; first, competency domain 1 (ensuring appropriate therapy and outcomes); second,

competency domain 2 (selection and dispensing medications and health products); and third, competency domain 3 (health promotion and disease prevention); fourth, competency domain 4 (health systems management). Thus, the researcher surveyed the faculty members' opinions about the weight factor of the four domains by using the AHP questionnaire and calculated for the mean, median, and mode of the data.

Table 4.19 Descriptive value of the pair-wise comparison

No.	The pair-wise comparison	The first choice is less important				The first choice is more important			
		N	Mean	Median	Mode	N	Mean	Median	Mode
1	Ensuring Appropriate Therapy and Outcomes vs. Selection and Dispensing Medications and Health Products	9	6.33	7	5	28	5.5	5	* 5
2	Ensuring Appropriate Therapy and Outcomes vs. Health Promotion and Disease Prevention	7	4.43	4	3	26	5.31	5	* 7
4	Ensuring Appropriate Therapy and Outcomes vs. Health Systems Management	9	4.4	4	3	34	4.6	5	* 5
5	Selection and Dispensing Medications and Health Products vs. Health Promotion and Disease Prevention	14	5.4	5	5	23	5.21	5	* 7
6	Selection and Dispensing Medications and Health Products vs. Health Systems Management	14	5.6	5.5	3	24	5.1	5	* 3
7	Health Promotion and Disease Prevention vs. Health Systems Management	17	4.2	5	5	20	4.45	3.5	* 5

Note: the blank with "*" was the chosen numeric set

The consideration was made over numbers from the calculation of descriptive statistic of mean, median and mode. The researcher selected "mode" from the group that had most responses. Considering the first pair of the questionnaire, it revealed that number of responses of "the first choice is strong important than the second choice" was larger than the number of responses of the second group "the first choice is less important than the second choice". Therefore, the "Mode" variable of "5" was selected from the group of "The first choice is strong importance than the second choice. It could be concluded that "ensuring appropriate therapy and outcomes" was more strong importance than "selection and dispensing medications and health products". The selection method was applied to each pair of the questionnaire in order to get the result of numeric set. Overall consideration of the result showed that the data come from the decision-making was not coherent in the item number 6 of AHP questionnaire. As a result, the alternative selection was applied by choosing the opposite pair, which provided more coherent set of information.

Step 2: Content Designs (Area 2)

The results of the house of quality were used for curriculum planning. The researcher designed contents from the translation of activity competency into course contents. This stage needed information from several sources, for instance, a study of the curriculum of first-class universities from abroad, or a study of their rules and standard, etc. The course contents were designed based on the structure of the pharmacy body-of- knowledge to serve as a framework.

1. Structure of the Pharmacy Body-of-Knowledge

According to pharmacy contents design from the activity competency which was related to the pharmacy competency domain number 1 to 4, it was shown that the pharmacy contents relating to professions as according to the regulations of the Thai Pharmacy Council were comprised four content areas, the basic biomedical sciences, pharmaceutics sciences, clinical sciences, and social and administrative pharmacy sciences. The design contents were a design of the contents at level 4 and were grouped into courses at level 3. These courses were created within the fields of pharmacy knowledge at level 2 which comprised the aforementioned four sciences of content.

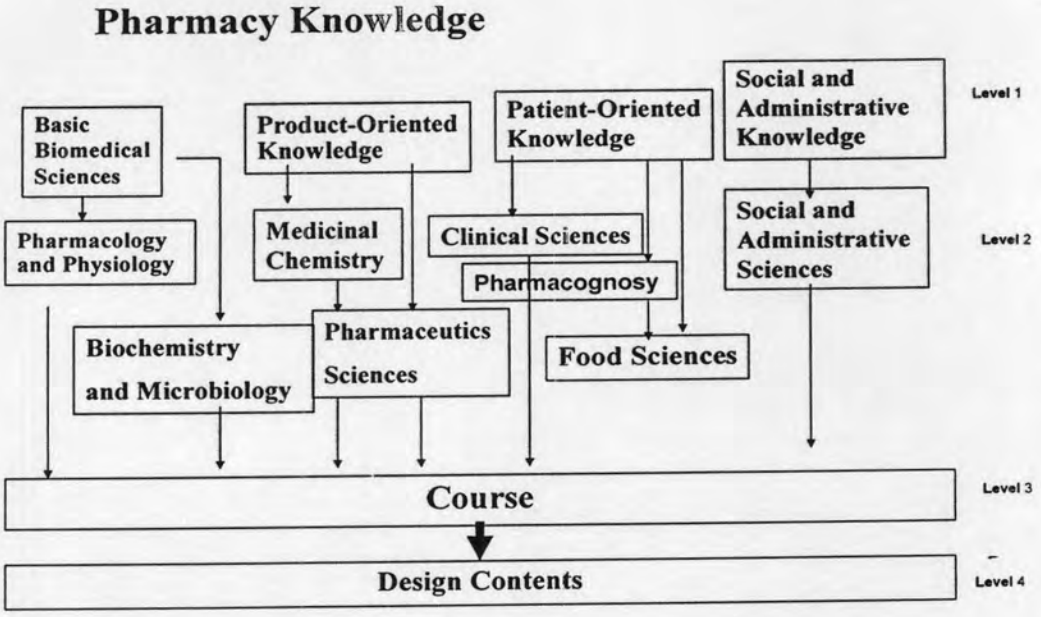


Figure 4.15 Structure of the pharmacy body-of- knowledge

The designed curriculum was divided into 2 groups – the contents for core curriculum courses and the contents for the elective courses. This result was focused only in the design of the core curriculum courses.

2. Pharmacy Curriculum Contents

In this study, the pharmacy contents were conducted by translation from the functional competency (pharmacy competency domain 1 to 4). It was found that competency activity or the ability in pharmaceutical care of the operating-level pharmacist, was able to be transformed into major contents. Therefore, the contents were major topics which could be gone into details at several levels. Once obtained the major topics, the instructors classified and named the group of knowledge.

Table 4.20 The example of the summary of activities-contents courses

Pharmacy Activities	Group of Pharmacy Knowledge
1.1.4.1 Ability to know the creditworthy data source	Informatics, Literature evaluation, Research methodology and Statistics.
1.1.4.2 Ability to search the documentation and research related to the patients' care	
1.1.4.3 Ability to select the documentation and research and evaluate the fairness and creditworthiness	
1.1.4.4 Ability to analyze and define the research outcomes	

From the example of the study in Table 4.20, it was found that the contents that directly enable the pharmacist's ability to research and analyze data in patient's care are the knowledge in Informatics, Literature evaluation, Research Methodology and Statistics. To create further detailed contents, the instructors must research from additional documents to write down the details of course contents, instruction methods, and course evaluation. In addition to the four main courses that enabled the pharmacist's ability to research and analyze data in patient's care, other courses also required researching for data, for example, to answer disease or medicine's questions or to do additional reports, however they were not considered to be the outcome of course contents but rather the outcome of the instructional methods. In curriculum design, after specifying the major topics and grouping the contents as shown in Table 4.20, the instructors of each field categorized the knowledge according to their specialized area and further confirmed from textbooks and documents relating to their certain areas They also compared with pharmacy curriculum from both domestic and abroad pharmacy schools. The obtained contents were used to create undergraduate contents and could also be linked to further create graduate contents.

The knowledge created was the core knowledge for the pharmacists which were; pharmaceutics sciences, clinical sciences, and social and pharmacy administrative sciences. Furthermore, the biomedical sciences, which were the basic courses, were created too. However, sciences foundation and mathematic knowledge were not designed in this study.

The proposed Pharm.D. curriculum was divided into 4 contents areas as aforementioned. The contents areas were described as following;

2.1. Biomedical Sciences

This study, it was found that the pharmacy competencies were translated into biomedical sciences contents as presented in Table 4.21.

Table 4.21 The example of biomedical sciences topics

Class of Pharmacy Activities	Course	Course contents of undergraduate pharmacy
1.1.2.2 Ability to assess the health behavior of patient and any relevant factors health product 1.1.3.1 Ability to analyze and assess to identify the preliminary health problem	Anatomy and Physiology, Pathophysiology	-Anatomy and physiology knowledge which related to any symptom and well-known disease in Thailand. - Epidemiology (incidence and prevalence of diseases) and guideline of treatment the diseases.

After obtained group of biomedical sciences knowledge, the instructors completed the details of course contents, by studying from the pharmacy documents or textbooks, as well as studying from the domestic and abroad curriculums. Thus, it was found that, there were 13 courses biomedical sciences knowledge.

2.2. Product-Oriented Knowledge

In this study, pharmaceutics sciences topics were created from pharmacy competency standard, especially in competency domain 2 (selection and dispensing medication and health products). The example results of the design contents using QFD were shown in Table 4.22.

Table 4.22 The example of pharmaceutics sciences topics

Class of Pharmacy Activities	Course	Course contents of undergraduate pharmacy
2.1.1.1 Selection the medication and health product 2.1.1.1.1. Ability to evaluate medication using physical and chemical knowledge.	Pharmaceutical Dosage Forms and Drug Delivery Systems	- Principles of dosage form design and development - Solid Dosage forms and modified release DDS - Semi-solid and Transdermal System - Pharmaceutical Inserts - Liquid Dosage Forms - Sterile Dosage Forms and Drug Delivery Systems - Novel and Advanced Dosage Forms, Delivery systems and Devices - Dosage form evaluation and quality control (every dosage forms) - Stability, storage condition and incompatibility (every dosage forms) - Laboratory - Good compounding practices - Extemporaneous preparations of various dosage forms - IV admixture and Aseptic technique, Cytotoxic drug preparation (observation)

The instructors completed the details of course contents, by studying from the pharmacy documents or textbooks, as well as studying from the domestic and abroad curriculums. After finish the grouping of course contents, there were 16 courses for pharmaceutics sciences area.

2.3 Patients-Oriented knowledge

In this study, clinical sciences topics were created from pharmacy competency standard, especially in competency domain 1(ensuring appropriate pharmacotherapy and outcome). There were 23 courses for clinical sciences areas. The example results of the design contents using QFD were shown in Table 4.23.

