






RESEARCH ARTICLE

A Taiwanese pharmacy graduate-oriented questionnaire reveals higher confidence and self-evaluation in Pharm.D. graduates

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Keywords

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Abstract

Background: Pharmacy education reform in Taiwan began with the publication of a White Paper on Pharmacy Education in Taiwan (WPPET), leading to the introduction of six-year Pharm.D. programme in local schools. However, there's still diversity in educational goals among domestic pharmacy schools, and education recipients' perspectives are unreported. **Methods:** An education receivers-oriented, web-based questionnaire was employed to assess self-evaluated confidence and competency in pharmacy practice, adherence to WPPET, and opinions on pharmacy education reform, as well as the ideal pharmacy education. **Results:** A total of 458 responses were valid and included in the final analysis. Pharm.D. graduates showcased higher levels of confidence, self-evaluated competency, and overall satisfaction with their education compared to B.Pharm graduates. The direction for pharmacy education reform centred on course integration and advanced competency accreditation. Most respondents favoured retaining the national license test and introducing a new B.Pharm-based programme with choices for advanced capstone courses. **Conclusion:** This study implies the successful Pharm.D. programmes implementation aligned with WPPET. Future research should focus on course integration and advanced competency accreditation. A flexible, localised system providing diverse education options for recipients appears to be the most favourable.

Introduction

Pharmacy education has undergone significant reformation over the past few decades with the development of clinical pharmacy. With the increasing need for healthcare systems to attain favourable patient outcomes, pharmacists are now expected to be directly integrated into interprofessional medical teams, optimise medication use across the entire spectrum of patient care, and actively promote health, wellness, and disease prevention (Jacobi, 2016). This paradigm shift began in the United States, where, after a prolonged debate spanning more than half a century, the Doctor of Pharmacy (Pharm.D.) degree with a more clinical-oriented focus was designated as the entry-level qualification for the profession (Knoer *et al.*,

2016). Following this pivotal development, the Pharm.D. programme has gradually been formulated and introduced in several Asian countries, including Japan, Korea, and Thailand (Yang *et al.*, 2005; Inoue, 2007; Chaiyakunapruk *et al.*, 2016)

In Taiwan, local pharmacy education had historically comprised four-year or five-year Bachelor of Pharmacy (B.Pharm) programmes, with a primary focus on pharmaceutical sciences. However, in 2005, the Pharmaceutical Society of Taiwan recognised the ongoing trend of reform in pharmacy education and issued the White Paper on Pharmacy Education in Taiwan (WPPET) (Lin Wu *et al.*, 2005). The WPPET was designed to guide pharmacy schools in Taiwan toward introducing Pharm.D. programmes, and it formulated the standards regarding the curriculum, teacher

performance appraisal, internship programmes, and equipment for pharmacy education, which particularly reinforced the importance of clinical courses such as pharmacotherapy, evidence-based medicine, pharmacy administration, and social pharmacy.

The first Pharm.D. programme was introduced at National Taiwan University in 2009 (Guh *et al.*, 2016), followed by the other pharmacy schools proactively adjusting their programmes to align with the evolving trends in pharmacy education. Such adjustments have led to a notably diverse landscape of pharmacy education programmes. Currently, of the nine pharmacy schools in Taiwan, three schools introduced novel six-year Pharm.D. programmes while retaining their original B.Pharm programmes, another two continued with B.Pharm programmes while extending the academic year requirement, and the remaining four schools exclusively adopted six-year Pharm.D. programmes. In addition to the programme difference, the curriculum designs in Pharm.D. programmes also exhibit distinct variations. Some schools introduced two-year clinical practice-based courses and internships to the original four-year curriculums, while some reserved the final academic year for research purposes.

The diversity in pharmacy education programmes in Taiwan reflects differing opinions within the pharmaceutical community about the profession's future. Nevertheless, graduates holding either a B.Pharm or Pharm.D. degree are eligible to take the same national licensure examination. Due to the absence of advanced certification or accreditation opportunities throughout pharmacists' career paths in Taiwan, educational programme reforms have not yet led to practical changes, such as modifications in licensure policies or career position distinctions. Drawing from previous in-house qualitative research, certain Pharm.D. graduates acknowledged the rationale behind establishing Pharm.D. programmes and recognised Taiwan's ongoing transition from B.Pharm to Pharm.D.. Nonetheless, they held reservations about the practicality and career benefits of these reforms. This situation has amplified the importance of discussions on educational reform.

