

INSTRUCTIONAL DESIGN AND ASSESSMENT

Curriculum Reform in Finnish Pharmacy Education

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Objective. To improve pharmacy education through integrating theory and practice, coherent constructively aligned course entities, and enhanced deep-level learning.

Design. The reform was conducted collaboratively with faculty and staff members, students, and stakeholders in pharmacy. The curriculum, syllabus, and teaching methods were assessed through evaluations and research, conducting core content analyses, and measuring the workload of pharmacy education courses. The new curriculum, launched in August 2005, consists of 6 strands, comprised of different courses which run through the entire program.

Assessment. Three years after the introduction of the reformed curriculum, the results of the reform are being evaluated. Ongoing assessments of teaching and learning will reveal how the education at the faculty level has developed since the reform. These assessment procedures are an integral part of the faculty's quality assurance program.

Conclusion. The integration of practical training and theoretical studies was improved with personal study plans introduced to enhance students' learning.

Keywords: curriculum, pharmacy education, Bologna process, Finland, curriculum reform

INTRODUCTION

European ministers of education signed the Bologna Declaration in 1999¹ to create a European Higher Education Area (EHEA) by harmonizing the structures of European university degrees, improving the transparency of the degrees, and promoting mobility and cooperation throughout Europe. At the same time, student-centered learning and the shift from knowledge transmission to enhancing students' knowledge became more emphasized in higher education.² To achieve optimal learning outcomes, the focus of curriculum design lies in the learning process, not only in the content of the curriculum, lectures, assignments, and practical periods. Constructive alignment combines a student-centered focus in teaching, alignment among curriculum objectives, teaching, and learning activities, and the assessment of the process and its outcomes.^{3,4} Content, teaching, and assessment methods should foster deep-level learning, and achievement of the objectives of the curriculum and individual study courses.

While higher education is based on arts and sciences and can be considered theoretical, graduates must be prepared for professional practice in diverse and constantly developing settings.⁵ As pharmacists practice in a variety of settings, eg, community and hospital pharmacies, regulatory and other authorities, the drug industry and research, pharmacy schools and colleges are challenged to prepare students to confront these multidimensional, dynamic forces in society. Thus, pharmacy graduates must commit themselves to lifelong learning and continuous development after graduation, as identified by the World Health Organization (WHO) and the International Pharmaceutical Federation (FIP), to meet the requirements of an evolving society.⁶ Furthermore, practicing as a pharmaceutical expert requires the ability to think analytically, clearly, critically, and to interpret scientific evidence. Curriculum design and teaching practices influence the development of scientific thinking and lifelong learning skills,⁷⁻¹⁰ and thus were considered essential attributes when developing the educational curriculum of future pharmacists.

In Finland, the Bologna Process was led by the Ministry of Education. The curriculum reform process of the Faculty of Pharmacy, University of Helsinki, Finland, was viewed as an opportunity to develop pharmacy education to reflect modern concepts of learning and

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teaching in higher education. The reformed bachelor's and master's degree programs were launched in August 2005 and 2006, respectively, after developing the curriculum by: combining courses and forming larger coherent entities, improving the integration of theory and practice, and fostering deep-level learning.

In accordance with the Bologna Declaration, the Finnish Ministry of Education instructed colleges and universities to adopt the 2-cycle degree system and the European Credit Transfer and Accumulation System (ECTS) by August 2005.¹¹ The 2-cycle system enables students to obtain a 3-year bachelor's degree and continue with a conditional 2-year master's degree. The University of Helsinki complied with the instructions and provided further directives for its faculties and departments.^{12,13}

Prior to the Bologna Process, pharmacy education in Finland consisted of a 3-year bachelor of science in pharmacy degree and a 2-year master of science in pharmacy degree to be completed after the bachelor's degree. At the University of Helsinki, the Faculty of Pharmacy accepts approximately 140 students annually for the bachelor's degree program and 55 for the master's degree program.¹⁴

Nationally, the 3 Faculties of Pharmacy at the Universities of Helsinki, Kuopio, and Åbo Akademi reached a consensus with the goals for the BSc and MSc degrees in pharmacy (Appendix 1). In addition, the Directive 85/432/ETY outlined European pharmacy education at the time of the reform.¹⁵ Since October 2007, the Directive 85/432/ETY has been repealed and replaced by the Directive 2005/36/EC on the recognition of professional qualifications.¹⁶

