

Teaching students with different backgrounds and different chosen education lines

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Background

Pharmaceutics and Drug Development (PDD) is a course in the Master's in Pharmaceutical Sciences. This course has been held once, in autumn 2010, and at the time of writing it is being organized for the second time. The students who were enrolled in this programme held their Bachelor's degree in various disciplines such as biology, chemistry and medicine. At the start of their Master's programme, they chose one of three education lines: Drug Discovery, Drug Development and Social Pharmacy. PDD is one of three compulsory courses in block I and II.

The feedback from the students' evaluation in 2010 was very mixed. For example, only two-thirds of the students found the course useful for their educational objectives, but on the other hand most of them found the laboratory exercises relevant. Some of the students found the content of the course not to be MSc level and too basic. This might be because the teaching was mainly based on a text book for normal pharmacy undergraduate students. However, the course was meant as an introduction to formulations and manufacturing and therefore it covered broad topics. This means that none of the topics can be covered in detail. Hence, one of the challenges in the course is that the students have various backgrounds and have very different expectations of this course, and it is difficult to tailor such a course to suit every student.

Plan and execution of project

This project is intended to identify students' expectations and evaluate TLAs in order to design a more relevant course for students who have chosen different education lines. A questionnaire was conducted to identify the students' expectation before starting the course. A mixed teaching format was planned: lectures, laboratory exercises and literature reports. The lectures were divided into two parts. One part was given before starting the lab exercise. The other part was planned after the lab exercise.

In the first part, the lectures were focused on basic theoretical knowledge of pharmaceuticals, using the text book for normal pharmacy undergraduate students. These lectures were intended to help the students to understand the lab content and facilitate completing the lab exercises. In turn, the lab exercises were intended to help students digest the theoretical knowledge learned in the lectures.

In the second part of the lectures, two senior scientists from the pharmaceutical industry were invited to hold two sessions, and their talks would be focused on the relevance of this course to the pharmaceutical industry and the society. Meanwhile, two lectures were planned to introduce students to advanced pharmaceuticals and drug delivery systems.

A mid-way evaluation of the course was conducted after the first part of the lecture and the lab exercises. The students were asked to fill out a short questionnaire and give comments on the course. An interview with lab teachers was also conducted to have their input on this course. The final evaluation of the course was to be carried out at the end of January 2011. Due to the time limit (deadline of project is 6 January 2011), this report was drafted based on the expectation survey, the mid-way evaluation and the interview with lab teachers. The project will continue when the final evaluation of the course is received.

Summary of expectation survey, mid-way evaluation and interview with lab teachers

Students' expectation of this course (26 students replied)

As shown in figure 14.1, the students in this course are from ten different disciplines. Ten of them have pharmacy Bachelor's degree. The rest of them have Bachelor's degrees in biology, chemistry, biotechnology and medicine

etc. Among them ten students chose Line II: Drug Development, five chose Line I: Drug Discovery, and six chose Line III: Society and Medicine. Five students were enrolled as Erasmus students, as shown in figure 14.2, who were on pharmaceuticals courses back in their own faculties.

Bachelor degree	No. of student	Bachelor degree	No. of student
Biochemistry	2	Medicine	1
Biology	3	Molecular Biology	1
Biotechnology	3	Molecular Biomedicine	1
Chemistry	3	Nanoscience	1
Chemical Engineering	1	Pharmacy	10

Fig. 14.1. Bachelor degrees held by the students.

Lines	No. of students
Line I: Drug discovery	5
Line II: Drug development	10
Line III: Medicine and society	6
Others	5

Fig. 14.2. Education lines that the students chose.

According to the survey, the students' expectation of this course could be divided into four aspects: basic pharmaceuticals, hands-on experience (laboratory exercise), advanced pharmaceuticals and GMP rules. Out of 26 students, 21 expected to learn basic knowledge and an overview of pharmaceuticals and drug development. This fits quite well with the objective of this course, which is intended to give an overview of and introduction to pharmaceuticals and drug development to the students. Interestingly, 12 out of the 26 students pointed out that they looked forward to lab exercises and gaining some hands-on experience in drug manufacturing and formulation development.

