

PHARMACY EDUCATION AT UTRECHT UNIVERSITY: AN EDUCATIONAL CONTINUUM

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SUMMARY

The Department of Pharmaceutical Sciences (Utrecht University) has revised its curriculum since the beginning of this century. Change was inspired by a shift in professional profile of the Dutch community pharmacists and newer educational insights; the results of an external visitation also indicated the need for change. Chemical and biomedical aspects of drugs are treated in the 3-year bachelor-programme in integrated courses. During the 3-year Pharm.D.-programme students are prepared for a professional life in a patient- or product-oriented pharmacy practice setting. The Pharm.D. curriculum prepares students for a pharmacists' professional life, in which further education is a recurring requirement. The development of the required professional competencies is stimulated by using problem- and project-based educational methods. Problem-solving, communicative and metacognitive skills are entwined in the entire curriculum. In this way students are prepared for a life of life-long learning. At the same time a 2-year M.Sc. programme (Drug Innovation) was created to educate pharmaceutical researchers.

KEYWORDS

Curriculum development, problem-based learning, project-based learning, competencies

INTRODUCTION

Deprofessionalization in the area of pharmaceutical manufacturing and analytical quality control in community pharmacies and re-professionalization in the area of pharmacotherapy, pharmacovigilance and pharmaceutical care in both the community and hospital pharmacy, have led to a change in required competencies of pharmacy graduates, both in the USA (Hepler and Strand 1990) and in Europe (van Mil et al. 2004). In a written agreement between the KNMP¹

and the Ministry of Health the Dutch government has acknowledged the role of pharmacists as pharmacotherapeutic consultants for patients and prescribers. Pharmacists, in addition to medical doctors, are recognized as being jointly responsible (together with medical doctors) for the patient outcomes of pharmacotherapy (according to the WGBO-act²). This professional profile requires that – in addition to their content-specific knowledge – students should be trained

¹ KNMP = Koninklijke Nederlandse Maatschappij ter bevordering der Pharmacie: Royal Dutch Association for the Advancement of Pharmacy, the pharmacists' professional organization.

² WGBO = Wet op de Geneeskundige Behandelings Overeenkomst. This act regulates the relations between patients and health care professionals: general practitioners, medical specialists and pharmacists.

in communication and management skills. Furthermore, they should develop the attitude of a life-long learner (FIP 2000).

The development of a balanced curriculum for any study programme is not an easy task. The required contents, as well as the didactical insights are often changing in time gradually. This affects the didactical form, which needs to be used in order to turn out graduates, which are competent in the area of the particular study. Construction of an adequate programme is complicated for a Pharmacy curriculum (Kerr 2000, Stull & Carter 2002). The addition of pharmacotherapeutic responsibilities of the pharmacist requires the development of a balanced curriculum. According to the BIG-act³ the pharmacist is considered a specialist, which is held responsible for individual patient care. According to the Drug Act⁴ dispensing of prescribed drugs is a responsibility, *restricted* to pharmacists. Even though both community pharmacists and hospital pharmacists spend only a small part of their time preparing pharmaceutical dosage forms, they are held responsible for the quality of the drugs

dispensed, and the required competencies (drug production, analytical drug control) need to be incorporated in a new curriculum to a sufficient level. Consequently, the content of a Pharmacy curriculum needs great flexibility due to the continuous changes in medication policies and the students need to develop an attitude in which continuous (re)schooling is seen as a natural phenomenon.

The above-mentioned developments were also signalled by the Visitation Committee Pharmaceutical Education, which scrutinized the education programme in Utrecht in January 2000. This committee consisted of specialists in both the pharmaceutical and the educational area. Unfortunately, their findings were not very positive (**table 1**). As a consequence of their report a curriculum committee (CURC) was installed by the head of the Department of Pharmaceutical Sciences.

The CURC was composed of 6 faculty members from the department, 2 students and 3 educational specialists. With respect to the content of the curriculum, the mission was to combine newer tasks (based on the WGBO, see above) with the traditional pharmacists' responsibilities (based on the Dtug Act, see above). A more general problem was the development of a student-oriented, multidisciplinary, and competency-targeted curriculum, in contrast to the traditional curriculum, which was largely teacher-oriented, monodisciplinary and knowledge-targeted.

