

Balancing Science and Practice in the PharmD Curriculum



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General Outline & Learning Objectives

General Outline

Evolution of the pharmacy curriculum

Baccalaureate to PharmD program

Basic science and therapeutics in the curriculum

Emerging curriculum

Learning objectives

Describe outcomes of clinical education in PharmD programs

Discuss the value of integration of science and therapeutics coursework

Stimulate ideas for improving contextual relationships between science and clinical education





BS Pharmacy Curriculum 1995-1996

Outcomes

Ability to:

- Apply clinical pharmacy knowledge and skills

- Apply pharmaceutical and general practice knowledge and skills

- Apply management and administrative knowledge

Competency Areas

- Monitor Therapies

- Provide Drug Information

- Patient Counseling

- Communication Skills in the Clinical Area

- Pharmacy Management

- Jurisprudence

- Compounding, Dispensing and Drug Delivery



BS Pharmacy Curriculum 1995-1996

Prerequisites

Two years and minimum 61 semester credit hours

General education

General chemistry, organic chemistry, general biology
and microbiology all with laboratory

Calculus, English composition, public speaking,
social science

No physics, physiology, biochemistry, statistics





BS Pharmacy Curriculum 1995-1996

Three-year program after two years of prerequisites

Baccalaureate Curriculum 1995-96

(Years in Professional Program)

BS PROGRAM (current)

1ST YEAR - 32 credit hours

FALL (15 HOURS)

PHPR 3200 Pharmacy & Health Care	3
PHPR 3090 Medical Terminology	2
PHSC 3100 Pharmaceutics I	3
PHSC 3400 Physiology & Pathology I	3
PHSC 3611 Biochemistry & Biotechnology	4

SPRING (17 HOURS)

PHPR 3070 Pharmacy Communications	3
PHSC 3110 Pharmaceutics II	3
PHSC 3111 Pharmaceutics Lab & Calcs	3
PHSC 3410 Physiology and Pathology II	4
PHSC 3510 Cellular Pathology	2
PHSC 4720 Medicinal Chemistry	2

2ND YEAR - 33-35 credit hours

FALL (17 HOURS)

PHSC 4520 Pharmacology I	4
PHPR 4600 Pharmacotherapeutics I	3
PHSC 4730 Medicinal Chemistry II	4
PHPR 4680 Pharmacy Management	3
PHPR 4300 Non-prescript. Drugs	3

SPRING (16-18) HOURS)

PHSC 4530 Pharmacology II	5
PHPR 4610 Pharmacotherapeutics II	5
PHPR 4790 Biopharmaceutics & P'kinetics	4
PHSC 4740 Toxicology	2
(PHXX xxxx Elective - optional)	2)

3RD YEAR - 30-31 credit hours

FALL (12-13 HOURS)

PHPR 4400 Intro Externship	2
PHPR 4500 Pharmacy Law & Ethics	3
PHSC 3520 Immunology	3
Elective	2
Elective	2-3

SPRING (18 HOURS)

PHPR 4910 Ambulatory Externship (6 wks)	6
PHPR 4912 Institutional Externship (6 wks)	6
PHPR 4938 Elective Externship (6 wks)	6

Total credit hours - Prof - 95; Pre & Prof - 156 minimum



University of Colorado
Anschutz Medical Campus

School of Pharmacy



BS Pharmacy Curriculum 1995-1996

Percentage of coursework devoted to basic sciences and clinical courses

	Year 1	Year 2	Year 3	Total
Basic science	75%	58%	10%	48%
Clinical (total)	16%	33%	83%	42%
Therapeutics	0%	33%	15%	9%
Other	9%	9%	10%	9%

Types of delivery methods

Mostly didactic lectures

Modest skills development

Experiential



PharmD curriculum

Started 1999-2000 academic year

Foundational principles:

- General practice competency

- Abilities-based education

- Integration of subject matter

- Longitudinal experiential programming

- Active learning

- Patient focus



PharmD curriculum

Abilities Based Outcomes*

General Ability-Based Outcomes

Communicate using various modes of communication including people, text, media and technology

Think critically, solve problems and make decisions

Make value judgments and independent decisions

Integrate information derived from theory, concepts and factual evidence

Demonstrate effective interpersonal and professional interactions

Self-assess and engage in self-directed learning

Pharmacy Specific Ability-Based Outcomes

Integrate knowledge, skills and attitudes gained in basic, clinical and socio-behavioral sciences to provide pharmaceutical care to individuals, families and diverse patient populations in various practice settings

Apply the principles of economic and administrative sciences to address the pharmacy-related needs of contemporary society

Engage in activities to provide drug information and education and to promote public health