- A Line II student: I'd like to do more laboratory exercises to learn how to manufacture products and to see how to use GMP rules. This course can help me understand manufacturing process of different dosage forms.
- A Line I student: I expect to get an overview of the drug development phase and a thorough insight into the formulation and manufacturing processes of drug development. I expect to learn the key theoretical concepts and to get some hands-on experience.

Five out of 26 students expressed their expectation of gaining deeper insight in advanced pharmaceuticals and drug delivery systems. Another three students would like to learn more about GMP rules from this course, as one student wrote: "I would like to have an extended and more professional pharmaceutical technology knowledge which covers GMP rules and more". Apparently, their expectation somewhat exceeds the scope of this course and they wanted to gain more profound knowledge on this subject. However, it is hard to say that the different expectations are due to the different education lines they have chosen. Instead, the different expectation seemed to be correlated to students' backgrounds, e.g. pharmacy students expected a higher level of this subject.

Meanwhile, in the questionnaire, students were also asked to comment on whether this course is relevant to their education lines. Most of the students (19 out of 26 students) are positive towards the relevance of the course to their education line, although among them three are Erasmus students.

- A Line III student: I think it is good to get an understanding of the drug-development process, even though this will not be my primary interest field when I get a job.

Four students were not sure about whether this course was really relevant to their chosen lines: "Not sure at this point. Maybe will know at the end of the course.". And three students did not think this course is relevant to their education line. But these students stated that this course is relevant to the Master's programme or it will help them to understand better the line they have chosen: "It is relevant to the master program, but not that relevant to my line, since I chose Line I", "It is basic knowledge to better understand my own field – yes. However, practically not (relevant to my line)", "I think that is not really relevant as in the third line we focus more on the social part of pharmacy but definitely is a prerequisite, because we should know how the drugs are formulated in order to be the final medicines". This indicates that the students were a bit unclear about the role of this course in the

Master's programme. They believe this course is more relevant to Line II than other lines. They took this course because it is a compulsory course. More guidance to the students on how this course aligns with other courses in the education lines should be given to the students, which may need to be included in learning objectives of this course.

Mid-way evaluation of the course (21 students replied)

The course consists of four elements: lecture, laboratory exercise, literature report and examination. This mid-way evaluation was conducted after the students had attended the first part of the lectures and all the laboratory exercises. The literature report project was also initiated, but will continue until examination at the end of January 2011.

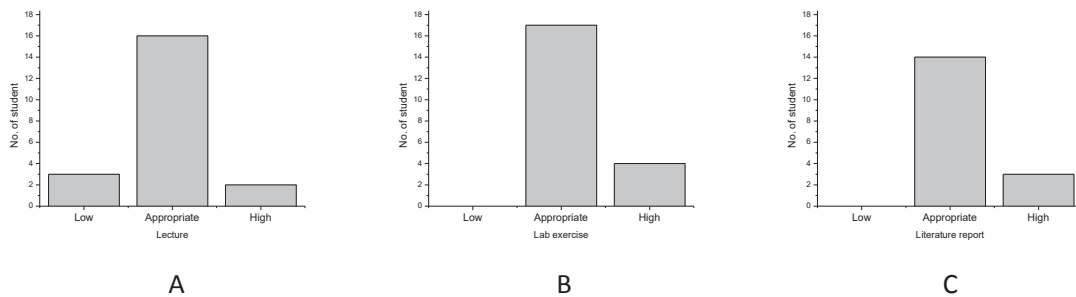


Fig. 14.3. Feedback on the level of content. A: lecture; B: lab exercise; C: literature report (four students did not reply on literature report).

Regarding the content of each teaching element, three students commented that the level of lecture content was low and two students commented that it was high, as shown in figure 14.3A. The rest of the students considered the level of lecture content appropriate. For the lab exercise and literature report, none of the students felt the level was low. But a few found the level was high.

About 80% of the students (16/21) found the workload in lab exercises too high, and they could not find time to work on literature reports. This is most likely because of the block structure. These students have to attend two or three times lab sessions per week, while normal undergraduate pharmacy students attend only once per week. The workload on the lab exercises was actually designed to suit the one-week workload for normal undergraduate pharmacy students. Hence, the workload in the current format for these

students is about two to three times higher than for normal undergraduate students. Meanwhile, a more thorough introduction for the students on how the lab exercise is organized, how the students should conduct the exercises and how to prepare lab reports seemed desirable. Students praised the content of the lab exercises, but they were not used to the structure of lab teaching. An introduction lecture will facilitate students' lab work and motivate them.

