# Chapter 39
# Teaching Pharmaceutical Care at University Level


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**Abstract** The practice change and needs of the pharmacy profession have created a shift in pharmacy education. Schools of pharmacy globally attempt to respond to the recommendations issued by the WHO and FIP, by modifying their curricula, especially with the introduction of clinical and social content. However, it appears that pharmacy education in Europe, compared to the U.S., maintains a greater focus on basic sciences. Competency frameworks for pharmacy education and practice have emerged. Their use in curriculum development is extremely important, but to ensure that the competencies are achieved by graduates to enter pharmacy practice, the syllabi must align competencies, educational contents, learning activities, and assessment tasks. The teaching of pharmaceutical care benefits from the use of active learning methods, such as problem-based learning and team-based learning, allowing students to develop skills of communication, teamwork, and critical thinking. Although curriculum integration presents some implementation difficulties, its use allows students to integrate concepts from different areas throughout the curriculum. The use of assessment methods based on student performance, such as OSCE and OSATS, is most appropriate to evaluate students regarding the development of competencies in relation to pharmaceutical care and technical skills.

**Keywords** Pharmaceutical care · Education pharmacy · Academic education Competency framework · OSCE

## 39.1 Pharmaceutical Care in the Academic Pharmacy Education

Following the shift from a product-centered to a patient-centered practice, international organizations such as the World Health Organization (WHO) and International Pharmaceutical Federation (FIP), recommended that the pharmacist'

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education should mirror these changes. In 1993, at the second meeting on "The role of the pharmacist: quality pharmaceutical services—benefits for governments and the public", the WHO established a list of recommendations that the profession and educators should follow to provide pharmacists with pharmaceutical care skills [1]. The first recommendation emphasized the continuous review of the outcomes, content, and process of the undergraduate curriculum, to ensure pharmacy education prepares graduates to practice pharmaceutical care. For this, it is necessary to ensure an adequate balance of curricular contents of basic sciences, pharmaceutical sciences, biomedical and clinical sciences, socioeconomic, and behavioral sciences with practical experience. The introduction of courses related to the implementation of patient-centered care such as communication, was also recommended. In addition to these curricular changes, it was also suggested more practical and problem-oriented teaching methods, interprofessional education, and a clinical internship period was necessary for achieving competencies in pharmaceutical care. In the field of continuing education and postgraduate studies, the WHO also recommended adopting the philosophy of pharmaceutical care (see Sect. 9.2) [1].

### *39.1.1 WHO and FIP Pressure*

In 1997, the WHO continued emphasizing the need for an education that allows students to obtain the knowledge, skills, attitudes, and behaviors for the practice of pharmaceutical care. Although each country has its own educational needs, related to its own context, the WHO recommended that there are common core elements essential to all pharmacy curriculum. For example, educational results can be related to the concept of the seven-star pharmacist (caregiver, decision-maker, communicator, leader, manager, lifelong-learner, and teacher), educational methods should become student-centered, and educators should continually update the curriculum as a dynamic process to meet the changing needs of the profession [2].

FIP also recommended improvement of pharmacy education, stressing the importance of clinical education and patient-centered care curricula. In the curriculum design, FIP proposed that educators ensure that the competencies required to enter pharmacy practice are attained by all graduates. For that, schools of pharmacy should: "systematically evaluate and validate its curricular structure, content, organization, teaching and learning methodologies, and outcomes" [3].

### *39.1.2 Changes in Pharmacy Education Around the World*

Pharmacy schools around the world attempted to respond to WHO and FIP recommendations through changes in pharmacy education. The curricula of countries such as Australia, Canada, the United States, and New Zealand have undergone

notable changes with the introduction of disciplines from the clinical pharmacy and social, administrative and behavioral pharmacy areas.

In the United States, the main change in pharmacy education was the creation and implementation of the doctor of pharmacy (PharmD). This program is the sole degree required to enter professional practice, and should follow the Accreditation Council for Pharmacy Education (ACPE) standards and guidelines (see Box 1). The ACPE requires at least two academic years or the equivalent college-level course work prior to the admission into a PharmD program (four academic years). The pharmacy curriculum was designed to comprise an appropriate balance of biomedical, pharmaceutical, social/behavioral/administrative, and clinical sciences, and an integration of pharmacy practice experiences in different settings [4]. Currently, only some Canadian pharmacy schools offer a PharmD degree. However, the Association of Faculties of Pharmacy of Canada recommended that all pharmacy schools change the entry-to-practice degree for pharmacy from the Bachelor of Science in Pharmacy to the PharmD by the year 2020. Other countries such as Japan, Saudi Arabia, and Thailand have also adopted the PharmD as their entry-level degree for the profession.