Table 4.23 the example of design clinical sciences topics

Class of Pharmacy Activities	Course	Course contents of undergraduate pharmacy.
1.1.1.1 Ability to interview the patient or patient's representative	Communication Skills	- Interviewing techniques - Psychology in communication - Pharmacy performance - Effective verbal and written interpersonal communication
1.1.1.3 Ability to read and interpret the basic lab result for the preliminary physical examination	Patient-related Activities	- Obtaining a comprehensive patient history - Familiarity with basic assessment techniques (inspection, palpation, percussion, auscultation), terminology, and the modifications caused by common disease states and drug therapy - Knowledge of the basis for common clinical laboratory values and diagnostic tests - Influences of common disease states.

2.4 Social and Administrative Pharmacy-Oriented knowledge

This study, social and administrative pharmacy sciences topics were created from pharmacy competency standard, especially in competency domain 3 and 4. There were 6 courses for social and administrative pharmacy. The example results of the design contents using QFD were shown in Table 4.24.

Table 4.24 The example of social and administrative pharmacy topics

Class of Pharmacy Activities	Course	Course contents of undergraduate pharmacy
2.1.1.1.3 Ability to evaluate medication using knowledge related to social and administrative field.	Health Care Policy, System and Services, Pharmacoeconomics, Drug Use Evaluation, Informatics and Literature Evaluation	-Legal basis of pharmacy practice -Pharmacist's responsibilities and limits under the law -Pharmacist's role in reducing liability by reducing drug-related misadventure - Concepts of pharmacoeconomics in relation to patient care - Applications of economic theories and health-related quality-of-life concepts to - Improving allocation of limited health care resources

Step 3: Identification of the Relationship among the Pharmacy Competency and Course (Area 3)

In order to examine the relationship between the course content and pharmacy competency, the evaluation form were developed by the researcher. These forms were distributed to all course coordinators. The course coordinator reviewed their course contents and then identified the relationship between objective and competency which they taught. The results of this step were shown in Table 4.25.

Table 4.25 Frequency of courses addressing each pharmacy competency

Pharmacy Competency	Number of Course			
	No relationship	Slight relationship	Medium relationship	Strong relationship
Domain 1 Ensuring Appropriate Therapy and Outcomes	*26*	*17*	*8*	*7*
1.1 Competency to gather and assess the information for the pharmaceutical care purpose (13 items)	20	22	7	9
1.2 Competency to provide pharmaceutical care(17 items)	19	23	4	12
1.3 Competency to manage the patient data (4 items)	38	7	12	1
Domain 2 Selection and dispensing medications and health product	*33*	*10*	*8.5*	*7*
2.1 Competency to evaluate medication and health products (7 items)	28	9	17	4
2.2 Competency to analyze the prescriptions (9 items)	21	18	7	12
2.3.1 Ability to compound pharmaceutical products with the details on the standard formulation	44	5	3	6
2.3.2 &2.3.3 Ability to demonstrate the knowledge of pharmaceutical control AND extemporaneous preparation	37	12	3	6
2.3.4 Ability to apply SAR and biopharmaceutical knowledge to select the appropriate treatment options or disease prevention for patients.	36	1	6	15
2.3.5 &2.3.9 Ability to dispense medication	28	17	11	2
2.3.10 Ability to manage risks of drug usage for patients	36	6	12	4
Domain 3 Health Promotion and Disease Prevention	*50*	*5*	*2*	*1*

Pharmacy Competency	Number of Course			
	No relationship	Slight relationship	Medium relationship	Strong relationship
3.1 Competency of access and learning the community(3 items)	**51**	**4**	**1**	**2**
3.2 Competency to promote good health and prevent community-based problems (5 items)	**49**	**6**	**3**	**0**
Domain 4 Health Systems Management	***52***	***4***	***1.5***	***1.5***
4.1&4.2 Competency to Manage medications throughout the health system and manage drug system(6 items)	**49**	**6**	**2**	**1**
4.3 Competency to perform the professional within ethical and merit aspects(4 items)	**53**	**2**	**2**	**2**
4.4 Competency to perform the professional in accordance with law (4 items)	**53**	**4**	**0**	**1**

The pharmacy competency domains were classified into 15 categories for analysis. Table 4.25 describes the frequency of courses addressing each pharmacy competency.

It was found that, all pharmacy competencies were address in the course. There were four level of the relationship between pharmacy competency and course contents which were; first, no relationship; second, slight relationship; third, medium relationship; and fourth, strong relationship. The first set ("no relationship") contained those competencies which do not deal with the course at all. The second set ("slight relationship") contained the courses which address the pharmacy competency not extensively. The third set ("medium relationship") contained the courses which address the pharmacy competency somewhat extensively. The fourth set ("strong relationship") contained the courses which addressed the pharmacy competency extensively.

This table illustrated the emphasis placed on the competency statement number 2.3.4 (ability to apply SAR and biopharmaceutical knowledge to select the appropriate treatment options or disease prevention for patients); statement number

1.2 (competency to provide pharmaceutical care; 17 activities) and statement number 2.2 (competency to analyze the prescriptions; 9 activities) which were addressed through "the strong relationship" by the large frequency of courses. The competency statement number 2.1 (competency to evaluate medication and health products; 7 activities), statement number 2.3.5 and 2.3.9 (ability to dispense medication) and statement number 2.3.10 (ability to manage risks of drug usage for patients) which are addressed through "the medium relationship" by the large frequency of course. The competency statement number 1.1 (competency to gather and assess the information for the pharmaceutical care purpose; 13 activities)", statement number 1.2 (competency to provide pharmaceutical care; 17 activities)" and statement number 2.2 (competency to analyze the prescriptions; 9 activities) which were addressed through "the slight relationship" by the large frequency of course. This was because the basic sciences knowledge which were not directed to the pharmacy competency. In this study, the faculty members only related the basic sciences knowledge to the pharmacy competency activities. Thus, the relative factor of the basic sciences and pharmacy competency were too low which the faculty rated "weak relationship. For the competency statement in domain 3 and 4 were addressed through "no relationship" by the large frequency of course. It was because of the characteristic of the Pharm.D. curriculum, which mainly emphasized patient-oriented.

Step 4: Identification of the Pre-requisite Course Using the Correlation Matrix (Area 4)

According to the new CU pharmacy competency standard, 102 competency activities were translated into course contents, which categorized into four content areas: biomedical sciences, pharmaceutics sciences, clinical sciences or pharmacy practice, and social and pharmacy administrative sciences. The courses' contents were grouped into 13 courses of biomedical sciences, 16 courses for pharmaceutics sciences, 23 courses for clinical sciences, and 5 courses of social and pharmacy administrative sciences. In this step, view points of the faculty members and their teaching experiences were critical to fine tune the sequences of the courses, thus group discussion was used for determining the course sequence. The faculty members applied the prerequisite learning approach for determining the course sequences. The results of this step were filled in the correlation matrix as shown in the Area 4 of the house of quality. The sequences of course of all sciences were presented as follow;

1. Biomedical Sciences

The biomedical sciences introduced the students to the basics of pathophysiology, pharmacology, medicinal chemistry, and pharmacodynamics. It was determined to focus on biochemistry, microbiology, and anatomy and physiology for the science foundation at first level of course sequences. This is because these courses were set the foundation for a better understanding of various disease states and their management. The next sequences were pharmacology, medicinal chemistry, and immunology. Pharmacology is offered concurrently but independently from medicinal chemistry, and precluded an exact sequencing of topics. This was because the pharmacy students should apply structure-activity relationship (SAR) to explain the pharmacology and support therapeutics decision.

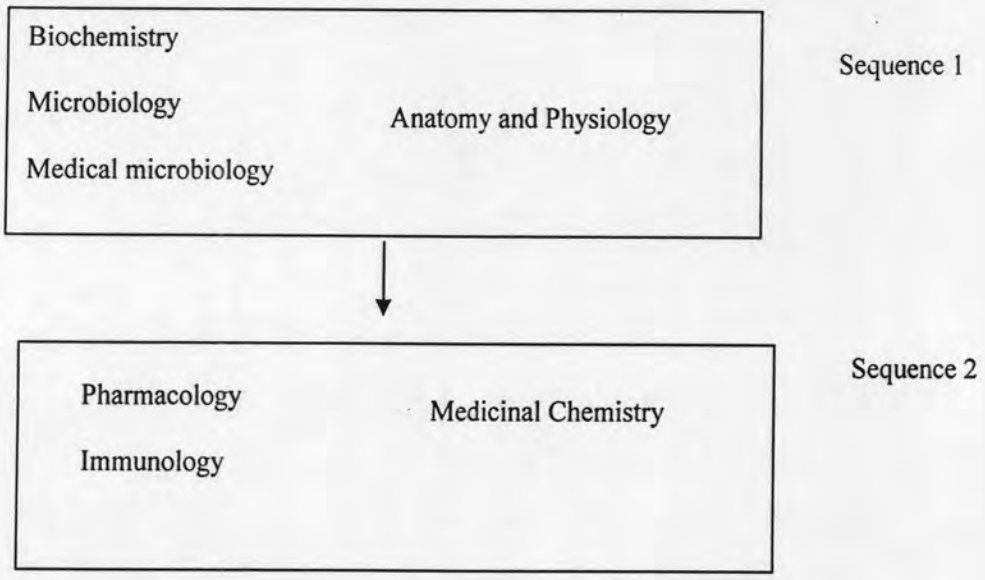


Figure 4.16 The course sequence of biomedical sciences

2. Product-Oriented Knowledge

Pharmaceuticals knowledge encompassed physical and chemical principles of dosage forms and drug delivery systems. Pharmaceutics in Pharm.D included an ability to accurately and safely compound drugs in appropriate dosage forms. Pharmaceutics contents was begun with physical-chemical properties of the drug and the pharmaceutical calculation, moved on explaining various dosage forms, biopharmaceutics and pharmacokinetics, and ended up with good practices for the preparation of pharmaceutical dosage form and compounding dosage forms.