Demonstrate professional and social responsibility

*ABOs derived from national outcomes documents



PharmD curriculum

2009 Revisions

Curriculum Mission Domains

Patient Care

Systems Management

Public Health

Professionalism and Communication

Scholarship





PharmD curriculum

2009 Revisions

New ABOs – The Colorado 14



1. Collect appropriate patient data to make an assessment
2. Conduct a patient-centered assessment
3. Design, implement, evaluate and adjust a patient-centered pharmacy care plan
4. Process medication related orders
5. Provide population-centered care
6. Manage aspects of pharmacy operations using appropriate data and procedures
7. Manage a successful patient-centered practice
8. Retrieve, evaluate, and utilize basic science, professional, and lay information
in a critical and scientific manner that enhances the practice of pharmacy
9. Manage medication use systems to optimize patient and population outcomes
10. Develop and participate in health promotion, disease prevention, and public health policy
11. Exhibit the highest standards of professional and ethical behavior in pharmacy practice
12. Maintain professional competency and professional stewardship
13. Apply basic and clinical scientific principles and methods to identify and solve problems
14. Communicate effectively using multiple strategies to improve health outcomes



PharmD curriculum

Prerequisites - 1999

Same as for BS program

Plus: anatomy or anatomy & physiology; general physics 1;
macro or microeconomics

Prerequisites - 2009 revision

Same as above plus

Biochemistry

Human Physiology

Additional General Education credit hours

Recommended courses: cell biology and immunology

Total = 90 credit hours = 3 years





PharmD curriculum

Four-year professional program

P1	Fall	PHRD 3600 Science Foundations I 3 graded	PHRD 3610 Science Foundations II 4 graded	PHRD 3000 Introduction to Pharmacy 2 P/F	PHRD 3500 Pharmacy Law & Management 3 graded	PHRD 3400 Principles of Drug Information 1 graded	PHRD 3410 Public Health, Health Econ & Policy 2 graded	PHRD 3200 Professional Career Development 1 P/F	PHRD 3100 Prof Skills Development I 3 P/F	PHRD 3300 Experiential Practice I 1 P/F
	Spring	PHRD 3650 Principles of Drug Action 4.5 graded	PHRD 3750 Integrated Organ Sys 1 4 graded	PHRD 3760 Integrated Organ Sys 2 3 graded	PHRD 3550 Health Care Ethics I 0.65 P/F	PHRD 3450 U.S. Health Care Systems 2 graded			PHRD 3150 Prof Skills Development II 3 P/F	PHRD 3350 Experiential Practice II 1 P/F
P2	Fall	PHRD 4600 Clinical Science Foundations 3 graded	PHRD 4700/10 Integrated Org Sys 3/4 5 P/F	PHRD 4720 Integrated Org Sys 5 4 graded	PHRD 4500 Health Care Ethics II 0.65 P/F	PHRD 4400 Biostatistics 2 graded	PHRD 4200 Instructional Methods 1 1 P/F	PHRD 4100 Prof Skills Development III 3 P/F	PHRD 4300 Experiential Practice III 2 P/F	
	Spring		PHRD 4750 Integrated Org Sys 6 4 graded	PHRD 4760 Integrated Org Sys 7 3 graded	PHRD 4770 Integrated Org Sys 8 4 graded	PHRD 4450 Advanced Drug Information 2 graded	PHRD 4250 Instructional Methods 2 1 P/F	PHRD 4150 Prof Skills Development IV 3 P/F	PHRD 4350 Experiential Practice IV 2 P/F	
P3	Fall		PHRD 5700 Integrated Org Sys 9 4 graded	PHRD 5710 Integrated Org Sys 10 3 graded	PHRD 5720 Integrated Org Sys 11 4 graded	PHRD 5400 Pharmacoeconomics 2 graded	PHRD 5200 Seminar (part 1) 1 graded	PHRD 5100 Prof Skills Development V 3 P/F	PHRD 3300 Experiential Practice V 2 P/F	
	Spring					PHRD 58XX ELECTIVE 2 graded	PHRD 58XX ELECTIVE 2 graded	PHRD 5250 Seminar (part 2) 1 graded	PHRD 5650 Comp Patient Care 9 P/F	PHRD 5350 Experiential Practice VI 2 P/F



PharmD curriculum

Comparison 1995 Baccalaureate vs. 2011 PharmD

Curriculum Area	1995 vs. 2011 Credit Hours	1995 vs. 2011 Percentages
Basic sciences	46 vs. 33.5	48% vs. 22%
Clinical total	40 vs. 99	42% vs. 65%
Pharmacotherapeutics	[9 vs. 31]	[9% vs. 20%]
Other	9 vs. 23	9% vs. 15%

Types of courses offered

- Increased active learning
- Increased skill development
- Increased experiential
- Reduced didactic
- Integrated coursework
- Emphasis on EBP and problem solving
- Increased technology