The bachelor's and master's degrees, designed to prepare students for professional practice, include 6 months of practical training in a community or hospital pharmacy. The reform added elective courses to the bachelor's degree. The master's degree aims at developing further the students' scientific skills and includes a 5-month research project at the end of the degree. In Helsinki, the fourth year (first year of the master's degree) has consisted traditionally of compulsory courses, while during the fifth year, students conduct advanced studies in the discipline of their choice. In Finland, graduates with the bachelor or master of science in pharmacy are eligible to practice as pharmacists, however, only pharmacists with a master's degree may own a community pharmacy.¹⁷

In addition to the Bologna Process, education at the Faculty of Pharmacy has been enhanced continuously based on needs arising from external and internal evaluations.¹⁸⁻²¹ For example, in the 1990s, the number of pharmacy practice-related courses, such as pharmacotherapy, was increased, and more student-centered teaching methods and problem-based learning were applied to the curriculum.

The objective of our study was to describe the curriculum reform process and give a preliminary assessment of the results of it.

DESIGN

In 2004, the contents of individual study courses and the entire bachelor's and master's degree programs were evaluated utilizing core content analyses.^{11,12} Core content analysis was used to evaluate the content of degrees, modules, or courses, to identify unintentional overlapping, and to assess the workload of the curriculum. Teachers responsible for each course defined the contents into 3 categories: core contents (must know), additional contents (should know), and special contents (good to know), with the core contents providing the essential scientific or practical competencies. In addition, the goals of the courses, appropriate teaching methods, and possible overlap were assessed. Based on the assessments, courses were categorized to form larger coherent entities, ie, strands (Table 1), that would support the achievement of the goals of the curriculum reform.

Evaluation of Teaching and Learning

Based on evaluation and pedagogic research of teaching and learning at the Faculty, the curriculum, syllabus, and teaching methods were accessed.¹⁸⁻²¹ Studies showed that students found the previous curriculum fragmented and considered the theoretical studies challenging. Trends of surface-level learning also were demonstrated which was manifested in fact memorizing and difficulties knowledge application by the students.¹⁹ The 6-month practical training enhanced students' deep-level learning and facilitated linking theoretical studies with practice.²¹ However, the quality of precepting in different pharmacies was reported to vary.²⁰ An international evaluation panel also suggested that the 6-month experiential training should be utilized in the curriculum more effectively.¹⁸

The commitment of the entire organization has been emphasized as a prerequisite for successful education

Table 1. The Strands of the Reformed Bachelor's Degree are Spread Over 3 Years (ECTS = European Credit Transfer and Accumulation System)

Strand	Name	ECTS
1	Scientific thinking and professional development	40
2	From molecule to drug preparation	56
3	Patient and medication therapy	40
4	Medicines and society	12
5	Interaction and communication	14
6	Optional studies	18

development.²²⁻²⁴ Thus, collaboration among teachers, and among teachers and students, was highlighted in the reform process. The curriculum reform was planned, organized, and supervised by the Studies Committee of the Faculty, chaired by the Vice Dean of Education. The Education Committee appointed a curriculum reform working group consisting of 1 member from each of the Faculty's 6 Divisions (Biopharmaceutics and Pharmacokinetics, Pharmaceutical Biology, Pharmaceutical Chemistry, Pharmaceutical Technology, Pharmacology and Toxicology, and Social Pharmacy) and 1 student member representing all students of the Faculty. In addition, a full-time planning officer was employed through funding from the Ministry of Education to coordinate the reform. While the working group and the planning officer coordinated the modifications, all Faculty personnel and students were encouraged to contribute throughout the reform process. For example, teachers contributed ideas for new teaching and assessment methods, reorganization of course content, and course scheduling.

Stakeholders in Finnish pharmaceutical settings were invited to participate in the curriculum reform to ensure that the courses would meet the requirements of the real world. In 2004-2005, the Faculty organized discussion panels for the students, teachers, and stakeholders, who included representatives from professional associations, community pharmacies, the pharmaceutical industry, and governmental authorities. Key elements of the reform were discussed, and issues raised were considered for further curriculum development.