³ BIG = Beroepen Individuele Gezondheidszorg. This act regulates the responsibilities and obligations of professionals, which are involved in individual patient care.

⁴ Geneesmiddelenwet (Drug Act). This act regulates the supply of medicines.

Table 1. Summary of the findings of the visitation committee (January 2000)

- Disproportionate balance in the development of knowledge, skills and attitudes. The curriculum is largely knowledge-oriented.
- Use of educational methods, which are less effective according to modern standards.
- Weak internal coherence. Separate courses are given in isolation, without mutual interrelations.
- Limited orientation on the pharmacy profession. The student is unable to develop a professional attitude during the initial years of the curriculum.
- Clinging to a unitary pharmacy licence in which too little attention is paid to the recent shift from a product-oriented to a patient-oriented setting.

The CURC was commissioned to “Construct a curriculum that takes into account (the changes in) the pharmacists’ responsibilities and that uses modern educational methods”.

The first students entered the new curriculum in September 2001, obtained their bachelor’s degree in 2004 and became available on the labour market in 2007. The new Pharm.D. programme (see below) also started in September 2001, while the M.Sc. (Drug Innovation) programme started a year later. The quality of all programme elements is extensively monitored (Koster et al. 2007) and the quality was assessed by the QANU agency in January 2006 (B.Sc. and Pharm.D. programmes) and January 2007 (M.Sc. programme) on a large number of aspects, which relate to the content, the organization and the quality control of the programmes. The newly developed curriculum was found to be sufficient or good on all 21 aspects of the assessment (QANU 2006, 2007) and accreditation for the next period of 7 years was granted (Meijerman et al. 2007).

THE PHARMACISTS’ RESPONSIBILITIES AND COMPETENCIES

The CURC started by analysing the competencies, required for a pharmacist in the Dutch society. Representatives of the following organisations were interviewed: KNMP (see above), Association of Hospital Pharmacists, Association of Industrial Pharmacists, Medicine Inspection, UIPS (University Institute Pharmaceutical Sciences). These interviews confirmed the view that in community pharmacies the main tasks consisted of distribution of medicines in combination with patient-oriented pharmacotherapeutic activities. In hospital pharmacies product-oriented activities, such as (large-scale) production, chemical analysis, bioanalysis and toxicology keep playing an important role. In an industrial environment a wide variety of tasks is apparent: traditional pharmacy (production, analysis), registration, and pharmaceutical business-development.

The pharmacists’ tasks were also analyzed from an international (*i.e.* European) perspective. The European Council already stated in 1997 that both the pharmaceutical *profession* and the pharmaceutical *education* should be adapted to the increasing role of pharmacists as pharmacotherapeutic advisers.

The CURC considered that it would be impossible within a 6-year programme to prepare students for both the patient-oriented tasks and the product-oriented tasks at a sufficient level of professionalism. It was decided to implement 2 different profiles within the Pharm.D.-programme: a patient-oriented profile and a product-oriented profile. These profiles extend over 26 weeks in the 2nd and 3rd year of the Pharm.D.-programme (see **figure 1**). It was decided to focus on the training of a “basic pharmacist”, which is prepared for a role in the health care system. The following 4 primary tasks are considered essential for the “basic pharmacist”:

- I. *Pharmaceutical care*. This task involves all drug-related activities related to the treatment of *individual* patients, such as medication surveillance and providing individual drug information.
- II. *Medication policy*. This task involves all the aspects, which affect the rational and expenditure-conscious prescription and dispensing of medicines. The organization of pharmacotherapeutic consulting between pharmacists, general practitioners and medical specialists belongs to this primary task.
- III. *Production and dispensing*. This involves all tasks, which under Dutch law are exclusively reserved for pharmacists (see above).
- IV. *Pharmaceutical management*. This involves all aspects, related to the management of a high-quality (community or hospital-) pharmacy. Medical-pharmaceutical ethics plays an important role in this primary task.

These primary tasks are comparable to the learning outcomes, described for an USA-based Pharm.D. curriculum (Reiersen-Draugalis 2002). Our postgraduate curriculum in the Netherlands is called a master programme, but the intended outcomes (contents, skills, attitudes) makes it comparable to the Pharm.D. programmes in the USA and Canada (Koleba et al. 2006).

