

Supplementary

Appendix A: Preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews (PRISMA-ScR) checklist

Section	Item	PRISMA-ScR checklist item	Reported on page #
Title			
Title	1	Identify the report as a scoping review.	1
Abstract			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions related to the review questions and objectives.	1
Introduction			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	2-3
Objectives	4	Provide an explicit statement of the questions and objectives being addressed concerning their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	4
Methods			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and provide registration information, including the registration number if available.	5
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	6-7
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources) and the date the most recent search was executed.	5-6
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, so it could be repeated.	6 & Appendix B
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	6-7
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that the team has tested before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	7
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	8
Results			

Section	Item	PRISMA-ScR checklist item	Reported on page #
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	29
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	9, 30-33
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	34-43
Synthesis of results	18	Summarise and/or present the charting results as they relate to the review questions and objectives.	10-15
Discussion			
Summary of evidence	19	Summarise the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	16-19
Limitations	20	Discuss the limitations of the scoping review process.	19
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	20
Funding			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	20

Appendix B: Search strategy for two databases

PubMed search strategy

S/N	Search strategy	Results
#7	#1 AND #2 AND #3 AND #4 AND #5 AND #6	20
#6	((Pharmacy practice experience[Title/Abstract]) OR (Practice-based learning[Title/Abstract])) OR (Pharmacy practice settings[Title/Abstract])	2,230
#5	(((((Pharmacy students[Title/Abstract]) OR (Pharmacy education[Title/Abstract])) OR (Experiential learning[Title/Abstract])) OR (Student learning[Title/Abstract])) OR (Student competencies[Title/Abstract]))	13,723
#4	(((((Technical skills[Title/Abstract]) OR (Non-technical skills[Title/Abstract])) OR (Skill development[Title/Abstract])) OR (Clinical skills[Title/Abstract])) OR (Professional skills[Title/Abstract])) OR (Skill acquisition[Title/Abstract]))	22,066
#3	Pharmacy students[Title/Abstract]	3968
#2	(Technical skills[Title/Abstract])	6089
#1	(Pharmacy practice experience[Title/Abstract])	510

AJPE search strategy

Search strategy	Results
Pharmacy students	3,783
"pharmacy practice experience" OR "experiential learning" OR "practice-based learning"	2,301
"technical skills" OR "clinical skills" OR "professional competencies" OR "skill development" OR "competency mapping"	644
non-technical skills" OR "communication skills" OR "interpersonal skills" OR "teamwork" OR "problem-solving"	1,269
"student outcomes" OR "curriculum" OR "competency assessment" OR "learning outcomes"	2,617
"Pharmacy students" AND ("pharmacy practice experience" OR "experiential learning" OR "practice-based learning") AND ("technical skills" OR "clinical skills" OR "professional competencies" OR "skill development" OR "competency mapping") AND ("non-technical skills" OR "communication skills" OR "interpersonal skills" OR "teamwork" OR "problem-solving") AND ("student outcomes" OR "curriculum" OR "competency assessment" OR "learning outcomes")	186

