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Pharmacy Education: Towards Pharmaceutical Sciences

Organising an international bachelor test as part of pharmacy training

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Introduction: Pharmacy students at the University of Antwerp (UAntwerp, Belgium) are offered maximum opportunities for acquiring international learning experiences.

Material and Methods: In the framework of an elective course entitled 'Bachelor test: international internship' in the Department of Pharmaceutical Sciences at UAntwerp, a three-day visit to a foreign university is organised every year. This trip is meant for students in the third year Bachelor of Pharmaceutical Sciences and aims to stimulate student mobility and Erasmus exchange during the Master's programme. It also helps Bachelor students in choosing suitable Master's training offered at UAntwerp (Master in Pharmaceutical Care or Drug Development). A typical programme for such a visit includes (but is not limited to) some of the following elements: visiting a pharmacy faculty abroad; visiting local hospital pharmacy and community pharmacy; visiting a pharmaceutical company and participating in a mini-symposium where the students present English presentations about research themes that are being carried out in the Pharmacy Department of UAntwerp. Students of the foreign university are also welcome to give presentations so that there is sufficient interaction between both universities.

Results: More than half of our third year Bachelor students choose an international internship as part of their Bachelor test. Importantly, many students are encouraged by this initiative to carry out a Master's thesis or part of their pharmacy internship abroad during their Master's programme. The students and also an external review team were very positive about this international internship.

Conclusions: This concept is unique in Belgium and was introduced to give internationalisation within the Bachelor programme additional incentives. Solid language skills and adaptability to a constantly changing environment are important assets in pharmacy. An experience abroad is the ideal way to acquire these skills and thus has become an important part of pharmacy training at UAntwerp.

FIP Global Conference on Pharmacy and Pharmaceutical Sciences Education – a consensus framework to transform pharmaceutical education

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Introduction: In 2016, the International Pharmaceutical Federation (FIP) hosted a Global Conference on Pharmacy and Pharmaceutical Sciences Education in Nanjing, China with the goal of producing global consensus on the future of pharmaceutical education.

Materials and Methods: Eighty draft statements describing a future framework for pharmaceutical education worldwide were drafted and submitted to a first validation phase through an open consultation amongst academics, practitioners, professional organisations and regulators. From the 3,216 comments received from 31 countries, 70 statements were presented at the Global Conference for a second round of validation. During the conference, the statements were supported by the Nanjing Vision and Pharmaceutical Workforce Development Goals (PWDGs) designed as a roadmap for the impact of the statements on workforce needs. Workshops on PWDGs to implement the vision and statements were organised during the Conference. An online third validation exercise was undertaken for statements that did not achieve 80% consensus during the Conference validation process. During this exercise the country delegations were asked to state reasons for voting against the statements and based on these remarks rewording was considered.

Results: A consensus 80% vote of 36 country delegations was achieved on 64 statements at the second validation phase. The six statements not accepted were revised and consensus reached on three statements in the third validation phase resulting in 67 approved statements. Workshops resulted in agreement that the PWDGs were relevant, achievable, evidence-based, developmental and dynamic to serve as a framework for implementation of the Nanjing Vision and statements. The Nanjing Vision, statements and PWDGs have been published by FIP (nanjing2016.fip.org/key_outcomes) for all to use in transforming pharmaceutical education in their home countries.

The research internship in ‘Pharmacy’ and ‘Industrial Pharmacy’ degrees in the Italian university scenario: An analysis of Parma University

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Introduction: In the Italian university system, Master’s degrees in ‘Pharmacy’ and ‘Industrial Pharmacy’ are five-year courses, including 300 European Credit Transfer System (ECTS). Graduation is achieved by discussing a thesis, elaborated during a research internship in which the student participates at firsthand to a research project. This training activity is compulsory in the Industrial Pharmacy degree, and optional in Pharmacy. In both cases the research internship allocates 27 ECTS (675 hours), and contributes up to six points to the final score. Students may decide to carry out the internship working in one of the Department’s research laboratories, as well as in other public or private institutions, also abroad.

Material and Methods: Data were retrieved by searching the Parma University Library database and AlmaLaurea database; the research covered a five year period (2013-2017) and considered, among others, number of graduates, academic disciplines involved, language of the thesis manuscript, type of institution hosting the student during internship.

Results: In the period covered by the analysis, on average more than 50 graduates per year discussed a Master’s thesis derived from a research internship; notably, a relevant number of students who graduated in Pharmacy chose the research internship, although not mandatory. The majority of research activities were done at the Department of Food and Drug (formerly Department of Pharmacy) at Parma University, and only a small percentage of students spent the internship abroad, within Erasmus mobility. All academic disciplines were equally represented and the language mainly used for thesis writing was Italian; English was chosen in particular by students who did their internship abroad.

Conclusions: The present analysis underlines the lack of international experience for graduates; future candidates should be encouraged to take advantage of all the possibilities that international mobility offers. Additionally, the number of theses deriving from an industrial internship is still limited, even for Industrial Pharmacy students.

A core anatomy syllabus for pharmacy students: A Delphi study

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Introduction: The role of the pharmacist has changed from one that was traditionally based on dispensing to one that encompasses treatment, diagnosis and acting as the first port of call for patients. Given this seismic shift, it has never been more important for pharmacy graduates to have a strong foundation upon which to build their pharmacological knowledge - this includes anatomy. This study describes the creation of a core anatomy syllabus for pharmacy students.

Material and Methods: The Delphi approach was employed to seek consensus on which learning outcomes should be included in such a syllabus. A Delphi panel was constructed involving ‘experts’ (individuals from different professional backgrounds with experience of teaching pharmacy students anatomy). Members of Council and/or the Education Committee of the Anatomical Society nominated the panel members. The resultant panel had 34 experts. Using existing frameworks, the research team performed an initial screen of outcomes to remove outcomes that were obviously not applicable (n=10). The experts were asked in two stages to ‘accept’, ‘reject’ or ‘modify’ (first stage only) each learning outcome. A final formatting was performed by the research team to standardise presentation, make changes either to correct any anatomical or minor syntax errors

Results: In stage 1, 163 outcomes were presented to the Delphi panel. Fifty-three outcomes remained after stage 1 and 49 after stage 2. All learning outcomes achieved over 80% acceptance by the panel. The final syllabus consisted of 49 learning outcomes, each mapped to possible teaching content within an integrated curricula.