In Europe, the ministers of education from 29 countries signed the Bologna Declaration in 1999, creating the European Higher Education Area (EHEA) [5]. With the Bologna Declaration the European higher education institutions work in an integrated and harmonized way, allowing students from any European university to begin, continue, and complete their education and obtain a European diploma that would be recognized in any of the EHEA universities. To make this possible, a system that encompasses easily comparable degrees was adopted among the EHEA Members States. This system was based on two main cycles (undergraduate and graduate) and a system of credits (ECTS—European Credit Transfer and Accumulation System) was established [5]. Presently, 48 Member States participate in the Bologna process. As a result of the Bologna process, the European Parliament and the Council of the European Union has approved legislation on the recognition of pharmacist professional qualifications, defining knowledge, skills, and core competencies that pharmacy students must achieve to become pharmacists [6]. The pharmacy degree became organized into two training cycles with the duration of at least 5 years, including a 6-month traineeship at a community or hospital pharmacy during or at the end of the program. At the end of the 5 years of study, a total of 300 ECTS is required to complete the pharmacy degree. Following the Bologna Declaration, the European pharmacy schools conducted curricular revisions, including the introduction of some clinical sciences and social aspects associated with pharmaceutical practice. However, despite these changes, European pharmacy education maintains a greater focus on basic sciences and a lower emphasis on patient care-centered course load compared to the United States pharmacy curricula [7]. This suggests that European countries should consider reviewing their pharmacy curriculum so as to comply with the WHO and FIP recommendations.

### 39.1.3 Competency Frameworks in Pharmacy Education

A curriculum must be developed taking into account the needs of society as to prepare students with the necessary competencies to respond to the individual patient and to population health-related needs [3]. When developing a curriculum, these competencies must be expressed in course curricula or discipline syllabi. The syllabus is an important document that includes the course plan, and works as a tool that improves student learning, assists faculty teaching, promote communication between faculty members about courses, and increases curricular quality. A course syllabus should contain information such as general course information, course instructional team, course goals, course objectives (skills, knowledge, and attitudes that students need to acquire), description of course content including the sequence of topics/readings and learning activities/assignments, time schedule, learning and teaching methods, student assessment and grading, and academic policy information. Competencies should direct the syllabi that in turn inform the alignment of learning outcomes, learning activities, and assessment.

The development of competency frameworks for pharmacy education and practice has emerged worldwide, and is established in countries such as Australia, Canada, Ireland, New Zealand, Portugal, Singapore, Spain, Thailand, the United Kingdom, and the United States. The global competency framework created by FIPEd (FIP Education Initiatives and partnerships with WHO and UNESCO), contains a core set of competencies that can be used to indicate the achievement by graduates to enter pharmacy practice. This framework serves as a mapping tool and undergoes changes with the evolution of the pharmacy profession [8]. Other competency frameworks for pharmacy education and training have also been developed, for example, the PHAR-QA project in Europe that is used as a quality assurance system of pharmacy education [9].

Competency frameworks are extremely important in guiding curriculum development, but it is critical to ensure that students' actually achieve these competencies. However, the translation of frameworks into practice competencies does not always occur, and there are reports of competencies misuse [10]. Ideally, the competency framework should be created by the profession, and disciplines should have their programmatic content perfectly aligned with each topic of the competency framework [10].

### 39.1.4 Pharmaceutical Care Educational Contents in the Pharmacy Curriculum

With the aim of assisting in the creation of an undergraduate pharmacy curriculum, which focuses on preparing students for a patient-centered practice, a catalog of educational contents was created through a qualitative analysis of the educational contents included in the syllabi of the disciplines from undergraduate pharmacy