PharmD curriculum

Integrated coursework

BS program

- Discipline specific courses

PharmD program

- Fewer discipline specific courses

- More integrated coursework

- Integration of sciences within science courses

- Integration of science with pharmacotherapeutics

- IOS – integrated organ systems courses

- Integration with skills and experiential



PharmD curriculum

Basic sciences

SF 1 = Science Foundations 1: pharmaceuticals

SF 2 = Science Foundations 2: biochemistry and cell biology introduction

PDA = Principles of Drug Action: principles of pharmacology and medicinal chemistry

CSF = Clinical Science Foundations: PK and ADME; PG; toxicology

IOS 1 = Physiology

Pathophysiology and pharmacology – IOS courses



PharmD curriculum

IOS/Therapeutics courses

Primarily pharmacotherapeutics

Pathophysiology, pharmacology

Minor pharmaceuticals and medicinal chemistry

Lectures and case studies

IOS 1 = physiology (no therapeutics)

IOS 2 = pharmacology of ANS and anti-inflammatory agents

IOS 3,4,5 = renal, CV, pulmonary systems

IOS 6 = immunology and oncology

IOS 7 = GI, liver, nutrition

IOS 8 = CNS, neurology

IOS 9 = endocrine

IOS 10, 11 = infectious diseases

Total of 37 credit hours



PharmD curriculum

IOS 3 and 4 (5 cr)

Renal: pharmacology of diuretics; acid/base and fluid/electrolytes;
pathophysiology and therapeutics of acute and chronic renal diseases
CV: HTN pathophysiology; pharmacology and therapeutics of anti-HTN
drugs
CV: dyslipidemia including angina pathophysiology; pharmacology/med
chem.; and therapeutics of dyslipidemia drugs

Pathophysiology = 26%

Pharmacology = 21%

Therapeutics = 53%





PharmD curriculum

IOS 5 (4 cr)

Anti-coagulation

Heart failure

Acute coronary syndrome

Dysrhythmias

Pulmonary - allergic rhinitis; asthma; COPD; CF

Pathophysiology = 21%

Pharmaceutics = 4%

Pharmacology = 21%

Therapeutics = 54%



PharmD curriculum

Pharmacotherapeutics covers:

Drugs

Dosages

Indications and use (drug of choice; second choice; combination, etc.)

Combinations where appropriate

Clinical guidelines and EBP

Side effects and toxicities

Monitoring drug therapy

Interactions

Contraindications

Case studies

Clinical controversies



PharmD curriculum

Active learning courses

P1-P3 skills development

- Patient interviews, counseling and education; communications with HC professionals
- Physical assessment skills, health screening skills
- Application of IOS/therapeutics and other (e.g., DI, primary literature) material
- Case studies, simulated patients, MTM skills
- Verbal and written assessments; PBEs and OSCE type assessments
- Increasing complexity and difficulty P1 to P3 years
- Aligned with other components of the curriculum, e.g., in P1 year emphasis on OTC products and patient counseling aligned with IPPE activities and expectations

Comprehensive Patient Care (CPC)

- Capstone course
- Application of all learned material, primarily pharmacotherapeutics
- Case studies
- Primarily PBL type course and OSCE type assessments



PharmD curriculum

P3 Professional Skills Development

Outcomes

1. Collect appropriate patient data to make an assessment
2. Conduct a patient-centered assessment
3. Design, implement, evaluate and adjust a patient-centered pharmacy care plan
4. Process medication related orders
5. Retrieve, evaluate, and utilize basic science, professional, and lay information in a critical and scientific manner that enhances the practice of pharmacy
6. Communicate effectively using multiple strategies to improve health outcomes

Competency based course

Must demonstrate competency in each skill in order to pass each exercise and the course

Verbal and written assessments

Simulated patient exercise, PK calculations, medication review, chart review, communications skills (in person or telephone), case studies, health screenings, etc.



PharmD curriculum

P3 Professional Skills Development

Active learning

All active learning (no lectures) through

In class activities (e.g., group discussion; think-pair-share; simulations; role-playing; debates; sample cases; standardized patient interviews) and

Self-learning activities (e.g., textbook and literature materials, Powerpoint and video demonstrations)

Two examples of course activities

Clinical recommendations in a dispensing role with limited information

Student given Rx medication profile and patient provided OTC meds only

Student must determine medical conditions, identify drug related problems, formulate recommendations to physician(s), determine what lab values are needed to fully assess patient conditions and needs

Self learning and demonstration of specific skills, e.g., assessment of patients with diabetes including glucometer training, insulin training and foot exam

Student assessed on ability to perform each activity according to a standard rubric.

Students given multiple chances to demonstrate competency

Pharmacotherapeutics

All exercises require application of pharmacotherapeutics knowledge





PharmD curriculum

Comprehensive Patient Care (CPC)

Capstone course in P3 spring just before full year of clinical APPEs

100% active learning, self-learning course

Various activities related to patient centered care

All exercises involve patients with multiple, complex medical conditions (less complex conditions used in skills courses)

All require application of prior learning – focused mainly on pharmacotherapeutics but also science knowledge, skills development, literature evaluation, etc.