The CURC formulated final study goals, which must be met by the students before receiving their Pharm.D.-degree. In addition to study goals, related to the above-mentioned 4 primary tasks, study goals were formulated for the development of general academic, research and communication competencies of the “basic pharmacist”. A complete overview of the final

study goals can not be given in this paper, but two relevant remarks can be made:

- Final goals are formulated in terms of competencies and attitudes, rather than in terms of knowledge and capacities.
- A distinction is made in the level of competency, required for a Pharm.D.-graduate, for the area of the primary tasks I, II and III. For a student, who chooses the patient-oriented profile, the highest level of competency needs to be reached in area's I and II. The same applies for area III for a student who chooses the product-oriented profile.

EDUCATIONAL PRINCIPLES

The design of the curriculum derives from the primary tasks of a graduate, as described above. In addition, educational psychology and didactical aspects of effective educational programmes play an important role. In making choices, the CURC was guided by 7 educational principles (**table 2**). The extent of integration of knowledge, skills and attitude development increases as the curriculum progresses (*cf.* Kerr 2000, Stull & Carter 2002).

The specific knowledge of the "basic pharmacist" is placed in the area between

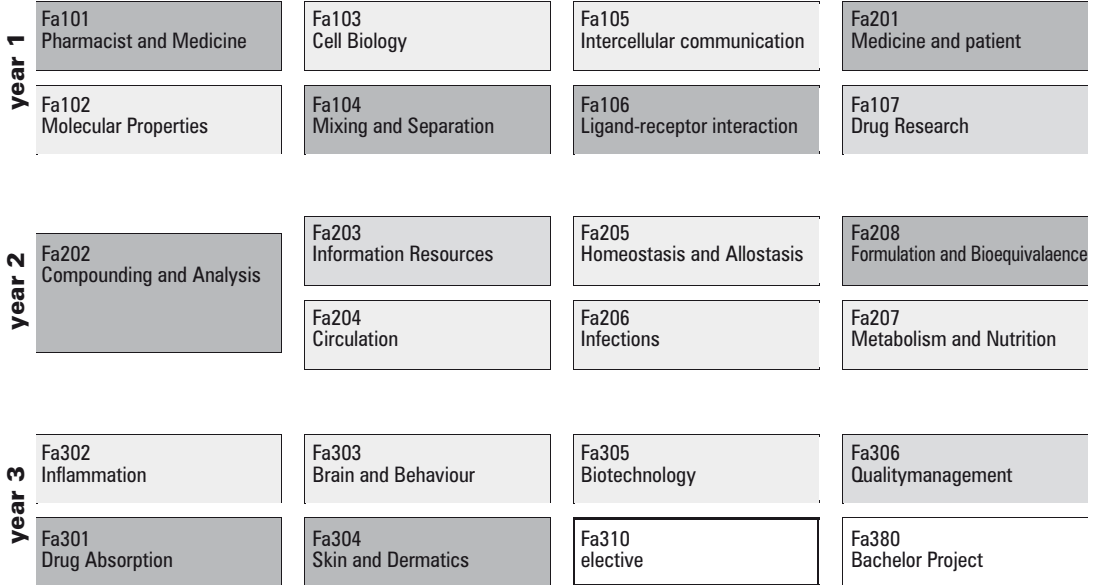
physicochemical sciences on the one hand, and biomedical sciences on the other hand. This means, that the professional knowledge, which has to be acquired, needs to be approached from both a patient-oriented and a product-oriented perspective. In the curriculum an important place is reserved for thematic courses (guiding principles 1 and 3). In these courses training and practicing of manual skills and communicative skills is organized and supported by "skills labs", where students are offered additional training facilities in order to achieve the required balance and relationship between knowledge and skills. A few methodological courses are organised in order to function as a scaffold, which can be filled by the students in subsequent thematic courses (see **figure 1**). Academic skills (academic writing, scientific presentations), which are characteristic for the pharmacy-curriculum, are developed by using problem-based and project-based educational methods and traineeships (rotations; guiding principles 1 and 4).