curriculum in Australia, Canada, New Zealand, and the United States [10]. The selection of these countries was based on the fact that they have a wide implementation of pharmacy services and have undergone a curriculum change to incorporate more clinical models. All courses with patient-centered educational contents (topics described under clinical sciences and social/behavioral/administrative sciences) were included for content analysis. Educational content related to pharmacy practice were analyzed and extracted from 1703 syllabi belonging to 110 pharmacy schools in Australia, Canada, New Zealand, and the United States. Using the ACPE "Guidance on the Science Foundation for the Curriculum" [4] as a coding framework, a final coding tree with 4 hierarchical levels and 355 topics of educational contents for a patient-centered undergraduate pharmacy curriculum was created. The first hierarchical level comprises four main groups in which the area of pharmacy practice could be divided: (1) Clinical Sciences Aspects, covering topics related to patient care, the processes associated with patient care, and clinical health outcomes; (2) Social and Behavioral Pharmacy Sciences Aspects, includes topics on the relationship with the patient and society (in the role of public health); (3) Administrative Pharmacy Sciences Aspects, covering procedural and technological aspects that support the role of the pharmacist as a health professional; (4) Miscellaneous, including cross-sectional educational contents for the groups above, such as the design and interpretation of research and the history of pharmacy. Figure 39.1 shows the two higher hierarchical levels of educational contents for a patient-centered pharmacy curriculum [10]. Universities should follow competency-based curriculum design, but each competency must be scrupulously aligned with the corresponding educational contents.

## 39.2 Teaching and Learning Methods

Teaching methods are the principles and strategies used by instructors to promote student learning. In addition to facilitating the achievement of learning outcomes, teaching methods can help students engage in the learning process, support their responsibility for self-directed learning, and promote peer interaction and collaboration.

Teaching philosophies can be divided into teacher-centered approaches and student-centered approaches. A teacher-centered instruction model emphasizes the lecturer taking a more authoritarian role and assuming control of the classroom, while students act as passive subjects who receive information provided by the professor through lectures, with a final aim of assessing their knowledge. In teacher-centered education, the student engagement in the learning process, participation in the class, and the development of communication and teamwork skills is low. The transition to a student-centered teaching model has several advantages, beginning with responsibility for the learning process. The role of the instructor changes from authoritarian to facilitator leading to an increase in student participation, responsibility for self-directed learning, and involvement in the assessment


**Fig. 39.1** Two higher hierarchical levels to code the educational contents for a patient-centered pharmacy curriculum [10]

process. In a student-centered model, teaching and assessment are linked since student learning is measured continuously during the teaching process. The use of a student-centered approach to learning, with the use of active learning strategies, seems to be more appropriate for the patient-centered education aimed for in pharmaceutical care.

### *39.2.1 Different Teaching Methods*

Different teaching methods relate to different contexts, and the chosen teaching method (or mix of methods) depends mainly on the subject area being taught and the characteristics of the learners. Additionally, the educational philosophy and beliefs of the teacher, the teaching context, the resources available, and the school mission are several factors that influence the choice of a particular teaching method.

Higher education institutions and teaching methods have evolved according to the social, economic, and political contexts. Until the nineteenth century, the lecture was the most traditional method used in the classroom teaching. In the late twentieth century with the rise of the digital age, new teaching methods began to emerge. The presence of technology in the classroom for teachers and learners has become commonplace, including laptops, tablets, mobile phones, and digital projection of content (e.g., PowerPoint®). The focus of teaching has changed from the simple transmission of information to knowledge management, "where students have the responsibility for finding, analyzing, evaluating, sharing and applying knowledge, under the direction of a skilled subject expert" [11]. The use of active learning strategies engages and motivates learners and assists them in understanding and retaining information. These new strategies include laboratory experiences, case studies, small group discussions, brainstorming of ideas, games, peer teaching, role plays, and other practice-based exercises. In active learning, the instructor must carefully structure the activities in which the learner will be involved, such that regardless of the methods used, the student is actively engaged in the educational process.

With the educational evolution from basic sciences to clinical and integrated courses, the use of active learning strategies in pharmacy education was essential to provide pharmacy graduates with the necessary integration of knowledge, skills, attitudes, values, and behaviors to a patient-centered practice. According to the Standards for Curriculum published by ACPE, the pharmacy curriculum should promote lifelong professional learning through an emphasis on active, self-directed learning [4]. The integration of active learning strategies in the didactic and practice-based coursework is fundamental to the development of critical thinking, problem-solving skills, communication, and teamwork; all which construct the foundation of the effective delivery of pharmaceutical care.