Based on the assessment exercises, the following key issues were emphasized in the curriculum reform: improving the integration of theory and practice; forming coherent and logical course entities; and fostering deep-level learning.

The ECTS system for defining the workload and assessing the courses and degrees was implemented according to the requirements of the Ministry of Education¹¹ and the University of Helsinki. One academic year represents 1,600 working hours and grants 60 units. Half of the workload for each course was designed to be performed in contact with teachers, and the other half as independent study. Contact hours and independent study hours were calculated, compared, and adjusted in conjunction with the core content analyses, and the workload was matched with the ECTS units assigned for each course, strand, and degree.

ASSESSMENT AND EVALUATION

Reformed Curriculum Structure

The reform curriculum consists of a 5-year entity (master's degree) that includes the 3-year bachelor's de-

gree as an integral part. The reformed structure of the bachelor's degree consists of 6 broad study entities, known as strands, that are spread over the entire bachelor's program (Table 2).

Courses in the strands are designed in a continuum around the theme of each strand. Within the strands, teaching is provided collaboratively by multiple disciplines at the Faculty. One aim of this design is to help the students achieve a comprehensive understanding of

Table 2. Structure of the Reformed Bachelor's Degree (180 ECTS^a)

Strand		ECTS
1	Scientific thinking and professional development	40
	Introduction to university studies in pharmacy	4
	Practical training period	30
	Bachelor thesis and maturity test	6
2	From molecule to drug preparation	56
	Mathematics	3
	Statistics	2
	Basics of chemistry	3
	Organic chemistry	3
	Pharmaceutical chemistry, lectures, and laboratory classes	12
	Pharmaceutical technology, lectures, and laboratory classes	16
	Pharmaceutical microbiology, lectures, and laboratory classes	5
3	Biopharmaceutics and pharmacokinetics	6
	Pharmacognosy, lectures, and laboratory classes	6
	Patient and medication therapy	40
	Basics of biosciences in pharmacy	4
	Human biology and health	9
	Systematic pharmacology	12
	Pharmacotherapy	6
	Patient education and counselling	3
	Phytotherapy	2
	Toxicology	3
4	Biopharmaceutics and pharmacokinetics	1
	Medicines and society	12
	Pharmaceutical legislation	3
	Pharmacy management	4
5	Medicines in healthcare	5
	Interaction and communication	14
	Information and communication technology	3
	Foreign language	5
	Communication skills	1
6	Second national language (Swedish/Finnish)	5
	Optional studies	18
	Minimum 3 ECTS units from other faculties	

^a ECTS = European Credit Transfer and Accumulation System

the pharmacy profession and pharmaceutical research disciplines. Diminishing a fragmented study structure is an additional aim, which was an earlier problem²⁵ that hindered learning, as well as progress towards practicing pharmacy and in research.^{7,26}

To improve the integration of theory and practice, the 6-month experiential training was divided into two 3-month periods, one at the end of the second year and one at the middle of the third year. During both training periods, students were instructed to translate theory into practice and reflect what they learned through assessments in a training manual, which was an integral part of the training. Following both training periods, each student's training manual was assessed and discussed by the training coordinator of the Faculty. Because previous research indicated that practical training lacked structure and clear objectives, uniform, high-quality training was emphasized. In the middle and at the end of both training periods, students and preceptors were instructed to discuss the student's performance, learning, and development, and to set goals for learning during forthcoming theoretical studies and future practice.^{20,21} Practical experience should be integrated with theory to foster the development of expertise.^{8,21,27,28}

The structure of the master's degree is presented in Table 3. A strand entitled "Drug Development Process" (20 ETCS units) was developed and taught collaboratively by all divisions during the fourth year. This strand provides a comprehensive, logical overview of drug development, from drug discovery and drug formulation, to pharmacovigilance. Another large strand, "Economics and Leadership," was developed to introduce these important aspects to every masters-level student, regardless of the discipline.⁶