Students are expected to evaluate patient conditions, medications, other relevant information and develop specific pharmacy care plans with high, medium and low priority issues to be addressed

Assessment by in class patient case presentations, EBM sessions requiring student evaluation and application of primary literature to patient cases, and individual written and verbal exams and case presentations



PharmD curriculum

Experiential

A major component of the curriculum = approximately one-third of curriculum, P1-P3 IPPEs; P4 APPEs

Utilizes all learning in other parts of curriculum

Provides real life experience in all aspects of practice – dispensing, patient counseling, direct patient care (immunizations, health screenings, anti-coagulation monitoring, HTN, asthma, DM clinics, etc.), management, research opportunities, etc.



PharmD curriculum

Contextual Learning and Basic Sciences*

Learning a disease from a basic science vs. epidemiologic perspective leads to greater learning and application to clinical cases
(Woods et al, *The Value of Basic Science in Clinical Diagnosis. Acad Med.* 2006; 81(10 Suppl):S124–S127)

Contextual knowledge leads to increased learning and application.

**Dr. Kari Franson*



PharmD curriculum

Learning in context

- A newspaper is better than a magazine
- The coast is better than the street
- First it is better to run than to walk
- You will have to try it several times
- Some skill is required but it is easy to learn
- Even small children can enjoy it
- Once successful the chance for complications is minimal
- Birds seldom get too close
- Rain soaks in very fast
- A rock can be a good anchor
- Once it is broken loose you won't get a second chance





PharmD curriculum

Learning in context – **flying a kite**

- A newspaper is better than a magazine
- The coast is better than the street
- First it is better to run than to walk
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PharmD curriculum

Learning in context

What does this mean for the role of basic sciences in education?

Basic sciences are not *the* foundation

Basic sciences *are* essential

- To support hypothetical-deductive reasoning

- To provide meaningfulness to cases

- To provide a scaffold for deeper understanding

Basic sciences are relevant if they

- Relate to real life problems

- Are taught and assessed in relation to actual practice

- Are used to de-contextualise and re-contextualise



PharmD curriculum

Learning in context

What does this mean for the role of basic sciences in education?

Assessment of basic sciences in the curriculum:

- Is preferably problem or vignette-related

 - Context, meaningfulness, encoding specificity

- Has a clear relationship with practice

 - Relevance, context, meaningfulness

- Stimulates transfer

 - Understanding of deep structure





PharmD curriculum

Learning in context

Dual Roles

Science should be taught within the context of human health and disease and for us within the context of pharmacy practice

Clinical sciences and therapeutics should to be taught in the context of the scientific basis for understanding the disease state and its treatment

Question – how does our curriculum - or your curriculum – measure up?



PharmD curriculum

Changing Practice and Emerging Curriculum

Need for greater contextual learning

Dispensing role diminishing

Technology use in practice increasing

Patient-centered clinical roles emerging

Increased focus on health outcomes for reimbursement

“No longer go to pharmacy school to secure a job

Go to pharmacy school to help create your future”