There are numerous studies that address the implementation of active learning methods in pharmacy education such as problem-based learning, team-based learning, case-based learning, cooperative learning, project-based learning, simulation-based learning, ability-based education and assessment-as-learning, game-based learning, and blended learning. The next section will focus on the most widely used teaching methods in pharmacy education that prepare students for a patient-centered practice.

#### 39.2.1.1 Lecture-Based Learning

Lecture-based learning (LBL) is a traditional method where the instructor is in the center of the teaching approach. In this passive learning method, the instructor delivers the information to students who receive and attempt to memorize the content. During the lecture, the students can take notes while they are listening to the instructor, but there is less opportunity to interpret and use concepts. There tends to be poor engagement with the students with LBL and student attention and retention of information decline progressively after the first 10 min of lecture.

Although this teaching method is not the most appropriate to provide pharmaceutical care skills to graduates, it is one of the oldest methods and is still widely used in pharmacy education. It is a highly effective and efficient method of transmitting information to a large group of individuals, does not involve a large investment in material resources, and if the instructor is a good speaker, can captivate the audience. To make the LBL method more effective, the instructor can incorporate some active learning strategies during the lecture. For example, the use of question-and-answer techniques and group discussions increases feedback between the teacher and students, and helps to absorb and understand the information. In addition, if the instructor introduces real-life examples during the class, it may be easier for students to understand the information and relate to practice.

#### 39.2.1.2 Problem-Based Learning

The problem-based learning (PBL) model emerged in 1969 in the medical education at McMaster University in Canada. Since then, this method has been used among health sciences education programs successfully. An example of the student-centered PBL approach is the case studies model where a small group of learners, usually less than 10, are guided through a patient encounter by a faculty facilitator. A typical scenario of PBL is as follows: In the first class of the week, a case is presented to the students. During this week the students discuss the case and research the issues that arise, then present their interpretation in the second class of the week. Each week a new case is presented to the students along with a list of learning objectives which align with the corresponding educational content. The purpose of PBL is not to simply focus on problem-solving, but also for students to recognize their own learning needs as they make efforts to understand the problem. At the same time they gather and synthesize information and deepen concepts related to the problem, they apply a self-directed learning approach and enhance while enhancing group collaboration and communication skills, ultimately assuming responsibility for their learning.

Schools of pharmacy have implemented PBL in their curricula to be in line with the demand of the pharmacy profession, producing graduates that may be better prepared to provide quality pharmaceutical care. In the literature, there are several reports of the implementation and use of the PBL method in pharmacy education to supplement the traditional learning approach. For example, the University of Mississippi employs the PBL model in the third year of the professional degree in a course called “Pharmaceutical Care”. In this course series, the educational contents previously covered in different courses were integrated into clinical case scenarios and discussed by students in small groups oriented by a faculty facilitator [12].

Although the inclusion of the PBL method in the curriculum has several advantages, there are some barriers and limitations to its implementation and use. This method requires more human resources and more time invested by faculty in the preparation of patient cases. There needs to be a transition among the faculty to move from a traditional teaching method to a more innovative and active teaching

approach, which may be opposed by faculty who have successfully instructed their students for decades through LBL. Also, students are not always receptive to PBL because of their comfort as a passive learner. PBL also requires educational institutions to be well equipped with the necessary resources of books, journals, computers, and internet access which allows students to research effectively. However, if the students are not properly resourced or guided by the instructors, they could be overwhelmed with the information they identify. The use of PBL also requires instructors to change the student assessment, which usually requires lengthy grading of cases, redirecting learning and research, and incorporating the evaluation of noncontent characteristics such as participation, teamwork, and communication.

#### 39.2.1.3 Team-Based Learning

Team-based learning (TBL) is an active teaching method originally developed by Larry Michaelsen in the late 1970s when he was a professor of business at the University of Oklahoma and later adopted by health professions education.

TBL strategically organizes students into teams of 5–7 students with diverse backgrounds that remain fixed throughout the entire term. Furthermore, the educational course content is structured into main units or course blocks (6–10 h of coursework) with the goal of developing team learning simultaneously as students achieving course objectives. TBL consists of three phases: the preparation, the readiness assurance process (RAP), and the application. In the first phase, prior to class, the students read and study the assigned materials related to the unit of study. The second phase occurs in the classroom where students are assessed, usually by multiple-choice quiz, about the material studied previously provided. The students may then initiate an individual readiness assurance test (RAT) and subsequently answer the same RAT as a team where they reconcile their individual answers with the team. The instructor provides immediate feedback on their performance and clarifies doubts that have arisen during assessment with both individual and team RAT contributing to the final grade. In the last phase of the TBL method, students apply concepts and content that they have learned and tested to real-world problems through discussions, team activities, and exercises. The engagement of students with the TBL is higher, since the students spend more time in the preparation of the class and take more accountability for their own learning.

