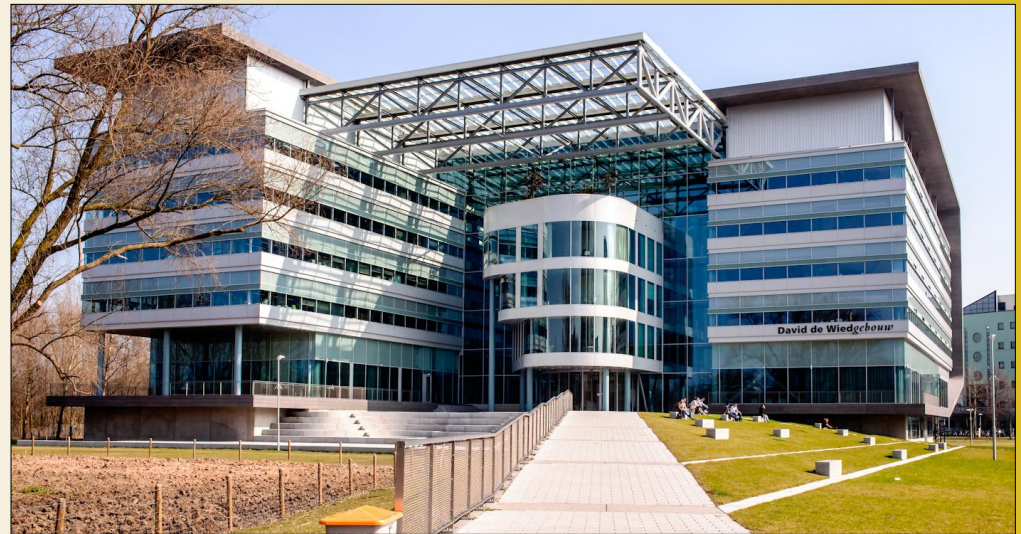


# How to use learning outcomes for curriculum development

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# Pharmacy Education

- Pharmacy curricula need to prepare student for the role(s) they will play in society after graduation
- Broad guidelines are given in European (or national) context, but further specification is necessary to accommodate differences in position and professional profiles of pharmacists in different countries
  - EU directive 2005/36/EC
- Specification of competencies can be used to guide the construction of new curricula or the 're-engineering' of existing curricula
- Designing curricula according to the principles of competency-based education makes it possible to create adaptable programmes, which can prepare students for their ever-changing roles



# Competency-based education (CBE): Why?

- Preparation for professional life: effective treatment, patient safety
- Accountability: It is considered no longer acceptable to simply *assume* that competence is automatically reached by education and training
- Explicit demonstration of competence is required to satisfy accreditation or governing bodies
- The concept of competency-based education is developing since the 1960's for professional (and vocational) higher education:
  - teacher education      Whitty & Wilmott (1991)
  - medicine                Frank et al. (2010)
  - dentistry                Spielman et al. (2005)
  - psychology             Falender & Shafranske (2012)
  - pharmacy                Bates & Bruno (2008)



# Professional competence

- Psychology: “the overall or integrated professional abilities”
- Medicine: “The array of abilities across multiple domains or aspects of physician performance in a certain context. Statements about competence require descriptive qualifiers to define the relevant abilities, context, and stage of training”
- Competence is multi-dimensional, dynamic, contextual and developmental. It changes with time, experience, and setting
- Competence is progressive: For each aspect or domain of competence, the spectrum of ability varies from novice to mastery. At any given point in time, and in a given context, an individual will demonstrate greater or lesser ability