Conclusions: The syllabus offers a basic anatomical framework upon which pharmacy educators can build the necessary clinical practice and knowledge. These learning outcomes could be used to develop anatomy teaching within an integrated curriculum as per requirements of the professional bodies such as the General Pharmaceutical Council (GPhC) within the United Kingdom.

Health Technology Assessment (HTA) – new field in pharmacy education in Bulgaria

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Introduction: Health Technology Assessment (HTA) is a new scientific field in Bulgaria. There is a lack of qualified HTA experts both in government bodies and in the pharmacy industry. Since the legal regulation of the HTA process in 2015 there is an increasing demand for HTA training. The aim is to study the current situation of HTA training as a new field in pharmacy education in Bulgaria.

Materials and Methods: Survey of the available HTA courses for pharmacists in Bulgaria by 2018 was conducted. Options for HTA training in terms of graduate and postgraduate studies were identified.

Results: HTA training in Bulgaria is provided as part of degree programmes in the Medical Universities (MU) in Pleven, Sofia and Plovdiv. University training in HTA dates back to 2014. It was first introduced in MU-Pleven as a mandatory subject in the Master's programme in Public Health and Healthcare Management (PHHM). Since 2016 it has been included in the curriculum of Master's in Pharmacy (M.Pharm.) as an optional subject. HTA is an optional subject for Master's in Medicine in MU-Plovdiv from 2017, but it is still not available for M.Pharm. MU-Sofia started HTA training in 2015 with two optional courses 'Introduction in HTA' and 'Methods and tools in HTA' for Bachelor's and Master's in PHHM but not for M.Pharm. Since 2016, 'Introduction in HTA' is offered at postgraduate level. Postgraduate courses in HTA are provided by MU-Pleven, MU-Sofia, National Center of Public Health and Analyses, Center for Analyses and HTA, Bulgarian Association for Drug Information, etc. MU-Varna provides no graduate or postgraduate training in HTA. No doctorate programmes in HTA are available. There is no specialisation in HTA for M.Pharm.

Conclusions: There is an unmet need for HTA training for pharmacists in Bulgaria. Hence it should be developed in terms of creating new Master's and doctorate programmes.

New strategies for the assessment of competences during the internship period for pharmacy students

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Introduction: The implementation of a six-month traineeship in the studies of Pharmacy, poses a big challenge to the universities, especially in those with a big number of students. Our Faculty of Pharmacy has managed to implement a traineeship for more than 300 students including three months in hospital and three months in a community pharmacy. This requires a big effort, also to establish a methodology for the evaluation of the competences of the students. GexCat, a software to design and correct objective tests is being successfully used. The aim of this study was to include a deep analysis of the reliability of each item and of the test to refine the results.

Material and Methods: An objective test comprising 50 items was carried out by a sample of 120 internship students chosen at random for the study. CORRECTOR 1.2 software was used to analyse the overall reliability of the test calculating facility index, bi-serial punctual correlation and Cronbach's *alpha*. The test was refined eliminating the items that did not meet the minimum requirements of predictability and reliability. The influence of the refinement over the reliability and the final mark of the students was determined.

Results: Ten items not showing acceptable predictability were erased from the test. The new analysis provided better results of the overall performance of the test without provoking a dramatic modification of the final marks. Only around 14% of the marks experimented a modification out of the range $\pm 5\%$ and none of them was out the range $\pm 10\%$ of the original marks.

Conclusions: It was evidenced that the efficiency of the strategy presented here constitutes a promising alternative for the improvement of the qualification system to elucidate the competences of big groups of pharmacy students at the end of their internship period.

Pharmaceutical students' role in pharmaceutical education: The EPSA Methodology Booklet and the EPSA Lifelong Learning Platform

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Introduction: The European Pharmaceutical Students' Association (EPSA) represents European pharmaceutical students and recent graduates. The Methodology Booklet and the Lifelong Learning Platform (LLeaP) were recently developed to collect EPSA members' input and advice on teaching methods employed by European faculties of pharmacy and to motivate students to strive towards lifelong learning, respectively.

Material and Methods: In 2014, an anonymous Methodology Booklet survey, consisting of 49 closed and open questions, was launched and responses were collected through 2016. In 2018, a follow-up survey with 72 questions, based on feedback and responses to the previous survey, was launched to improve the quality of the collected data. The surveys touch on topics ranging from teaching techniques, soft skills and mobility, to possible unification of pharmaceutical education in Europe. LLeaP is an online interactive platform, accessible to all EPSA members.

Results: Over 500 pharmaceutical students from 25 European countries responded to the first survey and a higher number of responses from 37 current member countries to the follow-up survey is expected. Once the responses to both surveys are collected, they will be analysed, compared and published as a booklet. LLeaP will result in an increasing amount of students taking part in educational activities, and sharing opportunities and knowledge among them.

Conclusions: Students and educators have to strive towards the continuous improvement of the pharmaceutical education. The Methodology Booklet will prove useful to educators implementing new and improved teaching techniques and to students by motivating them to consider the importance and implications of their education. EPSA will aim to launch one Methodology Booklet survey every five years. LLeaP will allow students to exchange learning opportunities and share the knowledge by interacting with each other, resulting in students gaining higher levels of additional knowledge and taking part in different activities, thus simultaneously increasing their mobility.

Academic performance in first year of health sciences studies depending on the university entrance route

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Introduction: In Catalonia (Spain) the number of places for undergraduate admissions for health sciences studies in public and non-profit universities are around 5,700.