A few students commented on examination of the literature report. The literature report is intended to let students have a chance to get a feeling of advanced drug-delivery systems, since the lecture and lab exercises are mainly focused on basic pharmaceuticals. Some students commented that the 2010 course was not at Master's level due to its main focus on basic pharmaceuticals. In the literature project, students were divided into some groups with four to five members in one group. They were required to write 20-25 pages per group on a specific topic assigned by a supervisor through literature searching, summarizing and compiling. Very often, such topics are about advanced pharmaceuticals since the supervisors usually assign a topic related to their own research interest. But the topics are also very specific, and the scope is rather narrow. Furthermore, the format of examination is oral presentation and questioning. Hence an examination on the literature report may not reflect students' true understanding of this subject (pharmaceuticals and drug development).

Interview with lab teachers

Three lab teachers were interviewed after the mid-way evaluation of the course with students. Most of the feedback from them was consistent with the comments from the students. All of them agreed that an introductory lecture on lab exercises was needed. In that lecture, the teachers can emphasize the goal of the lab course, instruct preparation of lab reports, tell what the teachers expect from them and what the students could expect from the teachers as well. They also pointed out that the workload seemed to be high for the students with the current content of lab exercises and block structure system. Again, since the students have put more time into lab exercises and lab reports, it may make more sense to assess the students based on lab reports rather than literature reports. It may also motivate the students on the lab courses more.

Discussion

It is inevitable to have students in a class who have different backgrounds and with different aims to pursue. The motivation of this project is that an early identification of the expectations of students may help a course leader to coordinate the course (between teachers and students) and keep motivating students during the course by adjusting some of the teaching elements accordingly. It is not possible to satisfy every student's expectation. However, by knowing students' expectations at an early stage a course leader may be able to prevent frustration caused by mismatch of expectations between teachers and students. A questionnaire survey was used in this project. The advantages of questionnaire survey include its possibility of producing higher response rate, saving time and an anonymous approach so students could feel free to express any concerns. The disadvantage of such a survey is that it is not possible to get deeper understanding of issues or thoughts. Nevertheless, it is still a good approach to grasp information in a broad manner.

The questionnaire survey showed that the students' expectations aligned well with the objectives of this course. Most of them expected to have an introduction to pharmaceuticals and drug development. Some students would like to have more profound knowledge on the subject. Most of these students had degrees in pharmacy and had already completed pharmaceuticals courses during their undergraduate study. Hence, their expectation of this course was higher than other students who held Bachelor degrees in disciplines other than pharmacy. However, this course was planned to be an introductory course in the Master's programme. The teaching materials employed in the course are mainly used for normal pharmacy Bachelor students. To avoid some students becoming bored with basic knowledge, lecturers on the course were encouraged to spice the lectures with their own research. Meanwhile, lecturers from industry were also invited in the second part of lectures to address the development of drug products in pharmaceutical industry.

Students found lab exercises very exciting and lab teaching motivated them. Some students even looked forward to lab exercises prior to the course. It is always one of the best ways for learning to combine theoretical knowledge with hands-on practice in teaching. However, the lab exercises in this course consist of both formulation and manufacturing sections, which were designed by two teaching groups, consequently students were quite confused about the structure. Meanwhile, the workload on lab reports

was too high, which may risk demotivating students. This may be the reasons why some students commented that the level of the lab exercise was a bit high. Some students also evaluated the level of the literature report to be high. One reason may be the fact that the topics assigned by supervisors were too specific and exceeded the scope of the teaching materials used in the lectures. Both students and teachers also pointed out that a final examination based mainly on the literature report might not adequately reflect students' learning (Gibbs & Simpson; 2003).

The above analysis of the survey suggests that there is room for improvement of the teaching and learning activities (TLAs) to implement constructive alignment of the current course (Biggs & Tang; 2007). Lectures should focus on introducing students to theoretical knowledge in the subject. Lecturers can be encouraged to apply more active teaching in the lecture to get the students involved in class discussion. In this way, teachers can sense whether the students with different undergraduate backgrounds understand the topics correctly. The content of the lectures can still be at normal undergraduate pharmacy level, since interested students who would like to gain profound knowledge in advanced pharmaceuticals have chances to attend elective courses on Advanced Drug Delivery and Advanced Drug Manufacturing in block 4 or second-year study.