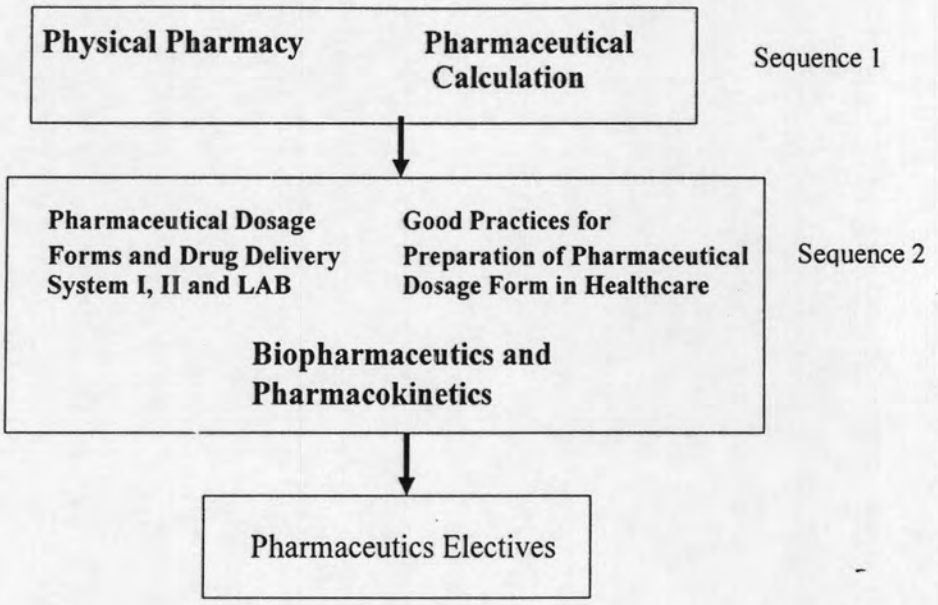


Figure 4.17 Course sequence of Pharmaceutics sciences

3. Patient-Oriented Knowledge

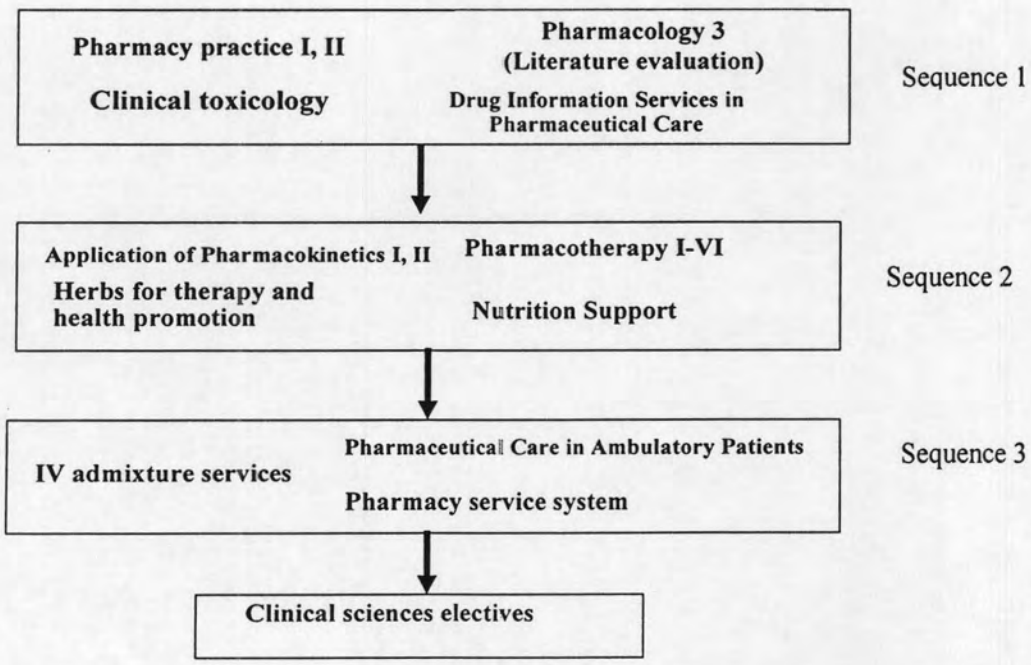


Figure 4.18 Course sequences of Clinical sciences

The clinical sciences contents were focused in pharmaceutical care management. It comprised 23 courses. Clinical sciences contents were divided into three groups of courses sequences which were;

3.1 The first sequence was comprised pharmacy practice, clinical toxicology, literature evaluation and drug information service. Thus, this sequence of clinical science contents focused on pharmaceutical care concept, communication, teamwork, dispensing vs. treating of common illness, and physical assessment, literature evaluation and drug information system.

3.2 The second sequences were comprised application of pharmacokinetics, herbs for therapy and health promotion, nutrition support, pharmacotherapy. Thus, this sequence of clinical science contents focused on the application of pharmacokinetics in clinical use, the integration of pathophysiology, pharmacotherapeutics, and clinical pharmacy practice for the provision of pharmaceutical care in the areas of organ disorder, the clinical nutrition course, and herbal drugs used in health promotion and in the treatment of some symptoms.

3.3 The third sequences were intravenous admixture services, pharmaceutical care in ambulatory patient's pharmacy service system. Thus, this sequence of clinical science contents focused on pharmacist-provided care for ambulatory-patients, preparation prescription for sterile injection, and medication dispensing and distribution system.

4. Social and Administrative Pharmacy-Oriented knowledge

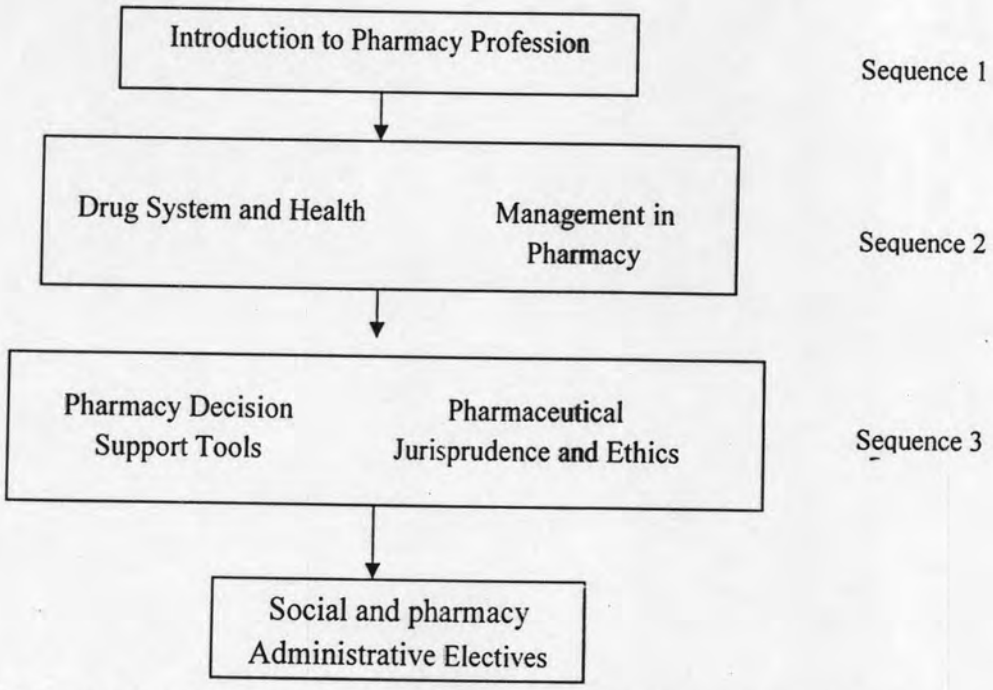


Figure 4.19 Course sequence of Social and pharmacy administrative sciences

Social and pharmacy administrative in Pharm.D was begun with introduction to pharmacy profession, moved on drug system and health, management in pharmacy, and ended up with pharmacy decision support tools, and pharmaceutical jurisprudence and ethics.

Step 5: Quality planning matrix (Area 5)

In traditional HOQ, this step was the process of competitive assessment. To build the curriculum, it was inappropriate to compare it with other curriculum in competitive way. It was only done by comparing with the other curriculum and then used such information for assessment the developed curriculum. This study applied the information of phase I needs assessment survey to be the input in the quality planning matrix as mentioned in the methodology.

Table 4.26 Quality planning matrix for course contents of Pharm.D. curriculum

Competency	1. competency weight factor	Quality planning						
		benchmarking		Planning			Weight	
		2. Student	2. Pharmacy Preceptor	3.Target Quality	4. Improvement rate	5. Emphasis	6. Absolute Weight Factor	7. Relative Weigh Factor
1.1 gather and assess information for pharmaceutical care	0.18	3	3	4	1.33	1.5	0.351	0.20
1.2 provide pharmaceutical care	0.18	3	3	4	1.33	1.5	0.351	0.20
1.3 manage the patient data	0.18	3	3	4	1.33	1.5	0.351	0.20
2.1 evaluate medication and health product	0.05	3	3	3	1.33	1.2	0.065	0.04
2.2 analyze the prescriptions	0.05	3	3	4	1.33	1.2	0.087	0.05
2.3.1compound pharmaceutical products with the details on the standard formulation	0.05	3	3	4	1.33	1.2	0.087	0.05
2.3.2 demonstrate the knowledge of pharmaceutical control; and 2.3.3 extemporaneous preparation	0.05	2	2	4	1.33	1.2	0.13	0.07
2.3.4 apply SAR and biopharmaceutical to select the appropriate treatment	0.05	3	3	4	1.33	1.2	0.087	0.05
2.3.5&2.3.9 dispense medication	0.05	3	3	4	1.33	1.2	0.087	0.05
2.3.10 manage risks of drug usage for patients	0.05	3	3	4	1.33	1.2	0.087	0.05
3.1 access and learning the community	0.01	3	3	3	1.33	1	0.009	0.01
3.2 promote good health and prevent community-based problems	0.01	3	3	4	1.33	1	0.012	0.01
4.1manage medications throughout the health system; and 4.2 manage drug system	0.02	2	2	3	1.33	1	0.037	0.02
4.3 perform the professional within ethical and merit aspects	0.02	3	3	3	1.33	1	0.025	0.01
4.4 perform the professional with law	0.02	3	3	4	1.33	1	0.033	0.02
							1.801	1.00

In consideration of the improvement rate of student competency, it was derived from the actual student's competency from the assessment of pharmacy graduate by his/herself which divided by the expected student's competency from pharmacy practitioner assessment. These values indicated the category of competency that can be improved or needed to be improved. The results showed that every aspect of pharmacy competency had the improvement rate more than 1 which meant that there were needs of improvement of the pharmacy competency in every

aspect. The first two competency aspects needed to improve were the competency number 2.3.2, 2.3.3 (demonstrate pharmaceutical control and extemporaneous preparation), and the competency number 4.1 and 4.2 (manage medications throughout the health system and drug system). Furthermore, it was found that the curriculum built by Pharm.D. curriculum which emphasized the maximum health care services to patients directly, therefore, the faculty members had to create the distinctive point for the graduate by using the first competency domain, ensuring appropriate therapy and outcomes.