Appendix C: List of excluded studies and reasons for exclusion

Number excluded	Study ID	Title	Reason for exclusion
n = 18	1. AC Hirsch, et al	1. A capstone course with a comprehensive and integrated review of the pharmacy curriculum and student assessment as preparation for advanced pharmacy practice.	Studies where skill development is not a focus
	2. VF Roche, et al	2. A collaborative and reflective academic advanced pharmacy practice experience	
	3. Ibrahim, , et al	3. A Comparison of Educational Interventions to Enhance Cultural Competency in Pharmacy Students.	
	4. Fernando et al	4. A Comparison of Patient-Centered Care in Pharmacy Curricula in the United States and Europe.	
	5. Nazar et al	5. A Consensus Approach to Investigate Undergraduate Pharmacy Students' Experience of Interprofessional Education.	
	6. C Lucas et al	6. Pharmacy students' utilisation of an online tool for immediate formative feedback on reflective writing tasks	
	7. R Fernandez et al.,	7. Using a human patient simulation mannequin to teach interdisciplinary team skills to pharmacy students	
	8. FN Hussain et al.,	8. Association of pharmacy students' cultural beliefs with perceived knowledge, beliefs, confidence, and experience with complementary medicine	
	9. K hall et al.,	9. Experiential training for pharmacy students: time for a new approach	
	10. EK dornblaser et al., 2017	10. A needs assessment of pharmacokinetic skills performed on advanced pharmacy practice experiences by student pharmacists	
		11. Pharmacy students' medication history taking competency: Simulation and feedback learning intervention	
		12. An introductory over-the-counter simulation for first-year pharmacy students using a virtual pharmacy	
		13. Cultivating Student Competencies and Practical Exploration in the Pharmaceutical Service Teaching Model	
		14.Feedback for a simulation practice on communication skills in pharmacy education: A pilot study	

Number excluded	Study ID	Title	Reason for exclusion
	11. D bajis et al., 2019	15. A review of capstones that synthesise and apply knowledge and skills in pharmacy education	
	12. TA Rude et al., 2023	16. Transitioning knowledge gained from simulation to pharmacy practice	
	13. Y Chen et al., 2024	17. Practice skill development through the use of human patient simulation	
	14. E Deniz et al., 2018	18. Simulation-based instruction for pharmacy practice skill development: A review of the literature	
	15. LM Minshew et al., 2020		
	16. HK Jin et al., 2019		
	17. KA Crea et al., 2011		
	18. SS Hassan et al., 2017		
n = 4	1. PC Walker et al 2. Donovan et al 3. Donovan et al 4. R Kassam et al	1. An advanced pharmacy practice experience in transitional care 2. An Applied Improvisational Pharmacy Communication Workshop Implemented During Orientation for First-Year Pharmacy Students 3. A needs assessment of pharmacokinetic skills performed on advanced pharmacy practice experiences by student pharmacists 4. An enhanced community advanced pharmacy practice experience model to improve patient care	Studies that do not involve original research

Appendix D: Complete study characteristics and outcomes extraction table

S/N	First Author /Year	State(s)/ Geopolitical Zone	Study setting (community or facility based)	Study population (Undergraduate, Post graduate, Intern)	Study design (specify)	What Skill	Type of Study	Total Number of participants	male (how many male participants in the sample)	Female (how many female in the sample)	Mean age (Years)	Type intervention/Method (list all applicable)	Perspectives of students	Challenges to Skill development	Role of Specific Practice Setting
1.	Wongwathananukit et al. (2013)	State of Hawaii, USA	University/Faculty Setting	second- and third-year pharmacy students	Quasi-experimental pre-post intervention study	diabetes care.	Quantitative (interventional)	175	36% male	64% female	N/A	10-hour classroom lectures on diabetes care. 4-hour hands-on workshop, including five rotating practical stations: Blood glucose monitoring. Insulin administration (self-injection with saline). Diabetic foot examination (using monofilament testing). Insulin delivery devices (pens/syringes). A1c interpretation and education.	Significant increase in confidence scores for both 2nd- and 3rd-year students ($p < 0.001$). Third-year students had higher baseline confidence, but both groups improved significantly. Example: Total confidence scores improved from 2.7 to 4.2 (third-year) and 1.9 to 4.0 (second-year).	Initial lack of practical exposure before workshop. Resource intensity: Faculty time and coordination for hands-on stations were substantial. Survey complexity: Multiple instruments may have led to some student confusion or survey fatigue	The Integrated Therapeutics courses served as a structured educational environment to combine didactic and experiential learning. The hands-on workshop offered practical skills application and bridged theoretical learning with clinical practice. Prepared students for real-world diabetes care, critical for their future pharmacy roles.
2.	Buring et al. (2007)	Cincinnati, Ohio, Canada	University/Faculty Setting	First year pharmacy students	Quasi-experimental pre-post intervention study	Counseling skills	Quantitative (interventional)	64	N/A	N/A	N/A	Introduction and instruction on the QuEST/SCHOLAR process — a structured, sequential self-care	They felt better equipped to assess and counsel patients on	Difficulty applying theoretical knowledge	The Pharmacy Practice Skills Development (PPSD) course at the University of

