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Insights from the United States to Integrate Pharmacy Education with the Pharmacist Licensure Examination to Improve Pharmacy Training in Taiwan

Shu-Wen Lin[1§]; Yu-Hsueh Wu[2§]; Li-Jiuan Shen[3*]

Abstract

This study aims to explore insights from the pharmacy education and pharmacist licensure examination system in the United States (U.S.), providing valuable guidance for improving pharmacy training in Taiwan. However, it is essential to recognize the differences in the educational backgrounds of incoming students and the distribution of graduates' professional fields between the U.S. and Taiwan. Consequently, we need to learn the principles and core values of U.S. pharmacy education while also aligning with and meeting the localized needs of Taiwan to achieve the goal of continuously enhancing and optimizing pharmacy education in Taiwan. Currently, pharmacy education and practice in Taiwan face several key challenges, including the transition from a Bachelor of Science (B.S.) degree to a six-year Doctor of Pharmacy (Pharm.D.) curriculum, the need for better integration of theoretical knowledge with practical applications, the optimization of licensure examination assessment methods, and the structural enhancement of internship opportunities.

The U.S. pharmacy education model has undergone a significant transformation, shifting its focus from a traditional emphasis on compounding and dispensing to a more patient-centered, clinical pharmacy practice approach. This transition has been accompanied by the adoption of a competency-based pharmacy education (CBPE) framework, which defines clear and assessable learning outcomes to ensure that graduates possess the necessary knowledge, skills, and clinical competencies to provide high-quality, patient-centered care. This CBPE model can serve as a valuable reference for Taiwan to enhance its own pharmacy education system.

Furthermore, the U.S. pharmacy education curriculum is closely integrated with the pharmacist licensing examination, namely the North American Pharmacist Licensure Examination (NAPLEX). This alignment ensures that the educational program prepares students for the licensure examination, which evaluates the minimal competencies required for entry-level pharmacists to provide direct patient care. Incorporating similar approaches in Taiwan could strengthen the connection between pharmacy education and the national licensure examination.

By learning from the successful practices of the U.S. pharmacy education and licensing system, professionals can refine their own pharmacy training framework, ultimately leading to the development of a more competent and adaptable pharmacy workforce that is well-prepared to meet the evolving demands of the healthcare landscape in Taiwan.

Keywords: pharmacy education, competency-based education, pharmacist licensure exam

[1] Associate Professor, Graduate Institute of Clinical Pharmacy, College of Medicine, National Taiwan University, Taipei, Taiwan/ Associate Professor, School of Pharmacy, College of Medicine, National Taiwan University, Taipei, Taiwan/ Director, Department of Pharmacy, National Taiwan University Hospital, Taiwan/

[2] Pharmacist, Department of Pharmacy, National Taiwan University Hospital, Taipei, Taiwan

[3] Professor, Graduate Institute of Clinical Pharmacy, College of Medicine, National Taiwan University, Taipei, Taiwan/ Professor, School of Pharmacy, College of Medicine, National Taiwan University, Taipei, Taiwan/ Pharmacist, Department of Pharmacy, National Taiwan University Hospital, Taipei, Taiwan

[§]Shu-Wen Lin and Yu-Hsueh Wu have equal contributions to this article

*Corresponding author

借鏡美國之整合性藥學教育到藥師執照考試精神，精進臺灣藥師之教考訓用

林淑文[1§]、吳侑學[2§]、沈麗娟[3*]

摘要

本研究旨在探討借鏡美國藥學教育和藥師執照考試制度，以提供改善臺灣藥師培訓寶貴指引。然而，我們應注意美國與臺灣在入學學生的教育背景與畢業生的專業領域分布上存在差異。因此，我們需學習美國藥學教育之原則和核心價值，同時也要符合並滿足臺灣在地化的需求，以達成持續提升和優化臺灣藥學教育的目標。目前，臺灣藥學教育面臨幾項關鍵挑戰，包括從藥學系四 / 五年的學士學位 (B.S.) 到六年制臨床藥學士 (Pharm.D.) 的課程、理論知識與實務應用的整合、藥師執照考試評估方法的優化，以及實習內容和安排的制度化。美國藥學教育模式經歷重大轉變，從傳統著重調劑的方式，轉向注重以病人為中心的臨床藥學實務方法。這一轉變伴隨採用以能力為本的藥學教育 (competency-based pharmacy education, CBPE) 架構，明確定義可評估的學習成果，確保畢業生具備提供高品質、以病人為中心的照護所需的知識、技能和臨床能力。此 CBPE 模式可為臺灣藥學教育提升提供有價值的參考。此外，美國藥學教育課程與北美藥師執照考試 (NAPLEX) 緊密銜接。這種一致性確保教育課程能夠為學生準備執照考試，該考試評估入門執業藥師提供直接病人照護所需的最基本能力。在臺灣採取類似方法，可加強藥學教育與國家藥師執照考試之間的連結。借鏡美國藥學教育和執照制度的成功做法，可讓臺灣的藥學教育結構更加完善，最終培養出可勝任國家社會需求的藥師人力，以滿足不斷變化的醫療保健需求。

