AN ANALYSIS OF DIPLOMA OF PUBLIC HEALTH PROGRAM (TECHNICAL PHARMACY) BASED ON PROFESSIONAL COMPETENCE

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ABSTRACT: The objectives of the study were to analyze the Diploma of Public Health Program (Technical Pharmacy) based on professional competence and to measure competence level of the curriculum. All course syllabi under the Diploma Program of Public Health were data sources of the study. Data to be collected were behavioral objectives and credit hours of each course classified across pharmacy technician competence, professional competence, and level of competence. The results illustrated that the core requirement of the program consisted of 31 subjects with a total of 80 credit hours. Fifteen subjects accounted for 38 credit hours under technical pharmacy area could be divided into 15.76, 9.62, 9.54, and 3.08 credit hours of pharmacy service, public health pharmacy, pharmaceutical production, and pharmaceutical inventory management, respectively. The curriculum contained all 5 professional competence domains with 75% of the required credit hours focusing on knowledge/cognitive and functional competences. The assessment on competence level reflected that the curriculum put more weights on "knows how" level at 36.58 credit hours. The study concluded that the curriculum possessed all dimensions of competences, however the proportion shared by each element needed further justification.

Keywords: technical pharmacy, professional competence, curriculum

INTRODUCTION: The curriculum represents the systematic arrangement of all subject matters in a particular scope and sequence in the program. It is what the teachers teach and the students learn. The curriculum development process must incorporate evaluative judgments as to the worth of the subject matter being considered and then organized. Educators at this stage also appraise their philosophical views of the curriculum and make judgments as to the sociopolitical climates within which the curriculum is to be managed. They would evaluate the content, materials, and the teaching methods used. What students are learning and what skills they can demonstrate also need to be assessed. They also want to know how much the new program costs and whether it is cost effective. The general public wishes to know the quality of education in comparison at the local and national levels[1,2]. Everyone thus agrees with the essence of the curriculum evaluation upon curriculum development, implementation, and maintenance[2].

Due to the scope and breadth of a curriculum, it can easily lose sight of its structure as a whole, particularly when revisions and modifications are made over time to individual courses and sections. The curriculum mapping technique is used to diagrammatically demonstrate the relationship of the core skills and content taught, processes employed, as well as assessments[3,4]. The educational researcher uses the curriculum map to provide the information about the educational context in which the intervention is being studied. The map may also help to plan how the approach or the area studied can be evaluated in relation to the expected learning outcomes. Many Canadian and UK medical schools are using the curriculum mapping as a part of curriculum evaluation, management, and quality assurance strategies to examine a specific component of the medical education curriculum[5,6].

Porter described a method for measuring and alignment between the content of instruction and the content of instructional materials[7]. With good measures of instructional content, not only the taught curriculum could be detailed but the degree to which a new curriculum was implemented could also be assessed. He presented 3 tools for measuring content and alignment including teacher surveys on their instructed content,

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content analysis of instructional materials, and alignment indices describing the degree of content overlapping between standards and assessment. To measure content and alignment, a uniform language/vocabulary for describing content must be developed and used as a measure of alignment. A uniform language can include the measurement of the level of coverage and the relative emphasis in terms of time demands for total instructional time spent on each topic or category. Porter suggested that content analysis of instructional materials from course syllabi could be used to examine the intended curriculum as a means for teaching improvement. This technique also provides a mechanism for visually determining when the curriculum competences are covered as well as when potential areas are not sufficiently covered.

Plaza and colleagues evaluated the pharmacy education program, at the University of Arizona College of Pharmacy, based on curriculum mapping and Porter's measuring method[6]. Competences in pharmaceutical sciences served as the guideline for assessing the scope of coverage. They determined that the health promotion and disease prevention domain appeared to receive less relative emphasis at the course level than the other domains. The patient care, dispensing medications and devices, and professionalism domains had greater emphasis relative to the others. The health systems management domain was even greater emphasized relative to the health promotion and disease prevention domain, still less than the rest.

Nattiya Kapol and colleagues evaluated the curricula content of Thai pharmacy schools based on the Thai pharmacy competence standards[8]. Questionnaires were distributed to course coordinators. The result showed that the ratio of patient-oriented, product-oriented, and social and administrative pharmacy-oriented content areas for bachelor of sciences in pharmacy degree was 2:3:1, which differed from the recommendation of the Thai pharmacy competence standard (3:2:1). However, the doctor of pharmacy degree program, the largest content area was on patient-orientation as suggested by the standard.