Several pharmacy schools in the United States have incorporated the TBL method into their curriculum to be in line with the ACPE Standards, which recommend active learning strategies that develop critical thinking, problem-solving, communication, and teamwork skills. The incorporation of TBL in pharmacy education provides for self-directed learning and allows students to solve clinical problems, while they build teamwork skills, essential to the delivery of patient-centered care as a member of the healthcare team.

The limitations to the implementation and use of the TBL method are similar to PBL and include faculty resistance, lack of training, increased workload, and the

costs of the resources needed to facilitate. As an economical alternative to the digital learning management systems, paper can be used to respond to the RATs, although it takes more time for the instructor to give feedback to the students and to grade them.

TBL with PBL have been compared extensively in academic literature, however, the main differences of the TBL method are the four essential principles: (1) creation and management of heterogeneous teams; (2) students are responsible for their individual and teamwork; (3) students should receive frequent and immediate feedback; and (4) group application activities must be designed to promote learning and team development. The TBL requires that students to attain knowledge before the class, while in PBL a new "problem" is presented to the students during the class where only after they apply a self-directed study to resolve it. In TBL, the instructor facilitates the discussion after all teams have submitted solutions (one instructor per classroom); in PBL, the instructor facilitates each team during the discussion (one instructor per group). Although the application of these two teaching methods differs, they both highlight critical thinking, communication skills, and student responsibility and engagement in their learning.

#### 39.2.1.4 Game-Based Learning

The use of educational games as a teaching method in pharmacy education is progressively increasing. Two different systematics reviews have been conducted with the aim of analyzing educational games adopted in pharmacy schools and to evaluate the effects of implementing games in the pharmacy curriculum [13, 14]. Different games have been used to introduce active learning into the curriculum to engage and motivate student learning. The literature identifies and describes the implementation of games such as bingo, Clue®, crossword puzzles, quiz shows, card/board games, and simulation games. For example, the University of Florida College of Pharmacy has created an educational tool, called Medication Mysteries Infinite Case Tool, for teaching pharmacy students to conduct medication history interviews and to perform medication reconciliation [15].

Although more studies are needed to prove that the use of games as a teaching method improves students' learning, the literature shows that students enjoy these strategies and their motivation, interaction and participation in the class are stimulated. While playing, students develop critical thinking, communication skills, and social collaboration, fundamental to the practice of pharmaceutical care. Another advantage of the game-based learning is that the instructor could use real-world situations but in a safe environment, being less stressful to the students.

The main limitations to the implementation and use of educational games as a teaching method relate to the challenge of designing an effective game, the time consumed, and the costs involved. Additionally, some games are difficult to apply in large classrooms, they may require the presence of more than one instructor for facilitation and moderation of the game, and some students may take the competition too seriously, increasing their anxiety and conflict.

#### 39.2.1.5 Blended Learning

Internet-based learning (e-learning) has emerged as an innovative method in which teaching is conducted online through internet-based tutorials, online reading materials, virtual patients, e-mail, online forums, videoconferences, online chat, and instant messaging. Through this method the communication between instructor and students can be synchronous, involving real-time interaction between participants over the internet (e.g., videoconference), or asynchronous, where instructor and student are not online at the same time (e.g., e-mail). The main advantage of the e-learning method is the access to educational content can occurs anytime and anywhere, depending only on internet access and the equipment necessary to access the internet.

In pharmacy education, this distance method is widely used for continuing education programs. However, the lack of interaction between students and instructor makes this method less appropriate to obtain the skills needed for patient-centered practice. As an alternative to e-learning, the blended learning (b-learning) method emerged. Blended learning is a student-centered learning approach that combines online resources with face-to-face classroom methods. With this model, also known as the "flipped classroom", the instructor makes the educational content available online. The students study the lecture material at home before class and during the class they apply the knowledge through work assignments.