關鍵詞：藥學教育、以能力為本的藥學教育、藥師執照考試

[1]國立臺灣大學臨床藥學研究所副教授／國立臺灣大學藥學專業學院副教授／國立臺灣大學醫學院附設醫院藥劑部主任
[2]國立臺灣大學醫學院附設醫院藥劑部藥師
[3]國立臺灣大學臨床藥學研究所教授／國立臺灣大學藥學專業學院教授／國立臺灣大學醫學院附設醫院藥劑部兼任藥師
[§]林淑文與吳侑學為共同第一作者
*沈麗娟為通訊作者

I. Current Challenges of Pharmacy Education and Practice in Taiwan

Pharmacy education and practice in Taiwan are currently navigating several challenges that present opportunities for improvement in preparing pharmacists for the evolving healthcare landscape (Lin et al., 2024; Huang et al., 2024). One area of focus is the transition from a Bachelor of Science (B.S.) degree to a six-year Doctor of Pharmacy (Pharm.D.) program, which has led to variations in curriculum implementation and student preparedness (Guh et al., 2016; Hung et al., 2019; Wu et al., 2016). Additionally, there is potential for enhancing integrated teaching methods that connect theoretical knowledge with practical applications, allowing students to better apply their learning in real-world settings. The licensure examination could also benefit from incorporating more case-based assessments, which would help evaluate candidates' clinical reasoning and problem-solving skills in a practical context. Furthermore, while internship opportunities exist, there is room for improvement in their structure to ensure students gain meaningful hands-on experience. Emphasizing patient-centered services alongside traditional pharmacy roles can also foster the development of essential skills needed for modern practice. Addressing these areas can enhance pharmacy education and practice in Taiwan, ultimately better equipping pharmacists to meet the demands of contemporary healthcare.

Exploring the United States (U.S.) pharmacy education system may offer valuable insights and solutions to address the current challenges faced by pharmacy education and practice in Taiwan. The U.S. model is renowned for its effectiveness in producing highly competent pharmacists who are well-prepared to navigate the complexities of modern healthcare. It emphasizes a comprehensive approach that integrates clinical practice with academic learning, fostering a patient-centered focus that aligns with contemporary healthcare needs. By examining the effective use of case-based assessments in the licensure examination, students' clinical reasoning and problem-solving abilities can be comprehensively evaluated. Additionally, the U.S. system's emphasis on interprofessional collaboration and practical training could inform the development of more structured and meaningful internship experiences for students.

Learning from these successful practices in the U.S. can assist educators in Taiwan in refining the pharmacy education framework, ultimately leading to a more competent and adaptable pharmacy workforce prepared to meet the evolving demands of healthcare. The fundamental structural difference between the U.S. Pharm.D. program and Taiwan's pharmacy education system lies in the educational background of the students entering these programs (Lin et al., 2024). In the U.S., students typically complete a Bachelor of Science degree or at least two years of undergraduate prerequisites before enrolling in the Pharm.D. program. This foundational education enables a concentrated focus on clinical competencies within the Pharm.D. curriculum. In contrast, the majority of the incoming students in Taiwan's current pharmacy programs graduate from senior high schools. Furthermore, pharmacy graduates in Taiwan pursue professional opportunities not only within pharmacy practice but also across various sectors, including industry, basic research, regulatory affairs, and public health. Notably, over 85% of registered pharmacists provide pharmacy services in hospitals, communities, and clinics (Huang et al., 2024). Consequently, it is important to learn the differences between the U.S. and Taiwan while also adapting the principles and core values of U.S. pharmacy education to align with the localized needs of Taiwan, thereby ensuring coherence with Taiwan’s educational mission.

II. Competency-based Pharmacy Education

The ongoing paradigm shift in medical education towards competency-based medical education (CBME) offers a valuable framework (Cooper & Holmboe, 2025) that can be effectively applied to pharmacy education through the concept of competency-based pharmacy education (CBPE). Similar to the medical field's need for graduates to possess both theoretical knowledge and practical skills, pharmacy education faces challenges in ensuring that graduates are adequately prepared for the complexities of patient care. Traditional time-based models often lead to variability in student preparedness, which can hinder pharmacists' ability to meet evolving healthcare demands. By adopting a CBPE approach, pharmacy programs can focus on defining clear, assessable outcomes that align with the needs of healthcare systems and patient populations. This shift would emphasize direct observation, formative

assessments, and tailored learning pathways, ensuring that graduates are not only knowledgeable but also proficient in clinical skills and interprofessional collaboration. Ultimately, integrating CBPE into pharmacy education can enhance the quality of training, better prepare pharmacists for real-world challenges, and contribute to improved health outcomes in the communities they serve.