Fostering Deep-Level Learning

Developing self-discipline is crucial in academics.^{19,30} Thus, an introductory course was developed to familiarize students with the pharmacy profession, orient them to active learning in higher education, and assist them in progressing in their studies. During the first semester, 5 tutorial sessions were held for groups of 10-12 first-year students, each group having 1 teacher and 1 second-year student as tutors. The themes of the tutorials were: (1) motives, goals, and expectations for studying, (2) group work and group dynamics, (3) studying and establishing a personal study plan, (4) introduction to employment opportunities in pharmacy, and (5) ethics in higher education and research, and introduction to scientific writing. Students were encouraged to adopt the philosophy of active learning, to consciously develop skills in scientific, critical thinking, to assess their own development, and to

Table 3. Structure of the Reformed Master's Degree (120 ECTS^a)

	ECTS
General studies	34
Basics of analytics	4
Drug development process	20
Drug discovery and development	4
Non-clinical research	6
Drug formulation	4
Clinical phases and introduction to biostatistics	2
From development to drug use	4
Personal study plan	1
Economics and leadership	9
Optional studies	16
Advanced studies	70
Studies on one of the following subjects:	30
Biopharmaceutics	
Pharmacognosy	
Pharmaceutical Chemistry	
Pharmaceutical Technology	
Pharmacology	
Social Pharmacy	
Master's thesis in the chosen subject	40

^a ECTS = European Credit Transfer and Accumulation System

set goals for learning. To familiarize the students with the pharmacy profession, they interviewed pharmacists in working environments and reported key findings in tutorial sessions, where requirements of professional practice and the need for lifelong learning were discussed.

The faculty's study guide and Web site present the goals of the course, core content, and method of assessment, which facilitates the students' orientation to and requirements of each course.^{31,4} Teachers also are encouraged to evaluate and develop their teaching practices towards constructive alignment.⁴ In constructive alignment it is important that goals, teaching methods, and assessment blend together, encouraging the same type of learning. Evaluation matrices for bachelor's and master's theses were constructed to harmonize evaluation practices and to assist the students in understanding the requirements of the BSc and MSc theses. Students' awareness of the assessment criteria facilitates helps them set goals for learning, which enhances deep-level learning.^{32,33}

Self-reflection, personal study plans, and learning portfolios enhance deep-level learning,³⁴⁻³⁶ therefore personal study plans were incorporated into the bachelor's and master's degrees. Personal study plans assisted the students in planning their studies, supported their learning abilities, and prevented unnecessary delays in graduation.

The plan was designed to serve as a learning portfolio to enhance self-reflection skills required for lifelong learning. Students completed their personal study plans during the first semester each year and updated them annually. Teachers provided feedback on the study plans annually through lectures and tutoring, and the students discussed their plans in peer groups.

Students were encouraged to develop their learning skills and assess their motives, goals, and expectations for studying. Pharmacy students received feedback and advice on improving their learning skills through continuous assessment of their approaches to, and experiences from, teaching and learning.³⁶ Upon completion of bachelor studies, students evaluated their development and set goals for continued professional development.

Progress and results of the curriculum reform were evaluated systematically. A standardized course evaluation form was used, allowing teachers to evaluate student feedback, inform students about the essential viewpoints, and provide information about the intended changes to the curriculum. Individual strands, the entire curriculum, and general teaching practices were evaluated by using the ETLQ, which is included in students' personal study plan.³⁷ Students received feedback on learning strategies from the questionnaire and use this to improve their study skills.

Information collected was discussed and evaluated first in the Studies Committee, during the biannual feedback sessions for teachers and students, and also during the faculty's staff development sessions. The integration of theory and practice, precepting systems, and feedback from pharmacies during and after the 3-month experiential periods were also evaluated systematically, and discussed during the annual continuing education day for practice preceptors.

DISCUSSION

Three years after the introduction of the reformed curriculum, the results of the reform are being evaluated. Ongoing assessments of teaching and learning will reveal how the education at the faculty level has developed since the reform. The implications of the modifications in the practical training also will be studied. These assessment procedures are an integral part of the faculty's quality assurance program.

The Faculty of Pharmacy at the University of Helsinki is committed to the continuous, comprehensive, and systematic development of pharmacy education and the pharmacy profession. The University's Program for the Development of Teaching and Studies urges that an academic degree of high quality shall aim at profound, research-based competence and expertise consisting of 5

main elements³⁸ (Figure 1). Although the curriculum reform at the faculty of pharmacy has touched on many of these elements, further development needs also have been identified. Based on scientific evidence and the strategic direction of the university, the faculty's implementation strategy for teaching in 2007-2009 promotes 5 priority areas: constructive alignment, the development of expertise, research-based teaching, international visibility and cooperation, and student participation in the faculty's activities, teaching, and learning.