The results of planning matrix were provided the value of absolute weight which differed from the value of the competency weight factor. The value from the competency weight factor was the weight of the importance of the pharmacy competency domain obtained from the assessment by faculty members whereas the value of absolute weight came from the needs of pharmacy practitioners, students and the faculty members by taking the existing resources and the distinctive competency to produce the graduates into consideration. The researcher recommended that the absolute weight can be used as index for course assessment. The course coordinator should use the absolute weight to reexamine whether the study of course was able to produce the students with what competency. If not meet the absolute values, which part of course contents should be added or reduced to best satisfy the stakeholders. Then, course coordinators used the absolute weight from quality planning matrix to evaluate courses whether students had pharmacy competency as the value of absolute weight. If it was less than absolute weight, the course should be adjusted. From the calculation of the value of the absolute weight, it was found that the scoring of competency could be divided into 3 levels, which were;

1. The pharmacy competencies which faculty members rated the high importance priority to emphasize (the level of importance scoring is ranged from 0.13 to 0.351) were the competency number 1.1 (gather and assess information for pharmaceutical care, the competency number); 1.2 (provide pharmaceutical care, the competency number); 1.3 (manage the patient data, and the competency number); 2.3.2 (demonstrate the knowledge of pharmaceutical control); and 2.3.3 (extemporaneous preparation)

2. The pharmacy competencies which the faculty members rated the medium importance priority to emphasize (the level of importance scoring is ranged from

0.065 to 0.087) were the competency number 2.1 (evaluate medication and health product, the competency number); 2.2 (analyze the prescriptions, the competency number); 2.3.1 (compound pharmaceutical products with the details on the standard formulation, the competency number); 2.3.2 (demonstrate the knowledge of pharmaceutical control); and 2.3.3 (extemporaneous preparation) and , 2.3.4 (apply SAR and biopharmaceutical to select the appropriate treatment); 2.3.5 & 2.3.9 (dispense medication); and 2.3.10 (manage risks of drug usage for patients).

3. The pharmacy competencies which the faculty members rated the low importance priority to emphasize (the level of importance scoring was ranged from 0.009 to 0.037 and below) were the competency number 3.1 (access and learning the community), the competency number 3.2 (promote good health and prevent community-based problems) and the competency number 4.1 (manage medications throughout the health system) and 4.2 (manage drug system), the competency number 4.3 (perform the professional within ethical and merit aspects), the competency number 4.4 (perform the professional with law).

As from the aforementioned information, the researcher summarized that if taking the needs of pharmacy practitioner, students and the faculty members into consideration, it was found that the pharmacy competency which they rated the highest importance priority was the first competency domain (ensuring appropriate therapy and outcomes) and the knowledge of pharmaceutical control and extemporaneous preparation where the second competency domain (selection and dispensing medications and health products) was the medium importance priority and the fourth competency domain (health systems management) and third competency domain (health promotion and disease prevention) were the least importance priority.

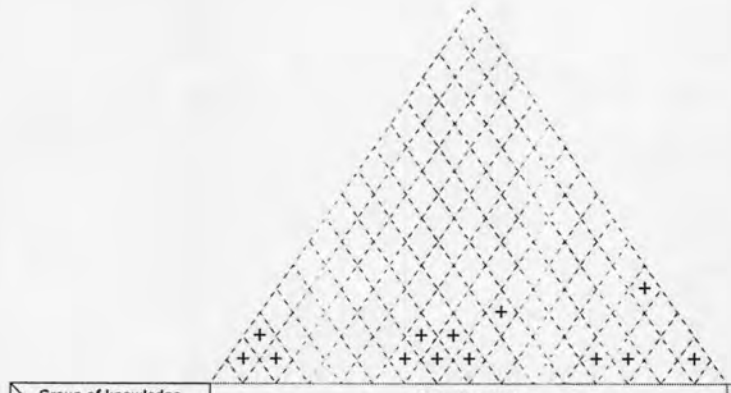
Step 6: Results on the Importance Priority of Pharmacy Knowledge (Area 6)

From the study in step 6, the house of quality was completed. From the analysis of the house of quality, the researcher could get the value of importance of course. The group of pharmacy contents which had the high importance scores meant that this group could create the highest pharmacy competency according to the needs of stakeholder. However, the group of pharmacy contents which had the lesser importance scores did not mean that this group was not important. For all pharmacy

contents that have been created, the researcher considered that they were important contents for creating the Pharm.D. curriculum. Even though such knowledge was only the basic knowledge which does not have the direct effect to the graduate qualification, for example, pharmacotherapy was classified as the group of core knowledge correlate directly with the pharmacy competency and affect to the ability in several competency domains while the Medicinal chemistry considers as the important course as this is the base knowledge for further add on in the other group of pharmaceutical knowledge i.e. Pharmacotherapy, but Medicinal chemistry did not have the high importance scores.

The results from HOQ can be divided into 3 groups of course areas which were; first, the house of quality for pharmaceutics sciences; second, the house of quality for biomedical sciences and clinical sciences; and third, the house of quality for social and administrative pharmacy sciences. The analysis results can be shown as follows:

1. The HOQ for Pharmaceutics Sciences



Group of knowledge / Competency	Basic Knowledge of Medicinal Chemistry	Medicinal Chemistry I	Medicinal Chemistry II	Quality Assurance in Pharmaceutical Products	Pharmaceutical calculation	Physical Pharmacy	Pharmaceutical Dosage Forms I	Pharmaceutical Dosage Forms II	Pharmaceutical Dosage Forms Lab	Pharmaceutical Dosage Preparation	Good Practices for the Pharmacokinetics	Biopharmaceutics and Pharmacokinetics	Basic Knowledge in Pharmacognosy	Herbs for Therapy and Health Promotion	Herbs for Therapy and Health Promotion Lab	Vaccines and Biological Products	Pharmaceutical Biotechnology	The relative weight factor	Benchmarking: Student	Benchmarking: Pharmacy preceptor	Planning: Target quality	Planning: Improvement rate	Planning: Emphasis	Weight: Absolute weight	Weight: Relative weight
1.1 gather and assess the information for the pharmaceutical care purpose														△ 0.35	△ 0.35	△ 0.35		0.18	3	3	4	1.3	◎	0.351	0.20
1.2 provide pharmaceutical care							△ 0.35	△ 0.35				○ 0.70		△ 0.35	△ 0.35	△ 0.35	△ 0.35	0.18	3	3	4	1.3	◎	0.351	0.20
1.3 manage the patient data															△ 0.35			0.18	3	4	4	1.3	◎	0.351	0.20
2.1 evaluate medication and health product	◎ 0.26	◎ 0.26	◎ 0.26	◎ 0.26		○ 0.13	○ 0.13	○ 0.13				○ 0.13	△ 0.07	○ 0.13	○ 0.13		△ 0.07	0.05	3	3	3	1.0	○	0.065	0.04
2.2 analyze the prescriptions	△ 0.09	△ 0.09	△ 0.09		△ 0.09	△ 0.09	△ 0.09	△ 0.09	△ 0.09			○ 0.17		○ 0.17	△ 0.09		△ 0.09	0.05	3	3	4	1.3	○	0.087	0.05
2.3.1 compound pharmaceutical products with the details on the standard formulation	○ 0.17	○ 0.17	○ 0.17		△ 0.09	◎ 0.35	◎ 0.35	◎ 0.35	◎ 0.35	◎ 0.35			△ 0.09					0.05	3	4	4	1.3	○	0.087	0.05
2.3.2 &2.3.3 demonstrate the knowledge of pharmaceutical control AND extemporaneous preparation				◎ 0.52	△ 0.13	◎ 0.52	◎ 0.52	◎ 0.52	◎ 0.52	◎ 0.52	◎ 0.52	○ 0.26	○ 0.26					0.05	2	3	4	2.0	○	0.130	0.07
2.3.4 apply SAR and biopharmaceutical knowledge to select the appropriate treatment	○ 0.17	○ 0.17	○ 0.17			◎ 0.35	◎ 0.35	◎ 0.35				◎ 0.35						0.05	3	4	4	1.3	○	0.087	0.05
2.3.5&2.3.9 dispense medication					△ 0.17	△ 0.09	△ 0.09	△ 0.09				○ 0.17			△ 0.09	△ 0.09		0.05	3	4	4	1.3	○	0.087	0.05
2.3.10 manage risks of drug usage for patients												△ 0.09			△ 0.09			0.05	3	3	4	1.3	○	0.087	0.05
3.1 access and learning the community																		0.01	3	3	3	1.0		0.009	0.01
3.2 promote good health and prevent community-based problems														○ 0.02	△ 0.01			0.01	3	3	4	1.3		0.012	0.01
4.1 & 4.2 manage medications throughout the health system AND manage drug system												△ 0.04						0.02	2	3	3	1.5		0.037	0.02
4.3 perform the professional within ethical and merit aspects																		0.02	3	2	3	1.0		0.025	0.01
4.4 perform the professional with law							△ 0.03	△ 0.03						△ 0.03				0.02	3	3	4	1.3		0.033	0.02
Importance of group of knowledfe	0.70	0.70	0.70	0.78	0.48	1.52	1.90	1.90	0.96	0.87	1.91	0.41	1.06	1.46	0.79	0.50	16.64							1.801	1.00
Relative importance of knowledge	0.04	0.04	0.04	0.05	0.03	0.09	0.11	0.11	0.06	0.05	0.11	0.02	0.06	0.09	0.05	0.03	1.00								

Figure 4.20 House of Quality for Pharmaceutics Sciences

The HOQ for Pharmaceutics Sciences contents provided information about the evaluation of the study contents as shown in Figure 4.20. The following "courses" were found to be the most important and need to be considered on the curriculum design: biopharmaceutics and pharmacokinetics (1.91), pharmaceutical dosage forms and drug delivery system I, II (1.90, and 1.90). In the case of the course that provided the less importance competency, this course did not mean that it was not important course but it did not directly correlate with the competency.