Beyond the reveal of how each curriculum performed on its compentency, these studies also demonstrated methodology that can be used to understand and evaluate curriculum by using existing data.

Sirindhorn Colleges of Public Health, under Praboromarajchanok Institute for Health Workforce Development, Ministry of Public Health, has upgraded their curriculum from Certificate in Public Health Program (Pharmacy Technique) 2002 to Diploma of Public Health Program (Technical Pharmacy) which accepted its first class of students in academic year 2007. In upgrading the curriculum, the program was revised by including subject details, curriculum planning and design. This revised and being used curriculum covered 86 credits over 2 academic years. Integrated and student-centered instruction was emphasized in order to develop student ability to critically think, do, and solve the problem. The graduate, who would be equipped not only professional knowledge and skills but ethics and moral principles, were expected to work in communities and effectively serve the public health system[9].

The curriculum mapping could be used in this process to make certain that the course offered knowledge and skills needed for the graduation. The purposes of this study were thus to map curriculum with professional competences and to measure competence level of the curriculum. The results of this study could add specific information and detail for future curriculum improvement of the Diploma of Public Health Program (Technical Pharmacy).

MATERIALS AND METHODS: This study is a descriptive research using all core courses of the Diploma of Public Health Program as subjects to be studied and analyzed.

Out of 53 courses of the technical pharmacy curriculum under the Diploma of Public Health Program, 31 courses were required as core knowledge and skills for technical pharmacy students. The study thus included only these 31 core courses and excluded elective courses since they were not common to all students.

Thirty-one course syllabi were retrieved from documentary collection of course syllabi of the Diploma of Public Health Program (Technical Pharmacy). Behavioral objectives of selected courses were used to represent the course contents and the number of hours spent on each topic represents the concentration of each content topic. Both the behavioral objectives and time spent characterized the data of this study.

The data collection started with the review of all course syllabi. Then two instruments for data gathering were developed. The first instrument was the two-dimensional matrix for mapping behavioral objectives and contents of a course. One matrix was required for each subject. A total of 31 matrices were prepared for the two-dimensional objective-content map. The second instrument was the four-dimensional matrix, which represented the operational definitions of the major concepts of the study objectives including curriculum, pharmacy technician competence, professional competence, and level of competence.

The curriculum was operationalized into 245 behavioral objective items from 31 subjects. Pharmacy technician competence was based on the most recent updated task of pharmacy technician from Office of the Civil Service Commission (OCSC), Thailand. The OCSC classified roles of Thai pharmacy technicians into 4 tasks, including pharmacy service (pharmacology, dispensing, and clinical pharmacy), public health pharmacy (consumer protection and the other pharmacy roles in community), pharmaceutical production (preparation of non-sterile and sterile products), and pharmaceutical inventory management (procurement and purchase of pharmaceuticals and control of inventory[10]).

The provisional model of professional competence, a holistic model developed by Cheetham and Chivers, was used to illustrate professional competence[11]. This model has been empirically tested through a series of 80 in-depth interviews with practitioners from 20 different professions[12]. At the heart of the model, there were four core components of professional competence, knowledge/cognitive, functional, personal/behavioral, and values/ethical competence. Knowledge/cognitive competence was defined as the possession of appropriate work-related knowledge and the ability to put this into effective use. Functional competence was defined as the ability to effectively perform a range of work-based tasks to produce determined outcomes. The definition of personal or behavioral competence was the ability to adopt appropriate and observable behaviors in work-related situations. Values/ethical competence was defined as the possession of appropriate personal and professional values and the ability to make sound judgments based upon these values in work-related situations. Overarching of the model were a number of meta-competences, that enabled individuals to monitor and develop other competences, or that spanned other competences to enhance or mediate them[13]. These included communication, self-development, creativity, analysis, and problem solving. The model allowed the possibility that different professions would require a different mix of the core components. Similarly, a different mix of the core components might be necessary for different branches within the same profession.