PharmD curriculum

Changing Practice and Emerging Curriculum

Basic sciences

Prerequisites

Pharmacy curriculum – more contextual, more application

Clinical sciences and therapeutics

Greater use of science in context of diseases and therapies

IPE





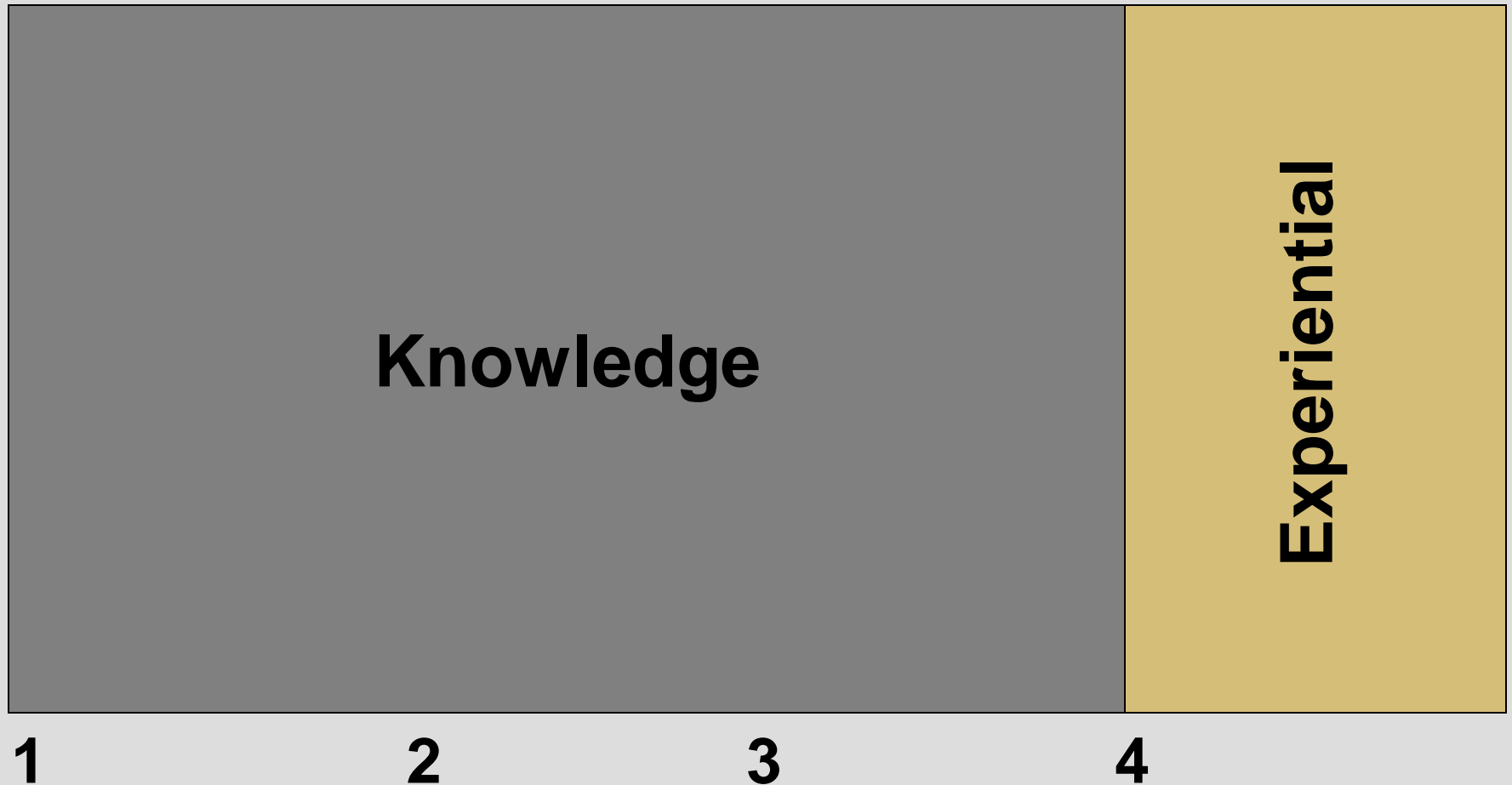
PharmD curriculum