The history of pharmacy education reform in the U.S. has undergone significant changes over the past several decades, particularly with the establishment of the Pharm.D. degree and the expansion of clinical pharmacy practice (Figure 1). Beginning in the 1960s, the role of pharmacists evolved from traditional compounding and dispensing to a more patient-centered focus, emphasizing direct patient care and clinical competencies (Urick & Meggs, 2019). The introduction of Pharm.D. programs in the 1950s and 1960s marked a pivotal shift, as these programs aimed to equip pharmacists with the necessary skills to engage in patient care effectively. The American Association of Colleges of Pharmacy (AACP) played a crucial role in advocating for these changes, culminating in 1992 when the Pharm.D. was designated as the sole professional degree in pharmacy. This transition not only enhanced the educational framework but also aligned with the growing recognition of pharmacists as integral members of the healthcare team. The majority of Pharm.D. applicants receive bachelor's degrees from undergraduate programs before applying to Pharm.D. programs, with some applicants completing 2-year, non-degree preparatory courses before the application. Pharm.D. students can also choose to enroll in a dual or a joint degree program, in which they can receive an extra degree of Doctor of Philosophy (PhD), Master of Public Health (MPH), or Master of Business Administration (MBA) upon completion of an extended 6-year study. Pharm.D. students interested in the basic pharmaceutical sciences can choose a pathway of a dual degree of B.S. in pharmaceutical sciences, or they can choose to earn graduate degrees in pharmaceutical sciences after completing a Pharm.D. program (AACP, 2025). The Accreditation Council for Pharmacy Education (ACPE) serves as the national agency that sets the standards of Pharm.D. programs and continuing education programs, and it also accredits these professional programs.

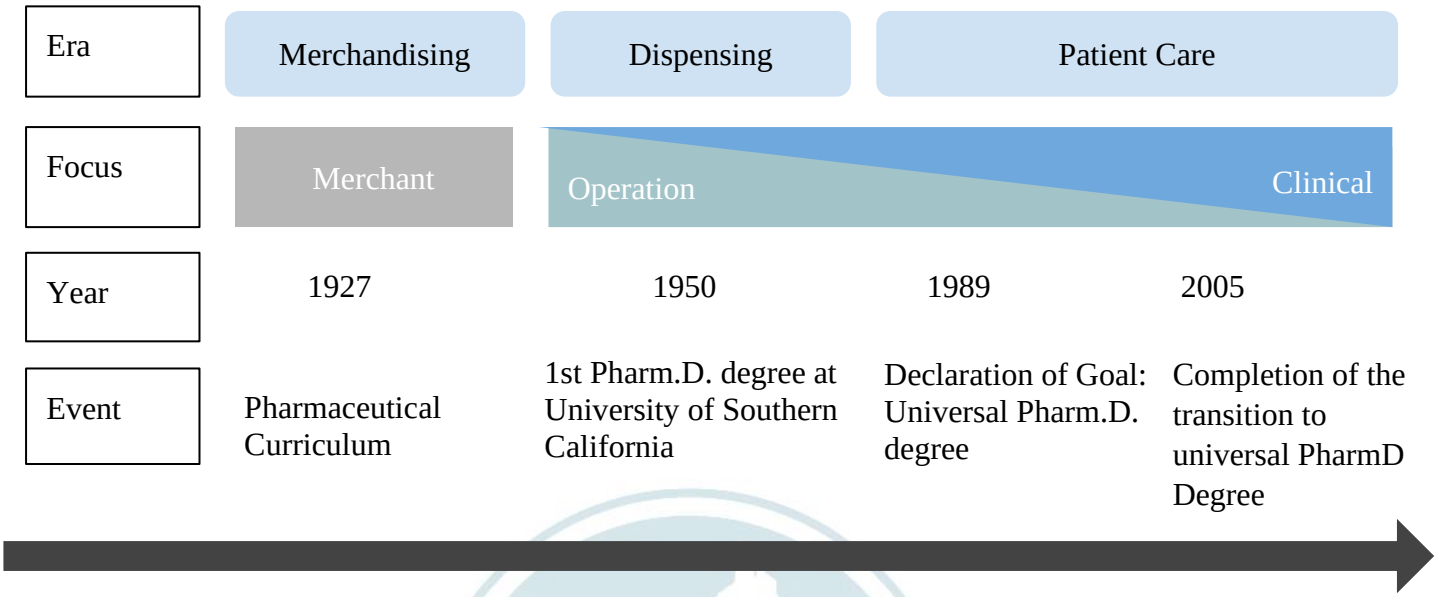
As outlined by Carter (2016) in his discussion of clinical pharmacy's evolution, these educational reforms have been accompanied by advancements in residency training and the integration of clinical pharmacists into patient care settings, ultimately supporting the implementation of CBPE. CBPE focuses on defining clear, assessable competencies that pharmacists must demonstrate, ensuring they are well-prepared to meet the complex demands of modern healthcare and provide high-quality, patient-centered care.