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												counseling framework.	self-care issues using a structured method. After learning and applying the QuEST process	e to practice	Cincinnati College of Pharmacy (UCCOP) provided a structured, controlled academic setting where students could learn, practice, and be assessed on self-care counseling skills.
3.	McDowell et al. (2016)	Parkville, Australia	University /Faculty Setting	First Year Pharmacy students	Cross-sectional survey with descriptive performance analysis and qualitative feedback	Dispensing skills	Mixed - methods	199	N/A	N/A	N/A	A development team used an Agile software development method to create MyDispense, a web-based simulation. Modeled on virtual learning environments elements, the software employed widely available standards-based technologies to create a virtual community pharmacy environment.	In the student view During exercises, students see virtual representations of patients, prescriptions, products on shelves, products for labeling, dispensary and ancillary labels, and note-taking tools.	Implementing the software presented many challenges. The short development timeframe to version 1 required fast responses to unanticipated complications.	Helped gain access to First-year pharmacy students who used the software in their tutorials,

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4.	Porter et al. (2023)	Wisconsin-Madison, Madison, USA	University /Faculty Setting	graduating classes of 2018 to 2020.	Retrospective cohort study	critical thinking.	Quantitative (observational/survey)	403	N/A	N/A	N/A	Students were coded as APPE poor performers (final course grade ,83%) or acceptable performers. Assessments in pharmacy practice didactic and skills-based courses in students' second and third years were included in the analysis, with thresholds correlating to grade cutoffs. The association between poor performance mean examination scores and performance-based assessments with APPE performance was calculated.	In the student view During exercises, students see virtual representations of patients, prescriptions, products on shelves, products for labeling, dispensary and ancillary labels, and note-taking tools.	Resource intensity: Faculty time and coordination for hands-on stations were substantial.	The hands-on workshop offered practical skills application and bridged theoretical learning with clinical practice.
5.	Sales et al. (2013)	Pittsburgh, Pennsylvania USA	University /Faculty Setting	Second-year pharmacy students	Quasi-experimental pre-post intervention study (3-arm comparison)	Cultural competency skills	Quantitative (interventional)	108	N/A	N/A	N/A	Lecture Group: A 50-minute formal lecture on cultural competence, including 2 patient case descriptions. Written Case Scenarios Group: 10-minute lecture on cultural competence. Group work on	Students recognised improvement in specific components of cultural competency after participating in the educational interventions	Time limitation, Domain-specific improvements suggest that a single intervention may not cover	The setting facilitated controlled implementation of interventions, allowed for comparison across groups, and ensured that students were exposed

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												written case studies. Simulated Patient Group: 10-minute lecture on cultural competence. Participation in 2 simulated patient encounters (played by pharmaceutical sciences graduate students from diverse backgrounds).	. For example: Simulation and lecture groups felt more confident in adjusting their communication styles and interviewing techniques to meet diverse cultural needs. Students in the simulation group expressed a desire to learn more about the health beliefs and practices of different cultures, showing increased cultural curiosity and openness. Case-scenario group students became	all facets of cultural competence.	to consistent learning objectives

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													more aware of the importance of mastering cultural competency as a skill in healthcare.		
6	Fejic et al. (2016)	Southeast Queensland	University /Faculty Setting	First Year Pharmacy student	Mixed-methods study (pre-post quantitative surveys with qualitative content analysis)	Core Knowledge	Mixed - methods	93	0.344	0.656	24	Six Simulated Learning Models scenarios were created by the teaching team who drew on their professional experience as educators and practitioners.	Students expressed increased in clinical skills and confidence to deal with patients	Some practice group sizes were big, which perhaps limited students' opportunity to engage and made time management more challenging. Actors' abilities sometimes varied, which could have affected the dynamic and quality of the role-plays and	The simulated learning program helped students to understand their role better in clinical settings.