Table 4.27 Importance score and credit hours of pharmaceutics sciences

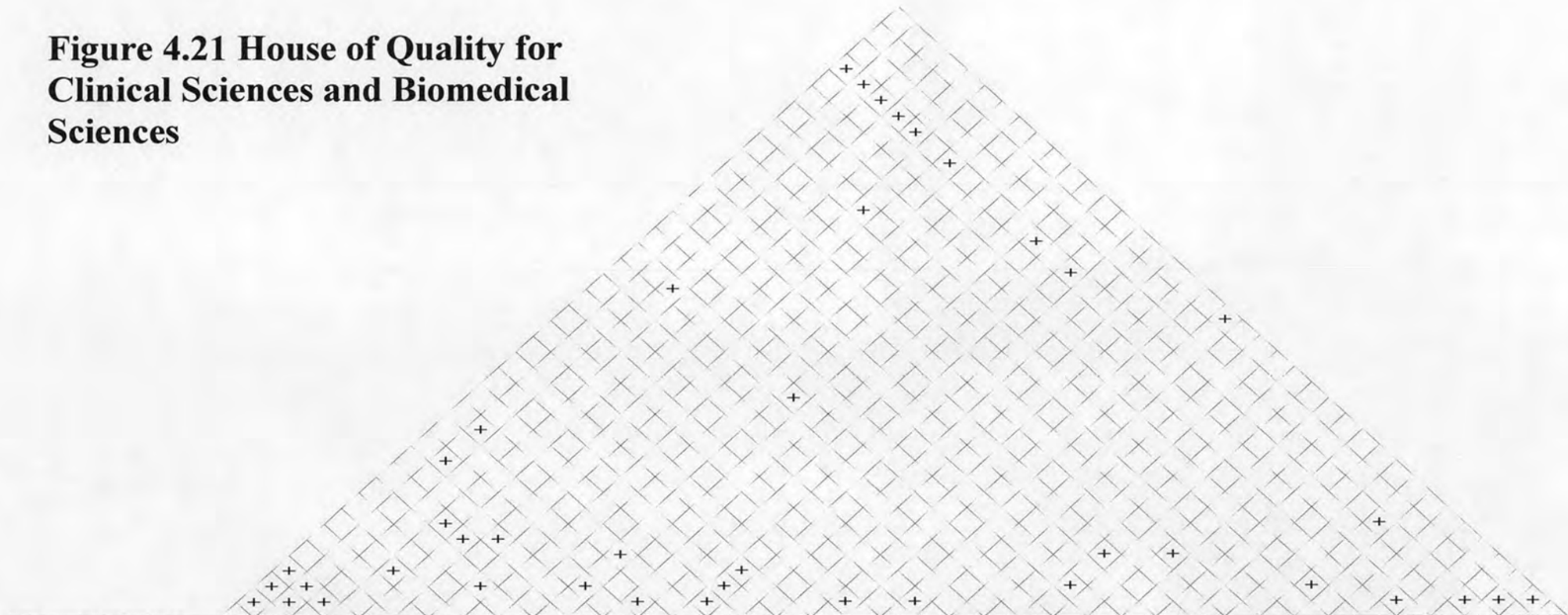
First level	Second level	Tertiary level	Importance Score	Proposed Credit
2. Pharmaceutical Sciences	2.1 Medicinal Chemistry	Basic Knowledge of Medicinal Chemistry	0.70	1
		Medicinal Chemistry I	0.70	1
		Medicinal Chemistry II	0.70	1
		Quality Assurance in Pharmaceutical Products	0.78	1
2. Pharmaceutics Sciences	2.2 Pharmaceutics Sciences	Pharmaceutical calculation	0.48	0.5
		Physical Pharmacy	1.52	2
		Pharmaceutical Dosage Forms and Drug Delivery System I	1.90	2.00
		Pharmaceutical Dosage Forms and Drug Delivery System II	1.90	2.00
		Pharmaceutical Dosage Forms and Drug Delivery System Laboratory	0.96	1.00
		Good Practices for the Preparation of Pharmaceutical Dosage Form in Healthcare Establishment	0.87	1
		Biopharmaceutics and Pharmacokinetics	1.91	2
	2.3 Pharmacognosy	Basic Knowledge in Pharmacognosy	0.41	0.5
		Herbs for Therapy and Health Promotion and LAB	2.52	3
	1.2 Biochemistry and Microbiology	Pharmaceutical Biotechnology	0.50	1
		Vaccines and Biological Products	0.79	1
		Total	**16.64**	**20**

From the results of HOQ for Pharmaceutics Sciences as shown in Table 4.27, it was found that the credit hours which were calculated from the importance score of biopharmaceutics and pharmacokinetics was the highest. The second rank of the credit hours was pharmaceutical dosage forms and drug delivery system (I, II, Lab).

2. The HOQ for Clinical Sciences and Biomedical Sciences

From the evaluation of HOQ for clinical sciences and biomedical sciences as shown in Figure 4.21, it was found that the following "courses" were found to be the most important and need to be considered on the curriculum design which pharmacotherapy, pharmacy practice and pharmacology but the course which provided the less importance scores did not mean that such course was not important. The biomedical sciences such as microbiology, anatomy and physiology which were the important foundation courses but when calculating the correlation between the pharmacy competency and such courses which were indirect importance, the result of the correlation came out to be less. It also meant that this study course did not create the competency directly but it was the foundation curriculum for having more understanding on clinical science and pharmacy practices.

Figure 4.21 House of Quality for Clinical Sciences and Biomedical Sciences



Group of knowledge / Competency	Medicinal Chemistry II	Basic Knowledge of Medicinal Chemistry	Medicinal Chemistry I	Anatomy and Physiology I	Anatomy and Physiology Laboratory I	Pharmacology III	Anatomy and Physiology II	Clinical Toxicology	Anatomy and Physiology Laboratory II	Pharmacology I	Pharmacology II	Biochemistry	Clinical Biochemistry Laboratory	Microbiology I	Microbiology Laboratory	Medical Microbiology	Immunology	Nutrition Support	Food and Nutrition	Pharmacotherapy 5	Pharmacotherapy 6	Pharmacotherapy Laboratory I	Pharmacotherapy Laboratory II	Pharmacy Practice I	Pharmacotherapy Laboratory III	Pharmacy Practice II	Pharmacy Service System	Pharmacy Practice lab I	IV Admixture Services	Pharmacy Practice lab II	Pharmaceutical Care in Ambulatory Patients	Drug Information Services in Pharmaceutical Care	Pharmaceutical Care in Ambulatory Lab	Application of Pharmacokinetics I	Application of Pharmacokinetics II	Pharmacotherapy 1	Pharmacotherapy 2	Pharmacotherapy 3	Pharmacotherapy 4	The relative weight factor	Quality planning: Benchmarking: Student	Benchmarking: Pharmacy preceptor	Benchmarking:	Planning: Target quality	Planning: Improvement rate	Planning: Emphasis	Weight: Absolute weight	Weight: Relative weight
1.1 gather and assess the information for the pharmaceutical care purpose				△ 0.35	△ 0.35	○ 0.70	△ 0.35	△ 0.35	△ 0.35	△ 0.35	△ 0.35	○ 0.70	△ 0.35	△ 0.35	△ 0.35	○ 0.70	△ 0.35	○ 0.70	△ 0.35	◉ 1.41	◉ 1.41	◉ 1.41	◉ 1.41	△ 0.35	◉ 1.41	○ 0.70		△ 0.35		○ 0.70	△ 0.35	○ 0.70	△ 0.35		△ 0.35	◉ 1.41	◉ 1.41	◉ 1.41	◉ 1.41	0.18	3	3		4	1.3	◉	0.351	0.20
1.2 provide pharmaceutical care				△ 0.35	△ 0.35	△ 0.35	△ 0.35	○ 0.70	△ 0.35	◉ 1.41	◉ 1.41			△ 0.35			△ 0.35			◉ 1.41	◉ 1.41	◉ 1.41	◉ 1.41	△ 0.35	◉ 1.41	○ 1.41		△ 0.35	△ 0.35	△ 0.35	○ 0.70	○ 0.35	○ 0.70	△ 0.35		△ 0.35	◉ 1.41	◉ 1.41	◉ 1.41	◉ 1.41	0.18	3	3		4	1.3	◉	0.351	0.20
1.3 manage the patient data						○ 0.70		△ 0.35		○ 0.70	○ 0.70									○ 0.70	○ 0.70	△ 0.35	△ 0.35	○ 0.70	△ 0.35	○ 1.41		△ 0.35			△ 0.35		○ 0.70			○ 0.70	○ 0.70	○ 0.70	○ 0.70	0.18	3	4		4	1.3	◉	0.351	0.20
2.1 evaluate medication and health product	◉ 0.26	◉ 0.26	◉ 0.26			△ 0.07		△ 0.07		△ 0.07	△ 0.07	△ 0.07	△ 0.07					○ 0.13	○ 0.13	○ 0.13	○ 0.13	○ 0.13	△ 0.13	○ 0.13	○ 0.13												○ 0.13	○ 0.13	○ 0.13	○ 0.13	0.05	3	3		3	1.0	○	0.065	0.04
2.2 analyze the prescriptions	△ 0.09	△ 0.09	△ 0.09	△ 0.09	△ 0.09	○ 0.17	△ 0.09	△ 0.09	△ 0.09	◉ 0.35	◉ 0.35									◉ 0.35	◉ 0.35	◉ 0.35	◉ 0.35	○ 0.17	◉ 0.35			○ 0.17	△ 0.09	○ 0.17	◉ 0.35			◉ 0.35	△ 0.17	○ 0.09	◉ 0.35	◉ 0.35	◉ 0.35	◉ 0.35	0.05	3	3		4	1.3	○	0.087	0.05
2.3.1 compound pharmaceutical products with the details on the standard formulation	○ 0.17	○ 0.17	○ 0.17																					△ 0.09		△ 0.09		△ 0.09	△ 0.09	◉ 0.35										0.05	3	4		4	1.3	○	0.087	0.05
2.3.2 & 2.3.3 demonstrate the knowledge of pharmaceutical control AND extemporaneous preparation															△ 0.13					△ 0.13	△ 0.13	△ 0.13	△ 0.13		△ 0.13				○ 0.26								△ 0.13	△ 0.13	△ 0.13	△ 0.13	0.05	2	3		4	2.0	○	0.130	0.07
2.3.4 apply SAR and biopharmaceutical knowledge to select the appropriate treatment	○ 0.17	○ 0.17	○ 0.17			○ 0.17				◉ 0.35	◉ 0.35									◉ 0.35	◉ 0.35	◉ 0.35	◉ 0.35	◉ 0.35	◉ 0.35	○ 0.17		◉ 0.09		○ 0.17	△ 0.09						◉ 0.35	◉ 0.35	◉ 0.35	◉ 0.35	0.05	3	4		4	1.3	○	0.087	0.05
2.3.5 & 2.3.9 dispense medication					△ 0.09	○ 0.17		○ 0.17	△ 0.09	△ 0.17	○ 0.17							△ 0.09		△ 0.09	△ 0.09	△ 0.17	△ 0.17	○ 0.35	○ 0.17			◉ 0.35	△ 0.09	△ 0.09	○ 0.17		○ 0.17				△ 0.09	△ 0.09	△ 0.09	△ 0.09	0.05	3	4		4	1.3	○	0.087	0.05
2.3.10 manage risks of drug usage for patients						△ 0.09				△ 0.09	△ 0.09									○ 0.17	○ 0.17	○ 0.17	○ 0.17	◉ 0.35	○ 0.17	◉ 0.35	◉ 0.35	◉ 0.35						○ 0.17			○ 0.17	○ 0.17	○ 0.17	○ 0.17	0.05	3	3		4	1.3	○	0.087	0.05
3.1 access and learning the community								△ 0.01																		△ 0.01					△ 0.01									0.01	3	3		3	1.0		0.009	0.01
3.2 promote good health and prevent community-based problems						○ 0.02				△ 0.01	△ 0.01								△ 0.01								△ 0.01													0.01	3	3		4	1.3		0.012	0.01
4.1 & 4.2 manage medications throughout the health system AND manage drug system						△ 0.04				△ 0.04	△ 0.04																△ 0.07													0.02	2	3		3	1.5		0.037	0.02
4.3 perform the professional within ethical and merit aspects																								△ 0.02																	0.02	3	2		3	1.0		0.025	0.01
4.4 perform the professional with law																																									0.02	3	3		4	1.3		0.033	0.02
Importance of group of knowledge	0.70	0.70	0.70	0.79	0.88	2.49	0.79	1.74	0.88	3.53	3.53	0.77	0.42	0.70	0.48	0.70	0.70	0.92	0.49	4.73	4.73	4.47	4.47	2.39	4.47	4.31	0.43	2.10	1.13	1.49	2.01	1.06	2.45	0.53	0.79	4.73	4.73	4.73	4.73	82.37							1.801	1.00
Relative importance knowledge	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.02	0.01	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.06	0.06	0.05	0.05	0.03	0.05	0.05	0.01	0.03	0.01	0.02	0.02	0.01	0.03	0.01	0.01	0.06	0.06	0.06	0.06	1.00								