The standards set by the ACPE are to expect pharmacy graduates to be practice-ready for direct patient care in team-based healthcare settings (ACPE, 2025). These standards are the minimal requirements for Pharm.D. programs to maintain ACPE-accredited status, and the Pharm.D. curriculum is designed to achieve these educational outcomes. Pharmacists who provide clinical services should possess knowledge and clinical skills of both disease states and management. Therefore, the current U.S. Pharm.D. pharmacy education system is created specifically to prepare pharmacy students to provide clinical services in a multidisciplinary team upon graduation. The content of the pharmacist licensure examination is also carefully designed to set the standard for minimal competency in direct patient care for each entry-level pharmacy graduate. Precisely, the U.S. Pharm.D. program adopts an outcome-based, practice-led approach to ensure pharmacy learners can seize all the essential knowledge and skills for work during the training phase. The examination that pharmacists must pass to obtain a professional license to practice represents the formal training and education, which provides them with the knowledge and skills necessary to pass the licensing exam.

The relationship between pharmacy education and the pharmacist license exam is cyclical. Pharmacy education serves to guide and prepare students for the pharmacist license exam. By passing the exam, pharmacists are then able to fulfill and apply the training they have received through their education. This circular dynamic ensures that pharmacists possess the requisite competencies to effectively carry out their professional responsibilities. The successful completion of the licensing exam validates the objectives of the pharmacy education curriculum, creating a mutually reinforcing cycle between the exam and the educational program.

Figure 1

Evolution of Pharmacy Education in the United States (Urick & Meggs, 2019)



III. Pharmacist Licensure Examination

The U.S. Pharm.D. education is based on the market demand for practice-ready pharmacists, which is objectively measured by the pharmacist license exam. Therefore, it is important to have a basic understanding of the exam to gain a comprehensive knowledge of the U.S. Pharmacy education. Pharmacy graduates who wish to serve as pharmacists must achieve passing scores on the North American Pharmacist Licensure Examination (NAPLEX) and the state-specific Multistate Pharmacy Jurisprudence Examination® (MPJE®). In California, however, individuals seeking licensure as pharmacists are also required to take the California Practice Standards and Jurisprudence Examination for Pharmacists (CPJE) in addition to NAPLEX. All of these exams in the U.S. are both computer-based and computer-adapted, allowing for a tailored testing experience based on the examinee's performance. The call for the Pharm.D. degree being the single degree eligible for pharmacist licensure exams was made in 1984 and the complete transition to a universal Pharm.D. degree was made in 2005 (Figure 1).

The NAPLEX exam lasts six hours, and there are 225 questions. Of these, only 200 questions are used for scoring; the remaining 25 are experimental items.

Examinees cannot identify which are scored versus experimental, so appropriately answering all of the 225 questions is the best policy to increase the chance of passing the exam. Examinees will receive a "pass" or "fail" for their NAPLEX scores. The passing cutoff score is 75, which is validated to demonstrate the competency of an entry-level pharmacist.

A. Syllabus

The National Association of Boards of Pharmacy® (NABP®) developed the NAPLEX Competency Statements to guide examinees in preparing for the NAPLEX. The question items assess knowledge, judgment, and skills that an entry-level pharmacist is expected to possess. Six areas and their corresponding percentages are outlined as follows. Each area has its own topics covered, and the percentage of questions on the test varies. Among these six areas, it is clear that the NAPLEX places a much heavier emphasis on clinical pharmacy practice compared to the pharmacy dispensing component:

Area 1 (18.2%) – Obtain, Interpret, or Assess Data, Medical, or Patient Information

Area 2 (14.1%) – Identify Drug Characteristics

Area 3 (35.4%) – Develop or Manage Treatment Plans

Area 4 (14.1%) – Perform Calculations

Area 5 (11.1%) – Compound, Dispense, or Administer Drugs, or Manage Delivery Systems

Area 6 (7.1%) – Develop or Manage Practice or Medication-Use Systems to Ensure Safety and Quality

B. Content

There are three kinds of formats in the exam: multiple-choice questions, multiple-response questions, and constructed-response questions. The scenario-based format is the most common question type throughout the exam, requiring examinees to respond to questions based on the information provided in the patient cases.