A pharmacy-graduate will lead a professional life that can vary from a patient-oriented to the product-oriented field. Therefore, during the bachelor phase the student is confronted with both aspects and is given the opportunity to choose the direction, which fit with his/her

Table 2. Didactic principles guiding the curriculum design

- The curriculum is designed as a coherent programme.
- The programme stimulates active study behaviour, is challenging and varied.
- Acquisition, application and integration of knowledge and skills take place in a context relevant for the future profession.
- Within the programme systematic and explicit attention is paid to the development of academic and personal skills and values.
- Direction of the learning process is gradually shifted from teacher to student.
- The programme enables students to follow individual interests by offering elective courses and a patient- or product-oriented profile.
- A well-balanced system of mentoring and assessment is used, which takes into account the steering effects of testing.

B.Sc.(Pharmacy) program



Pharm.D. program

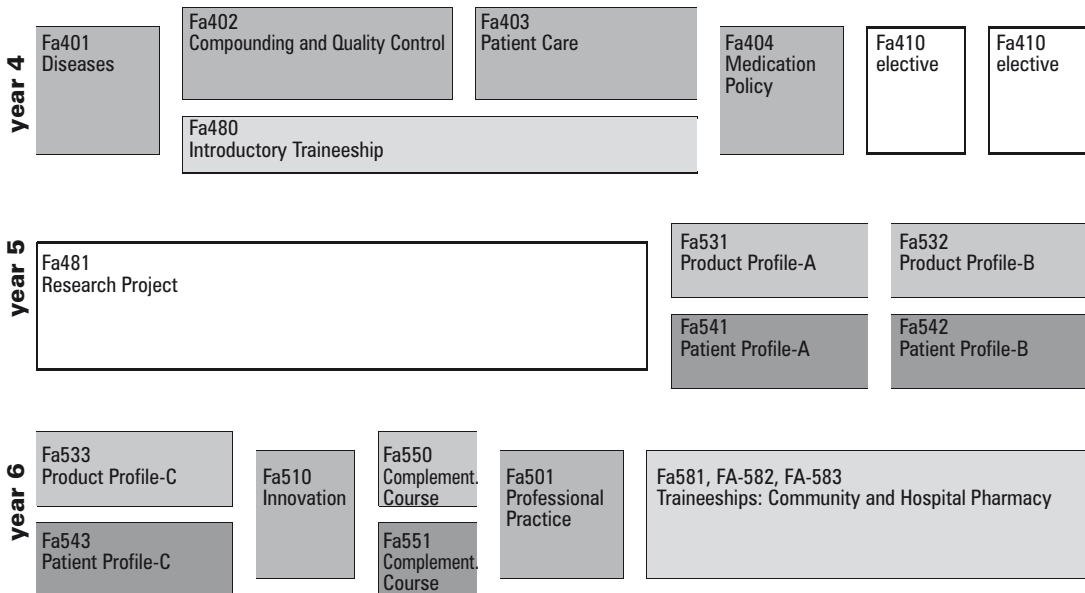


Figure 1: Schematic representation of the Pharmacy curriculum

preference (guiding principles 1, 5 and 6). A definitive choice for the patient- or product-oriented profile has to be made during the Pharm.D.-programme.

The curriculum is characterized by a concentric construction, in which the same subjects recurs a number of times. At each level the complexity and the degree of self-steering of the students increases (guiding principles 1 and 5). Three concentric levels are distinguished:

- The first year of the bachelor's degree. Two thematic courses and one methodological course and addition to biological and chemical basal knowledge.
- The second and third year of the bachelor's programme. Mostly thematic courses; a limited number of electives. Development of skills is context-related and monitored in the students' portfolio.
- The Pharm.D.-programme. Mostly integrated courses, a research project and rotations in public and hospital pharmacies. Teaching and assessment of skills are fully integrated.

In this sequence a transition is effectuated from a scientific into an integrative patient- or product-oriented approach. During the bachelor's phase an orientation on the professional life is made; the postgraduate phase is focussed on the acquisition of professional skills and attitudes.

Teaching methods are directed at the independent acquirement, application and integration of knowledge, skills and attitudes. Problem-based learning, project-based learning, and other forms of student-centered educational forms are used in order to make students familiar with ways of pharmaceutical thinking, decision making and acting, in which attention is paid to the necessary skills and attitude (guiding principles 2, 3 and 4). Development of skills and attitudes of individual students is documented by the students' portfolio, in which proofs of his/her progress are collected. During the bachelor programme the portfolio mainly records the development of practical competencies (oral and written communication, compounding, pharmaceutical calculations, laboratory skills, methodology, management) combined with the students' self-reflection on progress made. During the Pharm.D. programme the portfolio

requires reflective analyses on the pharmacists' role in a professional setting.