The aim of the present study was to compare the academic performance at university of first year students in our School of Health Sciences depending on their previous studies.

Materials and Methods: All the students enrolled in Pharmacy, Nursing, Physiotherapy or Dietetics at Ramon Llull University. The final two examination options attempts of the first year were considered in our study. Their outcome was compared based on the access route to university: a) baccalaureate; b) the more specific and practically oriented training (VET); c) students with a previous university degree; and d) mature students with direct access to university (specific exam for over 25 years of age).

Results: A total of 17,802 records were analysed coming from 1,864 students of the School of Health Sciences from 2009 to 2016. Sixty-four percent were female students, with their academic results after the first year at university being better than male students (6.7 vs 6.3, respectively). On average, 6% of the total students had a previous university degree, with 8% being in Pharmacy studies. Taking into account all the subjects of the four degrees of students coming from baccalaureate (n=1276), VET (n=427), other degrees (n=119) and mature students (n=42); the median (interquartile range) marks were 6.5(5.6-7.4), 6.4(5.5-7.4), 7.1(6.1-8.0) and 6.8(6.0-7.7) respectively.

Conclusions: Academic results in the first year at university of health sciences' degrees are almost identical among students coming from vocational education and baccalaureate, meanwhile significantly higher scores were obtained with students coming from other degrees.

Science-based courses in the curriculum at the Faculty of Pharmacy in Bratislava

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Introduction: The Faculty of Pharmacy in Bratislava decided, after changes in society in 1990, to discontinue the previous system of three pharmaceutical study branches. Instead, a united curriculum in Pharmacy is offered that gives students the possibility to specialise in the given framework of non-obligatory courses.

Material and Methods: The obligatory courses build the backbone to all aspects of general pharmacy education. They are accompanied by a choice of 50 obligatory-elective and another 10 elective courses, offered to students to give them the possibility to differentiate their curriculum based on personal skills, as well as on future career prospects. This way the students can deepen their knowledge in several scientific branches and/or come in contact with pharmacy professionals from within and outside academia. It is possible to gain one to four credits per course, according to the standard European Credit Transfer System (ECTS).

Results: The Faculty is proud to employ an expert group with scientific excellency in the fields of molecular modelling and drug design based on computational chemistry and quantum chemical calculations. This reflects in a range of science-based obligatory-elective courses that offer students a faculty-specific insight into the science of small drug-like molecules, their computer-aided design, study of physicochemical properties, structure-activity relationships, pharmacokinetic profiles, and biotransformation. The respective courses include: Principles of Molecular Modelling, Molecular Basics of Drug Development, and Pharmacokinetic Modelling in Drug Development. Another range of courses is provided by the Faculty in cooperation with experts from in- and outside academia (e.g. clinics, hospitals, industry, regulatory, authorities): Innovative Medicines in Pharmacotherapy, Basics of Regulatory Pharmacy, Promoting Public Health, and Health Technology Assessment.

Conclusions: The five-year Master's study curriculum in Pharmacy comprises obligatory, obligatory-elective and elective courses. A minimum of 300 credits is needed to complete the study, and 43 credits at least should be achieved in non-obligatory courses. The study is concluded by five state exams (finals) and a diploma thesis.

'Virtual Atlas of Natural Drugs' project funded by EAFP Partnership for Faculty Education and Research Grant

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Introduction: The European Association of Faculties of Pharmacy's (EAFP) Partnership for Faculty Education and Research (PFER) Grant is a year-long faculty development programme designed to support early career academics and researchers in attaining the next level in their education, research and leadership development. The grant is primarily intended to ease the start-up of new projects and to assist in the development of an effective collaboration.

Material and Methods: The University of Veterinary Medicine and Pharmacy in Košice (UVMP) as an institutional member of EAFP received a grant from PFER 2017. The University of Veterinary and Pharmaceutical Sciences Brno, Czech Republic (EAFP member institution from another country) is a collaborating partner. The aim of the project is to prepare a virtual atlas of natural drugs in three languages (Slovak, Czech and English), which will be published on the EAFP website. It should include a detailed macroscopic and microscopic description of the natural drugs, their parent plants or parent animals, the main content substances responsible for the drugs' effect, and the information about their use. The macroscopic and microscopic description of natural drugs will be complemented by a high quality photographic supplement.

Results: For virtual atlas preparation, the pharmacognostic collections of natural drugs available at the UVMP as well as the University of Veterinary and Pharmaceutical Sciences Brno are used. Pharmacognostic atlases are relatively few in number, they are poorly available and obsolete.

Conclusions: The creation of a new virtual atlas available on the internet will improve pharmacognosy teaching and provide better access to relevant and verified information for Slovak, Czech and foreign students, and for the general public.

Evaluation of clinical/communication skills of pharmacy students using objective structured clinical examination (OSCE)

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Introduction: Pharmacy education has undergone changes as it involves skill acquisition and practice development. As supported by its reliability and validity, Objective Structured Clinical Examination (OSCE) has become the standard for evaluation of clinical skills in pharmacy students worldwide. A pilot study on OSCE and their development and application for assessing competences among pharmacy students is described.

Material and Methods: A five-station OSCE was designed and implemented with key processes involving development of a blueprint serving as guideline; development and validation of stations according to the blueprint; design of dichotomous performance checklist/assessment instruments for stations; feasibility/pilot testing/rehearsals of stations; and to conduct the final examination. The competencies tested in OSCE included, *inter alia*, patient counselling and communication, identification and resolution of drug-related problems (DRPs) and literature evaluation/drug information provision.

Results: The study revealed students were better in performing patient counselling and identification/resolution of DRPs than in obtaining drug information. Implementation of OSCE among fifth-year students was technically feasible and allowed evaluation of clinical competences and communication skills. Preliminary results indicate that students feel the OSCE was well structured and assessed clinical/communication needed for a professional pharmacist.

Conclusions: OSCE is an important tool for assessment of entry to practice competency and complements traditional examinations.