The major difference lies in the syllabus. As previously emphasized, the NAPLEX aims to assess whether examinees are well prepared for their first day on the job as pharmacists. In contrast, the counterpart exam in Taiwan may encounter obstacles due to its unintegrated questions, lack of pre-testing for efficacy, and overly detailed

questions designed to avoid similarity with previous exams. These factors undermine the goal of licensure exams, raising concerns about whether Taiwanese pharmacy graduates who pass the two-step exam can function effectively as pharmacists. Some Taiwanese pharmacy graduates are not ready to practice shortly after graduation, despite holding a pharmacist license, largely because their pharmacy education has not adequately prepared them.

Additionally, the examination system in Taiwan is only computer-based and lacks the adaptive component. It does not utilize integrated questions; instead, the tests are organized by different subjects. This means that examinees are assessed separately on various subject areas rather than through a comprehensive, integrated approach.

IV. Structure and Curriculum Framework in the U.S.

A. From Educational Goals to Curricular Outcomes

The curricula of U.S. Pharm.D. programs have been significantly revised over the last decades since the 1950s. This includes the transition from a sequential course arrangement to an integrated curriculum that is revised every three years, and the newly consolidated concept of the AACP 2022 Curricular Outcomes and Entrustable Professional Activities (COEPA), which replaced the 2013 Center for the Advancement of Pharmacy Education (CAPE) and 2016 Entrustable Professional Activities (EPAs). The first Pharmacotherapy Didactic Curriculum Toolkit, released by the American College of Clinical Pharmacy (ACCP) in 2009, along with its subsequent updates in 2016 and 2019, and the most recent version in 2023 (Medina et al., 2023), has served as guidance for pharmacy curriculum development by colleges of pharmacy in the U.S. The learning objectives are carefully aligned with the goal of meeting healthcare needs (ACPE, 2025; Medina et al., 2023). The Pharmacists' Patient Care Process (PPCP), endorsed by the Joint Commission of Pharmacy Practitioners, is developed to ensure consistency in the practice provided by every pharmacist in any healthcare setting (Joint Commission of Pharmacy Practitioners, 2025).

The PPCP is a foundational framework in pharmacy education that emphasizes a patient-centered approach to medication management and health outcomes. The PPCP

outlines a systematic method for pharmacists to deliver comprehensive care across various practice settings. It consists of five key steps: **Collect**, **Assess**, **Plan**, **Implement**, and **Follow Up: Monitor and Evaluate**, which guide pharmacists in gathering patient information, evaluating medication therapies, developing personalized care plans, implementing interventions, and monitoring patient progress. *The integration of the PPCP into pharmacy curricula ensures that students are well-prepared for the pharmacist licensure exam, which assesses their ability to apply these principles in real-world scenarios.* Integral to the PPCP are the principles of **communication**, **collaboration**, and **documentation**. Pharmacists establish trusted relationships and foster effective communication with patients, caregivers, and other healthcare providers to ensure coordinated, team-based care. They document their patient care activities to facilitate continuity of care and enable the secure exchange of patient information through standardized data-sharing solutions. By aligning educational programs with the PPCP, future pharmacists gain the essential skills needed to effectively collaborate with patients and healthcare teams, thereby enhancing the quality of care and promoting optimal health outcomes. This structured approach not only prepares students for their roles as medication experts but also meets the evolving demands of the healthcare system and the emphasis on team-based, person-centered care.

The NAPLEX competency statements, on the other hand, define the knowledge, skills, and abilities required for entry-level pharmacist licensure. The COEPA document integrates these various components, aligning the educational outcomes (EOs) with the EPAs (Medina et al., 2023). The EOs describe the **knowledge**, **skills**, and **attitudes** that all pharmacy graduates should demonstrate, while the EPAs translate these outcomes into practical, workplace-based activities. *By ensuring that the curriculum, learning objectives, and assessment strategies are designed to address both the EOs and EPAs, pharmacy programs can effectively prepare students for the NAPLEX and their future roles as competent, patient-centered pharmacists.* This comprehensive, integrated approach to pharmacy education allows for the seamless development of pharmacists who are equipped to optimize medication use, enhance

patient outcomes, and contribute to the interprofessional healthcare team, all while upholding the core values of the pharmacy profession.