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7	Vyas, McCulloh, et al. (2012)	Missouri-Kansas City, United States	University /Faculty setting	undergraduate students, graduate students, and students in professional programs	Quasi-experimental pre-post intervention study	Team work	Quantitative (interventional)	280	N/A	N/A	N/A	Simulation Exercise	Students expressed some confusion about their roles and responsibilities during the simulation, especially the health management students.	Students with little or no clinical experience were noted to have the most difficulty and stress during the simulation.	This course provided pharmacy students the opportunity to collaborate with other healthcare professionals and sensitised them to patient safety issues that they may not have encountered in their classroom or experiential coursework.
8	Bravo et al. (2019)	Toronto, Canada	Hospital Setting	Fourth Year Pharmacy student in Four-year Doctor of Pharmacy program	Qualitative study (semi-structured interviews)	Information Gathering	Qualitative	10	N/A	N/A	N/A	Explore Student Perceptions on the Use of Virtual Interactive Cases	Virtual Interactive Cases Facilitated Student Skills in Information gathering,	Strength of prior clinical knowledge, student preceptor learning styles, Experiential site continuity	Hospital setting provided student with a platform to carry out virtual interface setting.

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9	Rotz et al. (2016)	Philadelphia, USA	University setting	first-year and second-year pharmacy and medical students	Cross-sectional survey with performance-based behavioral assessment	knowledge of the medication use process, use of information related to drugs and human diseases currently being taught in class, basic patient assessment skills, apply drug information analyt	Quantitative (observational/survey)	163	N/A	N/A	N/A	Performance Assessment of Communication and Teamwork (PACT) novice tool and the Student Perceptions of Physician-Pharmacist Interprofessional Clinical Education (SPICE) Instrument	Student perceptions to the study was generally positive, larger percentage of students agreed that they understood the roles of other professionals within the interprofessional team	coordination of logistics, scheduling, and satisfaction of accreditation requirements for two distinct academic institutions. Additionally, limited space and resources, including financial and personnel, are expected barriers in any free, student-run clinic environment.	The study was a simulation of actual practice experience of pharmacy and medical students in a student run clinic. The stimulation helped them understand their role in such practice setting.

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						ical skills, team based care,									
10	Coons et al. (2019)	Pennsylvania USA.	University setting	fourth-professional year students,	Quasi-experimental pre-post intervention study	Clinical Skills, Patient Care roles,	Quantitative (interventional)	68	N/A	N/A	N/A	Pharmacotherapy Scholars Program was created and designed to be an intensive training experience integrated into the PharmD curriculum as an area of concentration.	Students agreed to have gained valuable experience in data management, analysis, and interpretation.	Resource intensive, and increase in competition to enter into the program.	Significant improvements were observed in both pharmacotherapy care plan development and monitoring, as well as comprehensive knowledge over the course of the program.
11	Theodorou et al. (2018)	Philadelphia, Pennsylvania	Facility-based	Third year pharmacy and both third and fourth year dental students	Quasi-experimental pre-post intervention study (interprofessional)	Interprofessional collaboration	Quantitative (interventional)	188	N/A	N/A	N/A	Students Perception of Interprofessional Clinical Education-Revised(SPICE-R)	Most students agreed that the learning objective of this practice experience was achieved which was to satisfy IPE accreditation standards as well as to better prepare students to build more	Variability in student engagement, work flow disruptions in dental clinic	Allowed real-world application of interprofessional collaboration in patient care and provided structured interprofessional interactions

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													effective collaborative health care teams		
12	Tucci et al. (2019)	Massachusetts and Connecticut	Facility-based	First to fourth year Pharm. D students	Cross-sectional survey with curriculum mapping	Leadership competencies, self-efficacy in leadership, engagement in leadership activities	Quantitative (descriptive/cross-sectional)	362	N/A	N/A	N/A	Curriculum mapping of leadership competencies in pharmacy education, Survey on leadership engagement and self-efficacy and Comparison of students with active leadership roles versus those without.		Leadership education mostly limited to a single course (Pharmacy Care Management), Lack of vertical and horizontal integration of leadership development across the curriculum and Limited formal leadership training opportunities outside student organisations	Professional pharmacy organisations provided the strongest impact on student leadership development, experiential learning (IPPEs and APPEs) had potential but lacked clear leadership-focused components and Pharmacy school curriculum mapping helped identify leadership education gaps.