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Interdepartmental approach to education and science as a tool of empowering students

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Introduction: Pharmaceutical Sciences are becoming more interdisciplinary at present. Knowledge of chemistry, biochemistry, biology, genetics, pharmaceutics and other fields of knowledge are necessary for a researcher and teacher; yet, the traditional pharmacy curriculum is still based on mastering separate courses, taught at specialised departments.

At the Faculty of Pharmacy in Brno, adopting an interdisciplinary approach is supported not only to provide new knowledge and publish it meaningfully, but because such an approach is to be taught to pharmacy students from the beginning of their training.

Materials and Methods: To facilitate this shift from traditional department-based teaching methods, we have set up a new facility. The Central Laboratories have become a hub of the Faculty; modern laboratories, concentrating on obtaining new equipment and state-of-the-art instruments. This in itself would not help the teaching process or promote research cooperation though; the key approach is to structure teaching particular courses to ensure that: a) teachers with different expertise share the lectures and especially practical classes; b) the courses utilise laboratory equipment so that the different stages of an experiment are performed throughout different lessons; and c) a system of teams assigned to different instruments has been set up, consisting of a core of experts with a student or a group of students joining the team when needed, learning the desired methods and passing on the knowledge. At the moment, there is a nuclear magnetic resonance team, an electron microscope team, and a group testing drugs on an artificial digestive system.

Results: During the four years since setting up the Central Laboratories, many students have in their time chosen one of the teams and trained in one or more of the instruments, bringing their fresh ideas to the process.

Conclusions: A new generation of pharmacists is slowly emerging thanks to this approach, guided by the best specialists toward a common goal – a pharmacist able to see the big picture before committing himself or herself to exploring a small fraction of it.

Pharmacogenetics as a tool for teaching precision medicine to pharmacy students

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Introduction: Pharmacy education has the potential to bridge the current gap between exponential growth in pharmacogenetic research and limited incorporation into clinical practice. Teaching precision medicine demands the integration of knowledge in the basic sciences, such as chemical analysis and genetics, with applied pharmacology, pharmacotherapeutics, toxicology, and regulatory sciences.

Material and Methods: A multiplicity of methods with clinically relevant examples are necessary to stimulate interest in the forthcoming generation of pharmacists for providing patients with the expected benefits of precision medicine. The case of amitriptyline is considered as prospective teaching material. An example of integrated pharmacy teaching is developed, considering the following aspects: i) analytical (determination of the metabolite to parent drug concentration ratio to understand potential correlations between polymorphic gene alleles of the drug metabolising enzymes CYP2D6 and CYP2C19 and metabolic phenotype); ii) clinical (treatment plan revision based on recommendations of gene/drug practice guidelines published by the Clinical Pharmacogenetics Implementation Consortium, a pharmacist-led initiative); iii) regulatory (implications of the level of harmonisation in pharmacogenomics guidelines and labelling).

Results: Pharmacy teaching, embracing science and practice, shall expound how the interpretation of pharmacogenetic data, as it correlates to blood levels, can support in exploiting the benefit of drugs. Specific sessions, targeting each of the implicated contexts, complemented by an overarching session, are proposed to outline implementable scenarios for using genotyping to translate biomarkers into personalised therapy.

Conclusions: The amalgamation of analytical, clinical and regulatory aspects to explore pharmacogenetics illustrates how effective curricular coverage of precision medicine may be advanced. This sets a pragmatic approach for transposing knowledge of the basic sciences to clinical practice relevance in modern-day pharmacy education.

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Compounding in hospital pharmacies - experiences of activating teaching methods

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Introduction: Constructive alignment is a pedagogical model to enhance quality of learning (Biggs, 2012); a coherence should be achieved between teaching methods, assessment and learning outcomes. At the present course, we have built various teaching and evaluation methods to make the learning outcomes a concrete goal to the students. ‘Compounding in Hospital Pharmacy’ is intended for third-year students and recommended to be completed before their internship at a hospital pharmacy. In addition, our exchange students are able to enrol via the practical exercises.

Material and Methods: The learning outcomes of the present course have been set according to Bloom’s taxonomy. The contents were planned together with the hospital pharmacists at Kuopio University Hospital. Various teaching methods were applied and after the course, anonymous student feedback was collected.

Results: Among Finnish students, the response rate was 73.8% (n=45) at 2017 and 74.2% (n=49) at 2016. The response rate of exchange students was 100% (n=11) and 69.2% (n=9), respectively. The students gave positive feedback of the various teaching and learning methods. For example, most of the Finnish students (2017: n=37, 2016: n=43) wrote that the learning diary promoted their learning and/or helped to reach the learning objectives during the lectures.

Conclusions: Based on the self-evaluation of the students, it seems the diverse teaching and learning methods selected for aseptic compounding (i.e. videos, group discussion, practical exercises and proficiency test) resulted in the highest feedback scores at 2017; the learning objectives were met well or very well (average 4.51 for Finnish and 4.36 for exchange students at scale 1-5, respectively). Considering the teachers’ perspective, the student-centered and flipped classroom methods were the most suitable to activate students during the course.

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Development of an online educational tool to enhance student learning in the Biochemistry course in the pharmacy curriculum

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Introduction: The Biochemistry course, a component of pharmacy curriculum, is essential to understand the endogenous targets for drug therapy and the rationale for drug design. There is considerable interest in the development and implementation of new technology in the classroom. Blended learning combines traditional classroom learning and electronic or mobile learning components into a hybrid form of learning.

The objectives of this longitudinal study were to develop and assess the effectiveness of a learner-driven online application to supplement the didactic curriculum in Biochemistry. The specific aims were: 1) assess students perception of level of difficulty of the course topics and methods that can be used to reinforce course material; 2) develop an online application; 3) assess student readiness to adopt an online application; 4) assess student perceptions of the value of the online application; and 5) compare student performance pre- and post-use of the application.