B. Integrated Curriculum

The comprehensive curriculum framework ensures that Pharm.D. students receive a well-rounded education, covering both the theoretical and practical aspects of pharmacy, preparing them for successful careers as pharmacists. The Pharm.D. program is structured across four academic years (PY1 to PY4). In PY1, students cover the "Fundamentals" of pharmacy, including introductory and practice-based coursework. The "Integrated Core" in PY2 then covers key areas such as pharmacy systems and quality, chemical and molecular pharmacology, and clinical and population therapeutics. This is followed by a "Pre-APPE Readiness" period at the end of PY2. In PY3, students have the opportunity to take "Elective Courses," participate in "Discovery Seminars," and work on a "Longitudinal Project." Finally, PY4 is dedicated to "Advanced Pharmacy Practice Experiences" (APPE), which consists of eight six-week rotations in various pharmacy settings, including institutional and community-based practices.

The integration of foundational science and clinical science education is a crucial aspect of pharmacy curriculum design, especially for the courses in PY1-PY3. Foundational sciences, including physiology/pathophysiology, medicinal chemistry, pharmacodynamics/pharmacokinetics (PK/PD), and pharmaceutics, are integrated into domain-specific clinical science courses (Greene et al., 2018). Foundational science knowledge serves as an essential framework for understanding clinical practice; however, teachers may face challenges in relating basic science to clinical applications. Key recommendations include aligning course learning objectives with the pharmaceutical science competencies outlined by accrediting bodies, scaffolding the learning experience by starting with simpler clinical cases and gradually increasing complexity, promoting collaboration between foundational science and clinical faculty to co-develop and co-teach integrated course materials, and reinforcing foundational science concepts within clinical pharmacotherapy courses, with clinical faculty explicitly drawing connections between basic science principles and clinical decision-

making. A more advanced model of spiral integration--i.e., allowing learners to revisit and reinforce fundamental concepts as the degree of relevant course content becomes deeper or broader--has been gradually adopted. DiVall et al. (2020) offered practical steps and considerations in their commentary on course integration. The content delivered in the courses is anchored to the predefined outcomes outlined in the COEPA, and COEPA is developed to meet the outcome measurements in the NAPLEX. The methods of knowledge and skills delivery include didactic lecture, flipped classroom, recitation/case-based discussion, team-based presentation, practice lab, debate, journal club, etc. (Zakeri et al., 2024). During the activities, Pharm.D. students not only receive information, but also apply what they learn in the interactions. A well-designed integration with ongoing reinforcement that builds in complexity over time could enhance knowledge retention, critical thinking, and clinical decision-making.

In addition to the foundational and clinical science components, clinical research, drug information, social & behavioral pharmacy, pharmacoeconomics, pharmacy administration and informatics, pharmacy regulations, and ethics are woven into PY3 curriculum. These components are considered equally important to sculpt a practice-ready pharmacist as they represent the soft skills essential for clinical practice and academic environment that are hard to acquire from textbooks. Critical thinking and problem-solving skills are remarkably polished further in these lectures (Sun et al., 2023). However, the issue is the insufficient integration of social and administrative science (pharmacoeconomics, communication, policies/laws, ethics, professionalism, healthcare delivery system) into clinical science when compared to the foundational sciences. The importance of social and administrative science in shaping a versatile pharmacist is well known, but the allocated time in the curriculum is affected by the promotion of NAPLEX pass rates during pharmacy school recruitment seasons, as NAPLEX focuses on clinical practice (Zakeri et al., 2024). Pharmacy educators are concerned about this shift in curriculum and are starting to assist pharmacy schools with a smoother integration of social and administrative sciences in learning.

C. Pharmacy Practice Experiential Training

Experiential training is a critical phase for Pharm.D. students. The core coursework lays the foundation of knowledge, and experiential training prepares students for practice. Introductory Pharmacy Practice Experiences (IPPEs) require at least 300 hours of experience, starting in PY1 and lasting until the end of PY3. IPPEs take place in hospitals, ambulatory care, and community pharmacies, where students learn procedures like blood pressure measurement, insulin administration, and immunization. They also perform tasks like verifying prescriptions, contacting prescribers, and providing patient education. The grading rubric consists of predefined category points and a rating scale. With the help of the grading rubric, both the grader and the students have a clear rule to follow (Peeters et al., 2010).

APPEs are the second part of experiential training, consisting of eight to ten rotations of four to six weeks each, totaling at least 1,440 hours. APPE students provide direct patient care under the supervision of precepting pharmacists in various practice settings. APPEs are viewed as a crucial stepping stone to students' careers, as preceptor recommendations can significantly impact their prospects for postdoctoral training or employment interviews. Leveraging the skills gained in coursework and IPPEs, APPE students further develop their knowledge, critical thinking, and patient care abilities.