To reinforce a seamless implementation of the strand model, procedures to foster cooperation among teachers, increased student participation in education design, and appropriate pedagogic education for the teachers are being developed. Teachers and students are encouraged to share experiences and good practices through regular meetings and feedback sessions. An interview study revealed that teachers at the faculty are motivated to develop their teaching and assessment practices, but require further assistance.³⁹ Shifting the behavior of the teachers towards a student-centered approach remains challenging. Since teachers' approaches to, and conceptions of, teaching affect students' approaches to learning,^{2,40,41} pedagogic training of teachers and improved teaching practices are currently being emphasized.

In May 2007, the University of Helsinki awarded the Faculty of Pharmacy with a grant and the status of High-Quality Educational Unit for its ongoing efforts to improve pharmacy education. In November 2008 the Faculty of Pharmacy received the status of National Center of Excellence in Teaching. The awards encourage the faculty to develop further pharmacy education based on scientific evidence from Finland and elsewhere.

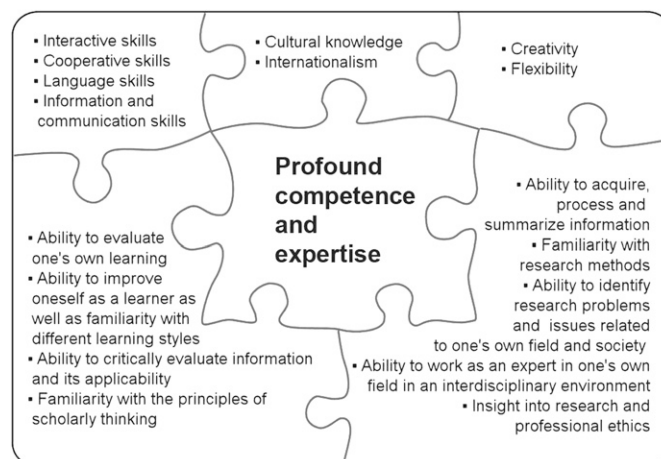


Figure 1. The components of an academic degree of high quality according to the University of Helsinki, 2006.

SUMMARY

The curriculum reform process was seen as an opportunity to develop not only the content of the degrees but also to improve the quality of learning, and further, to improve the integration of theory and practice. In order to be successful active involvement by teachers, students, and stakeholders was needed, which is why discussion forums were held. The different courses in the curriculum were organized into broader entities, which we called strands, and the reason for this was that the student would get a better overview of the content. A successful curriculum reform and the enthusiasm among faculty members have formed an excellent basis for further development work.