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13	Pittenger et al. (2019)	Minnesota	University setting	Third year pharmacy Students	Quasi-experimental pre-post intervention study	Psychiatric pharmacotherapy, clinical decision-making, evidence-based medicine application, and APPE readiness	Quantitative (interventional)	12	10	2	Mostly between 23 and 26 years old, with one student aged 42	A one-credit elective psychiatric pharmacotherapy course, case-based learning with whole-task and guided reflection educational principles, use of cloud-based learning technologies (Google Docs, Cisco Meeting Server), student-led case work-ups evaluated by board-certified psychiatric pharmacists, weekly complex patient cases with evidence-based justifications, pre-class personal learning objectives and post-class reflections and self-assessment using Entrustable Professional Activities (EPA) framework.	Increased awareness of clinical judgement gaps, enhanced understanding of evidence-based medicine beyond guidelines, improved appreciation of patient-centred care in psychiatric pharmacy, greater excitement and confidence about beginning APPEs, and some students reported increased interest in psychiatric pharmacy specialisation	Limited prior exposure to psychiatric pharmacy practice settings	Visiting psychiatric pharmacists provided real-world insights, video conferencing allowed experts to participate remotely, cloud-based tools enabled collaborative learning and documentation and the model itself demonstrated feasibility for enhancing psychiatric pharmacy education without increasing faculty workload
14	Bray et al. (2011)	Washington DC and Pennsylvania	University setting	Pharmacy Students	Narrative review	Simulation-based learning	Review	N/A	N/A		N/A	Review of different stimulation-based learning methods, including human	Positive feedback on simulation-based	Lack of validated tools to assess	Human patient simulation allows student

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						ng, critical thinking, clinical decision-making, interprofessional collaboration and self-efficacy						simulation, standardised patients and role-playing; assessment of existing simulation-based learning tools in pharmacy curricula; categorisation of assessment tools into satisfaction/self-efficacy surveys, knowledge assessments, performance -based skill evaluations, problem-solving evaluations, and team-based behaviour assessments	learning for improving confidence, clinical reasoning and decision-making; improved self-efficacy in interprofessional collaboration after participation in simulated team exercises and some students also reported that limited exposure to simulation negatively affected knowledge retention	simulation-based learning outcomes and faculty limitations in developing structured simulation assessments	to practice clinical decision making in a controlled environment and interprofessional simulation experiences enhance teamwork and communication among healthcare students
15	Bullock & Horne (2019)	Texas	University setting	Second and third year pharmacy students	Quasi-experimental pretest-posttest study	Clinical skills and business management	Quantitative (interventional)	20	13	7	N/A	A 15-week, two-credit elective course	Significant improvement in knowledge of pharmacist-led patient care, public health, communication,	Difficulty in understanding financial and business components	The course replicated real-world community pharmacy roles through guest lecturers and hands-on assignment

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						knowledge							leadership and legal aspects and an increased confidence in performing clinical services and patient care in community pharmacy		and it also helped students integrate business and clinical responsibilities in pharmacy practice.
16	Morbitzer et al. (2021)	North Carolina, USA	University setting	first year to fourth-year pharmacy students	Mapping review	Leadership-related competencies	Review	N/A	N/A	N/A	N/A	Team based learning, interprofessional simulations, workshop	N/A	Lack of standardised teamwork training programs, variability in assessment methods	Interprofessional practice experiences
17	Hussainy et al. (2012)	Victoria, Australia.	University /Facility-based	Second and third year pharmacy students	Mixed-methods study (cross-sectional survey with qualitative focus groups)	Communication skills	Mixed-methods	108	40	68	N/A	The use of virtual practice environment in Communication skills development	Most students believed the virtual practice environment was a useful teaching resource and that the video component enabled them to contextualise	Learning could be less engaging	The virtual practice environment provided a meaningful context for communication skills development.