THE B.PHARM. CURRICULUM

The 1st concentric circle of the programme consists of year 1 (**figure 1**). In this year the transition from secondary education is effected by the basic courses 'Molecular Interaction', 'Cell Biology' and 'Intercellular Communication'. The thematic courses 'Pharmacist and Medicine' and 'Medicines and Patient' are each others mirror-images, in which pharmacy is approached from the patient-side and the product-side, respectively. The courses 'Mixing and Separation' and 'Ligand-receptor Interaction' concentrate on physicochemical and pharmacochemical concepts and techniques. The methodological course 'Drug Research' forms the base for a large number of experimental and research skills.

The 2nd concentric circle of the curriculum consists of year 2 and 3 of the bachelor's phase, in which the courses are mostly thematic. The choice of themes is largely governed by the diseases, which are relevant for a professional pharmacist. Based on the diseases' clinical picture, the physiology, anatomy, biochemistry and pharmacology are treated. In every course attention is paid to aspects of drug manufacturing, bioanalysis and pharmacotherapeutic principles with respect to the theme of the course. In the course 'Information Resources' student learn to handle the large number of available sources (text books, reference sources, scientific literature, CD-ROMs, internet). Within this course, the assessment of the quality of these sources is a particular goal. In year 3 the individual 'Bachelor Project' has to be chosen; for the majority of students this project involves writing a literature survey.

The B.Pharm.-degree can be obtained by the end of year 3 or as soon as 180 European credit points (EC) are collected. This degree entitles the student to enter the Pharm.D.-programme, or to enter the 2-year M.Sc.-programme 'Drug Innovation'. This programme is organised in collaboration with the School of Biomedical Sciences as of September 2002, and is also accessible for students with other B.Sc.-degrees.

THE PHARM.D. CURRICULUM

The Pharm.D.-programme lasts 3 years, in which 180 EC's can be earned; it forms the 3rd concentric circle of the curriculum. Courses in this phase of the programme are mostly thematic and prepare the students for a professional life in either a patient- or a product-oriented context. Electives, which are regularly updated, are used to pay attention to a state-of-the-art treatment of subjects, which are considered particularly new and relevant for the pharmaceutical profession.

Rotations (traineeships) are an essential part of the Pharm.D.-programme and aim at the functioning of the student in the environment of a public or hospital pharmacy. The first rotation (**figure 1**) is planned at the beginning of the Pharm.D.-phase in order to familiarize the student immediately with his/her ultimate working environment. This rotation is organized in parallel with the first 3 courses of year 4. In this way mutual interactions between practice (rotation) and theory (thematic courses) can be realized. A 2nd and 3rd rotation (in a community and/or hospital pharmacy) is carried out immediately before obtaining the Pharm.D.-degree. During the course 'Professional Practice' the Pharmacy game Gimmics® is implemented, in which groups of students run competing virtual pharmacies (Sillius & van der Werff, 2005).

Doing a research project is considered an important constituent of the Pharm.D.-programme. In this 6-month project the student must apply the multifarious academic skills, obtained during the bachelor-phase, in an individual pharmaceutical research project. This results in a research report (or a scientific publication in exceptional cases). Many students spend their research project time at universities abroad (especially USA, Canada, Australia, UK are popular).

After six years the Pharm.D.-degree can be obtained, which is also a licence to work as a pharmacist. This degree will also give the student the opportunity to specialise even further (*e.g.* in hospital pharmacy), sometimes combined with the pursuit of a Ph.D. degree.

THE M.Sc. (DRUG INNOVATION) CURRICULUM

Besides the Pharm.D. program, a 2-year M.Sc. program Drug Innovation was initiated in 2002. This program aims to prepare students for a research career in the pharmaceutical field or a career in drug regulation. Students who have obtained a B.Sc. degree (in pharmacy, chemistry or biomedical sciences) can apply and follow this highly individualized track, largely consisting of on-the-job training.