Education providers, such as professors of pharmacy schools and opinion leaders, have engaged in vigorous debates about the objectives of pharmacy education since the publication of WPPET (Li *et al.*, 2018). However, the opinions of pharmacy graduates have rarely been reported. On that note, the success of educational reform hinges on the alignment of opinions from every stakeholder, particularly the recipients of education. These perspectives should reflect the existing educational system, offer constructive insights,

and ultimately translate into actionable steps. Therefore, this study aims to gather feedback from pharmacy school graduates in Taiwan on the current education system and potential reforms. It emphasises the confidence of young pharmacists in their practice, agreement with educational principles, and their views on the future of pharmacy education.

Methods

Design

A cross-sectional, web-based questionnaire survey was conducted to collect reflections and self-evaluations from pharmacy graduates and young pharmacists. Their opinions on pharmacy education reformation and ideal pharmacy education were also collected.

Questionnaire development and verification

The questionnaire comprised four domains with 53 items. The first domain (six items) was used to collect the characteristics of the respondents, including their graduation year, graduation school, graduation programme, admission to postgraduate school (including Master's programme and Ph.D. programme), current occupation, and work experience.

The second domain comprised two sections (30 items) to evaluate respondents' confidence and competency in their pharmacy practice. The first section included 18 statements about the duties of pharmacists based on the Pharmacist's Act, article 15, including dispensing, storage management, manufacturing, medicine management, and pharmaceutical care. The respondents were asked to rate their confidence in their ability to perform these duties on a six-point confidence scale from 1 (very unconfident) to 6 (very confident). The second section comprised 12 statements describing pharmacy professional competency according to the FIP Education Initiatives-Pharmacy Education Taskforce, a Global Competency Framework (International Pharmaceutical Federation (FIP), 2012). The respondents were required to indicate their agreement with these competencies on a six-point agreement scale, from 1 (absolutely disagree) to 6 (absolutely agree).

The third domain (13 items) asked the respondents to evaluate their degree programmes' adherence to the WPPET. Narrative statements of standards of pharmacy education from WPPET were provided, such as developing curriculums systematically according to the educational goal and developing standardised internship courses. Respondents indicated their agreement with the adherence using a six-point scale.

Further, the respondents were asked to give an overall satisfaction rating on a ten-point scale based on their pharmacy education experience.

The fourth domain (two items) is comprised of two sections. The first section measured the subjective priority of pharmacy education reformation tasks in the future, and the respondents were asked to rank five out of eight pre-designated options. In the second section, the respondents were requested to choose one out of four ideal pharmacy education systems in Taiwan. The items in this domain were derived from previous in-house qualitative interviews with Pharm.D. graduates.

The final version of the questionnaire was originally designed in Mandarin. Other questions regarding domestic interests (e.g. traditional medicine) were not displayed in this study. The content validity of the questionnaire was verified by three professors whose expertise was in social pharmacy, behavioural pharmacy, and pharmacy education.

Questionnaire distribution

Eligible candidates were graduates from nine pharmacy schools in Taiwan who had completed their studies from 2013 to 2021. It was chosen as the starting point because 2013 was the first year graduates from Taiwan's Pharm.D. programme graduated. While convenience sampling was used to select candidates, a minimum number of 30 was set to balance the number of replies from different schools and graduate years. The questionnaire was distributed via social media to collect a broad and diverse sample. This method capitalises on the benefits of online surveys, including swift deployment, extensive reach, cost-effectiveness, flexibility, and automation, potentially leading to a greater likelihood of respondents completing the questionnaire (Ball, 2019). As an advertising incentive, a total of 100 participants who completed the survey with valid responses were eligible for a lucky draw and received 100 NTD (equivalent to 3.3 USD) gift cards.