REFERENCES

1. Anonymous. The Bologna Declaration of 19 June 1999: Joint declaration of the European Ministers of Education. Available at: http://www.bologna-berlin2003.de/en/main_documents/index.htm. Accessed November 23, 2009.
2. Trigwell K, Prosser M, Waterhouse F. Relations between teachers' approaches to teaching and students' approaches to learning. *Higher Educ.* 1999;37(1):57-70.
3. Biggs J. Enhancing teaching through constructive alignment. *Higher Educ.* 1996;32(3):347-64.
4. Biggs J. Teaching for quality learning at university, 2nd ed. The Society for Research into Higher Education & Open University Press; 2003.
5. Hager P, Smith E. The inescapability of significant contextual learning in work performance. *London Rev Educ.* 2004;2(1):33-46.
6. Wiedenmayer K, Summers RS, Mackie CA, Gous AGS, Everard M. Developing pharmacy practice - A focus on patient care. World Health Organization and International Pharmaceutical Federation 2006. http://www.who.int/medicines/publications/WHO_PSM_PAR_2006.5.pdf, accessed November 23, 2009.
7. Trigwell K, Prosser M. Improving the quality of student learning: The influence of learning context and student approaches to learning on learning outcomes. *Higher Educ.* 1991;22(3):251-266.
8. Tynjälä P. Developing education students' conceptions of the learning process in different learning environments. *Learning Instruction.* 1997;7(3):277-292.
9. Tynjälä P. Traditional studying for examination versus constructivist learning tasks: Do learning outcomes differ? *Stud in Higher Educ.* 1998;23(2):173-190.
10. Tynjälä P. Writing as a tool for constructive learning: Students' learning experiences during an experiment. *Higher Educ.* 1998; 36(2):209-230.
11. Ministry of Education Report of the committee for the development of university degree structure [in Finnish]. Ministry of Education 2002. http://www.minedu.fi/OPM/Julkaisut/2002/yliopistojen_kaksiportaisen_tutkintorakenteen_toimeenpano, Accessed November 23, 2009.
12. Lindblom-Ylänne S, Hämäläinen K. The Bologna Declaration as a tool to enhance learning and instruction at the University of Helsinki. *Intl J for Acad Dev.* 2004;9(2):153-165.
13. Tutkinnonuudistuksen tukiryhmä. Tutkinnonuudistuksen linjaratkaisut Helsingin yliopistossa [in Finnish]. University of Helsinki. http://www.helsinki.fi/tutkinnonuudistus/materiaalit/tukiryhman_muistio.pdf Accessed October 29, 2009.
14. Faculty of Pharmacy. Faculty of pharmacy - Annual review 2006. http://www.helsinki.fi/farmasia/materiaalit/Farmasia_2006.pdf Accessed October 29, 2009.
15. Council of the European Communities (1985). Directive 85/432/EEC of 16 September 1985 concerning the coordination of provisions laid down by law, regulation or administrative action in respect of certain activities in the field of pharmacy. Council of the European Communities. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31985L0432:EN:html> Accessed June 10, 2009.
16. European Parliament, & Council of the European Union (2005). Directive 2005/36/EC of the European Parliament and of the Council of 7 September 2005 on the recognition of professional qualifications. European Parliament and Council of the European Union. http://eurlex.europa.eu/LexUriServ/site/en/oj/2005/l_255/l_25520050930en00220142.pdf Accessed October 29, 2009.
17. Bell JS, Väänänen M, Ovaskainen H, Närhi U, Airaksinen MS. Providing patient care in community pharmacies: practice and research in Finland. *Ann Pharmacother.* 2007;41(6):1039-1046.
18. Vuorela H. *Final report on the evaluation of pharmacy. Evaluation of the quality of education and the degree programmes of the University of Helsinki.* Helsinki University Printing House 2003.
19. Nieminen J, Lindblom-Ylänne S, Lonka K. The development of study orientations and study success in students of pharmacy. *Instructional Sci.* 2004;32(5):387-417.
20. Katajavuori N, Lindblom-Ylänne S, Hirvonen J. Pharmacy mentors' views of practical training. *Res in Sci Educ.* 2005; 35(2/3):323-445.
21. Katajavuori N, Lindblom-Ylänne S, Hirvonen J. The significance of practical training in linking theoretical studies with practice. *Higher Educ.* 2006;51(3):439-464.
22. Senge PM. *The fifth discipline: the art and practice of the learning organization.* New York: Doubleday Currency; 1990.
23. Senge PM. Leading learning organizations. *Training and Dev.* 1996;50(1):36-37.
24. Richardson V, Placier P. Teacher change. In: Richardson V, ed. *Handbook of research on teaching* 4th ed. Washington DC: American Educational Research Association; 2001: 905-939.
25. Hyvönen S, Lähdevuori M. *Selvitys farmasian opetuksen ja tutkintojen tilasta sekä uudistamisesta Helsingin yliopiston farmasian laitoksella [in Finnish].* Helsinki: University of Helsinki; 2001.
26. Crawford K, Gordon S, Nicholas J, Prosser M. Qualitatively different experiences of learning mathematics at university. *Learning and Instruction,* 1998;8(5):455-468.
27. Boshuizen HPA, Schmidt HG, Custers EJFM, van De Wiel MW. Knowledge development and restructuring in the domain of medicine: The role of theory and practice. *Learning and Instruction,* 1995;5(4):269-289.
28. Leinhardt G, McCarthy YK, Merriman J. Integrating professional knowledge: The theory of practice and the practice of theory. *Learning and Instruction* 1995;5(4):401-408.
29. Vermunt JD, Verloop N. Congruence and friction between learning and teaching. *Learning and Instruction* 1999;9(3): 257-280.
30. Rosenfield S. Developing instructional consultants: From novice to competent to expert. *J Educ Psychol Consult.* 2002;13(1/2): 97-111.
31. Alderman MK. *Motivation for achievement. Possibilities for teaching and learning.* Mahwah, New Jersey: Lawrence Erlbaum Associates; 1999.
32. Zimmerman BJ. Self-regulated learning and academic achievement: an overview. *Educ. Psychol.* 1990;25(1):3-17.