Lab exercise is certainly a valuable teaching element in this course. Students have the chance to work in a group, to solve problems and address questions together (Tamir; 1989). Meanwhile the students have more chances to interact closely with teachers. The structure of lab exercises may need an effort to be aligned (i.e. formulation and manufacturing) and a more thorough introduction to lab exercises is required prior to starting the course. For the high workload, the ideal solution is to spread the lab course over a longer period, e.g. one exercise per week. However, it may be quite challenging to do so due to the block structure. Another solution is to decrease the content of lab exercises and lab reports, which should be carefully adjusted by evaluating the alignment between ILOs and this teaching activity.

Serious consideration should be given to the literature report and assessment. The literature project could be a good student-centred activity where students can work in groups to deal with all the important aspects of formulation, production and biopharmaceutical characteristics based on one or more specific drugs. An assessment on such project may align well with ILOs and reflect the students' learning (Gibbs & Simpson; 2003). It requires more competent supervisors who can define appropriate projects

to students and fairly assess the students during examination, however, due to limited resources, most of the supervisors in this course are PhD students and postdocs. An improvement may be achieved by shortening the literature reports and assess students' learning on both lab reports and literature reports. Thus students may also feel appreciated for their hard work on lab exercises. A lab teacher also suggested introducing a written examination in the course, but its applicability need to be further debated. Another improvement that should be considered is to apply more formative feedback in correcting the lab reports than summative feedback. Students usually learn more from formative feedback than summative feedback which has been shown in didactics studies (Yorke; 2003).

Conclusion

An early identification of students' expectation and mid-way evaluation could provide a course leader with valuable insight in students' motivation and course structure. It is especially helpful for coordinating and teaching a course where the students have different background and have chosen different education lines. The questionnaire survey showed that the students' expectation of this course seemed to differ, mainly because of their different backgrounds rather than the education lines chosen. Most of the students recognized the relevance of this course to their own education lines. The mid-way feedback from the students indicated that they appreciated TLAs in this course, which included lectures, lab exercises and literature report. However, there is room for improvement on the lab course structure and the literature report project. Further improvement should also be focused on the structure of the course by optimizing the alignment of ILOs, TLAs and assessment.

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A Questionnaire survey on students' expectation

Pharmaceutics and Drug Development:

1. You got your bachelor degree in:

Biochemistry		Medicinal Chemistry	
Biology		Molecular Biology	
Biotechnology		Molecular Biomedicine	
Chemistry		Molecular Medicine	
Chemical Engineering		Nanoscience	
Engineering		Pharmacy	
Medicine		Science	
Others:			

2. Your education line:

Line I: Drug discovery	
Line II: Drug development	
Line III: Medicine and society	
Others	

3. What is your expectation of this course?

4. Do you think this course is relevant to your education line? Why or why not?

5. Regarding groups, you wish to form

by yourself	
by course leader	
Do not care.	

B Survey on mid-way evaluation of the course

Middle way evaluation of the course (5-10 min):

The course has passed one month. Please help us improve the quality of teaching.

1. You got bachelor degree in:

Analytical chemistry		Medicinal biology	
Biochemistry		Medicine	
Bioengineering		Molecular Biology	
Biology		Molecular Biomedicine	
Biotechnology		Molecular Medicine	
Chemistry		Nanoscience	
Chemical Engineering		Organic chemistry	
Medicinal Chemistry		Pharmacy	

2. Your education line is:

Drug discovery	
Drug development	
Medicine and society	
Others	

3. How was the level of the content?

Level	Low	Appropriate	High
Content			
Lectures			
Lab exercises			
Literature report project			

4. How was the course structure i.e. lecture, lab exercise and literature report? Should any of them be reduced or increased?

5. What do you miss from this course? Or would you like to have other elements in the course? (considering the education line you chose)

All contributions to this volume can be found at:

http://www.ind.ku.dk/publikationer/up_projekter/2010-3-1/

The bibliography can be found at:

http://www.ind.ku.dk/publikationer/up_projekter/kapitler/2010_vol3_bibliography.pdf/