Statistical analysis

After the questionnaire was retrieved, survey data cleaning was performed. Data with the following situations were considered invalid: (1) inconsistent answers to reverse-coded items, (2) duplicate replies, and (3) mismatches in graduation year and programmes. Descriptive statistics were used to describe the characteristics of the respondents and the questionnaire results. The independent-sample Mann-Whitney U test was conducted in the second and the third domains to identify any differences between graduates with Pharm.D. and B.Pharm degrees, as well as their overall satisfaction ratings. When analysing the first section of the fourth domain, the final rank was displayed as a total score, with the highest rank scoring five and the lowest rank scoring one. All analyses were conducted using SPSS 11, and the significance threshold was designed as a probability of type 1 error less than 0.05.

Results

Characteristics

A total of 506 replies were collected from June to July 2021, with 458 meeting the criteria for validity following a data cleaning process and 48 being identified as invalid (39 inconsistently answered, one duplicate reply, and eight programme-graduation year mismatches) (Figure 1). Of the respondents who provided valid replies, 48.7%, 36.0%, and 15.3% graduated from four-year B.Pharm, five-year B.Pharm, and six-year Pharm.D. programmes, respectively. Most respondents graduated in 2021 (19.7%), and the numbers decreased over the graduation year. The majority were working as hospital pharmacists (39.5%), followed by postgraduate students (28.2%) and community pharmacists (13.8%) as shown in Table I.

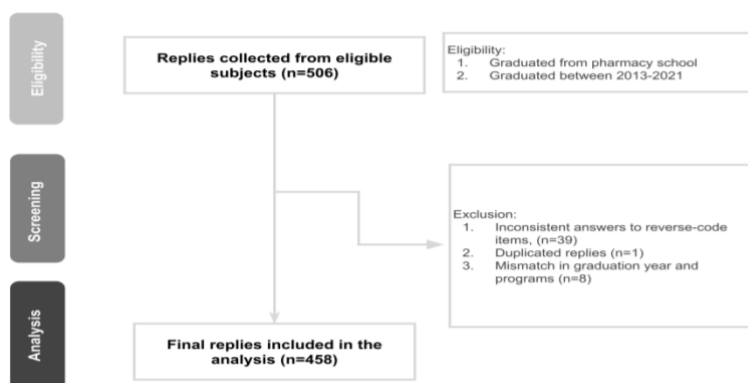


Figure 1: Chart of the study

Table 1: Respondents' characteristics collected in pharmacy education receivers-oriented questionnaire

Questions	Respondents	Percentages (%)
Graduation year		
2021	90	19.7
2020	65	14.2
2019	59	12.9
2018	42	9.2
2017	49	10.7
2016	54	11.8
2015	39	8.5
2014	29	6.3
2013	31	6.8
School		
China Medical University (CMU)	115	25.1
Taipei Medical University (TMU)	101	22.1
Chia Nan University of Pharmacy and Science (CNU)	74	16.2
Kaoshiung Medical University (KMU)	57	12.5
Tajen University (TJU)	50	10.9
National Taiwan University (NTU)	31	6.8
National Cheng Kung University (NCKU)	14	3.1
National Defense University (NDU)	11	2.4
National Yang Ming Chiao Tung University (NYCU)	5	1.1
Programme		
Fourth-year	223	48.7
Fifth-year	165	36.0
Sixth-year	70	15.3
Postgraduate school		
Yes	132	28.8
No	326	71.2
Current job		
Hospital pharmacist	181	39.5
Student	129	28.2
Community pharmacist	63	13.8
Industrial pharmacist/ Clinical trial institute	39	8.5
Primary care pharmacist	22	4.8
¹ Others	18	3.9
Governmental agencies	6	1.3
Work experiences		
Hospital pharmacist	262	57.2
Student	180	39.3
Community pharmacist	107	23.4
Industrial pharmacist/ Clinical trial institute	55	12.0
Primary care pharmacist	52	11.4
Others	19	4.1
Governmental agencies	11	2.4

¹Others included post-doctoral researcher (1), research assistant (3), lecturer (1), biomedical company (1), medical student (1), medical editor (1), salesperson (1), and between jobs (9)

Confidence in duties of pharmacy practice and agreement with self-evaluated competencies

The respondents considered they were most confident in “correctly dispensing according to the prescription, including medication, quantity, labelling, and packaging” (median: 5, IQR (5, 6)) and least confident

in “Manufacture and supervision of medicated cosmetic products” (median: 3, IQR (2, 4)). In the subgroup analysis, the Pharm.D. graduates demonstrated significantly higher confidence in “evaluating prescription”, “assessing adverse drug reaction”, “assessing potential drug-drug interactions”, “carrying out medication reconciliation”, “assessing current

disease status and drug-related problems”, “utilising evidence-based medicine to answer drug-related questions”, “establishing treatment plans and monitoring relevant parameters”, and “ensuring therapeutic drug monitoring base on pharmacokinetics and pharmacodynamics” (Table II).