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18	Conway & Ahmed (2012)	Minneapolis	University setting	Third year pharmD students	Quasi-experimental educational intervention study	Clinical and professional skills	Quantitative (interventional)	160	N/A	N/A	N/A	Active learning and problem based learning	patient problems. Students agree that the course integrated material across the curriculum and improved their clinical writing skills	Time-intensive case creation and grading complexity	Integration of diverse clinical scenarios and focus on clinical decision making
19	Bowers et al. (2017)	North Carolina, USA	University setting	first year pharmacy students	Cluster randomized controlled trial	Insulin injection technique and counselling skills	Quantitative (experimental/RCT)	103	N/A	N/A	N/A	USE OF STANDARDISED SIMULATED PATIENTS AND TEACH-BACK METHOD FOR COUNSELLING	IMPROVED COUNSELLING SKILLS AND KNOWLEDGE RETENTION	TIME CONSTRAINT AND LACK OF LONG TERM FOLLOW-UP	SIMULATED PATIENT INTERACTIONS WITHIN THE PHARMACY SKILLS LAB IMPROVED KNOWLEDGE RETENTION AND COUNSELLING APTITUDE
20	Baalman et al. (2023)	Kansas, USA	University setting	Second and third year pharmacy students	Quasi-experimental pre-post intervention study	Interprofessionally communication	Quantitative (interventional)	282(145 PHARMACY AND 137 MEDICAL STUDENTS)	N/A	N/A	N/A	TELECOMMUNICATION CONSULTATION SIMULATION	IMPROVED USE OF TELECOMMUNICATION CONSULTATION	ACKNOWLEDGING ERRORS AND ANTICIPATING PATIENT QUESTIONS	

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21	Tofil et al. (2010)	Alabama	University setting	Third Year Pharmacy student	Quasi-experimental pretest-posttest study	Knowledge and application skills	Quantitative (interventional)	42	N/A	N/A	N/A	Use of Simulation to Enhance Learning in a Pediatric Elective	Students felt the learning experiences were positive and realistic	shortage/lack of pediatric pharmacy education resources	Course changes resulted in an increase in student perception of their skills and knowledge related to pediatric pharmacy problems
22	Trujillo et al. (2016)	Colorado	University setting	First professional year PharmD curriculum students	Quasi-experimental pre/post-test intervention study	Achievement, preparedness and attitudes	Quantitative (interventional)	319	N/A	N/A	N/A	Standalone, Patient-centered Communication Course Series	Students felt more positive that the evaluation format used in the course series was patient-centered and an effective way to evaluate course outcomes	Time constraint and integration of the curricula into content-heavy courses without sufficient emphasis on communication	The standalone PCC course series effectively achieved PCC outcomes and improved student preparedness for communication-based activities
23	Vyas, Bhutad a, et al. (2012)	California	PharmD students and clinical faculty members	Quasi-experimental Intervention Study	Quasi-experimental pre/post intervention study	Assess student's competencies in core pharmacy	Quantitative (interventional)	88	N/A	N/A	N/A	Simulation based intervention with a pre/post assessment to evaluate students competencies in core pharmacy domains before they begin advanced pharmacy	100% of the students felt that the course increased their awareness of patient safety	Lack of real-world experience, time constraints, resource limitations	Overall, this 3-week course was successful in reinforcing patient safety concepts and was able to touch on several of the ACPE