Just like the Pharm.D. curriculum, the educational approach of this program is to provide the students with academic skills and values to prepare them for life-long-learning within a relevant future profession. In this M.Sc. curriculum the acquisition, application and integration of knowledge takes place in a research context; the students participate in two projects in a research laboratory under guidance of Ph.D. students and faculty members. A major research project (51 ECTS) is carried out in one of the participating biomedical or chemical Research Institutes of the University. A minor research project (33-42 ECTS) can be done in the University or elsewhere in the country or abroad, but must be related to the field of drug innovation. In this way the professional skills, which are characteristic for their (sub)discipline are transferred effectively. The remainder of the program is filled with obligatory courses, optional master classes and seminars of the Academic Biomedical Centre. Finally, a master thesis is required (9 ECTS).

POST-UNIVERSITY EDUCATION

After having received the Pharm. D. degree, pharmacists can choose different kinds of professional careers and most of them find a job in community pharmacy, hospital pharmacy or industrial pharmacy. These different fields offer additional programmes in order to make specialisation possible. To become a registered specialist in community pharmacy practice ("community pharmacist") pharmacists have to work for 2 years in a community pharmacy, where they are supervised by a registered community pharmacist. At the same time the pharmacist has to attend several courses (in total 30 days/2 years) in the field of project management, human resource development and pharmacotherapy. To

become a registered hospital pharmacist, pharmacists have to work in a hospital pharmacy for 4 years, supervised by a registered hospital pharmacist. In addition to these requirements, the pharmacist has to attend monthly courses in the field of hospital pharmacy. Community and hospital pharmacies must have an educational licence before they are allowed to supervise beginning pharmacists. For registration as an industrial pharmacist two years of working in the pharmaceutical industry combined with four different courses are required.

In addition to this system of specialisation, pharmacists need continuously to be re-educated in order to hold their license for practising patient care. For hospital pharmacists every 5 years 200 hours of further education and for community pharmacists every 5 years 30 days of continued education are required for reregistration, apart from at least two days/week of pharmaceutical work. The departments of pharmacy of both universities in the Netherlands (Utrecht and

Groningen) are involved in the pharmacists' continuing education, by being a member of the governing board of the organizing institute as well as by offering courses to practising pharmacists.

CONCLUSION

In the past 10 years the educational spectrum, leading from secondary education to a pharmacists' professional life, was fully redesigned. A 3-year bachelor programme and 3 years postgraduate education (Pharm.D.) prepare students for a "life of life-long learning" in the professional environment of a community or hospital pharmacy or the pharmaceutical industry. During this trajectory the emphasis shifts from basic biomedical and physicochemical subjects to fully integrated professional activities, supplemented with courses and on-the-job training and supervision. All stages of this trajectory are subject to quality control and licensing procedures.

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TIIVISTELMÄ

Utrechtin yliopiston farmasian laitos on uudistanut opetussuunnitelmaansa vuosisadan alusta lähtien. Uudistustarpeeseen vaikuttivat Alankomaiden avoapteekkien henkilökunnan ammattikuvan muutokset sekä uudenlainen koulutusajattelu. Edellä mainittujen lisäksi myös laitoksella vierailleen ulkoisen arviointiraadin mukaan muutokselle oli tarvetta. Uudessa kolmevuotisessa kandidaattiohjelmassa käsitellään lääkkeiden kemiaa ja biokemiaa muihin kursseihin integroituna. Ohjelman aikana opiskelija perehtyy potilas- tai tuotelähtöiseen ammatilliseen toimintaan työelämässä, jossa täytyy myös syntyä valmius osallistua täydennyskoulutukseen. Vaadittavien ammattiin liittyvien kompetenssien saavuttamista tuetaan käyttämällä ongelmalähtöisiä tai projektityyppisiä opetusmetodeja. Ongelmanratkaisu-, viestintä- ja metakognitiivisten taitojen opettelu sisältyy kaikkeen opetukseen läpi koko koulutusohjelman. Tämä valmistaa opiskelijoita elinikäiseen oppimiseen. Samaan aikaan on kehitetty myös kaksivuotista maisteriohjelmaa (Lääkeinnovaatio) farmasian alan tutkijoiden kouluttamiseksi.