Regarding professional competency, the median agreement score was as high as 5.0 overall. The only exception was the statement, “I can keep abreast of drug information that is about to enter the market”, which received a median agreement score of 4. Additionally, when comparing Pharm.D. graduates to B.Pharm. graduates, the former showed a stronger agreement with the statement, “I make my medication choices based on scientific evidence” (Table II).

Agreement with programmes' adherence to the WPPET

The highest agreement was with “The pharmacy school/department arranged standardised internship programmes” (median: 5, IQR (4, 5)), and the lowest agreement was with “The teachers taught in creative and interactive ways” (median: 3.5, IQR (3, 4)). The Pharm.D. graduates demonstrated significantly higher agreement than B.Pharm graduates on most items, except “The pharmacy school/department designed an efficient teaching feedback system” and “The teachers stated clearly on learning goals and future applications before the courses.” The median overall satisfaction rating for pharmacy education among all respondents was 7 out of 10. Pharm.D. graduates also showed significantly higher satisfaction than B.Pharm graduates (median: 8 vs. 7, $p < 0.001$) as shown in Table II.

Table II: The rating of practice confidence and the rating of agreement with self-evaluated competency and programmes' adherence to WPPET

	Rating of all respondents N= 458 Median (IQR)	Rating of B.Pharm graduates Median (IQR)	Rating of Pharm.D. graduates Median (IQR)	p-value
Confidence in pharmacy practice				
Evaluating prescription, including drug type, dosage, frequency, route of administration, course of treatment, etc.	4 (4, 5)	4(4, 5)	5(4, 5)	.013 [†]
Correctly dispensing according to the prescription, including medication, quantity, labeling, and packaging.	5 (5, 6)	5(5, 6)	5.5(5, 6)	.104
Altering dosage forms and compounding according to prescription	4 (3, 5)	4(3, 5)	4(3.25, 5)	.901
Carrying out medication education	5 (4, 5)	5(4, 5)	5(4, 5)	.053
Assessing adverse drug reactions	4 (3, 5)	4(3, 5)	5(4, 5)	<.001 [†]
Assessing potential drug-drug interactions	4 (3, 5)	4(3, 5)	5(4, 5)	<.001 [†]
Carrying out medication reconciliation	4 (3, 5)	4(3, 5)	5(4, 5)	<.001 [†]
Assessing current disease status and drug-related problems based on patient's clinical data	4 (3, 5)	4(3, 5)	5(4, 5)	<.001 [†]
Utilising evidence-based medicine to answer drug-related questions	4 (4, 5)	4(3, 5)	5(5, 6)	<.001 [†]
Establishing treatment plan and monitoring parameters	4 (3, 5)	4(3, 4)	5(4, 5)	<.001 [†]
Ensuring therapeutic drug monitoring based on pharmacokinetics and pharmacodynamics	4 (3, 4)	3(3, 4)	4.5(4, 5)	<.001 [†]
Implementing formulary management within the institute	4 (4, 5)	4(4, 5)	4(4, 5)	.268
Vending and managing over-the-counter medication	4 (3, 5)	4(3, 5)	4(3, 5)	.148
Manufacture and supervision of medicated cosmetic products	3 (2, 4)	3(2, 4)	3(1.25, 4)	.460
Vending and managing medical equipment/devices of a certain level	3 (2, 4)	3(2, 4)	3(2, 4)	.418
Conducting pharmaceutical measurement and analysis according to regulations	3 (2, 4)	3(2, 4)	3(2, 4)	.825
Conducting quality control and assurance according to regulations	3 (2, 4)	3(2, 4)	3(2, 3.75)	.341