Contextual Learning in the Curriculum

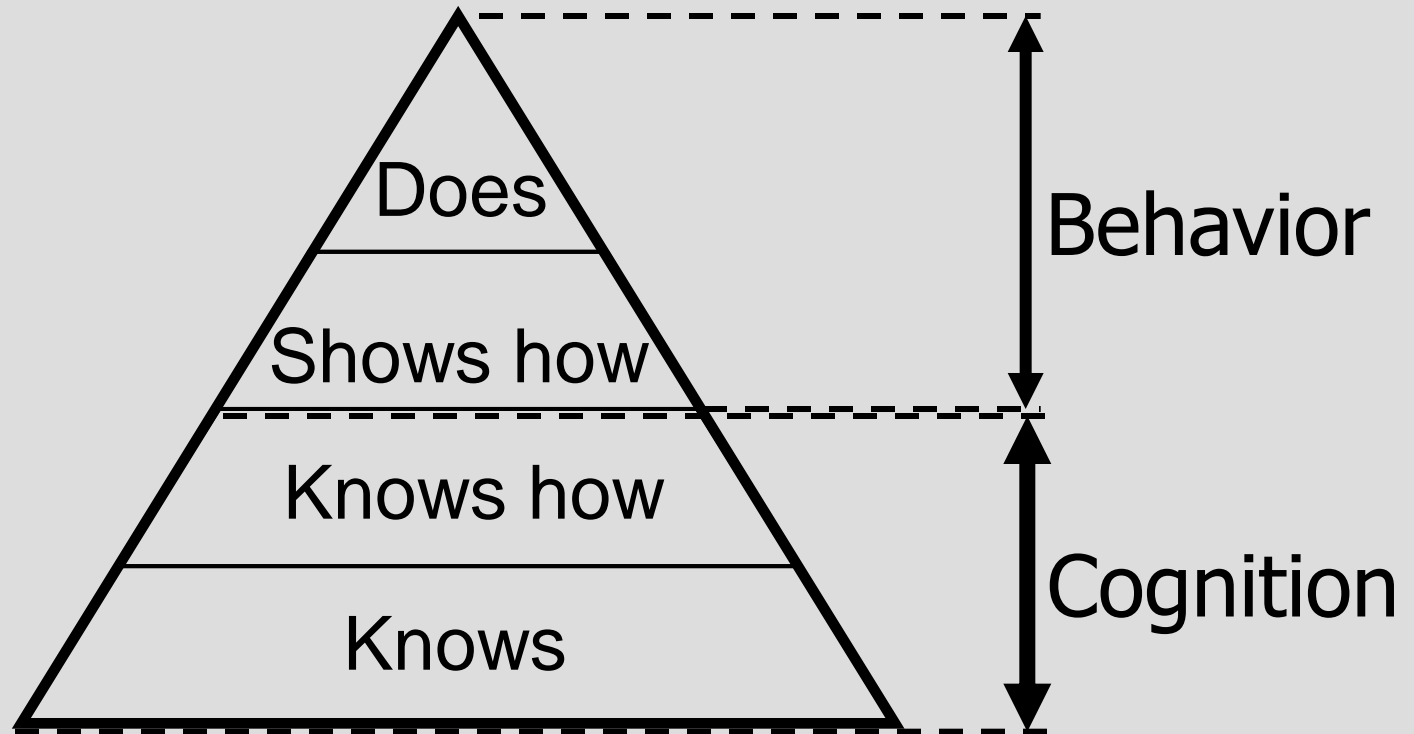
Historical perspective

Hopkins model

University of Colorado 1911 - 1998



Assessing student levels of competence

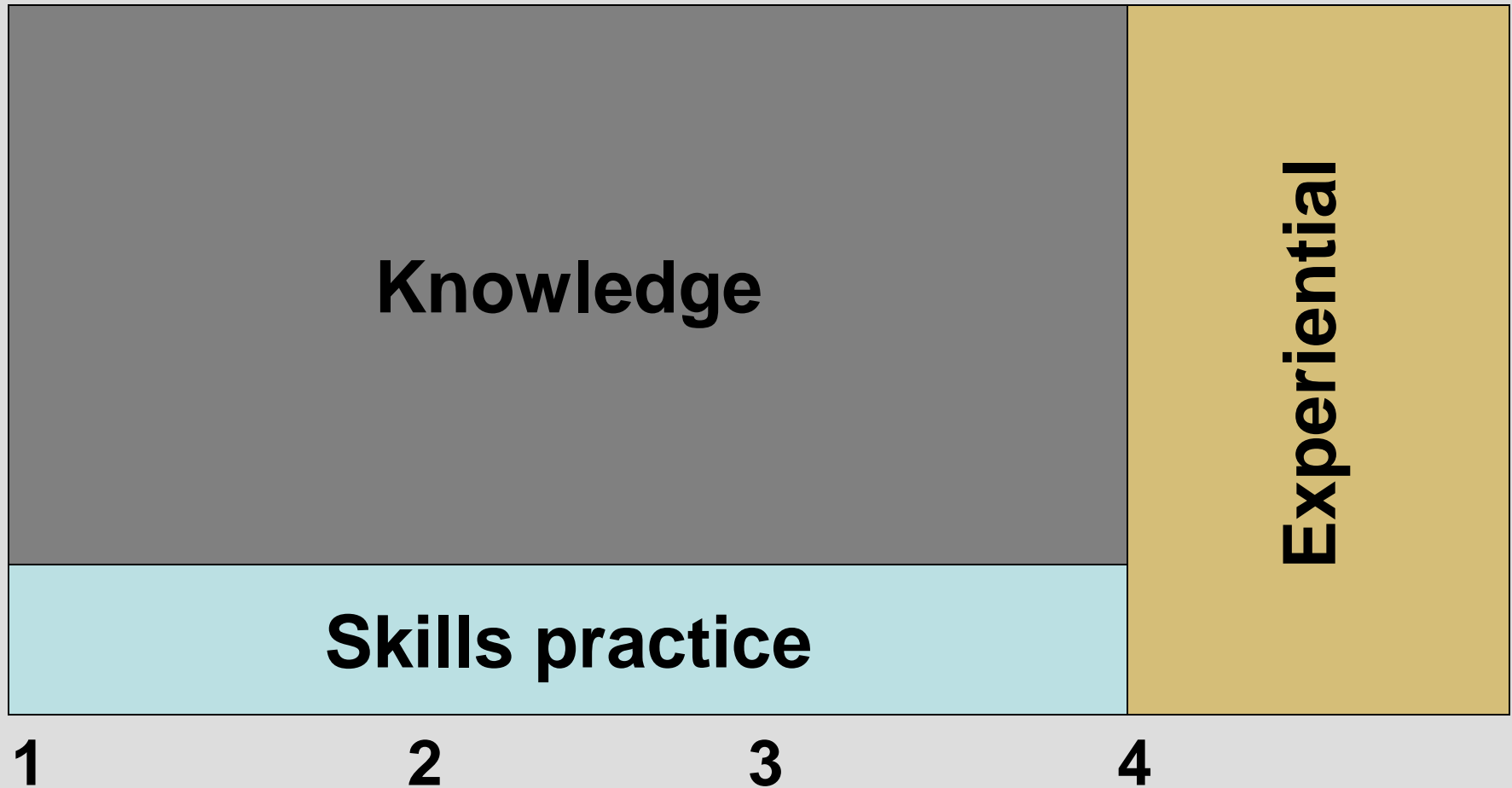


Miller GE. The assessment of clinical skills/competence/performance. *Academic Medicine*, 1990