The study used the level of competence defined by Miller's pyramid of competence. George E. Miller, psychologist, proposed a simple conceptual framework for assessing clinical competence[14]. The 4 levels of pyramid were "knows" at the lowest level, then "knows how", "shows how", and "does" at the top of the pyramid. "Knows" level referred to knowledge or the recall of facts, principles and theories. "Knows how" level was referenced to competence involving the ability to solve problems and describe procedures. "Shows how" level usually involved performance on human, mechanical or computer stimulations that were related to demonstration of skills in a controlled setting. "Does" level referred to action or ability in real practice. For each of these levels, the student can demonstrate the ability to imitate or replicate a protocol, apply principles in a familiar situation, adapt principles to new situations, and associate new knowledge with previously learned principles[15].

The first mapping was conducted onto the two-dimensional objective-content matrix of each subject. On each matrix, each content topic listed in the syllabus was aligned with the matching behavioral objective. The alignment was conducted both qualitatively and quantitatively. The researcher qualitatively judged the matching between the objective and content. The number of hours assigned to each topic represented the quantitative portion of the subject. The number of hours of each content topic had been transformed and standardized into the number of credit hours for the purpose of comparison across different dimensions. The number of credit hours of each content topic was then allocated to the corresponding behavioral objective. In case that a content topic served more than one behavioral objective, the credit hours were equally divided and distributed to all behavioral objectives sharing the same content. The output table of this mapping showed the credit hours assigned to each behavioral objective item.

The second mapping used 4-dimensional matrix as the instrument to align behavioral objective items with 3 other dimensions including pharmacy technician competence, professional competence, and level of competence. Similar to the first map, this mapping was also conducted quantitatively and qualitatively. The quantitative amount was identified using the number of hours, which had been standardized into the number of credit hours. Some behavioral objectives that could be mapped with more than one aspect of each competence dimension would be equally divided and allocated to all aspects under that competence. Three dimensions were independently mapped with the behavioral objective dimension.

Five experts were recruited for data verification. Those who had been instructors at Sirindhorn Colleges of Public Health for at least ten years were purposively selected. The roles of the expert panel were to review the list of keywords and to verify the two data mapping matrices.

To validate all classifications of the mapping conducted by the researcher, the expert panel reviewed both mappings, two-dimensional and 4-demensional matrices. In case that disagreement between the researcher and the experts was identified, the revision of the mapping was made using the criterion of three-fifths agreement.

A Microsoft Excel spreadsheet was developed to summarize the data collection. The 2 maps were finally combined into one spreadsheet by matching all dimensions from both instruments, which consisted of objective items, credit hours, pharmacy technician competence, professional competence, and level of competence.

As mentioned in the data mapping section, the concentration of curriculum was identified by hours spent for each topic. To be able to compare across several variables and aspects, time spent was standardized into credit hours, which were used in the data analysis for this study. The transformation from number of hours into number of credit hours followed the criteria of this curriculum[9]. The credit hour calculation method was stipulated as 1 credit hour of lecture for 18 hours per semester, 1 credit hour of practice for 36 hours per semester, and 1 credit hour of trainee for 54 hours per semester.

Descriptive statistics including frequency and percentage were used to describe general characteristics of the curriculum. Comparison of credit hours across dimensions was conducted to demonstrate the competence of the curriculum.

RESULTS: Sirindhorn Colleges of Public Health has offered the Diploma of Public Health Program (Technical Pharmacy) since the academic year 2007. This 2-year program had 3 required areas including 20 credit hours of general education, 22 credit hours of professional foundation, and 38 credit hours of technical pharmacy areas. The curriculum consisted of 62.5% lecture, 25.0% practice and 12.5% trainee. When taking into consideration only courses under technical pharmacy competence, 38 credit hours were categorized into 4 main tasks according to pharmacy technician competence. The curriculum consisted of 41.5% pharmacy service, 25.3% public health pharmacy, 25.1% pharmaceutical production, and 8.1% pharmaceutical inventory management. The details were shown in Table 1.

