

ORIGINAL ARTICLE

The introduction of new teaching methods in pharmacy education-II. The starting point

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Abstract

This article is the second paper in a series that describes the reform of pharmacy studies at the Vrije Universiteit Brussel (Belgium). This reform was necessary to prepare pharmacists to be able to face with the challenges of the 21st century. Here, we describe the main educational innovations in the first year of the Bachelors degree in Pharmaceutical Sciences. The focus is on the course “Line project I: from molecule to patient”. The basis of this course is project-based learning, but several other contemporary and original educational methods were combined.

This course is the starting point of a “line project”, which continues throughout the three years of the Bachelors degree. Students can now explicitly demonstrate their newly acquired competences and also integrate them in a portfolio and in a public presentation. The portfolio is an instrument to show the development of competences and to reflect about these competences.

Keywords: *Competences, line project, project-based learning, reflection*

Introduction

In a previous article of this series (Petit, Foriers, & Rombaut, in press) we have indicated three incentives pointing out that a reform of the pharmacy studies and curriculum was necessary to prepare pharmacists to be able to face new challenges of the 21st century. These incentives are: (i) the profession of the pharmacist is changing rapidly; (ii) the Flemish higher education system (the Flemish community in Belgium is responsible for its own educational system) was reformed following the Bologna declaration, and (iii) an accreditation system installed by the government was implemented. For this new curriculum, goals and objectives were formulated. However, using the traditional educational methods some goals and objectives could not be reached. Therefore, educational innovations in the curriculum of Pharmacy education at the Vrije Universiteit Brussel were implemented.

In this paper, the main educational innovations in the first year of the Bachelor degree in Pharmaceutical

Sciences are described. This is the course “Line project I: from molecule to patient”. The basis of this course is project-based learning, but several other contemporary and original educational methods were combined.

The goals and objectives of this course in this first year of the Bachelor degree are that it: (i) offers students a first impression of the profession of a pharmacist, whereby, the students receive a perception of pharmaceutical and medical terminology, the use of medicines and different administration forms of medicines, (ii) promotes teamwork, (iii) enhances the communication level of students (in general, but also specific pharmaceutical), and (iv) increases interdisciplinary and lifelong learning.

However, as or maybe more importantly, this course is the starting point of a “line project”, which proceeds throughout the three years of the Bachelor degree. In each year of their Bachelor studies, students acquire new competences. By following this course, they can demonstrate their newly acquired competences and

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also integrate them in a (electronic) portfolio and in a public presentation. During their Bachelor programme, students receive an impression of the evolution of their competences.

The goal of our pharmacy curriculum is that the student acquires the competences necessary to practice the main tasks of pharmacy (wherever he/she works as a community pharmacist, in industry or in hospital; Petit et al., in press). In the goals and objectives that were formulated, knowledge is very important, but also skills and attitudes are equally so. As not all skills (communication, teamwork, critical reflection, developing a self-learning attitude [lifelong learning], taking responsibility for their own learning, and so on) can be reached by classical educational methods, new teaching methods were introduced. Using these new teaching methods the students were given more freedom, self-control and ownership over their own learning. Decision making and use of initiative is maximised throughout the project, from selection of information to design, production and presentation decisions.

We start with project-based learning in the first year of the Bachelor degree and the line project runs during the three years of the bachelor degree. It ends with a bachelor exam. During the first two years students work in groups, in the last year they work individually (Petit et al., unpublished).

Again, the basis of this course is project-based learning. This is a model for classroom activity that shifts away from the classroom practices of short, isolated, teacher-centred lessons and instead emphasises learning activities that are long-term, interdisciplinary, student-centred, and integrated with real world issues and practices. A major benefit of it, is that it can motivate students by engaging them in their own learning: it provides opportunities for students to pursue their own interests and questions and make decisions about how they will find answers and solve problems in professional life. It also provides opportunities for interdisciplinary learning: students apply and integrate the content of different subject areas at authentic moments in the production process, instead of in isolation or in an artificial setting. Project-based learning makes learning relevant and useful to students by establishing connections to life outside the classroom, addressing real world concerns, and developing real world skills. Many of the skills learned through project-based learning are those desired by today's employers, including the ability to work well with others, make thoughtful decisions, take initiative, and solve complex problems; <http://pblmm.k12.ca.us/PBLGuide/PBL&PBL.htm>; <http://pblmm.k12.ca.us/PBLGuide/pblresch.htm>; <http://pblmm.k12.ca.us/PBLGuide/WhyPBL.html>.

The (electronic) portfolio is the combining link. The purpose is that at the end of each year, both teachers and students can verify, if the goals were met and also how they were met.

In a portfolio, students show a selection of what they have collected (evidence material) during a certain period (Strickland & Strickland, 1998; Driessen, Beijaard, van Tartwijk, & van der Vleuten, 2002; Janssens, Boes, & Wante, 2002; Mansvelder-Longayroux, Beijaard, & Verloop, 2002; van Tartwijk, Driessen, Ritzen, Kösters, & Stokking, 2002). It is also an instrument to show the development of competences: a structured collection of evidence material to show learning results and learning experiences. The term portfolio-learning is originally derived from the graphic arts. In practice, a portfolio consists of two major components: (i) a collection of events and experiences and (ii) a reflection on what has been learned (Friedman, Davis, Harden, Howie, Ker, & Pippard, 2001). This last component may include written reflective accounts on the submitted evidence or personal reflections kept in the form of a journal or diary. Typically, these would include reflections on problem areas, what has been learned, what has still to be learned and plans for how new learning will be tackled.