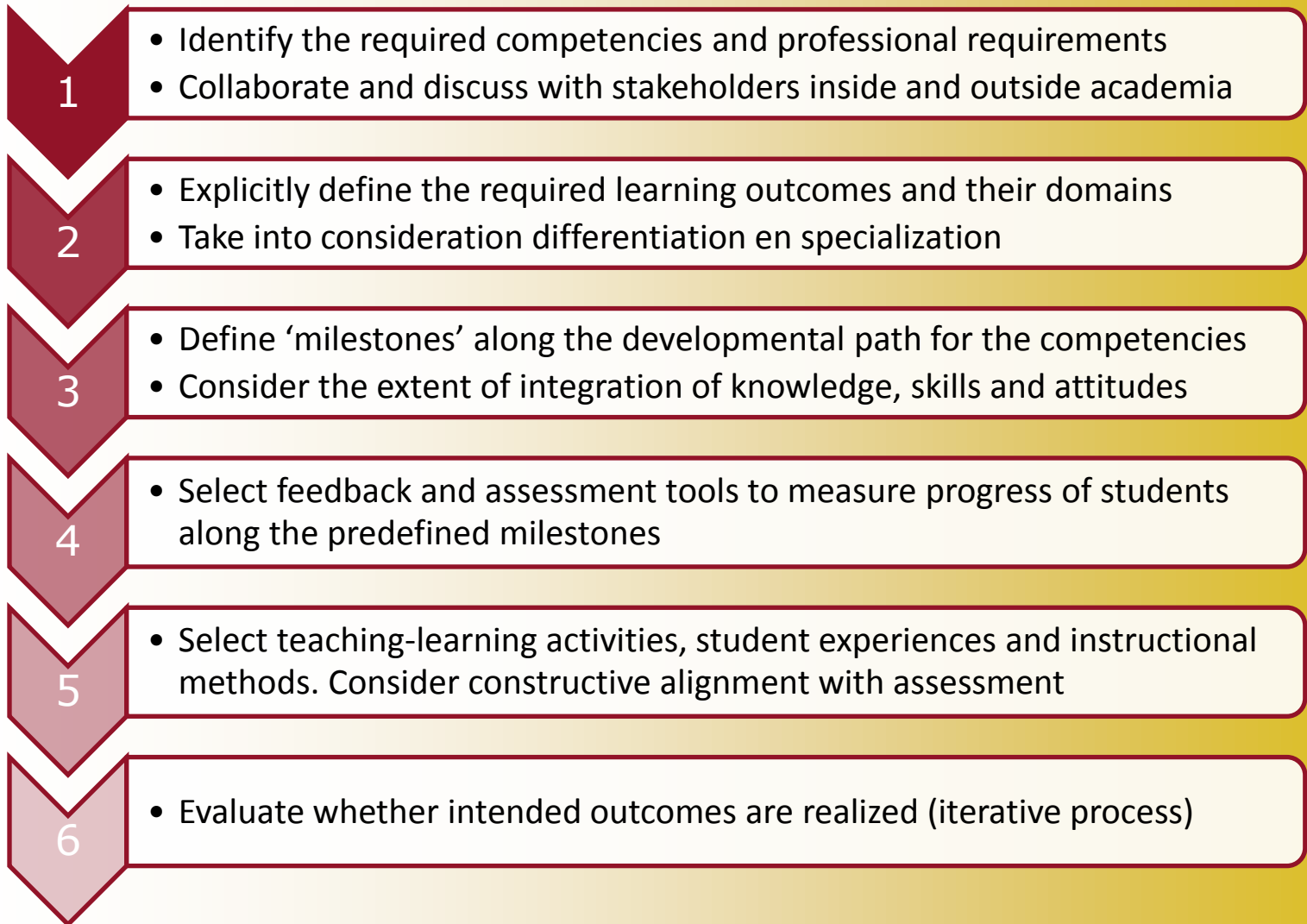


# Competencies and learning outcomes

- Competencies are the various ingredients of professional competence, specified as *observable abilities* of a pharmacist, integrating multiple components such as knowledge, skills, values and attitudes, expressed as behaviour
- Learning outcomes are the *observable results* of CBE and can be defined in terms of knowledge, skills and behaviour of students at specified stages of the curriculum
- Learning outcomes can be ordered in different domains and different developmental stages to ease curriculum development
  - domains: e.g. patient care, compounding
  - stages: e.g. bachelor, master



# Curriculum design for CBE



# Required competencies

- Can be defined at various levels of specification, depending on context (country, professional organization, college/faculty)
- Often part of (*or*: hidden in) accreditation standards:

## 3.4 Educational Outcomes

### Standards

#### Standard 25

The pharmacy program produces graduates who have the graduate attributes of the University and the knowledge, skills and attitudes necessary to commence supervised practice as an intern pharmacist.

#### Standard 26

The School of Pharmacy uses a range of assessment methods that are appropriate to the outcomes of the program.

#### Standard 27

The School of Pharmacy has policies and procedural controls that involve external assessment or moderation to assure integrity, reliability, fairness and transparency in the assessment of students.

### Intended learning outcomes

Standard 1: The intended learning outcomes of the programme have been concretised with regard to content, level and orientation; they meet international requirements.

### Teaching-learning environment

Standard 2: The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

### Assessment and achieved learning outcomes

Standard 3: The programme has an adequate assessment system in place and demonstrates that the intended learning outcomes are achieved.