Materials and Methods: Carbohydrates, glycolysis, cell signalling, RNA, DNA and biotechnology were identified as more difficult topics. Tests and quizzes were requested for all topics. Flashcards, flash animation and 3D models were chosen for many topics. Prior to launch, 80% of students reported they are comfortable using the internet and willing to adopt an application that would support a didactic course. Validity and reliability were assured. Statistical analysis were performed using Predictive Analytic Software and Excel Statistics

Results: After the launch, more than 75% of students found the application valuable and reported the application helped them to perform better in the course. Students using the application performed better on quizzes and exams (2017 vs. 2016 cohort).

Conclusions: Results from this study demonstrate that online application developed with the input of the learner community is well received and may improve student performance in the course. Future studies will follow to assess the value of the application to a broader audience.

Pharmaceutical and Regulatory Strategies in Medicinal Products Development: An innovative Master's course

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Introduction: The Master Course in Pharmaceutical and Regulatory Strategies in Medicinal Product Development, fully delivered in English, is promoted by the Food and Drug Department of the University of Parma. The Master's is designed to prepare experts able to apply for R&D positions in pharmaceutical (both human and veterinary), cosmetic, medical device and food supplement companies. The professional positions for which the Master's course is intended are those of the manufacture and development, quality assurance, regulatory, medicinal products and medical devices.

Material and Methods: The Master's has a duration of one academic year and is fully delivered in English. The lectures (19 European Credit Transfer System [ECTS]), include regulatory strategies, pharmaceutical drug development and production of medicines. Two ECTS are dedicated to the development and implementation of students' skills in team-working. The Master's programme is completed with an internship in a pharmaceutical/cosmetic/veterinary/medical device company (35 ECTS) followed by the final examination (3 ECTS), where the students present the project developed during the internship.

Results: Frontal lectures are delivered by industrial experts on different fields. The pharmaceutical manufacturing part describes the manufacturing function within the wider scenario of the pharmaceutical industry in the world, approaching the significant challenges to manufacturers, engineering professionals and equipment suppliers. For the regulatory field, together with the conventional lectures, practical examples and exercises will help the students 'digest' the regulatory critical steps. Finally, 2 ECTS are dedicated to introducing students to typical company teamwork activities (problem solving, project management, innovation) and to communication. This part of the course is delivered by industrial managers.

Conclusions: This is the first Master's course in Pharmaceutical and Regulatory Strategies fully delivered in English in Italy to date. The Master's was established in the academic year 2017/2018, so data on student appreciation, industry opinion and job placement are not available yet, although the general impression of students and faculty is very positive.

Performance development of pharmacists in a workplace-based community pharmacy specialisation programme

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Introduction: In The Netherlands, pharmacists have to complete a two-year postgraduate specialisation programme to become registered as a community pharmacist specialist. The programme focuses on workplace-based learning and feedback in order to develop the seven predefined roles for community pharmacists based on the CanMEDS-competency framework. The aim of this research is to find out how these roles develop during the two-year training programme. Role performance was assessed by the pharmacists' supervisors.

Material and Methods: Pharmacists in training, who started the specialisation programme between January 2012 and September 2015, were evaluated every three months by their supervisors during the specialisation programme. The online performance evaluation questionnaire included a score (1 = insufficient, 2 = moderate, 3 = adequate, 4 = good) for each of the seven CanMEDS-roles (pharmaceutical expert, communicator, collaborator, scholar, health advocate, manager, and professional) as well as an overall performance score. For this research, scores were extracted from the online portfolios in August 2017.

Results: Evaluation data for all six time-points were available for 265 of the 341 pharmacists in the training programme. A gradual increase was seen for all roles during the training programme. After three months (T1) 19.5% of pharmacists received an overall 'good' performance evaluation. The lowest and highest percentage of 'good' performance at T1 was for the roles of 'manager' (13.4%) and 'collaborator' (35.5%), respectively. After 21 months (T6) 83.4% of the pharmacists received a 'good' overall performance evaluation. The lowest and highest percentage of 'good' performance at this time-point was for the roles of manager (61.1%) and 'pharmaceutical expert' (90.1%), respectively.

Conclusions: Performance on all seven CanMEDS-roles improved gradually during the two-year training programme, but the starting point, speed of growth and final performance for each role was different.

Comparison of learning outcomes and teaching methods used in pharmacy practice education in Poland

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Introduction: Due to the European Directive and the Polish law regulations, the Chamber of Pharmacists is obligated to issue the professional license to all graduates with a Master's Diploma in Pharmacy immediately after graduation. The curriculum content in pharmacy education is based on national regulation (Standard in Pharmacy). Most of the graduates with a Pharmacy Diploma will be employed in community pharmacy or hospital pharmacy, so education should be focused on improving knowledge and skills in the formulation, medication dispensing, pharmaceutical counselling and pharmaceutical care. The study aimed to analyse and compare those learning objectives (LO) and teaching methods used to achieve them.

Materials and Methods: The desk analysis was based on syllabuses and course descriptions, published on websites of faculties of Pharmacy in Poland. Among the 110 of LO defined in pharmacy practice area, about 55 are restricted to community and hospital pharmacy practice. We collected the syllabuses of all courses in which at least three of those community/hospital pharmacy LO were included. All ten faculties offering a Master's Diploma in Pharmacy were included.

Results: At all faculties (n=10) the courses on Pharmaceutical Care, Pharmacy Practice, and Clinical Pharmacy or Pharmacotherapy covered the LOs dedicated to community and hospital pharmacy. Most of the courses offered lectures and seminars/workshops/laboratories, the number of contact hours differed between 30 and 60 per course (3-5 ECTS per course). The most common teaching methods were presentation/films and case study method at workshops and laboratories.

Conclusions: All faculties offered courses on Pharmaceutical Care and Pharmacy Practice, but they differed in teaching methods and number of hours. Further analysis is necessary to assess if teaching methods could have an impact on the level of competence achieved by graduates.