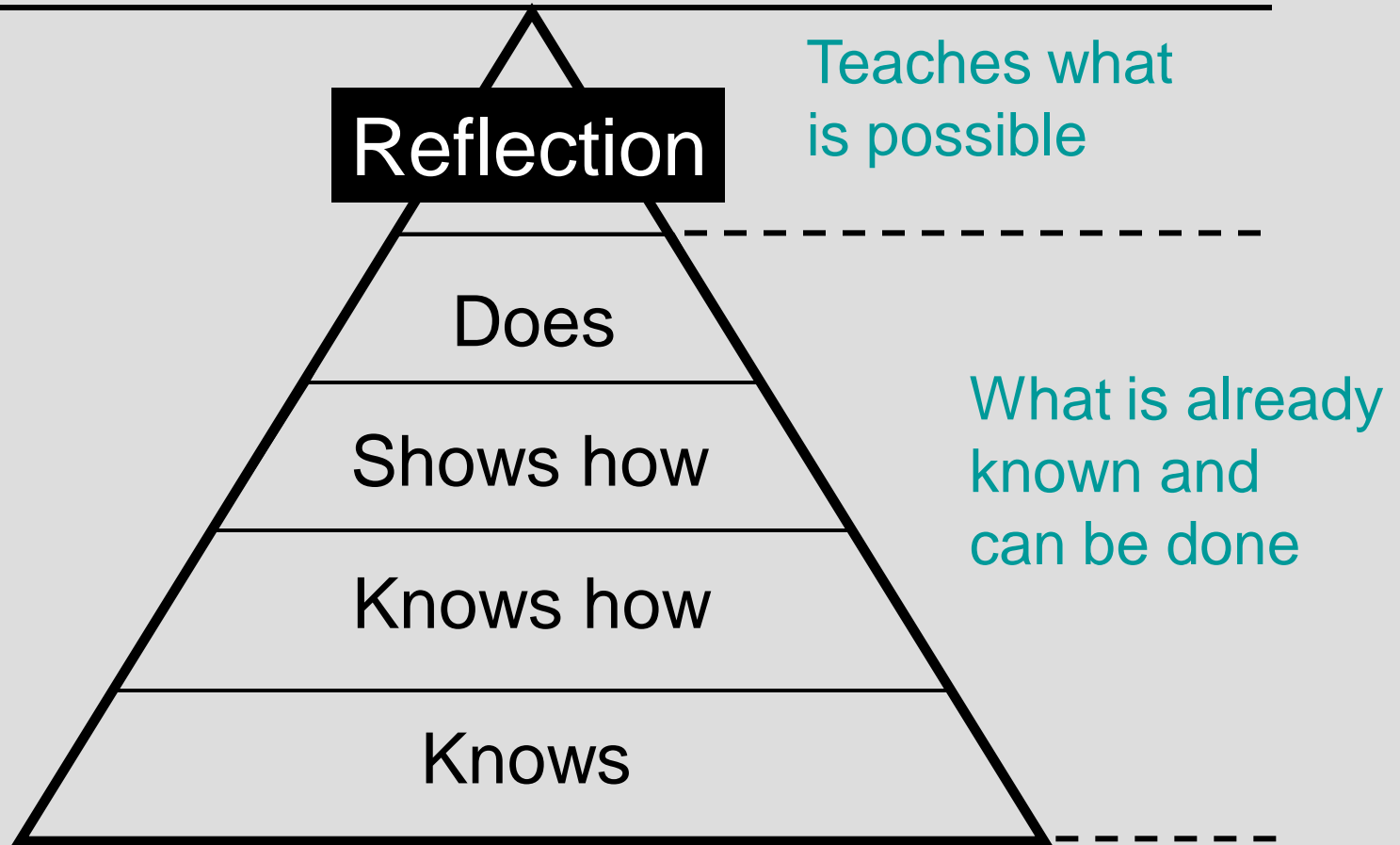


Modified Miller model

University of Colorado 1999 - 2012



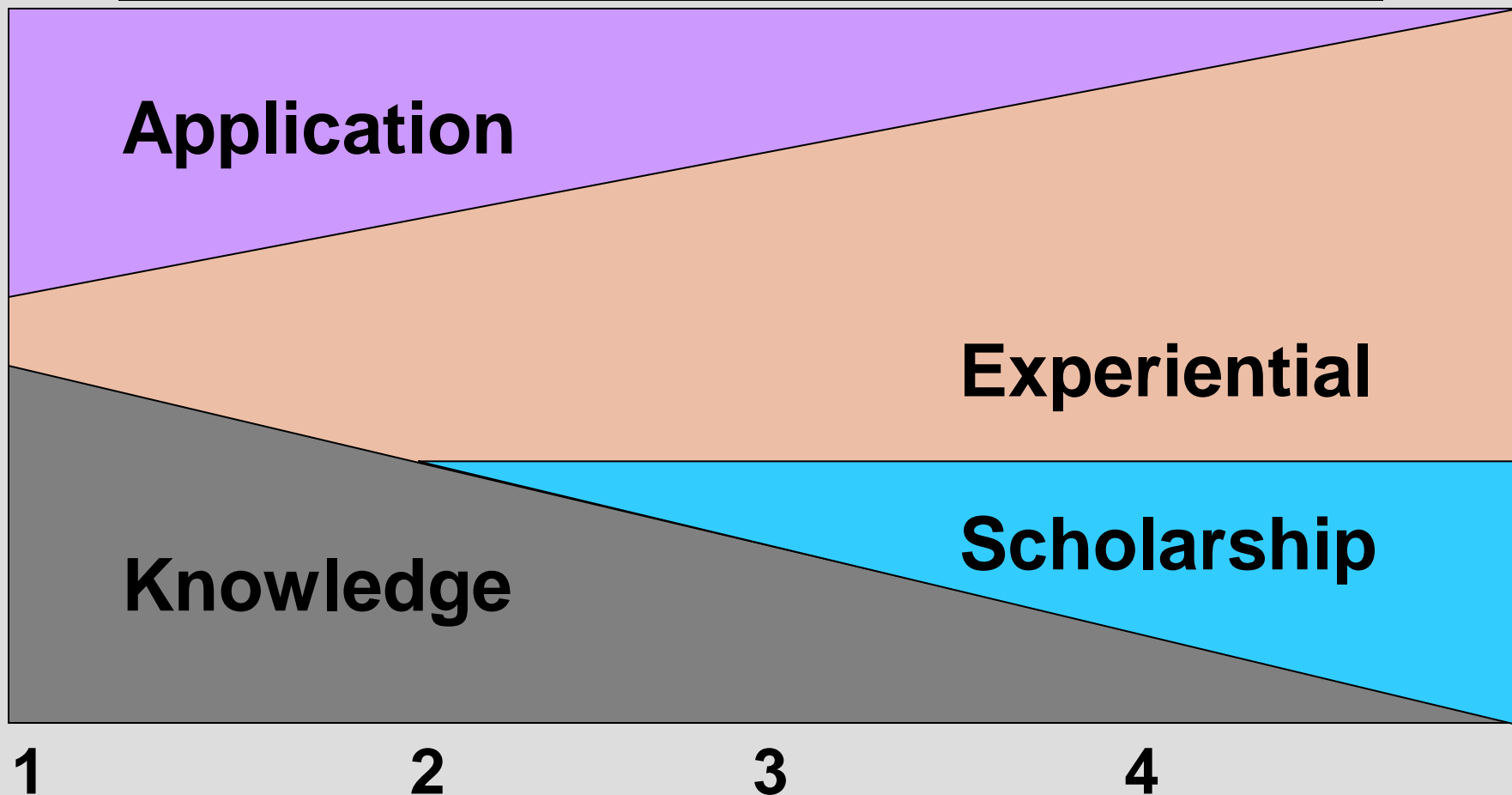
How to create professionals ready for life-long learning



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Interdependency model

University of Colorado 2012 - ?



Interdependency model translated into courses

P1 Fall	P1 Spring	P2 Fall	P2 Spring	P3 Fall	P3 Spring		P4 Summer	P4 Fall			P4 Spring			
Disease States	Pharmaceutic	Pharmacokinetics	Pharmacogenomic	Advanced Informatics	APPE	Foundational Sciences Capstone	APPE	Interession	APPE	APPE	APPE	Interession	APPE	APPE
Applied biological chemistry	Pharmacology	Medicinal Chemistry	Public Health & Outcomes	Pharmacy Management										
Communication Foundation	Communication Foundation	Advanced Health care Informatics	Integrated Clinical Sciences	Integrated Clinical Sciences										
Pharmacy Law Regulations	Introduction Drug Information	Public Health & Outcomes	Integrated Clinical Sciences	Integrated Clinical Sciences										
Practice & Informatics Fundamentals	Self - Care Nutrition	Integrated Clinical Sciences	Principles of Research											
Self - Care Nutrition	Integrated Clinical Sciences	Integrated Clinical Sciences				Clinical Capstone								
Professional Development Portfolio														