	Rating of all respondents N= 458 Median (IQR)	Rating of B.Pharm graduates Median (IQR)	Rating of Pharm.D. graduates Median (IQR)	p-value
Managing stability of medication by its ideal storage conditions	4 (3, 4)	4(3, 5)	4(3, 4)	.515
Agreement with professional competency				
I can efficiently communicate with other healthcare professionals	5 (4, 5)	5(4, 5)	5(4, 5)	.257
I am able to adapt the communication style to the needs of different patients	5 (4, 5)	5(4, 5)	5(4, 5)	.964
I can communicate in both verbal and non-verbal ways	5 (4, 5)	5(4, 5)	5(4, 5)	.267
I will practice with medical ethics (autonomy, beneficence, non-maleficence, justice, veracity, confidentiality)	5 (5, 6)	5(5, 6)	5(5, 6)	.684
I will take responsibility for my advice on medications	5 (5, 6)	5(5, 6)	5(5, 6)	.326
I base my medication choices on scientific evidence	5 (5, 6)	5(5, 6)	5(5, 6)	.002 [†]
I can keep abreast of drug information that is about to enter the market	4 (3, 5)	4(3, 5)	4(3, 4)	.737
I avoid interest conflict when evaluating medications	5 (4, 5)	5(4, 5)	5(4, 5)	.379
I will abide by the regulations in my practice	5 (5, 6)	5(5, 6)	5.5(5, 6)	.088
I can cooperate with other healthcare professionals in medical teams	5 (4, 6)	5(4, 6)	5(5, 6)	.129
I see the role of the pharmacist as a health promoter	6 (5, 6)	6(5, 6)	6(5, 6)	.479
I understand the value of the pharmacy profession and have faith in the pharmacy profession	5 (4, 6)	5(4, 6)	5(5, 6)	.867
Agreement with programmes' adherence to the WPPET				
The pharmacy school/department stated clearly on its educational goal and policy	4 (4, 5)	4(4, 5)	4(4, 5)	.008 [†]
The pharmacy school/department systematically designed courses based on its educational goal	4 (4, 5)	4(4, 5)	4(4, 5)	.008 [†]
The teachers hired by the pharmacy department/college are in line with the majors of their planned courses	4 (4, 5)	4(3, 5)	5(4, 5.75)	<.001 [†]
The pharmacy school/department arranged standardized internship programmes	5 (4, 5)	5(4, 5)	5(5, 6)	.021 [†]
The pharmacy school/department integrated professional courses	4 (3, 5)	4(3, 5)	5(4, 5)	.004 [†]
The pharmacy school/department reinforced courses in behavioral pharmacy, social pharmacy, pharmacy administration, and clinical science.	4 (3, 5)	4(3, 4.25)	4(3, 5)	.008 [†]
The pharmacy school/department designed an efficient teaching feedback system	4 (3, 5)	4(3, 5)	4(3, 5)	.286
The pharmacy school/department obtained sufficient hardware and experimental equipment.	4 (3, 5)	4(3, 5)	4.5(4, 5)	<.001 [†]
The pharmacy school/department obtained sufficient software and medical information resources.	4 (3, 5)	4(3, 5)	5(4, 6)	<.001 [†]
The teachers stated clearly on learning goals and future applications before the courses	4 (3, 5)	4(3, 5)	4(3, 5)	.239
The instructions of teachers helped students to comprehend the content of the courses.	4 (3, 5)	4(3, 5)	4(4, 5)	.015 [†]
The teachers taught in creative and interactive ways.	4 (3, 4)	3.5(3, 4)	4(3, 5)	.003 [†]
Efficient learning evaluations were arranged during and after the course	4 (3, 4)	4(3, 4)	4(4, 5)	.003 [†]
	Rating of all respondents N=458 Median (IQR)	Rating of Bpharm graduates Median (IQR)	Rating of Pharm.D. graduates Median (IQR)	p-value
Overall satisfaction rating for pharmacy education	7 (6, 8)	7 (6, 8)	8 (7, 8)	<.001 [†]