Hospital pharmacy specialisation in Parma

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Introduction: To fulfil the increasingly important role played by pharmacists as partners in the efficient use of the healthcare resources in an environment with high levels of risk and innovation such as the hospital pharmacy, professionals with specific competencies going beyond the basic education (five years) for pharmacists are required.

Material and Methods: The Postgraduate School in Hospital Pharmacy, open exclusively to graduates in Pharmacy and Pharmaceutical Chemistry and Technology, has been offered in Italy since 2008. The four-year course comprises face-to-face lessons (72 European Credit Transfer System [ECTS] units) and professional training experiences in hospital departments and territorial healthcare units (168 ECTS). The course aim is to provide students with expert knowledge and skills necessary to undertake aspects of clinical pharmacy, dispensary and drug distribution, administration and drug management, aseptic compounding, pharmacoconomics, pharmacovigilance and medicines/medical devices information. The health-system network connected with the Postgraduate School of the University of Parma comprises the Unit of Servizio Farmacia e Governo Clinico del Farmaco and the Pharmaceutical Departments of Parma and Piacenza healthcare unit districts.

Results: Every year three specialising students are admitted. Intensive practical experiences are gained by each student under the expert guidance of an assigned tutor in the structures of the health network. Practical experiences in European countries are supported within the Erasmus+ programme (e.g. at the Hospital Pharmacy of George Pompidou Hospital in Paris and at the Apotheke des Universitätsklinikums of Leipzig). Up to now 15 hospital pharmacy specialists have completed the course. They all have stable positions in hospitals and healthcare units in our region. In the current year six specialising students are attending the course in the first and second year.

Conclusions: The course is based on a valid educational project and represents a useful tool to intensify the relationship and exchanges between our University and Italian and foreign non-academic health structures.

Teaching topics in pharmaceutical care as a way to develop useful and practical research in community pharmacy

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Introduction: The professional philosophy of the correct, rational and economical use of medicines by patients and by society begins as a focal point-of clinical pharmacy. In the 1990's, some European countries developed this concept to provide support to the guidelines oriented to pharmaceutical care. In Portugal, a law established in 2007 (D.L. 307/2007, 31st August) gave the pharmacist the responsibility not only to dispense medicines but also to assist patients in obtaining the maximum benefit from their medication when interacting with health professionals, for improving their quality of life. With this purpose, the Faculty of Pharmacy oriented teaching topics and student learning methods to these. The final course appraisal is supported in a thesis, presented and discussed with a school jury. The student acquires knowledge on research and practical pharmaceutical care.

Material and Methods: Five student dissertations carried out in community pharmacies which were awarded the highest marks were identified. They were: 1) Follow-up of diabetic patients; 2) Cardiovascular risk evaluation; 3) Medication review on elderly patients; 4) Information on the interaction with anti-inflammatory non-steroid medicines; 5) Patients compliance with antihypertensive treatment.

Results: The results obtained provide positive details on the efficiency of our purpose. The latter can also be measured by the final marks obtained by the students and by the attributed marks from supervisor pharmacists where the work was developed and the patients recruited.

Conclusions: The patient-centred pharmaceutical care service is a formative requirement and the need in education is increasingly justified by the evidence in the services provided towards pharmaceutical care. Information on medicines, monitoring of health status, reviews of medication, pharmacotherapeutic follow-up in specific pathologies, collaboration with other health professionals in other structures providing healthcare are essential for better treatment and better health. The students learned a useful and practical approach to pharmaceutical care.

Use of learning portfolio for self-directed learning in pharmacy education

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Introduction: Portfolios are important tools for promoting reflective practice and self-education. Portfolios allow the student to build a database of theoretical or practical experiences, self-assess acquired knowledge and use that for further studies or future employment. The aim of this study was to evaluate how e-portfolio could be used as a tool to promote and support independent and reflective learning in pharmacy education.

Materials and Methods: Social pharmacy and drug safety (SPDS) I is a six European Credit Transfer System (ECTS) course taught for 4th year pharmacy students. To encourage independent and self-directed learning, students (n=22) filled in a structured e-portfolio every week at or after learning activities. They documented individual reflections, group discussions and other assignments in a special e-learning platform. Students were asked to complete a self-assessment of ability-based outcomes at the end of the course. In addition, a questionnaire was applied to collect students' feedback towards e-portfolio as a tool for documenting and assessing student-learning outcomes.

Results: Results demonstrated students' satisfaction with use of a structured e-portfolio providing a more flexible study environment. Students preferred to work independently with different assignments every week instead of having tests several times per course. The reflection assignments and group discussions on urgent daily topics guided them to constructive and analytical evaluation of acquired theoretical knowledge. Building up and use of e-portfolio was easy for most of the students.

Conclusions: The e-portfolio was an efficient tool to guide students in self-directed experiential learning and provided possibility for self-assessment by ability-based outcomes. Students appreciated increased independence and flexibility in the learning process and assignments which supported efficient linking of theoretical and practical knowledge.

Pharmaceutical sciences in an integrated pharmacy curriculum: A critical reflection on a gastrointestinal health module

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Introduction: Integrating pharmaceutical science and clinical concepts is an important challenge for the increasing numbers of faculty involved in designing or delivering integrated curricula. When designing the Royal College of Surgeons in Ireland (RCSI) integrated curriculum, individual disciplines (including pharmaceutical sciences) were strategically combined with the goal of creating an improved learning opportunities for students. The first fully integrated systems-based module was the six-week gastrointestinal health module.

Material and Methods: To achieve a high level of integration a number of innovative approaches were developed. Approaches included case drugs and video-based case patients, as well as laboratory sessions on diverse topics including taste and powder dosage forms. The impact of these innovations were formally evaluated by students at the end of the module, and the perspectives of faculty were obtained. These data formed the basis for a critical reflection on how pharmaceutical sciences were incorporated in the gastrointestinal module.