Some studies have described the implementation and use of b-learning in pharmacy education. For example, in the University at Buffalo School of Pharmacy and Pharmaceutical Sciences, a b-learning model that combines online videos with TBL, case-based learning and clinical skills laboratory was integrated into a "patient assessment" course sequence in the first professional year. This approach was well received by students and related with improved academic performance [16]. A list of best practices for the use of blended learning in pharmacy education was recently published, containing advice such as the inclusion of a schedule of the course activities on the syllabus, including a length of time for out-of-class activities; availability of materials on the online platform at least 2 weeks prior to the classroom lesson; review of the difficult content topics at the beginning of each class [17].

Although the b-learning method offers the advantages described above for the active methods, the main disadvantages are the high costs related to the preparation of online materials, costs of maintaining an electronic learning platform, and faculty online time. It should also be taken into account that technological resources should be affordable, reliable, up to date, and easy-to-use for students and instructors. Finally, the impact of blended learning on the student's ability to deliver pharmaceutical care has not been evaluated and creates opportunities for future academic research.

### *39.2.2 Integrative Teaching and Learning in Pharmacy Education*

The ACPE standards state that graduates must develop, integrate, and apply basic sciences knowledge to solve clinical problems, which has led to most colleges of pharmacy in the United States to develop some approach to integrate their curriculum. This educational strategy allows for the integration of contents from the basic sciences with clinical sciences, subsequently combining theory and practice, enabling a better assimilation and application of concepts by the students. Also a pharmacy curriculum with a complete integration of biomedical, pharmaceutical, social/behavioral/administrative, and clinical sciences was developed [18]. Evidence from the literature suggests that by integrating curricular content, students learn and understand concepts more quickly and easily by identifying connections from various areas across the curriculum. Additionally, curricular integration supports the development of problem-solving skills where students can apply basic science concepts to solve drug-related problems.

A curriculum can have "horizontal integration", when related educational content from different courses are taught at the same time, or "vertical integration", when content are taught at different stages of the program. A "spiral curriculum" model occurs when horizontal and vertical integration are adopted. Following this approach, at the beginning of the program, content and concepts are taught in a simpler way, increasing complexity over time. In curricular integration, it can be useful if the educational contents are organized by themes, such as discipline, organ system, chronological, and problem-based themes. Durham University in the United Kingdom has applied curriculum integration where modules are organized according to body systems, where each module does not correspond to a specific discipline, but is rather organized around the management of diseases specific to an organ system. For example, in studying the cardiovascular system, the student addresses hypertension taking into account pathology, public health, pharmacology, therapeutic drug monitoring, drug formulation and clinical therapeutics. The modules are linked to each other, and material is recurrently reintroduced throughout the program in more complex clinical situations. The curriculum works as a whole instead of the sum of the parts [19].

Despite the benefits of curricular integration in pharmacy education, the implementation of an integrated curriculum presents some limitations. The main barriers are the complex design process, the need to develop integrative pedagogical and evaluation strategies, and the time and resources consumed. Other obstacles to curricular integration are that traditionally, academic institutions are discipline-based, instructors from basic sciences and clinical sciences express different interests in this teaching model, and student's resistance to a new pedagogy.

## 39.3 Assessment Methods

The students' assessment process and the methods of reporting students' results is a fundamental part of the teaching and learning process. Assessment methods are strategies and instruments used to determine whether students have achieved the desired course learning objectives and is characterized by being a systematic and continuous process, which enhances student learning, and focuses on the improvement of curricular programs.

According to ACPE standards, every pharmacy school must develop and implement a plan to assess the attainment of educational outcomes to ensure that graduates are fit for practice. This assessment plan should combine systematic, valid, and reliable knowledge-based and performance-based formative and summative assessments. The assessment of student learning must comprise "student self-assessments and faculty and preceptor assessments of student development of the professional competencies and demonstration of professional behaviors". In addition, the instructor may document, for example, in student portfolios that graduates have achieved the desired competencies [4].