Table 1 Credit hours and percentage of subject area, teaching and learning method, and pharmacy technician competence

Data	Credit hours (%)
Subject area	
General education	20 (25.0)
Professional foundation	22 (27.5)
Technical pharmacy	38 (47.5)
Total	80 (100.0)
Teaching and learning method	
Lecture	50 (62.5)
Practice	20 (25.0)
Trainee	10 (12.5)
Total	80 (100.0)
Pharmacy technician competence	
Pharmacy service	15.76 (41.5)
Public health pharmacy	9.62 (25.3)
Pharmaceutical production	9.54 (25.1)
Pharmaceutical inventory management	3.08 (8.1)
Total	38.00 (100.0)

The curriculum contained all domains under professional competences. About 60 out of 80 credit hours or 75% were knowledge/cognitive and functional competences (32.24 and 27.05 credit hours respectively). Each subject area of the curriculum was analyzed according to 4 levels of competence including "knows", "knows how", "shows how", and "does". Most of curriculum credit hours were focused on "knows how" and "shows how" levels (36.58 and 23.04, respectively). When each professional competence was analyzed across 4 levels of competence, it revealed that some domains were not delivered at all levels. The majority of time teaching knowledge/cognitive, meta-competence, and value/ethical competences used "knows how" level (19.21, 6.59 and 1.46, respectively). It appeared that "does" level was not applied for these three domains of professional competence. Differently, the majority of credit hours spent on functional competence emphasized the "shows how" level (15.00), but no "knows" level. Only personal or behavioral competence had all levels and the majority of credit hours spent on "does" level (3.19). See Table 2.

DISCUSSION: Eighty credit hours of the Diploma of Public Health Program (Technical Pharmacy) were transferred into 2,160 actual hours of core courses in this curriculum.

Considering the American Society of Health-System Pharmacists (ASHP), which accredited technician training programs, required that programs had a minimum of 600 hours and a minimum duration of 15 weeks[16]. The directory of the Accrediting Commission of Career Schools and Colleges of Technology (ACCSCT) listed 129 "pharmacy" programs[17]. Most of them were Diploma degree and the others were Certificate, and Associate of Science degrees. These programs varied in duration from 640 to 1,790 hours (24-117 credit hours), with a median of 720 hours.

Confidently, this curriculum met the ASHP minimum requirements. However, the curriculum had almost 400 more hours than the largest program in the United States. This comparison was made using the total hours spent by students without taking into account the breakdown of teaching elements. Besides the total time, whether students spent more time on theory, practice, or trainee would also be an important factor affecting student competence. Likewise, some educators deplored the educational system that moved people into the work force too quickly. They believed rapid-training strategies were not the solution for health care personnel whose activities directly affected the safe and effective use of medications[16].

The curriculum included 4 pharmacy technician competences. The largest content area was pharmacy service. The ratio of credit hours among pharmacy service, public health pharmacy, pharmaceutical production and pharmaceutical inventory management were about 5: 3: 3: 1 or 41.47%, 25.32%, 25.10% and 8.11%, respectively. It was difficult to compare with those in the United States because of different tasks of pharmacy

Table 2 Credit hours of each professional competence domain categorized by level of competence

Domain	Knows	Knows how	Shows how	Does	Total
Meta-competence	0.31	6.59	3.77	0.00	10.67
Knowledge/cognitive competence	10.58	19.21	2.45	0.00	32.24
Functional competence	0.00	7.24	15.00	4.81	27.05
Personal or behavioral competence	0.19	2.08	0.72	3.19	6.18
Values/ethical competence	1.30	1.46	1.10	0.00	3.86
Total	12.38	36.58	23.04	8.00	80.00

technician were defined. For example, Thailand had public health pharmacy, whereas the United States did not define this role under their pharmacy technician function. However, the Pharmacy Technician Certification Board (PTCB) examination was based on a task analysis that defined the work of pharmacy technicians nationwide[18]. The content of exam was characterized under three function areas: 66% of exam was based on knowledge required to assist the pharmacist in serving patients, 22% on maintaining medication and inventory control system and 12% on participating in the administration and management of pharmacy practice. Thus, only one competence on pharmaceutical inventory management was the common task between the two countries. The emphasis put on this competence in the United States was 3 folds higher than in Thailand.

Even analysis was conducted based on different environments, the curriculum mapping method that was used to evaluate the curriculum by functional competence was also used by several professional education programs including nursing, medicine, and pharmacy[6,8,19-21]). This method also provided a mechanism for visually determining when the curriculum competences were covered as well as areas that were potentially not covered[6,21,22].

The curriculum contained all domains of professional competences. The credit hours of knowledge/cognitive competence were shown in the lead and functional competence in the second position.