Results: Students reported that the case drugs and video-based case patients helped them make connections between the subject matter within the module, as well as between the gastrointestinal health module and other modules. They also reported that they felt there was good consistency in information provided by different disciplines. The Faculty felt that the innovations had provided good opportunity to integrate pharmaceutical sciences with the clinical and life sciences concepts, and that pharmaceutical sciences were appropriately represented in the module rather than being reduced or marginalised as originally feared.

Conclusions: Developing integrated curricula provides an opportunity to demonstrate the strong links between pharmaceutical sciences and clinical concepts and improve student learning. In the RCSI experience, innovative approaches such as case drugs, video-based case patients, and novel laboratory practicals were positively evaluated by students and faculty as an approach to strengthen the integration and retain core pharmaceutical sciences material, and should be considered by those wishing to develop similar curricula.

Academic performance of pharmacy students in elective courses at Alcalá University

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Introduction: Pharmacy students at the University of Alcalá must cover 24 European Credit Transfer System (ECTS) credits through elective courses. There are 15 four ECTS courses grouped into two sections. Those taught in Autumn are oriented to the clinical field whereas an industrial focus is addressed in Spring. Students can either complete six elective courses of a single orientation, combine courses from both sections and/or do eight or twelve ECTS internship modules. Since it is a free choice activity, it is interesting to assess the preference and academic performance of students in order to adapt the offer.

Material and Methods: Assessment results and markers of academic performance in academic year 2016/2017 have been analysed considering the students enrolled and submitted for evaluation. Additionally, a short survey was introduced to identify the reasons behind the choice.

Results: There is a preference for the clinical field as shown by the average number of students enrolled (51 vs. 16.3). Professional interest or job placement was behind 77.3% of cases. Others were conditioned by the teaching period, compatibility with scheduled activities, expert qualification or the decision to mix courses from both sections. Concerning academic performance, 99.2±2.0% of students enrolled in industrial-related courses passed in the first call against 93.2±8.9% in the clinical field. However, 91.2% of those enrolled in the former attended the ordinary call compared to 98.9% in the latter. Globally, the results suggest a slightly higher advantage in the clinical branch (97.9±2.0% vs. 94.6±4.6%).

Conclusions: The overall academic performance in the Pharmacy degree is 81.3% suggesting that the interest of the student and the maturity reached at the end of the degree are associated with better academic achievements in electives. However, results presented in this abstract cannot be considered representative of a consolidated pattern and preferences should be assessed from year to year to draw consistent conclusions.

Advanced pharmacy curriculum development in Ankara University Faculty of Pharmacy

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Introduction: In this study, the process of development of an Advanced Curriculum Programme (ACP) of Ankara University Faculty of Pharmacy will be discussed. ACP includes the advantages of the Faculty of Pharmacy of the University of Ankara other than the core curriculum.

Material and Methods: This work constitutes the material of the core curriculum Faculty of Pharmacy determined in Turkey and Learning Outcomes of the Ankara University Faculty of Pharmacy. Core Curriculum Programme (CCP) of pharmacy education was accepted by the Turkish Higher Education Council on 23 December, 2015 in Turkey. CCP was aimed to establish a general framework for pharmacy education in Turkey. After the acceptance of the CCP, a joint book was published by pharmacy faculties of Ankara, Anadolu, Istanbul University which consisted of tables that showed how to lecture the competencies of CCP. According to CCP, the ACP studies began with consulting a specialist in the field of curriculum development at the Ankara University Faculty of Pharmacy. First, the vision and mission of the faculty were defined. After that, the faculty members of the ACP committee discussed the issue with their own departments and set out the competencies necessary to form the ACP in the context of vision and mission. In the second stage, ACP was sent to the academics to check the vertical and horizontal appropriateness of the curriculum and ACP was finalised with the feedback.

Results: New competencies about pharmacy policies, drug research and development, scientific research topics have been added to ACP. In addition, a variety of attachments have been made to existing competencies in the CCP, and ACP started to be implemented in the first semester of 2017-2018.

Conclusions: In the future, it is aimed to increase the quality of the education with the feedback received from the students, academics and other stakeholders of education.

Opinions of undergraduate pharmacy students about simulation-based assessment used in patient counselling course

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Introduction: The aim of the study was to evaluate undergraduate pharmacy students' perceptions regarding simulation-based assessment methods used in a patient counselling course. Simulated patients were used to assess students' counselling skills.

Methods: At the end of course students were provided with a feedback questionnaire related to simulation-based assessment to obtain their views and comments. The first part of the questionnaire was prepared to obtain students' views about assessment using open-ended questions. Second part consisted of statements in a 5-point Likert scale. Thematic analysis was conducted to evaluate open-ended questions. Additionally, basic descriptive statistics were used to characterise frequency of data.

Results: Many of the students (86.4%) regarded simulation-based assessment as a fair way to assess counselling skills. On the other hand some of the students (11.4%) expressed that being assessed on their performance with a patient caused excitement and so this way of assessment was not suitable for them. Some indicated that simulation should be used not only for assessing but also during education.

Conclusion: Although there were some challenges, students appreciated simulation-based assessment improved their knowledge, skills and confidence.

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Participative learning tools for 'Pharmacology and Pharmacognosy' and 'Phytotherapy' subjects in the degree of Pharmacy

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Introduction: Recent surveys among Pharmacy students at the University Complutense of Madrid (UCM) revealed the lack of transversal abilities acquisition which is reflected as a negative efficiency, particularly the lack of autonomous or team activities intended for oral presentations. Previous projects carried out by this team of professors achieved high student participation, with a quite positive final evaluation. During the last year, a web space was developed as an efficient learning tool, for the correct use and communication among students. Nonetheless, the need for improvement in the transversality of knowledge is still detected: the student should be able to learn one concept and then to relate it to the rest of the knowledge previously acquired and related to the professional scope. 'Pharmacology and Pharmacognosy' and 'Phytotherapy' are two compulsory subjects within the Pharmacy degree at the UCM for which the main transversal abilities are: to elaborate and write scientific reports; to demonstrate critical and self-critical reasoning; and to improve ability for working in multi-disciplinary groups, among others. Thus, the need for new learning tools aimed to improve these new abilities, is crucial.