In 1990, George Miller responded with the article "The assessment of clinical skills/competence/performance". Miller presented a framework for clinical assessment, which consists of a pyramid describing clinical competence with four hierarchical levels (Fig. 39.2). At the base of the pyramid is the knowledge (knows), followed by competence (knows how), performance (shows how), and action (does) [20]. The "knows" represents the knowledge that a student must achieve, and the "knows how" is the interpretation and application of this knowledge. These two base levels are within the scope of cognitive knowledge, and could be assessed using traditional assessment methods with written tests, multiple-choice questions, and oral exams. The "shows how" level is where students can demonstrate what they have learned and can be assessed in controlled situations through lab practicals, simulations, objective-structured clinical examinations (OSCE), and objective-structured assessment of technical skills (OSATS). The "does" corresponds to what happens in real-life practice and assessing the performance in the work environment. The upper two levels of the pyramid are related to behavioral

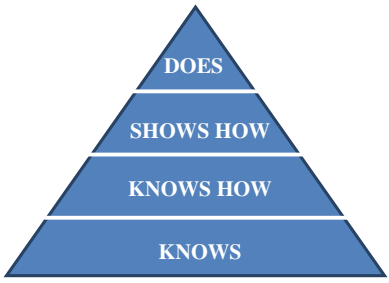


**Fig. 39.2** Miller's pyramid of clinical competence [20]

components. Research shows that the cognition area ("knows" or "knows how") and the behavior area ("shows how" or "does") have a weak correlation. For example, a pharmacy student who knows how to do a certain task does not automatically mean that they will perform as a competent pharmacist in practice. In order to help students to apply their knowledge in real life—to be competent—it is critical to select methods that allow them to "show" and "do".

There are several methods to assess student learning outcomes and the selection of the assessment method depends on the learning outcome supposed to be tested. The use of multiple methods in the student evaluation process could be useful to ensure that all student learning outcomes are assessed, sometimes termed as 360° assessment. There are direct and indirect methods of assessment. While in the first, the students are asked to demonstrate their learning (e.g., tests and presentations), in the second, the students are asked to reflect on their learning (e.g., course evaluation survey and syllabus review).

The students' assessment could be formative or summative. The formative assessments observe and help inform the student learning during the teaching-learning process, while the summative assessments occur at the end of a program or course. Formative assessments (also known as "low-stakes") are used for collected information and feedback about the students' progress in the course, such as what they know and can do, if they have misunderstandings or any learning needs, and if some gap on the educational process exists. This type of information allows the teacher to adopt strategies that improve the students learning. There are several examples of formative assessment techniques such as: prior knowledge assessment; written reflections such as minute paper or muddiest point; "wrappers" (set of reflective questions); case studies; and checks for understanding using audience response systems (used for quizzes, voting, and active learning). The summative assessments ("high-stakes") are used with accountability purpose to check what students have learned and what they are able to do at the end of the teaching-learning process, resulting in the assignment of a score or determining the progression of the student in the program. Tests and exams, portfolios, OSCE, papers, projects, and presentations are examples of summative assessment techniques.

### *39.3.1 Traditional Assessment Methods*

The most widely used traditional assessment methods are written examinations. These examinations may include mid-term exams, final exams, pop-quizzes, and mini tests, depending on the intention of the assessment (formative/summative). The content of the exam may include any combination of question types allowing students to demonstrate their knowledge, and fall in the categories of short answers, true/false questions, multiple-choice questions (MCQs), matching questions, or essays.

The main advantages of traditional evaluation methods are that they are easy to prepare, administer and evaluate, consume less time and resources, and are economical. In addition, it is a standard approach that evaluates the student's knowledge in an objective, reliable, and valid way. However, interpersonal skills, lifelong learning, professionalism, and integration of fundamental knowledge into decision-making can be underestimated. Since the traditional approach typically only evaluates the "knows" and "knows how" in the Miller's pyramid, these methods are not the most appropriate for assessing students abilities for practicing pharmaceutical care. Also, with this type of assessment, students are generally encouraged to memorize knowledge in producing the right answers, and in the particular case of MCQs or true/false questions, the correct answer is suggested to the students, reflecting the student's ability to take a test rather than the knowledge acquired.

### *39.3.2 Simulation-Based Assessment*

The integration of simulation methods in pharmacy education arose from the need to assess whether students were able to translate their knowledge into practice. Simulation-based assessment includes role plays with colleagues, standardized patients or clients, clinical skills-based assessment (e.g., prescription filing and checking), virtual patients, and human patient simulation (high-fidelity mannequin models). Simulation attempts to imitate real practice, but without resorting to real patients, since the use of real patients has some limitations such as patient accessibility and wellbeing, and the necessity to provide a controlled student assessment. Standardized patients or clients may be trained as actors that perform a specific role repetitively and systematically, being able to interpret a patient, caregiver, or health care provider.