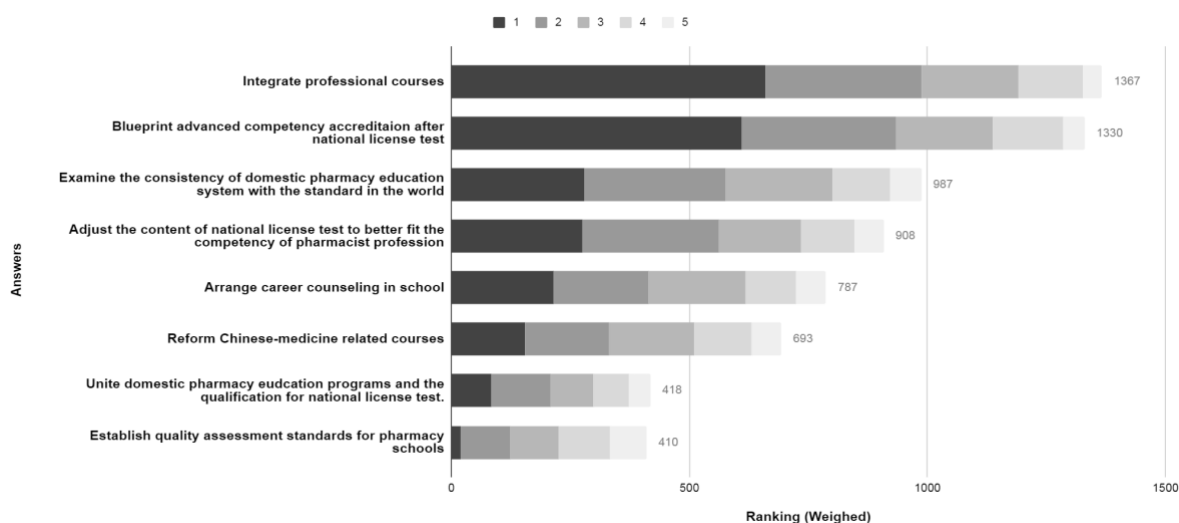
WPPET= White Paper on Pharmacy Education in Taiwan

[†] p value < 0.05

Opinion on pharmacy education reformation

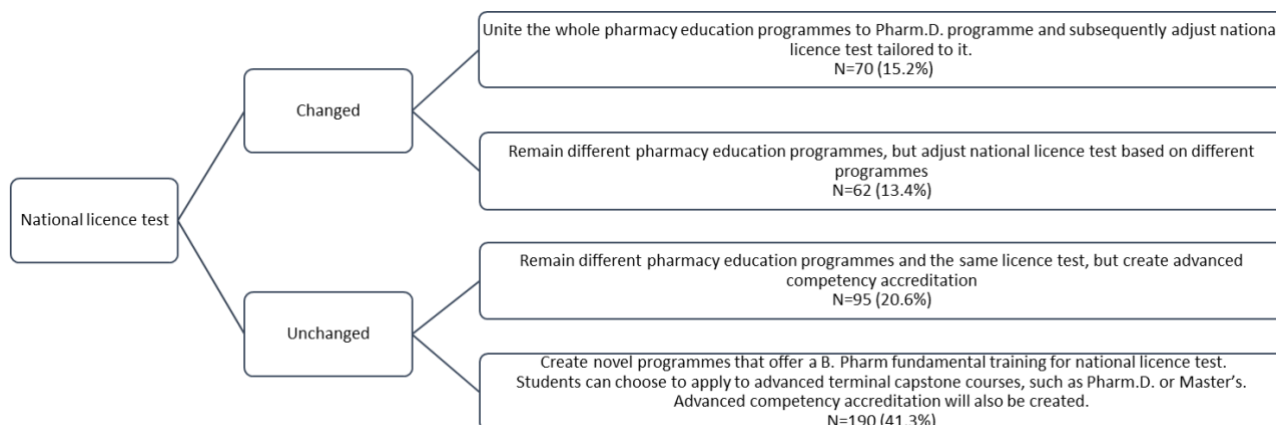
In the first section, the respondents ranked “integrate professional course” and “blueprint advanced competency accreditation after national license test” as the top two directions of pharmacy education reformation, with 1367 and 1330 points, respectively. “Examine the consistency of the domestic pharmacy education system with the standard in the world,” “Adjust the content of national certification exam to better fit the competency of pharmacist profession,” and “Arrange career counselling in school” were ranked third to fifth, respectively (Figure 2).