Table 4.28 Importance score and credit hours of biomedical sciences

First level	Second level	Tertiary level	Importance score	Credit
1. biomedical sciences	1.1 Pharmacology and Physiology	Anatomy and Physiology I	0.79	3
		Anatomy and Physiology Laboratory I	0.88	1
		Anatomy and Physiology II	0.79	3
		Anatomy and Physiology Laboratory II	0.88	1
		Pharmacology I	3.53	4
		Pharmacology II	3.53	4
	1.2 biochemistry and Microbiology	Biochemistry	0.77	4
		Clinical Biochemistry Laboratory	0.42	1
		Microbiology1	0.70	1
		Microbiology Laboratory	0.48	1
		Medical microbiology	0.70	3
		Immunology	0.70	2
	2.4 Food Sciences	Food and Nutrition	0.49	3
		Total	**14.66**	**31**

From the results of HOQ for biomedical sciences as shown in Table 4.28, it was found that the importance score of course were too low. This was because 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. Therefore, the result from the study of the house of quality, which was the importance score of the biomedical sciences course, was unable to be used and counted as credit hours or number of proper hours to teach that course. In this study, the researcher applied the credit hours of biomedical sciences based on the regulations by the Higher Education Commission.

Table 4.29 Importance score and credit hours of clinical sciences

First level	Second level	Tertiary level	Importance score	Proposed Credit
1. biomedical sciences	1.1 Pharmacology and Physiology	Pharmacology III (literature evaluation)	2.49	2.5
		Clinical Toxicology	1.74	2
	2.4 Food Sciences	Nutrition Support	0.92	1
3.Clinical Sciences	3 Clinical Sciences and pharmacy practice	Pharmacy Practice I, II, Lab	10.29	11
		Drug Information Services in Pharmaceutical Care	1.06	1
		Application of Pharmacokinetics in Clinical Practice I&II	1.32	1.5
		Pharmacotherapy I-VI	41.79	45
		Pharmacy Service System	0.43	0.5
		IV admixture Services	1.13	1.5
		Pharmaceutical Care in Ambulatory Patients	4.46	5
		Total	**65.63**	**71**

From the results of HOQ for clinical sciences as shown in Table 4.29, it was found that the credit hours which were calculated from the importance score of Pharmacotherapy I-VI were the highest.

3. The HOQ for social and administrative pharmacy sciences

The HOQ for social and administrative pharmacy sciences provided information about the evaluation of the study contents as shown in Figure 4.22. The following "courses" were found to be the most important and need to be considered on the curriculum design which was pharmacy decision support tools.

Group of knowledge / Competency	Group of knowledge						The relative weight factor	Quality planning								
								Benchmarking				Planning			Weight	
	Introduction to Pharmacy Profession	Pharmacy Decision Support Tools	Pharmaceutical Jurisprudence and Ethics	Drug System and Health	Management in Pharmacy	Research Methodology		Student	Pharmacy preceptor			Target quality	Improvement rate	Emphasis	Absolute weight	Relative weight
1.1 gather and assess the information for the pharmaceutical care purpose		△ 0.35				△ 0.35	0.18	3	3			4	1.3	◎	0.351	0.20
1.2 provide pharmaceutical care	△ 0.35	△ 0.35			△ 0.35		0.18	3	3			4	1.3	◎	0.351	0.20
1.3 manage the patient data						○ 0.70	0.18	3	4			4	1.3	◎	0.351	0.20
2.1 evaluate medication and health product			△ 0.07				0.05	3	3			3	1.0	○	0.065	0.04
2.2 analyze the prescriptions		△ 0.09					0.05	3	3			4	1.3	○	0.087	0.05
2.3.1 compound pharmaceutical products with the details on the standard formulation							0.05	3	4			4	1.3	○	0.087	0.05
2.3.2 &2.3.3 demonstrate the knowledge of pharmaceutical control AND extemporaneous preparation			△ 0.13				0.05	2	3			4	2.0	○	0.130	0.07
2.3.4 apply SAR and biopharmaceutical knowledge to select the appropriate treatment							0.05	3	4			4	1.3	○	0.087	0.05
2.3.5&2.3.9 dispense medication							0.05	3	4			4	1.3	○	0.087	0.05
2.3.10 manage risks of drug usage for patients		△ 0.09			○ 0.17		0.05	3	3			4	1.3	○	0.087	0.05
3.1 access and learning the community		◎ 0.04		◎ 0.04	△ 0.01	○ 0.02	0.01	3	3			3	1.0		0.009	0.01
3.2 promote good health and prevent community-based problems		△ 0.01		○ 0.02		△ 0.01	0.01	3	3			4	1.3		0.012	0.01
4.1 & 4.2 manage medications throughout the health system AND manage drug system		△ 0.04	△ 0.04	◎ 0.15	○ 0.07		0.02	2	3			3	1.5		0.037	0.02
4.3 perform the professional within ethical and merit aspects	○ 0.05		◎ 0.10			△ 0.02	0.02	3	2			3	1.0		0.025	0.01
4.4 perform the professional with law		△ 0.03	◎ 0.13				0.02	3	3			4	1.3		0.033	0.02
Importance of group of knowledge	0.40	1.00	0.47	0.21	0.61	1.11	3.79								1.801	1.00
Relative importance of knowledge	0.11	0.26	0.12	0.06	0.16	0.29	1.00									

Figure 4.22 House of quality for Social and Administrative Pharmacy Sciences

Table 4.30 Importance score and credit hours of social and administrative pharmacy sciences

First level	Second level	Tertiary level	Importance score	proposed Credit
4. Social and Administrative Sciences	4. Social and Administrative Sciences	Introduction to Pharmacy Profession	0.40	1
		Drug System and Health	0.21	0.5
		Management in Pharmacy	0.61	1
		Pharmaceutical Jurisprudence and Ethics	0.47	1
		Pharmacy Decision Support Tools	1.00	1.5
		Total	**2.69**	**5**

From the results of HOQ for social and administrative pharmacy as shown in Table 4.30, it was found that the credit hours which were calculated from the importance score of pharmacy decision support tools were the highest.

4. The results of overall importance scores of all courses

As the result of translation of pharmacy competency into course as shown in the three HOQ, the overall importance scores of all courses were calculated. The results of priority of the importance score of 58 courses were shown in the Table 4.31.

Table 4.31 Priority of the importance score of 58 courses.