D. Pharmacotherapy Topic Prioritization

Although the options of learning opportunities provided by the school are diverse and numerous, “course overload” has been a problem that is identified not only by pharmacy students but pharmacy educators. The advancement of technology facilitates the progression of medicine in disease diagnosis, assessment, and treatment options. For prescription drug products alone, there are over 23,000 products approved by the FDA circulating on the market as of 2024, with a steady pace of new drug approval each year. Pharmacy educators realize that it is impossible to include all the available prescription drugs in PY1-PY3, and a further refined teaching approach is desperately required.

The ACCP Pharmacotherapy Didactic Curriculum Toolkit designates three tiers of topics based on organ system and disease state, according to the breadth and depth of the content that should be considered during curricular revision (Kolanczyk et al., 2024). Tier 1 covers the core education and training to prepare students as practice-ready, collaborative pharmacists upon graduation. Tier 2 indicates that students receive a solid foundation, but require additional post-graduate training to become fully practice-ready. Tier 3 denotes limited education, requiring substantial post-graduate training to provide collaborative, person-centered care. This tiered framework helps pharmacy schools prioritize curricula and identify areas needing further post-graduate development for well-rounded, practice-ready pharmacists. Other than prioritizing the integral disease states taught in courses, each school of pharmacy also provides different electives for students who are interested in having a deeper dive into specific topics. Examples are transplant, toxicology, critical care, psychiatry, etc. In recent years, some schools have started to promote the concept of a “certificate”, which will be offered to pharmacy students who complete. Pharmacy students may have to pay an extra fee in addition to their tuition to earn the certificate upon completion of their studies. Examples are the Medication Therapy Management Certificate and the Personalized Medicine Certificate offered at the University of Florida, the Biomedical Regulatory Affairs Certificate offered at the University of Washington, and the Data Science in Health Economics & Outcomes Research Certificate offered at the University of Arizona.

E. General Milestones at Pharmacy School

The key milestones for pharmacy students in the U.S. Pharm.D. program are implemented to ensure the development of well-rounded, practice-ready pharmacists. These milestones often include obtaining certifications, demonstrating readiness for advanced practice experiences, and completing assessments to evaluate students' clinical skills, knowledge, and professional competencies. For instance, students may be required to obtain the American Pharmacists Association (APhA) Immunization Certification, participate in an APPE Readiness Panel, and pass Objective Structured Clinical Examinations (OSCEs) and a Pharmacy Curriculum Outcomes Assessment

(PCOA). Additionally, schools may incorporate milestones such as a Pharmacy Calculations Exam, Problem-Solving Exam, and an assessment of professionalism.

The specific milestones and their timing may vary across different pharmacy schools, but they are designed to holistically prepare students for the rigors of pharmacy practice. Successful completion of these milestones helps students develop the necessary knowledge, skills, and professional attributes required to become competent pharmacists. Ultimately, the mastery of these milestones prepares students for the NAPLEX, which is a critical step towards obtaining a pharmacist license in the United States.

V. Example of an Integrated Case of Foundational, Clinical, Social, and Administrative Sciences

Below is an example of a lecture applying the concept of practice-led pharmacy education.

A 55-year-old male is hospitalized with a 3-day history of recurrent fever and hypotension. The medical resident asked you, the pharmacist, during morning rounds about the antibiotic choice for *Pseudomonas aeruginosa* identified in the blood culture. They noticed the patient's medical chart listed an allergy to ampicillin and were curious whether cefepime could be prescribed to this patient.

- **Foundational science**: Recognize the chemical structure of antibiotics.
- **Clinical science**: Understand the relationship between the side chain and cross-reactivity between penicillins and fourth-generation cephalosporins.

The medical resident accepted your advice and chose the appropriate antibiotics for the patient. The patient has had a swift recovery and wishes to complete the rest of the antibiotic course at home to lower the cost. The medical team and the patient asked you, the pharmacist, to assist with this request.

- **Social and administrative science**: The role of pharmacists in the transition of care and medication access.

According to this scenario, a multiple-choice question is presented, comprising concepts that may appear in the NAPLEX, as demonstrated in the practice exam questions below (Bland, 2023).

ZL is a 30 year-/old non-pregnant female coming to your community pharmacy to pick up a new prescription for Augmentin® for a recently diagnosed acute bacterial sinusitis infection. As you are filling this prescription, you notice the patient has an allergy listed for amoxicillin. When the patient comes to pick up her prescription, you ask the patient which penicillin antibiotic she last took and what occurred when she took it. The patient tells you she had laryngitis last year and took amoxicillin. After taking amoxicillin she experienced shortness of breath and throat swelling requiring an ED visit. She tells you she recently moved to the area a month ago and she forgot to tell her new physician about the incident.