# Learning outcome domains (USA)

## Guideline 12.1

Graduates must possess the basic knowledge, skills, attitudes, and values to practice pharmacy independently at the time of graduation. In this regard, the college or school must ensure that graduates are competent, at a minimum, to:

- *provide patient-centered care*
- *provide population-based care*
- *manage human, physical, medical, informational, and technological resources*
- *manage medication use systems*
- *promote the availability of effective health and disease prevention services*

To be capable of the above, pharmacy graduates also must be able to:

- *communicate with patients and health care professionals*
- *retrieve, analyze, and interpret the professional, lay, and scientific literature*
- *evaluate the quality of basic science and clinical research evidence*
- *demonstrate expertise in informatics*
- *carry out duties in accordance with legal ... and professional guidelines*
- *maintain professional competence by identifying and analyzing emerging issues*

ACPE (Accreditation Council for Pharmacy Education; USA):

Accreditation Standards for the professional program in Pharmacy leading to the PharmD degree (2011)





# Learning outcome domains (Utrecht)

1 Academic competencies	<ul style="list-style-type: none"><li>• writing, critical assessment of literature</li><li>• lifelong learning attitude</li></ul>
2 Patient care	<ul style="list-style-type: none"><li>• individual care planning</li><li>• pharmacotherapeutic advising</li></ul>
3 Medication policy	<ul style="list-style-type: none"><li>• rational and cost-effective prescribing</li></ul>
4 Compounding	<ul style="list-style-type: none"><li>• extemporaneous preparations</li><li>• adequate storage</li></ul>
5 Professional practice	<ul style="list-style-type: none"><li>• adequate quality control systems</li><li>• management, law and regulations</li></ul>
6 Research	<ul style="list-style-type: none"><li>• research (patient care, policy, epidemiology)</li><li>• interpretation of literature</li></ul>
7 Communication, education	<ul style="list-style-type: none"><li>• oral communication (patients, health care professionals)</li><li>• writing, patient information</li></ul>



# Knowledge and skills domains (Utrecht)

- Internal coherence of the curriculum is constructed and monitored

Knowledge domains	Skills domains
Physiology & pathophysiology	Pharmaceutical calculations
Biotechnology	Information management
Biomolecular chemistry	Oral communication
Pharmacodynamics	Written communication
Pharmacokinetics	Laboratory skills
Pharmaceutical Technology	Compounding
Pharmacotherapeutics & epidemiology	Methodology (incl. Statistics)
Pharmaceutical Analysis	Management
Toxicology	Ethics and law
	Metacognition

- Consultants have access to all course materials and advise programme directors and course coordinators on a regular basis



# Knowledge domain: Pharmacokinetics

## **MASTER (patient profile): The student .....**

- ..... is able to calculate pharmacokinetic parameters from plasma-concentration time data, using nonlinear regression techniques (1- and 2-compartment models);
- ..... is able to design dosage schedules for multiple oral administrations and infusions, taking into account individual patient characteristics;

## **MASTER (product profile): The student .....**

- ..... is able to use pharmacokinetic models and calculations evaluating the release characteristics of dosage forms;
- ..... can explain in detail the mechanisms of drug absorption in relation to the characteristics of administration forms (tablet, slow-release, subcutaneous).

## **BACHELOR: The student.....**

- ..... is able to calculate pharmacokinetic parameters from plasma-concentration time data, using linear regression and curve-stripping techniques (1- and 2-compartment models);
- ..... is able to design dosage schedules for multiple oral administrations and infusions;
- ..... is able to explain absorption, distribution, metabolism and excretion mechanisms for drugs in relation to their physicochemical properties.

## **YEAR 1: The student .....**

- ..... can calculate primary pharmacokinetic parameters ( $Cl$ ,  $V_d$ ,  $k_a$ ,  $F$ ) from plasma-concentration time data after single dose administration (1-compartment model only);
- ..... can mention the main sources of variation of pharmacokinetic parameters and can explain how these variables affect the plasma concentration time-curve.



# Skills domain: Oral communication

## **MASTER (patient profile): The student .....**

- ..... is able to inform patients about medication use in a over-the-counter-session (first hand-out and second-handout of medicines, feedback);
- ..... is able to handle emotional and ethical aspects in one-on-one conversations;
- ..... is able to guide a pharmacotherapeutic policy session with other health care professionals;

## **MASTER (product profile): The student .....**

- ..... is able to communicate the results of quality control measurements to other health care professionals.

## **BACHELOR: The student.....**

- ..... is able to present a pharmaceutical subject, in correct English language, before a scientific audience and is able to answer subsequent questions;
- ..... is able to guide a oral conversation in a group of patients and/or health care professionals, in Dutch language;
- ..... is able to reach consensus in a group discussion about a scientific subject.