Considering the nature of professional practice based on research conducted by Cheetham and Chivers[23]. Six professions represented six functional groups of professions, namely, (1) pastoral/spiritual care (anglican clergy), (2) teaching/training (trainers), (3) legal and financial (accountants), (4) policy, administrative and business support (civil servants), (5) technical and scientific (surveyors) and (6) medical and health care (dentists)[13]. They displayed significant differences between professions in the perceived importance of the four different types of competence as knowledge/cognitive, functional competence, personal or behavioral and values/ ethical competence.

The pharmacy technician was considered both technical/scientific and medical/health care profession groups as compared to surveyors and dentists. Both groups were different on the largest competence, which surveyors contained high knowledge/cognitive competence and dentists more emphasized on functional competence. The other 2 competences had nearly equal share between both profession groups. Importantly, total of knowledge/cognitive and functional competences in both groups were more than half, but the same 2 competences of the curriculum in this study shared more than four-fifths. Even the environments were different, the above comparison suggested reconsideration on proportions of professional competence domains might be essential.

The content of instruction was an essential variable in research on factors affecting student achievement and few studies showed associations between results of assessment and actual clinical performance[7,15]. Therefore, the model of the curriculum for pharmacy technician training by the ASHP was developed as a nationwide project to provide educators with a prototype for training pharmacy technicians for service in all practice settings and in all geographical locations[24]. A design team analyzed the outcome of their task analysis to determine the knowledge, skills, attitudes, and abilities. They used a system called Bloom's taxonomy to identify objectives and instructional objectives for training. These became objectives of modules for instruction. Out of 456 objectives and instructional objectives, the largest area was "comprehension" level, followed with "knowledge" and "application" levels, respectively[24]. There were only a few objectives contributed to other levels.

As an alternative, this study assessed the content of curriculum using Miller's pyramid of competence. The model required that each level was a firm base on which to build the next one[25]. The pyramid reminded that the largest area was "knows" level and the others near the apex were smaller area respectively. Nevertheless, the finding

presented the largest area of this curriculum was "knows how" level, followed respectively with "shows how", "knows" and "does" levels. Indicatively, "knows" level might not be as suggested by Miller's model. In addition, the comparison between this curriculum and the ASHP model presented differently. If the "knowledge" and "comprehension" levels of Bloom's taxonomy were equivalent to "knows" level of Miller's model, and "application" level was comparable to "knows how" level, the curriculum was presented at a higher level of competence than the ASHP model[14]. The possible reasons that the curriculum contained less "knows" level included the "knows" level was not written or absent from instructional or behavioral objectives. Also, the "knows" level was embedded in "knows how" and "shows how" levels. To be able to achieve "knows how" and "shows how", students had to "knows".

The curriculum had all professional competence domains but not every domain contained all levels of competence, likewise the ASHP model. Curriculum mapping between professional competence and level of competence demonstrated the characteristics of the curriculum including areas, subjects, and objectives. Especially, the finding found that all of professional competences did not agree with level pattern of Miller's model not only the curriculum but also areas and subjects. These showed the process of the curriculum development, even was well planned, could be improved. The pharmacy technician competence requirements should be analyzed in advance. Then, identifying goals, objectives, and instructional objectives for training should base on these competences[24]. These would help developing modules and subjects of instruction, while using the curriculum mapping to support both constructing and sequencing the curriculum. These processes would also facilitate the curriculum evaluation by aligning what would be taught with competence requirements. Hale suggested that curriculum mapping did not perceive education as a static environment since learning, and learning about learning, is a continual process[26]. As long as teachers have new students, new classes and new school years, newly created and revised curriculum maps would provide evidence of a school or district's ongoing curriculum development.

CONCLUSIONS: The Diploma of Public Health Program (Technical Pharmacy) supported the ASHP minimum requirements and had more hours than the largest program in the United States. The curriculum included 4 tasks of pharmacy technician competence. The largest content area was pharmacy service and the smallest was pharmaceutical inventory management. Moreover, this curriculum contained all domains of professional competence with higher proportion of knowledge/cognitive and functional competences than personal or behavioral and values/ethical competences. Considering the level of competence, the curriculum was higher level than the model of the curriculum for pharmacy technician training suggested by the ASHP with the emphasis on "knows how" level.

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