In the second section, the majority (n=190, 41.3%) consented to retain the existing national licensing test while establishing a new programme that allows students to opt for various advanced terminal capstone courses and obtain different degrees, all accompanied by advanced competency accreditation. In addition, 95 respondents (20.6%) agreed with keeping the current condition but creating advanced competency accreditation. Another 70 respondents (15.2%) concurred with making the Pharm.D. degree a requirement for taking the national license test, and 62 respondents (13.4%) expressed that graduates with different degrees should take different national license tests (Figure 3).



The respondents were asked to rank five out of eight predesignated options concerning pharmacy education reformation. With the highest rank scoring 5 and the lowest rank scoring 1, the final rank was calculated by summing all scores

Figure 2: Ranking of directions of pharmacy education reformation



The respondents were asked to choose one out of four predesignated ideal pharmacy education regarding changes in national license tests and education programmes. The results showed that 41.3% of respondents consented to the notion of creating a B.Pharm-based pharmacy education programme, after which they could choose to apply for advanced terminal capstone courses, such as Pharm.D. or Master's degree, or just start their careers

Figure 3: The illustration of respondents' opinions on ideal pharmacy education

Discussion

In this study, Pharm.D. graduates demonstrated significantly higher confidence in their clinical practice duties and self-evaluated competencies compared to B.Pharm graduates. The items Pharm.D. graduates stood out were related to pharmaceutical care and evidence-based medicine, which aligns with the training objectives outlined in the WPPET. In line with the above results, Pharm.D. graduates also showed a higher agreement in the adherence of their programmes to the WPPET and were more satisfied with the education they received. Namely, the education reformation guided by the WPPET was passed on to the students and arguably improved the clinical capacity of pharmacists.

While the results were encouraging, pharmacy graduates expressed concerns about the future of pharmacy education. When questioned about their priorities for future reforms, *"Integrate professional courses"* emerged as the leading response. The notion of integrating professional courses has been long purposed to the reform of medical education, on either linking fundamental curricula with more advanced practical elements (also known as longitudinal integration) or transcending disciplinary boundaries (also known as horizontal integration) (Irby et al., 2010; Pearson & Hubball, 2012). Despite the introduction of the Pharm.D. programme, the integration has not progressed as outlined in the WPPET (Lin Wu et al., 2005). For instance, pharmacotherapy in the Pharm.D. curriculum has not been integrated with fundamental pharmaceutical science courses, including medicinal chemistry and pharmacology (Beleh et al., 2015). This phenomenon can be explained by parochialism or territorialism, a significant barrier to integrating courses identified in previous studies (Islam et al., 2016). Each department within a school remained entrenched in its way, and any attempts at communication often ended in frustration.

"Blueprint advanced competency accreditation after national license test" was another prompt demand, implying a massive gap between school and social demand. As mentioned before, due to the same national license examination, differences in degrees were not considered distinguishable in practical fields. Therefore, it seemed reasonable for the respondents to hope for the creation of advanced accreditation based on competencies. The result was consistent, as most respondents agreed with the necessity of creating advanced competency accreditation in domain four: ideal pharmacy education section (Figure 3). Similar to the results of this study, interviews with pharmacy stakeholders conducted in Thailand also revealed a mismatch between the pharmacy graduates'

competency and the job market's needs (Chanakit et al., 2015). Advanced competency accreditation may allow pharmacy graduates to demonstrate their learnings, encourage constant individual development in self-awareness and professionalism, and lead to further career development. The Competency Development and Evaluation Group's Advanced and Consultant Level Framework in the United Kingdom and the Australian Advanced Pharmacy Practice Framework both adopted competency-based recognition along with the natural careers of pharmacists. Likewise, the Board of Pharmacy Specialties in the United States certified pharmacists who attained advanced clinical skills in the defined areas of patient care (Waddell et al., 2016). The recognition, along with the implementation of the pharmacist career ladder, has been successfully endorsed in the practice field of hospital pharmacy in the United States (Heavner et al., 2016). This virtuous circle is expected to reinforce the transition of pharmacists toward more professional characteristics in society.