## **YEAR 1: The student .....**

- ..... is able to present a short presentation, in correct Dutch language, with adequate visual support (blackboard, overhead, presentation software);
- ..... is able to have a structured one-on-one conversation with a (simulation) patient;
- ..... participates actively in group discussions.



# Learning outcomes: assessment continuum

## **POSTGRADUATE: real working life**

- \* Assessment in work environment: community pharmacy (2 years), hospital pharmacy (4 years);
- \* Continued education (CE) and Continuous postgraduate development (CPD).

## **MASTER: complex skills in context**

- \* Testing of knowledge, skills and behaviour is fully integrated (contextual) in courses;
- \* Increased attention for authentic tasks (patient care, medication policy, compounding), role-playing (patient interviews) and serious gaming (e.g. GIMMICS);
- \* Blended learning: clerkships in community pharmacy, hospital pharmacy and/or industry;
- \* Research project (individual).

## **BACHELOR: skills in isolation**

- \* Assessment of knowledge is tested in individual tests (midterm, final) and group work (papers, project results) in the context of courses;
- \* Skills (calculations, compounding, laboratory skills, oral and written communication, management, ...) are tested or assessed in the context of courses, but ....
- \* If skills are assessed as 'insufficient' individual additional training and re-testing of separate skills is offered in the skills lab.



# Learning outcomes: design of TLE

- The teaching-learning environment comprises all components in the teaching system:
  - the curriculum and its intended outcomes
  - the assessment tasks
  - the teaching methods
  - the physical environment and the regulations
- Use constructive alignment to design students' assessment, learning activities, focusing on level-3 teaching

## **Level 2. Focus: what the teacher does**

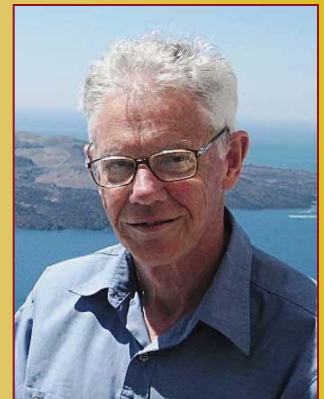
Learning is a function of teaching. The possibility is entertained that there may be more effective ways of teaching than what one is currently doing. Learning is seen as more a function of what the teacher is doing than of what sort of student one has to deal with.

→ **Blame the teacher**

## **Level 3. Focus: what the student does**

Learning is the result of students' learning-focused activities, resulting from their own perceptions and inputs, and of the total teaching context. Focus must be on all components in the systems.

→ **Blame the system**



**John Biggs**



# Outcomes: curriculum evaluation

- Curriculum mapping can be used to evaluate curricula and to guide improvement processes
- Essentially a matrix of teaching-learning activities and/or assessment *versus* intended outcomes

- *Intended* curriculum
- *Delivered* curriculum
- *Experienced* curriculum

Year	Course	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
P1	1.1					
	1.2					
	1.3					
	1.4					
	1.5					
	1.6					
	1.7					
	1.8					
	1.9					
	1.10					
	1.11					
	1.12					
P2	2.1					
	2.2					
	2.3					
	2.4					
	2.5					
	2.6					
	2.7					
	2.8					
	2.9					
	2.10					
	2.11					
	2.12					
P3	3.1					
	3.2					
	3.3					
	3.4					
	3.5					
	3.6					
	3.7					

Shading	Proportion of Domain Coverage Ranges
Black	0.81 – 1.0
Dark Gray	0.61 – 0.8
Medium Gray	0.41 – 0.6
Light Gray	0.21 – 0.4
White	0.01 – 0.2
White	0.00



# Outcomes: skills map

**BACHELOR PHARMACY: skills map**

Year	Course	Level	courses			educational formats					assessed skills					
			Written test	presentation	project	written report	poster/website	peer feedback	lab skills	oral communication	written communication	collaboration	lab skills	compounding	calculations	
1	FA-101	1	2											x	x	FA-101
	FA-102	1	2			i			i	x						FA-102
	FA-103	1	1								x					FA-103
	FA-104	1	3			g										FA-104
	FA-105	1	1							x		x				FA-105
	FA-107	1	1	g		g										FA-107
	FA-200	2	3		g	g			i							FA-200
	FA-201	1	1			g				x						FA-201
2	FA-202	2	2			g		g	i				x		x	FA-202
	FA-203	2	2				g				x	x				FA-203
	FA-204	2	2													FA-204
	FA-205	2	2		g											FA-205
	FA-206	2	1			i			i							FA-206
	FA-207	2	2			i										FA-207
	FA-208	2	1			i				x	x				x	FA-208
	3	FA-301	3	2			i									x
FA-302		3	1						i							FA-302
FA-303		3	1			g										FA-303
FA-304		3	1							x			x			FA-304
FA-305		3	1	g												FA-305
FA-306		3	1	g			i+g				x					FA-306
FA-307		3			i+g	i+g										FA-307
FA-380		3				i										FA-380