American Journal of Pharmaceutical Education 2009; 73 (8) Article 151.

33. Zimmerman BJ, Kitsantas A. Developmental phases in self-regulation: Shifting from process goals to outcome goals. *J Educ Psychol.* 1997;89(1):29-36.
34. Riley-Doucet C, Wilson S. A three-step method of self-reflection using reflective journal writing. *J Adv Nurs.* 1997;25(5):964-968.
35. Snadden D, Thomas M. The use of portfolio learning in medical education. *Med Teacher.* 1998;20(3):192-199.
36. McCombs BL. Self-regulated learning and academic achievement: a phenomenological view. In: Zimmerman BJ, Schunk DH, eds. *Self-regulated learning and academic achievement - theoretical perspectives* 2nd ed. Mahwah, New Jersey: Lawrence Erlbaum Associates; 2001: 67-123.
37. Economic and Social Research Council - Teaching and Learning Research Programme Enhancing teaching-learning environments in undergraduate courses. Experiences of teaching & learning questionnaire (ETLQ). Economic and Social Research Council, 2002. <http://www.tla.ed.ac.uk/etl/questionnaires/ETLQ.pdf> Accessed June 10, 2009.
38. University of Helsinki. Programme for the development of teaching and studies 2007 2009. Helsinki University Printing House, 2006. http://www.helsinki.fi/opetus/materiaali/Opetuksen%20ja%20opintojen%20kehitt_ohjelma%202007-2009.pdf Accessed October 29, 2009.
39. Postareff L, Katajaviuri N, Lindblom-Ylänne S, Trigwell K. Consonance and dissonance in descriptions of teaching of university teachers. *Studies in Higher Education*, 2008;33(1):49-61.
40. Trigwell K, Prosser M. Congruence between intention and strategy in university science teachers' approaches to teaching. *Higher Educ.* 1996;32(1):77-87.
41. Kaartinen-Koutaniemi M, Katajaviuri N. Enhancing the development of pharmacy education by changing pharmacy teaching. *Pharm Educ.* 2006;6(3):197-208.

Appendix 1. Goals of the Bachelor and Master of Science in Pharmacy degrees set by the teaching units (University of Helsinki, University of Kuopio and Åbo Akademi).

In addition to the minimum requirements specified in Directive 2005/36/EC of the European Union and of the Council for pharmaceutical education, students pursuing the bachelor of science in pharmacy degree must obtain theoretical and practical competencies for:

- acting in pharmaceutical positions in all sectors of healthcare;
- understanding the characteristics of drugs and excipients;
- the preparation and quality control of medicines;
- patient counseling in the use of prescription and self-care medications, the assessment of symptoms and referral to medical care;
- the recognition, assessment, and follow-up of problems in medical treatment and health promotion;
- scholarly thinking and independent, critical decision-making
- maintaining and upgrading professional competence, pursuing specialist studies and studies leading to the Master's degree.

Pharmaceutical education is based on scientific research and professional practices in the field. The education must provide adequate communication, language, and cooperation skills, and lay a foundation for professional ethics.

In addition to the requirements set for the degree of bachelor of science in pharmacy, students pursuing the master of science in pharmacy degree must obtain theoretical and practical competencies for:

- scientific and professional postgraduate training;
- research and development of drug molecules and pharmaceuticals, as well as research on rational and cost effective use of medicines;
- superior, expert, consultation and development in the pharmaceutical sector of healthcare.

Pharmaceutical education is based on scientific research and professional practices in the field. The education must provide adequate communication, language, co-operation and leadership skills and furnish expertise in economics and administration.