No.	Courses	Importance Score	Cumulative Importance Score
1	Drug System and Health	0.21	0.61
2	Introduction to Pharmacy Profession	0.40	1.00
3	Basic Knowledge in Pharmacognosy	0.41	1.41
4	Clinical Biochemistry Laboratory	0.42	1.83
5	Pharmacy Service System	0.43	2.25
6	Pharmaceutical Jurisprudence and Ethics	0.47	2.72
7	Microbiology Laboratory	0.48	3.20

No.	Courses	Importance Score	Cumulative Importance Score
8	Pharmaceutical calculation	0.48	3.67
9	Food and Nutrition	0.49	4.16
10	Pharmaceutical Biotechnology	0.50	4.66
11	Application of Pharmacokinetics in Clinical Practice I	0.53	5.18
12	Management in Pharmacy	0.61	5.79
13	Microbiology1	0.69	6.48
14	Medical microbiology	0.69	7.18
15	Immunology	0.69	7.87
16	Basic Knowledge of Medicinal Chemistry	0.69	8.57
17	Medicinal Chemistry I	0.69	9.26
18	Medicinal Chemistry II	0.69	9.96
19	Biochemistry	0.76	10.72
20	Quality Assurance in Pharmaceutical Products	0.77	11.50
21	Anatomy and Physiology I	0.78	12.28
22	Anatomy and Physiology II	0.78	13.06
23	Application of Pharmacokinetics in Clinical Practice II	0.78	13.85
24	Vaccines and Biological Products	0.78	14.63
25	Good Practices for the Preparation of Pharmaceutical Dosage Form in Healthcare Establishment	0.86	15.50
26	Anatomy and Physiology Laboratory I	0.87	16.37
27	Anatomy and Physiology Laboratory II	0.87	17.24
28	Nutrition Support	0.91	18.16
29	Pharmaceutical Dosage Forms and Drug Delivery System Laboratory	0.95	19.11
30	Pharmacy Decision Support Tools	0.99	20.10
31	Drug Information Services in Pharmaceutical Care	1.05	21.16
32	Herbs for Therapy and Health Promotion	1.05	22.21
33	Research Methodology in Pharmaceutical Care	1.10	23.31

No.	Courses	Importance Score	Cumulative Importance Score
34	IV admixture Services	1.12	24.43
35	Herbs for Therapy and Health Promotion Laboratory	1.45	25.88
36	Pharmacy Practice lab II	1.48	27.36
37	Physical Pharmacy	1.51	28.87
38	Clinical Toxicology	1.73	30.60
39	Pharmaceutical Dosage Forms and Drug Delivery System I	1.89	32.48
40	Pharmaceutical Dosage Forms and Drug Delivery System II	1.89	34.37
41	Biopharmaceutics and Pharmacokinetics	1.90	36.27
42	Pharmaceutical Care in Ambulatory Patients	2.00	38.26
43	Pharmacy Practice lab 1	2.08	40.35
44	Pharmacy Practice I	2.37	42.72
45	Pharmaceutical Care in Ambulatory Patients Laboratory	2.43	45.15
46	Pharmacology III	2.47	47.62
47	Pharmacology I	3.50	51.13
48	Pharmacology II	3.50	54.63
49	Pharmacy Practice II	4.28	58.91
50	Pharmacotherapy Laboratory I	4.44	63.35
51	Pharmacotherapy Laboratory II	4.44	67.79
52	Pharmacotherapy Laboratory III	4.44	72.22
53	Pharmacotherapy 1	4.70	76.92
54	Pharmacotherapy 2	4.70	81.61
55	Pharmacotherapy 3	4.70	86.31
56	Pharmacotherapy 4	4.70	91.01
57	Pharmacotherapy 5	4.70	95.70
58	Pharmacotherapy 6	4.70	100.00
		100.00	

It was found that the importance scores derived from courses can be divided into 3 groups according to the level of importance of scores as follows:

4.1 The high level of importance (score of importance course ≥ two) was the knowledgeable group relating to patient-oriented topic such as pharmacotherapy, pharmacy practice and pharmacology. Pharmacotherapy and pharmacy practice were the knowledgeable group that having the contents directly relating to the pharmaceutical care and were the direct course of Pharm.D. curriculum where the pharmacology 1 and 2 which were the foundation courses for the courses relating to the patients. These were the basic knowledge of pharmacist where the need of stakeholder deemed that this course had more important content than the other courses.

4.2 The medium level of importance (score of importance course more than 1 and less than 2) was the knowledgeable group emphasized mainly on the products. As the Pharm.D. curriculum was the curriculum relating to pharmaceutical care directly, therefore the knowledgeable group of patients considered as the first priority importance level where the knowledgeable group of products considered as the second priority which can refer to the speech of Prof Gordon Flynn "You don't necessarily have to know how to make the dosage forms, but you need to know why it contains certain ingredients, and what those ingredients do to heal or extend shell–life" (in his retirement speech at U M College of Pharmacy in 2002)

4.3 The low level of importance (score of importance course less than 1) was the knowledgeable group emphasizes mainly on the basic science knowledge or social and administrative pharmacy knowledge as follows.

- Knowledgeable group of biomedical sciences, which was the basic course of patient area, where each course did not have the direct correlation with the various competency but did have the indirect correlation which was the basic for the students to enable to work in the patient area.

- Knowledgeable group of pharmacy such as the basic courses relating to the products, i.e. basic knowledge in pharmacognosy and physical pharmacy, were the introduction courses for further study in deep contents of pharmacy foundation.

- Knowledgeable group of social and administrative pharmacy where the stakeholder rated the low priority importance level of competency domain, therefore, the courses contained in this group such as the management, drug system, had the low level of importance.

Phase IV Proposed Pharmacy Curriculum

The curriculum design was designed based on the results of the HOQ analysis, and the pharmacy rules and regulation. The objective of each school year derived from the gathering of requirement within the Faculty of Pharmaceutical Sciences which were;

The first year: Competency to understand the role of pharmacist and the basic knowledge on the research and communication.

The second year: Competency to understand the health care system and the patient's health care, able to do the research and communicate, understand the basic research and medical products.

The third year: Competency to analyze the situation and the problem, develop the simple strategy and provide the medication and assess the main quality of medication, well understanding on the disease and medicine.

The fourth year: Competency to analyze the problem of medication usage of the patient by using every knowledge aspects.

The fifth and sixth year: Competency to synthesize the choices and approach to solve the problem, design the system and organize the thinking and knowledge, apply the theory and knowledge.

From the procedures to design the Pharm.D. curriculum, the results of the model of Pharm.D. curriculum were as follows.

4. Proposed Pharmacy Curriculum model

1. Philosophy

The philosophy of Doctor of Pharmacy Education is to prepare the new Pharm.D. students who are able to provide good quality pharmaceutical care and pass the qualify examination. To achieve this philosophy, pharmacy students must develop knowledge, skills, and attitudes that enable them to pharmacy competency which had 6 domains

Domain 1: Ensuring Appropriate Therapy and Outcomes

Domain 2: Selection and Dispensing Medications and Health Products

Domain 3: Health Promotion and Disease Prevention

Domain 4: Health Systems Management

Domain 5: Professionalism

Domain 6: General Ability

2. Curriculum Objective

The objective of producing pharmacy undergraduates is to create the pharmacists with morals and ethics who possess knowledge in drug systems and health systems management, with leadership and skills in conducting pharmaceutical care, selection and dispensing health products, counseling, teaching, demonstrating, and managing the risks in drug usage, promoting health and preventing diseases, ensuring that people and individual patients in the community or clinics receive appropriate medicine treatments and protection, with the greatest benefits and in accordance with the need of society and country.

3. Competency

Year 1

Competency to understand the role of pharmacist and the basic knowledge on the research and communication.

Year 2

Competency to:

- gather and assess the information for the pharmaceutical care purpose.
- provide pharmaceutical care.

- evaluate medication and health product.
- analyze the prescriptions.
- compound pharmaceutical products with the details on the standard formulation.
- demonstrate the knowledge of pharmaceutical control AND extemporaneous preparation.
- apply SAR and biopharmaceutical knowledge to select the appropriate treatment
- dispense medication
- promote good health and prevent community-based problems
- perform the professional with law

Year 3 and Year 4

Competency to:

- gather and assess the information for the pharmaceutical care purpose.
- provide pharmaceutical care.
- manage the patient data.
- evaluate medication and health product.
- analyze the prescriptions.
- compound pharmaceutical products with the details on the standard formulation.
- demonstrate the knowledge of pharmaceutical control AND extemporaneous preparation.
- apply SAR and biopharmaceutical knowledge to select the appropriate treatment
- dispense medication
- manage risks of drug usage for patients
- access and learning the community
- promote good health and prevent community-based problems
- manage medications throughout the health system AND manage drug system
- perform the professional within ethical and merit aspects
- perform the professional with law

Year 5 and Year 6

Competency to:

- gather and assess the information for the pharmaceutical care purpose.
- provide pharmaceutical care.
- manage the patient data.
- evaluate medication and health product.
- analyze the prescriptions.
- demonstrate the knowledge of pharmaceutical control AND extemporaneous preparation.
- apply SAR and biopharmaceutical knowledge to select the appropriate treatment
- dispense medication
- manage risks of drug usage for patients
- access and learning the community
- promote good health and prevent community-based problems
- manage medications throughout the health system AND manage drug system
- perform the professional with law

Note: Pharmacy competency for each academic year was difference.