group:	3g	5g	6g	1g	1g											
individual:		3i	6i			5i	5	4	2	1	2	4				





# Usability of learning outcomes

- Competency based: explicit discussion about required competencies (priorities, feasibility, developmental stages)
- Commitment to outcomes: better serving patients and society
- Promote the development of a continuum of education
- Focus on assessment, aimed at reaching developmental stages (assessment for learning)
- Stimulus for developing learner-centered education
- Portability of training, facilitates transfer between countries and jurisdictions
- Improved understanding with other health care professions (medicine, nursing, ...)



# Conclusion

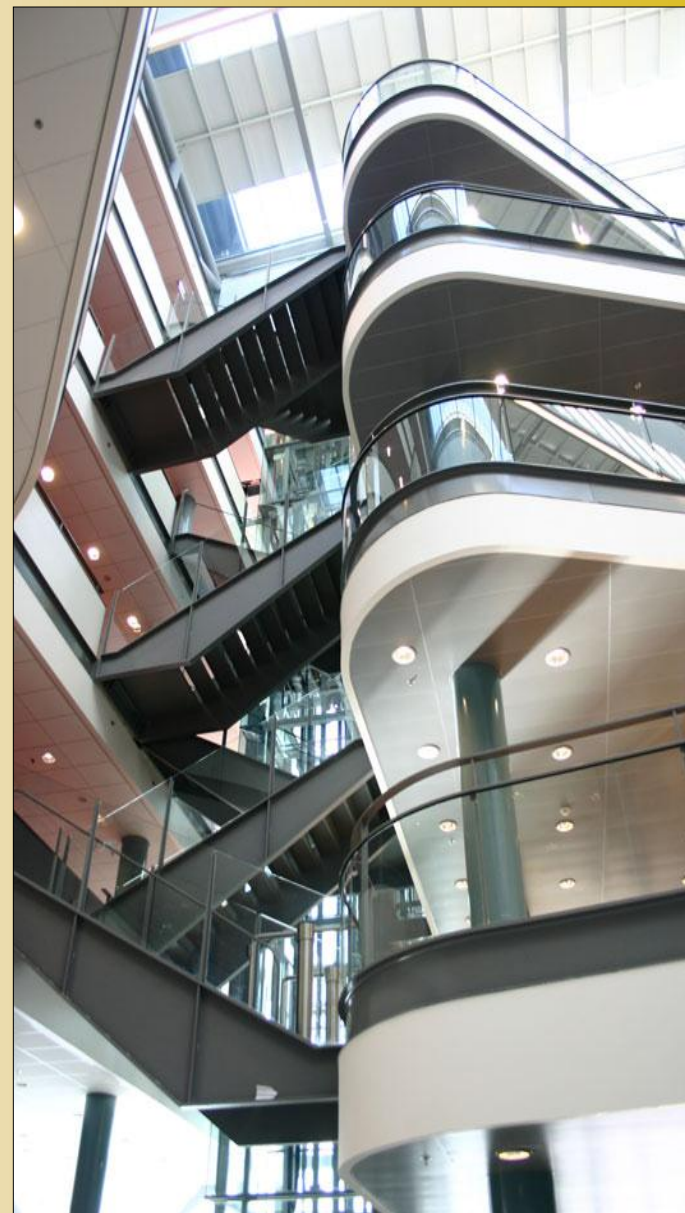
Specification of learning outcomes can be very helpful for the design and evaluation of competency-based curricula.

Constructive alignment of all aspects of the teaching-learning environment (outcomes, assessment, teaching formats) will allow pharmacy students to become competent practitioners and/or pharmaceutical researchers.

## *Important references*

1. Frank J.R. *et al.*, Competency-based medical education: theory to practice. *Med. Teacher* 32, 638-645 (2010)
2. Biggs J. and Tang C., *Teaching for quality learning at university* (4<sup>th</sup> ed.) Society for Research into Higher Education and Open University Press (2011)





***Thank you for your attention ....***

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