Simulation activities allow students to apply their knowledge into practice, and developing patient care skills such as communication, history taking, information-gathering, professionalism, active listening, counseling, problem-solving, and decision-making. Assessment in the simulated environment has the advantages of reflecting real life, being immediate, reliable, and consistent, and applied to formative feedback or summative evaluations. However, the use of isolated and poorly structured simulations does not allow students to be evaluated in a standardized, objective valid, reliable and feasible, as with the objective-structured clinical examinations.

### *39.3.3 Objective-Structured Clinical Examinations*

Objective-structured clinical examinations (OSCE) are an example of competence-based evaluation introduced in 1975 by Ronald Harden et al. at the University of Dundee, Scotland, with the aim of avoiding the disadvantages of the

traditional clinical examination in medical education [21]. The OSCE method was designed to assess student's clinical competence in a systematic and objective way, and is still employed today in various health care disciplines to assess student performance.

During the OSCE, the students typically rotate through a series of 12–16 stations and spend between 5 and 10 min at each station. The number of stations and the time spent at each one can vary depending on the OSCE design. There are procedure stations, where student must perform a real-world task such as history taking, physical examination, or interpretation of laboratory analysis and the examiner uses a checklist to score student performance. There are also question stations, where students must answer questions related to the information and findings attained from the prior station with evaluations usually consisting of multiple-choice questions. After the examination, the examiners' checklists and the students' multiple-choice answer tests are marked according to an established rubric. With this method, the use of a simulated patient (trained actors representing patients) can be substituted in the place of a real patient, since the OSCE is repeated a large number of times according to the number of students in the discipline [22].

In the assessment of competence in the history taking, a brief description of the patient is given to the student. During the student performance, the examiner listens and scores their performance on a checklist made previously in the examination, and the result must be reliable and objective. Examiners make notes on the student performance regarding their relationship with the patient, history taking technique, and inquiring about the key points in the history. The examiner marks with a tick on the checklist whether the student, during their performance, asked the patient certain key points. After the student performance on the procedure station, they must complete an MCQ test about the patient history. In assessing competence on physical examination, the student examines a limited area and the examiner evaluates his or her performance using a checklist with previously established topics. After that, the student also answers MCQs related to their findings about the physical examination. With the OSCE, in addition to being able to assess the student's competences in taking a patient history or doing a physical examination, the examiner can evaluate other situations such as inspection of a patient or images, interpretation of patient charts or laboratory data, and provision of health education to the patient [22].

The use of the OSCE as a method to assess pharmacy student performance has become more common in pharmacy schools worldwide. In Canada, it used as an assessment component of entry-to-practice examination for pharmacists, in the United States it is commonly employed as an evaluation method in pharmacy education, and it has been adopted globally in countries including the United Kingdom, Switzerland, Malaysia, Japan, and Australia. The use of the OSCE in pharmacy education parallels that described previously in medical education, but with the focus of the evaluation on the delivery of pharmaceutical care. Stations may include a scripted simulated interaction with a patient, caregiver, or health care provider aimed at assessing communication skills, patient counseling or demonstrating use of a medical device, where other stations may have students performing

pharmaceutical calculations or checking prescriptions for errors [23]. Furthermore, the OSCE methodology has been recognized as a valid, reliable, and feasible assessment tool through the use of specific checklists for scoring performance, increasing agreement among examiners [24, 25].

Ultimately, the logistics of using the OSCE are complex and require significant human and financial resources. Yet, when well planned and effectively executed, becomes a feasible assessment method, whether formative or summative, in different stages in the education of a variety of health care professions [24].

### *39.3.4 Objective-Structured Assessment of Technical Skills*

The objective-structured assessment of technical skills (OSATS) is a reliable and valid method that has been used to evaluate technical skills. This method has been developed and used to measure technical skills of surgical trainees, but it can be adapted to evaluate students from other areas of health, namely pharmacy. In pharmacy education, OSATS is useful to assess competencies relative to isolated techniques and complete procedures, such as administration of vaccines, inhaler devices techniques, glucometer usage, blood pressure assessment, and individual medication preparation. Students' technical skills are evaluated according to task-specific checklists that should be performed during the procedures. In the student performance evaluation, the examiner also use a global rating scale and a pass/fail judgment. Although this method is costly both in terms of time and resources, it allows students' technical skills to be assessed in a feasible and effective way.

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