Material and Methods: A web space within the UCM was adapted to help students to design and develop different kinds of oral presentations presented by the students and referred to the subjects 'Pharmacology and Pharmacognosy' and 'Phytotherapy'.

Results: The main results were reflected in presentations in video format which were shared among all the students within this academic course through a web space, with the aim of improving self-communication abilities and discussing arguments. The presentations included clinical practice cases with possible solutions; pharmaceutical care in the pharmacy; qualitative and quantitative analysis of raw material of vegetal origin.

Conclusions: Both the students and professors comments reflect the most positive consideration for these kind of activities, which in turn allowed the students to obtain higher final qualifications.

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Evaluation of the impact of team-based learning (TBL) on student performance across terms, in a fully integrated pharmacy curriculum

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Introduction: Recent Sussex Pharmacy was established in 2016 with an ethos of enhancing and transforming the student learning experience. The teaching team aims to engage students as learners by creating a dynamic learning environment that immerses students in deep thinking in a team-based learning (TBL) environment. This study aimed at evaluating the impact of TBL on student performance across two terms (December 2016 and May 2017).

Material and Methods: During a TBL session, students complete individual readiness assurance tests based on lectures and assigned study material. Tests are retaken within their formally designated teams using the 'Immediate-Feedback-Assessment-Technique', conducted in a dynamic-interactive-learning environment. Students receive immediate feedback whether the answer is correct, or incorrect, since students continue answering the question until they get it right. Individual student performance was assessed using a combination of individual, team and peer scores in term one and two. *Chi-square* for goodness of fit was used with categorical variables, Wilcoxon-signed rank test for the total scores obtained by students. The analysis was conducted using SPSS version 23.

Results: Thirty students completed the first year: 63% were female and 37% male ($p=0.14$). Three age groups were identified, 18-20 (66%), 21-25 (23%) and over 25 (10%) ($p<0.01$). Fifty-seven percent had a UCAS entry point score above 300. Twenty-nine were classified as home students and one overseas. In term one the median total score achieved by the students was 69.5 (IQR 62.5-74.3), in term two, 76 (IQR 71-80). A strong statistically significant difference between the median scores was found ($p<0.001$). Forty-seven percent of students achieved a score between 70-100 in term one; increasing in term two to 87%, showing a percentage increase in performance of 85%.

Conclusions: Results indicate that TBL enables students to improve their performance across terms. Further research is required to assess the sustainability of this improvement.

Changes in pharmacy curricula in Portugal after the Bologna process

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Introduction: The evolution of the pharmaceutical sciences course curricula over the years is intended to optimise the curricula to the new skills and competencies that are needed by the profession as it adapts to the new times and circumstances. The Bologna process was both a challenge and an opportunity and forced Pharmacy schools to adapt to a new reality, a situation that they used to implement substantial changes.

Material and Methods: Portuguese Pharmacy Schools Curricula from before and after Bologna were compared using the Pharmine subject areas classification plus practical contact periods. Where curricula had already changed after the Bologna process, that fact was noted and the latest version was considered. Three different academic pharmacists classified courses into different subject areas. Averages between different schools were calculated and differences were then analysed by comparing the relative importance in hours for the subject areas.

Results: After the Bologna process implementation, a trend could be observed of a diminution of the relative number of hours of Chemical Sciences, Physical and Mathematical Sciences, and Pharmaceutical Technology whereas an increase of the number of relative hours for Medicinal Sciences, general competencies and practical contact periods was found. The other areas of the Pharmine classification remained stable. It could also be observed that diversity between the curricular plans of different schools increased significantly after the Bologna process and that more optional courses are now offered to the students than before.

Conclusions: The changes that were made after the Bologna process reflect the trends in the Pharmacy profession of an increased focus in the medicinal sciences and in the patient and the societal demand for general competencies and soft skills. The increase in practical contact hours reflects the fact that the Pharmacy degree changed from 11 to 10 semesters while maintaining one semester for practical contact.

Development and evaluation of research seminars for postgraduate Doctorate in Pharmacy students

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Introduction: The Department of Pharmacy at the University of Malta offers an international three-year postgraduate Doctorate in Pharmacy programme in collaboration with the University of Illinois in Chicago. Students undertake applied research projects in the second and third year as part of the dissertation requirements in the programme. Research seminars have been designed to help students in writing, editing and presenting their research. The aim was to develop and evaluate research seminars for second year doctorate students.

Material and Methods: Six research seminars were developed and conducted over a three-month period (November 2017-January 2018) with the eight students currently in the second year of the programme. Topics covered included 'Proposal writing', 'Referencing', 'Applying for ethics approval', 'Writing scientific reports', 'Editing scientific reports' and 'Presentation skills.' At the end of the sixth seminar, students were asked to rate ten statements regarding the content and delivery of the seminars, on a 5-point Likert scale from 'Strongly agree' to 'Strongly disagree'. Students were asked to indicate the seminars which they found the most interesting and to include any additional comments or recommendations.

Results: All eight students (four males and four females, age range 24-48 years) completed the evaluation. Six students were Maltese, one student was Italian and one student was Spanish. All students agreed that the content of the seminars met their expectations, the seminars helped to enhance their knowledge and research skills, the seminars were well-organised, their participation was encouraged during the seminars and that delivery of the seminars was intellectually challenging. All students stated that they would recommend these seminars if given a choice.

Conclusions: The research seminars are designed to help students to improve their research and writing skills. The research seminars were positively evaluated by the students and will continue to be held on a regular basis.

Table I: Student Evaluation (N=8)

NUMBER OF STUDENTS					
STATEMENT	SA	A	NS	DA	SD
Titles of the topics reflected appropriately what was covered during the seminars	8	0	0	0	0
Seminars were understandable and stimulating	6	2	0	0	0
Quantity of material presented was adequate	6	2	0	0	0
Seminars were delivered using appropriate media	8	0	0	0	0