Universiteit Utrecht

Development and student evaluation of an Inquiry-based elective course on drug discovery and preclinical drug development

[Faculty of Science Pharmaceutical Sciences]

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Background

At Utrecht University, Department of Pharmaceutical Sciences, a new course was introduced as an elective for third-year Bachelor of Pharmacy students: "Development of New Drugs". The aim of this course is to introduce students to drug discovery and preclinical *in vitro* and *in vivo* drug development.

Course design and contents

The course is a 7.5-credit hour course dedicated to an introduction into Drug Discovery and Preclinical Development. It consists of four group projects and one individual assignment (Table 1). In addition there are supporting learning activities to help the students with their projects. To stimulate deep learning and critical thinking the course was designed according to the principles of inquiry-based learning (IBL) [1, 2].

Inquiry-based Learning (IBL)

- Driven by a process of inquiry
- Student centred approach: students actively explore and seek new evidence
- Teacher supports and facilitates students
- Students take more responsibility for their own learning process
- Collaborative work in small groups: improving team-working and project
 managment skills

Results

- The student evaluations of three consecutive years, 2008-2010 [3], show that:
- Students have a high appreciation of the course: 7.7 \pm 0.7 on a 10 point scale
- Students spent a high amount of time on the course: 18.5 ± 6.0 hours of the expected 20 hours/week.
- Students are highly motivated and challenged
- Students are stimulated into critical thinking and problem solving
- Students obtained knowledge of the world of industrial pharmacy, in particular to the preclinical part of drug discovery and development

Remarks of the students about the course

- "The assignments in this course were fun and challenging and therefore I learned a lot". "I think it is very positive that there are a lot of assignments and no written exam. This made me more motivated and lets me remember the subject far better"
- "The amount of freedom was scary at first, but afterwards very challenging and fun". "The protocol for the animal experiment and the ethical discussion allowed me to think
- critically about using animals in experiments and to think about alternatives".
- "The individual assignment seemed, to begin with, an impossible task. The knowledge gained from the whole course helped immensely".

Conclusion

The course "Development of New Drugs" is a succesful way of introducing students to preclinical drug discovery and development and underpins and supports the use of IBL in Pharmacy education.











Assignment number	Subject	Product	Learning activities
1	Drug Discovery: "Design your own 'mock' drug"	Report	 Five lectures on Drug Discovery and Development, Medicinal Chemistry, Drug targets in the CNS and Immune system, Drug Formulation and Delivery Workshop on writing a report, including peer-feedback part Group meetings
2	Preclinical <i>in vitro</i> Drug Development Practical: Perform an <i>in vitro</i> ADME-Tox-assay: - Cytochrome P450 inhibition - Inhibition of P-glycoprotein transport - Cytotoxicity assay	Poster	Poster discussion Group meetings
3	Preclinical <i>in vitro</i> Drug Development Design an in vitro experiment to test the efficacy, ADME or toxicity of one drug from assignment 1	Presentation	• Workshop • Group meetings
4	Preclinical <i>in vivo</i> Drug Development Write a protocol for the <i>in vivo</i> testing of the drug from assignment 1 for the animal ethical committee ('DEC'). Be part of the animal ethical committee to discuss and judge the protocol of other groups.	Protocol for the animal ethical committee and discussion as member of the ethical committee	 Three lectures on Animal Science, Preclinical Toxicology, and Drug Development from an Industrial Perspective Workshop provided by the industry (MSD/Organon, Oss, The Netherlands) on the development and design of an <i>in vivo</i> experiment with laboratory animals Two workshops on biostatistics Watch a television program on animal rights and ethics, discussion afterward Guided tour through the animal facilities of the University of Utrecht Group meetings
5	Research proposal: "Bring a drug back to the market"	Report	One (individual) meeting with the teacher Peer feedback session Presentations

Table 1. Design and contents of the 'Development of New Drugs' course

References

- [1] Lee VS (editor). Teaching and learning through inquiry. Sterling, VA20166, USA: Stylus Publishing; 2004.
- [2] Garcia-Cepero MC. The enrichment triad model: nurturing creative-productivity among college students. Innov.Educ.Teach.Int. 2008;45:295-302.
- [3] Meijerman I, Storm G, Moret E, Koster A. Development and student evaluation of an Inquiry-based elective course on drug discovery and preclinical drug development. Currents in Pharmacy Teaching and Learning 2012 In Press