One complex but imperative issue that the authors tried to address was the ideal pharmacy education system in Taiwan. The results demonstrated the demand for examining the consistency of domestic pharmacy education with the standard in the world; however, at the same time, most respondents favoured creating a new B.Pharm-based programme in which they can choose to advance to different degrees. Counterintuitively, although Pharm.D. graduates expressed higher practice confidence and adherence to their programme to the WPPET than B.Pharm graduates, uniting the whole pharmacy education programme to Pharm.D. programmes was not the most favourable choice, not even among the subgroup of Pharm.D. graduates (Appendix A). These conflicting results could be explained by the fact that pharmacy programmes in Taiwan (either B.Pharm or Pharm.D.) have continued to be widely considered undergraduate degrees. High school graduates only learned the pharmacy profession after entering the school so it is understandable that respondents wish to preserve the flexibility of their future choices by retaining the unchanged fundamental programmes. Moreover, previous reports suggested that graduates from the new education system may feel uneasy about entering the workforce, as the job market is still relatively unfamiliar with Pharm.D. graduates (Lin, 2012). Conversely, those who graduated from the old system are apprehensive about the possibility of becoming obsolete. The uncertainty surrounding the transition from B.Pharm to Pharm.D., including curriculum reform, changes in licensure requirements, and career

development, has also impeded the complete implementation of the Pharm.D. programme.

A comprehensive review of Pharm.D. development in several countries revealed that educational reform should cater to the needs of the healthcare system and pharmacy practice in each society (Supapaan *et al.*, 2019). Previous perspectives from education providers in Taiwan also underscored the necessity of shaping pharmacy education in response to local demands and prioritising diverse goals at different educational stages (Li *et al.*, 2018). These viewpoints are consistent with the findings of this study. Being consistent with the global standard does not necessarily mean imitating other countries' systems; instead, it means following the global goal of pharmacy advancement and catering to local requirements. As the transition to the Pharm.D. programme gradually gains more attention in Asian countries (Suttajit *et al.*, 2018; Alrasheedy *et al.*, 2022), the results of this study regarding Taiwan's situation may provide insights for other countries that have not yet started the transition or are undergoing the transition.

Limitations

This study still has limitations. First, the web-based survey could only be accessed online, and the representativeness might have been suboptimal. Also, the predetermined graduation year of 2013 to 2021 could not represent all pharmacy graduates. Nevertheless, the target population was initially set to be young pharmacists since they were the ones who would be impacted the most by the education reformation. Second, the minimum number of participants was set from each school to 30 to observe equally distributed respondents each year. However, the authors also understood that the number of graduates from each school was different every year and that there were two newly founded pharmacy schools in Taiwan, making it almost impossible to balance graduate schools and graduate years. The third limitation was recall bias. Questions about the agreement with the WPPET required the respondents to recall their school lives. Bias levels rise with the increasing time since graduation. Also, the possibility that participants' experiences in postgraduate school and the workplace might have affected their opinions on pharmacy education could not be ruled out. The complexity of human experiences made it impossible to purify their experiences in college, even though they were asked to do so while completing the survey.

Conclusion

This study disclosed significant elevations in practice confidence, self-evaluated competencies, and degree of agreement in pharmacy education in Pharm.D. graduates, which may imply the success of the implementation of Pharm.D. programmes according to the WPPET. Nevertheless, the respondents expected course integration and advanced competency accreditation to be carried out in the future pharmacy education reformation. Finally, a localised, diversified system that preserves flexible options for education receivers seemed to be the most favourable option concerning the ideal pharmacy education.

Conflict of interest

The authors declare no conflict of interest.

Ethics approval and informed consent

The Institutional Review Board of the En Chu Kong Hospital reviewed this proposal and approved this study (ID of approval ECKIRB1100508). All participants gave digital informed consent before taking part.

Grants and/or funding information

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Appendix A: Subgroup analysis of respondents' opinions on ideal pharmacy education

	B.Pharm graduates	Pharm.D. graduates	Total
Unite the whole education system to Pharm.D.	54	8	62
Remain different programmes, but adjust national license test	42	28	70
Remain different programmes, but create advanced competency accreditation	85	10	95
Create a novel B. Pharm-based programme and allow graduates to choose an advanced degree or accreditation	170	19	189