4. Curriculum Structure

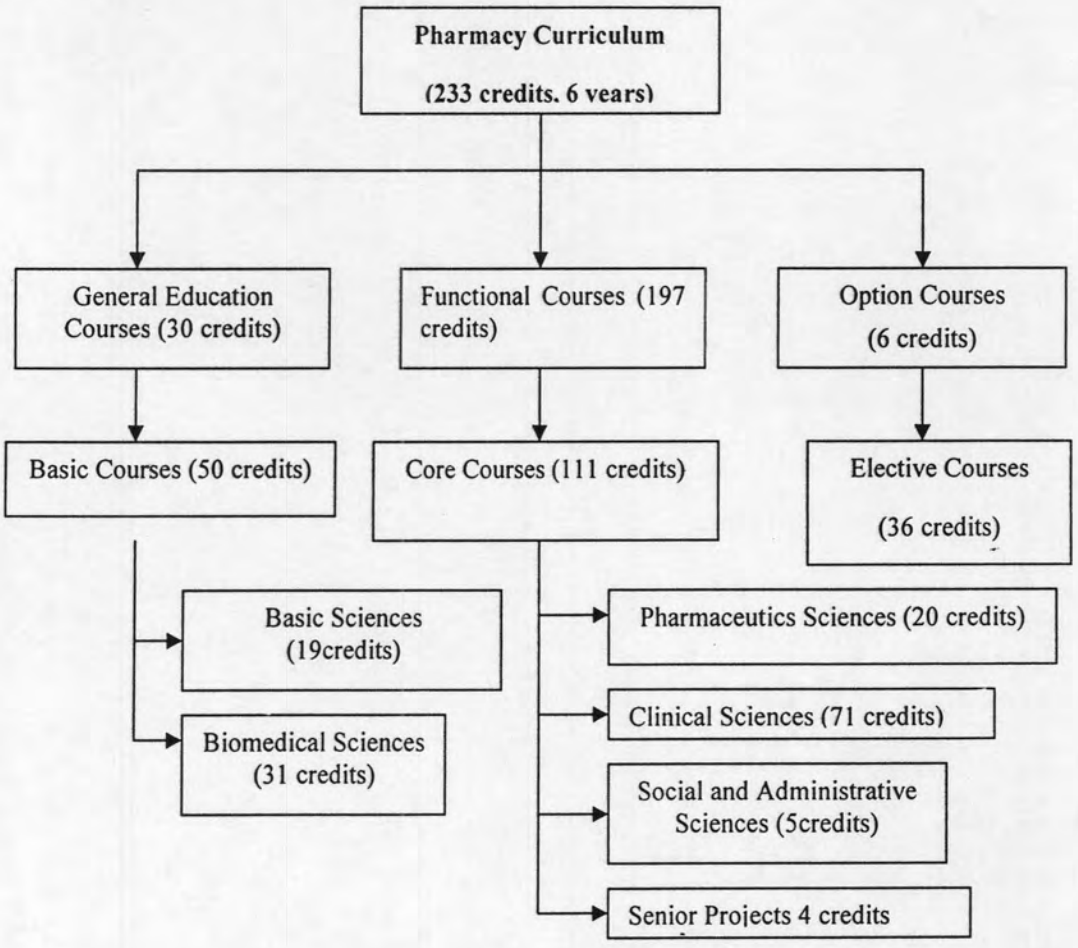


Figure 4.23 Curriculum Structure

5. Curriculum Subjects

Pre-Professional Curriculum (Year 1-2)

The Pre-professional curriculum was designed into three groups of subjects represents: 1. basic sciences, 2. biomedical sciences, and 3. general education.

1. **Basic Sciences (19 credits)**
   General Chemistry

   General Biology

   Medical Physics

   Organic Chemistry

   Experiential English

   Calculus

2. **Biomedical Sciences (31 credits)**

Anatomy and Physiology

Biochemistry

Microbiology; Medical Microbiology

Immunology

Statistics for Biological Science

3. **General Education (24 credits)** ; English for pharmaceutical profession, Public Speaking for Pharmacy Student, Foundation of Economics, Ethics, etc

Professional Curriculum (Year 3-6) (96 credit)

The professional curriculum was designed into five groups of subjects which were: (1) pharmaceutics sciences (2) pharmacotherapeutics (integration of pathophysiology, pharmacology, medicinal chemistry, therapeutics.) (3) pharmacy practices (professional skills development) (4) social and administrative pharmacy (5) seminars/ professional practice

1. Pharmaceutics Sciences (20 credits)

Medicinal Chemistry

Quality Assurance in Pharmaceutical Products

Pharmaceutics 1: Calculation and Physical pharmacy

Pharmaceutics 2: Pharmaceutical Dosage Form

Pharmaceutics 3: Biopharmaceutics and Pharmacokinetics

Pharmaceutics 4: Extemporaneous preparation, GMP

Herbs for Therapy and Health Promotion

2. Clinical Sciences (71 credits)

2.1 Clinical Sciences

2.1.1 Pharmacotherapeutics (Integration of Pathophysiology, Pharmacology, Medicinal Chemistry, Therapeutics)

Central Nervous System

Cardiovascular System and Renal disease

Infectious Disease

Respiratory Disease

Endocrine Disease

Neoplastic Disease

Gastrointestinal and Hepatic Disease

Musculoskeletal System

Men and Women Health

Inflammation and Dermatological disorder

Geriatric and Pediatric Pharmacotherapy

2.1.2 Other subjects;

Application of Pharmacokinetics

Pharmaceutical care in Ambulatory Patients

Clinical Toxicology

IV admixture Services

Nutrition support

2.2 Pharmacy Practices

- Pharmacy Practices: Communication Skills, Team work, Physical Assessment, Decision Making,

- Drug information Services

- Pharmacology 3 (Literature Evaluation)

- Pharmacy Service System

4. Social and Administrative Pharmacy and (5 credits)

Introduction to pharmacy profession

Pharmaceutical Jurisprudence and Ethics

Pharmacy Decision Support Tools

Pharmacy Administration; Drug System and Health

Pharmacy Administration; Management in Pharmacy

5. Seminars/Professional Practice

Pharm.D. Curriculum Model

12 Semesters

First Year; Semester 1

Course	Credits
Foundation English I	3
Calculus	3
General Chemistry	3
Organic Chemistry I	3
General Biology I	3
Elective in General Education	(3)
Total	**18**

First Year; Semester 2

Course	Credits
Foundation English II	3
Thai Language for Pharmacy Student	3
Organic Chemistry II	3
Organic Chemistry Laboratory	1
General Biology II	3
Medical Physics	3
Foundation of Economics	3
Elective in General Education	(3)
Total	**22**

Second Year; Semester 3

Course	**credits**
General Psychology	3
Anatomy and Physiology I	3
Anatomy and Physiology Laboratory I	1
Biochemistry I	4
Microbiology I	2
Pharmaceutical Calculation	0.5
Physical Pharmacy	2
Total	**15.5**

Second Year; Semester 4

Course	**credits**
Communication	3
Anatomy and Physiology II	3
Anatomy and Physiology Laboratory II	1
Medical Microbiology	3
Pharmaceutical Dosage Form and Drug delivery System I	3
Immunology	1
Basic Knowledge of Medicinal Chemistry	1
Total	**15**

Third Year; Semester 5

Course	**credits**
Pharmaceutical Dosage Form and Drug delivery System II	2
Pharmacology I	4
Medicinal Chemistry I	1
Food and Nutrition	3
Introduction to Pharmacognosy	0.5
Management in Pharmacy	1.0
Electives	(5)
Total	**16.5**

Third Year; Semester 6

Course	**credits**
Biopharmaceutics and Pharmacokinetics II	2
Pharmacology II	4
Medicinal Chemistry II	1
Pharmaceutical Biotechnology	0.5
Nutrition Support	1
Pharmacy Practice I	6
Total	**14.5**

Fourth Year; Semester 7

Course	**credits**
Guideline for Pharmacy Development	1
Clinical Pharmacokinetics	1.5
QA in Pharmaceutics Products	1
Pharmacology 3 (Literature Evaluation)	2.5
Pharmacy Practice II	5
Herbs for Therapy and Health Care	2.5
Drug System and Health	0.5
Electives	(2)
Total	**16**

Fourth Year; Semester 8

Course	**credits**
Biostatistics	3
Pharmacotherapy I	15
Vaccine and biological products	1
Pharmaceutical Jurisprudence and Ethics	0.5
Total	**19.5**

Fifth Year; Semester 9

Course	**credit**
Pharmacotherapy II	15
IV Admixture	1.5
Pharmacy Decision Support tools	1.0
Electives	3
Total	**20.5**

Fifth Year Semester 10

Course	**credit**
Pharmacotherapy III	15
Pharmaceutical care in Ambulatory Patients	5
Pharmacy Service System	0.5
Total	**20.5**

Sixth Year; Semester 11, 12

Course	**credit**
Advanced Pharmacy Practice Experience – Ambulatory Care	5
Advanced Pharmacy Practice Experience – Community Pharmacy	5
Advanced Pharmacy Practice Experience – Medicine	5
Advanced Pharmacy Practice Experience – Institution	5
Elective Experience	5
Elective Experience	5
Elective Experience	5
Total	**35**

Table 4.32 The subjects and credit hours of each subject areas

Biomedical Sciences	Product-oriented knowledge	Patient-oriented knowledge	Social and Administrative Pharmacy
Anatomy and Physiology I (3)	Basic Knowledge of Medicinal Chemistry (1)	Pharmacology III (literature evaluation) (2.5)	Introduction to Pharmacy Profession (0.5)
Anatomy and Physiology Laboratory I (1)	Midicinal Chemistry I (1)	Clinical Toxicology (2)	Drug System and Health (0.5)
Anatomy and Physiology II (3)	.Midicinal Chemistry II (1)	Nutrition Support (1)	Management in Pharmacy (1)
Anatomy and Physiology Laboratory II (1)	Quality Assurance in Pharmaceutical Products (1)	Pharmacy Practice I, II (11)	Research Methodology in Pharmaceutical Care
Pharmacology I (4)	Pharmaceutical calculation (0.5)	Drug Information Services in Pharmaceutical Care (1)	Pharmaceutical Jurisprudence and Ethics (0.5)
Pharmacology II (4)	Physical Pharmacy (2)	Application of Pharmacokinetics in Clinical Practice I&II (1.5)	Pharmacy Decision Support Tools (1)
Biochemistry (4)	Pharmaceutical Dosage Forms and Drug Delivery System I (2)	Pharmacotherapy I-VI (45)	
Clinical Biochemistry Laboratory (1)	Pharmaceutical Dosage Forms and Drug Delivery System II (2)	Pharmacy Service System (0.5)	
Microbiology I (1)	Pharmaceutical Dosage Forms and Drug Delivery System Laboratory (1)	IV admixture Services (1)	
Microbiology Laboratory (1)	Good Practices for the Preparation of Pharmaceutical Dosage Form in Healthcare Establishment (1)	Pharmaceutical Care in Ambulatory Patients (5)	
Medical microbiology (3)	Biopharmaceutics and Pharmacokinetics (2)		
Immunology (2)	Basic Knowledge in Pharmacognosy (0.5)		
Food and Nutrition (3)	Herbs for Therapy and Health Promotion (3)		
	Pharmaceutical Biotechnology (0.5)		
	Vaccines and Biological Products (1)		