Current Medications: Flonase 2 sprays daily for seasonal allergies, Yaz 1 tablet QD, Women's MultiVitamin once daily.

What course of action would you take regarding ZL's allergy to penicillin allergy based on her level of risk and type of reaction?

A. The patient had a low-risk isolated reaction and you can continue to fill the prescription as is.
B. The patient had a high-risk reaction and you call the physician to recommend the patient receive levofloxacin instead.
C. The patient had a low-risk isolated reaction and the addition of clavulanate should neutralize any risk of subsequent reaction.
D. The patient had a high-risk reaction and you call the doctor to recommend the patient receive cephalexin instead.

(Correct Answer: B)

NAPLEX Core Competencies covered: 2.1 (therapeutic class), 2.2 (Brand Generic), 3.6 (Drug allergies).

VI. Suggestions for Pharmacy Training in Taiwan

Although many pharmacy schools in Taiwan currently offer 4-year, 5-year, or 6-year programs in response to the increasing emphasis on clinical pharmacy, a critical issue remains: whether the curriculum and course content have been adequately transformed to equip pharmacy students with essential pharmacy practice knowledge and clinical skills. Below are suggestions for future improvements in pharmacy education in Taiwan.

A. Licensure Exam

The current pharmacy licensure exam in Taiwan presents an opportunity for alignment with the evolving needs of the healthcare industry and for the clinical abilities of pharmacy graduates. By reforming the licensure exam, we can strengthen the motivation for pharmacy schools to enhance their educational programs. Embracing an outcome-targeted educational approach will require a collaborative effort to update the licensure exam, ensuring it effectively reflects the competencies required in today's healthcare environment.

B. Course Coordination

The contemporary objective of pharmacy education in Taiwan is to cultivate practice-ready pharmacy graduates. To achieve this goal, a comprehensive revision of the pharmacy school curriculum is essential, with an emphasis on integrating pharmacy practice. Currently, pharmacotherapy courses tend to focus heavily on specific specialties, such as critical care and oncology, which may result in pharmacy students having limited exposure to the broader range of disease conditions encountered in the general patient population. It is important to engage in an in-depth discussion to identify fundamental topics that should be included in the curriculum to ensure a well-rounded education. Additionally, for more science-intensive courses, pharmacy students could have the option to pursue these courses as electives or at the graduate level.

C. Course Content

In addition to the need for transforming didactic lectures, pharmacy schools should also incorporate activities designed to enhance clinical skills preparation. For instance, the ability of pharmacy students to independently conduct patient care evaluation using the SOAP note format could be effectively assessed during the APPE phase.

D. Content Delivery

Pharmacotherapy courses should be taught by pharmacists who actively practice at the bedside as part of a multidisciplinary team. This approach ensures that students receive instruction from professionals who are directly engaged in patient care, rather than solely from physicians or pharmacists focused on operational activities.

E. Evaluation

In addition to quizzes and exams for didactic courses, tools such as EPAs should be utilized to support the development of individual clinical skills. This includes competencies in areas such as SOAP notes, patient interviews, and patient education.

VII. Conclusion

The insights gained from examining the U.S. pharmacy education and licensing examination system offer valuable guidance for improving pharmacy training in Taiwan. Several key lessons can be drawn. The U.S. model has transitioned towards a competency-based approach, where clear, assessable learning outcomes are defined to ensure graduates are equipped with the necessary knowledge, skills, and clinical competencies to provide effective, patient-centered care. This shift could serve as a framework for educators in Taiwan to enhance the pharmacy curriculum by adopting a similar competency-based approach.

The U.S. pharmacy education system is closely integrated with the NAPLEX, the required licensure exam. Adopting a similar approach in Taiwan could strengthen the connection between pharmacy education and the national licensure examination. In the U.S., the NAPLEX exam utilizes computer-adaptive testing, allowing for a tailored assessment based on examinee performance. Additionally, the inclusion of pre-evaluation questions and scenario-based assessments helps to evaluate candidates' clinical reasoning and problem-solving abilities, rather than just factual knowledge.

Incorporating these exam methods in Taiwan's licensure assessment could enhance the practical relevance and clinical competence of pharmacy graduates.

The U.S. model provides structured internships and APPEs to ensure that students gain meaningful hands-on experience. Strengthening the structure and quality of internship opportunities in Taiwan could better prepare pharmacy students for the realities of professional practice. By incorporating these key elements from the U.S. pharmacy education and licensure system, educators in Taiwan can work towards strengthening local pharmacy training programs and better aligning them with the national licensure examination. This integration can lead to the development of highly competent pharmacists who are well-prepared to deliver high-quality; and patient-centered care in the Taiwanese healthcare system.

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