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						domains before they begin advanced pharmacy practice experiences (APPEs)						practice experience (APPEs)			pre-APPE competencies
24	Donovan et al. (2020)	Texas	University setting	First year Pharmacy students	Qualitative descriptive study	Communication skills	Qualitative	124	N/A	N/A	N/A	Applied improvisational pharmacy communication workshop	The P1 students who participated in the communication workshop expressed that they valued the chance to establish relationships within their cohort, learn about audience-centered communication, practice explaining complex information in creative	It relied on self-report questionnaire data. Also, not all students who participated in the workshop provided comments.	The primary purpose of this project was to design and evaluate a brief communication skills workshop for P1PharmD students that could be delivered during their newstudent orientation

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													ways, and extend and apply what they learned through discussion		
25	Tsingos et al. (2014)	Australia (Sydney, New South Wales)	University-based	Pharmacy students (Undergraduate, Postgraduate, Interns)	Literature review	Reflective Practice, Critical Thinking, Problem-Solving	Review	N/A	N/A	N/A	N/A	Reflective practice tools (portfolios, blogs, journals, diaries, self-assessments, peer assessments)	Reflective practice helps bridge theory with practice, enhances communication, and encourages self-directed learning.	Lack of motivation, lack of structured frameworks, and difficulty in assessing reflective learning.	Reflective practice is valuable in pharmacy education and should be implemented throughout undergraduate and postgraduate training to enhance decision-making and integrate classroom learning with practical experience.
26	Rao (2011)	Australia (Adelaide, South Australia)	Educational (University-based)	Undergraduate pharmacy students (first-year)	Quasi-experimental study (role-play intervention)	Patient-care skills, communication, history-taking, active	Quantitative (interventional)	130 in semester 1, 129 in semester 2	Semester 1 – 20, Semester 2 – 29	Semester 1 – 38, Semester 2 – 67	Majority under 24 years old	Role-play model, peer observation, patient-pharmacist interactions, self-assessment, formative and summative assessment, structured feedback	Found role-play useful for communication, patient interactions, and self-assessment but less effective for documentation skills.	Students struggled with case note documentation; some found group size and repetitive nature of	Role-play should be integrated early in pharmacy education to help students develop patient-care skills before clinical placements.

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						listening, documentation, professional attitudes								cases a limitation.	
27	Lin et al. (2011)	USA (Illinois, Chicago)	Educational (University-based, some references to hospital settings)	PharmD students (Introductory Pharmacy Practice Experience - IPPE)	Literature review and feasibility analysis	Clinical decision-making, patient assessment, communication, pharmacy practice skills	Review	N/A	N/A	N/A	N/A	High-fidelity patient simulation, standardised patients, virtual reality simulations, full environment simulations, task trainers	Simulation provides a risk-free environment to practice, enhances confidence, and allows repeated exposure to clinical scenarios.	High cost, faculty training requirements, lack of real-world emotional and environmental factors, and unclear integration into IPPE requirements	Simulation can supplement real-world experiences but should not replace direct patient interactions.
28	Zakaria & Awaisu (2011)	Malaysia & Qatar	Facility-based (Hospital)	Undergraduate pharmacy students (Third-year and Fourth-year students)	Survey-based observational study	Communication, teamwork, problem-solving, patient	Quantitative (observational/survey)	138 (87 third-year, 51 fourth-year)	24 (third-year), 27 (fourth-year)	23 (third-year), 24 (fourth-year)	Not specified	Shared learning through mentorship (fourth-year students mentoring third-year students), Clinical pharmacy practice experience in a hospital setting, Group-based	Majority found shared learning improved teamwork and communication skills, Some students felt	Some students were uncomfortable working with a different student group,	Hospital setting provided real-world experience in patient care, Ward rounds and bedside discussions enhanced

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						t assessment, clinical decision- making						learning and patient case discussions, Ward rounds and bedside case discussions and	they could learn clinical problem-solving skills just as well with peers from their own group.	Differences in knowledge levels between third- and fourth-year students created imbalance, Some students felt one hospital assignment per disease state was not enough.	practical skills, Faculty preceptors and hospital-based mentors played a crucial role in skill acquisition.