Reflection is a concept that is central to two major theories of learning, namely experiential and deep learning. In the context of experiential learning, reflection is the process of purposefully examining experiences in the practice-based setting in order to learn from them (Kolb, 1984). Kolb describes a learning cycle whereby learning needs are identified through structured reflection on experiences. These needs are then fulfilled by educational activities, and the cycle is completed by applying the new learning to professional practice and in the process, identifying further learning needs arising from the new experience. With deep learning there is an attempt made by the student to understand concepts, processes and ideas and to evaluate and build on previous knowledge.

Working with a portfolio has different advantages: (i) students learn to collect and process information in an independent way so that they learn to solve problems (they adapt knowledge, but also skills and attitudes); (ii) increased motivation; (iii) more active approach to learning with stimulation of constructive learning; (iv) adjustment of the learning process by reflecting: students are aware of their own knowledge, skills and capacities; and (v) evaluation of the end product as well as the learning process is possible (Dochy, Schelfhout & Janssens, 2003).

Material and methods

Practical settings of problem-based learning

Size and selection of group. Evidence suggests that the ideal size of a group for maximum interaction is between 6–8 students (Moust, Bouhuijs, & Schmidt, 1997). Due to a shortage in tutors, in some academic

years, the size of student groups had to be increased to 8–10 students. However, we quickly learned that the increase in students per group decreased the performance of the group and the performance of students within the group significantly (results not shown). So, we also recommend a group of 6–8 students.

Moreover, from the beginning, we also decided to make a selection of students per group. This selection was made based on a learning type and style test. People tend to differ in the way they are processing information when learning. This habitual way of learning is called “learning style”. Even when students receive the same education, they realise different learning processes and learning results. A possible explanation for this can be that every student has different learning activities. A learning style can be described as the typical way of handling a task, without thinking of how to do it. Some learn by seeing (tables, pictures, etc.), others by hearing (lectures), others by acting, reflecting, reasoning logically, etc. Some like to learn alone, others in group. Knowing someone’s learning style can give an insight in possible problems with some courses and how they are learned by the student. Learning styles influence study motivation and results and also acquiring competences. So, by defining someone’s learning style, we can help the student to learn better. We use the learning style test of Kolb (1984) to know more about the learning styles of our students.

Doing so, we assemble in each group students with different learning types. It enhances also the homogeneity of each group. So, after the learning type test, each of the students is randomly allocated to a group. This method ensures equality of ability and cooperation between all the students.

Each group (8–10 students) will be guided by a tutor (see Tutor) and receives a pharmaceutical product. This can be a human or veterinary medicine or any other pharmaceutical product, which can be found in a Belgian community pharmacy (as there are cosmetic products, dietary products, nutraceuticals and herbal products). Each pharmaceutical product is provided in the original package and authorised presentation, containing the package leaflet (if available).

The project runs during one week (at the end of the second semester of the academic year). The first day, there is an introductory course, given by the project leader. Students also get an instruction manual (see Instructions manual). They are expected to collect during this week information, necessary to fulfil the goals. They have to make a portfolio (with a selection of the information, references, journal, reflections on their own work and on the work of the others, etc.) On the last day of the project week they give a presentation (oral and poster) for a panel of teachers (peers).

Every group of students has a small room where they can work during the project week. In this

room, they have at least one computer with internet access, print possibilities, books they can use to find information, etc. Tutors and project leader keep contact with every group on a regular basis.

During the project week students have contact hours with their tutor. The tutor guides, supervises and evaluates the students’ evolution. For other problems they can contact the project leader who will visit also frequently the different groups.

After the project week there will be an interview by the project leader with every individual student. During this interview students give and get feedback about their individual reflection, the peer-assessment and the group work. There is also an evaluation of their development of new competences.

Instructions manual. On the first day of the project week students receive an instruction manual. During the introductory course the content of this manual and the used educational method is explained.

This manual consists of:

- (i) A general part: with an explanation of project-based learning (competences, self-education, feedback, reflection, peer-assessment, interview), organisation of the project week, allocation of the different student groups, portfolio, presentation/poster, evaluation of their work (feedback)
- (ii) A specific part: introducing the different pharmaceutical products for the different groups, presenting the responsible tutors with their coordinates, describing the goals students have to reach after the project week and finally adding some references for the students.

You can find an instruction manual on <http://pointcarre.vub.ac.be/CMS/help/gebruikers/opleidingspecifieke/farma>

Tutor. Every group of students has a tutor: this is a professor, member of the Faculty of the School of Pharmacy. He or she is responsible for the group. The tutor gets assistance by a junior staff in education.

The tutors help the students in searching the correct information. Tutors also help students to integrate their information and to make a good presentation/poster and provide them with guidelines for the oral presentation and the discussion. Tutors do not teach their group about the topic of the pharmaceutical product. Students have to search for information about their topic and discuss this with each other and with their tutors. The result is a collaborative working situation between the students and the tutors.

Feedback. Feedback can be a powerful instrument in the learning process of the students: it helps the student with his reflection on his own activities and the effect of these activities on the action of others.

When giving feedback, it is important to discuss not only the negative points, but also the positive remarks. Positive feedback is functional for the teamwork, and especially for the motivation that will result from it. Critical feedback has to be formulated in a way which makes it clear to the receiver what he has to do (always provide concrete behavioural suggestions when giving negative feedback).

Receiving feedback is a skill that students often have to develop. A lot of students will have a defensive attitude when receiving critical feedback, so it is possible that the learning process will be blocked at the moment of feedback.

When one asks to receive feedback, first formulate some points of attention and questions so the feedback giver knows what you want to know about your attitude and actions (Dekeyser & Baert, 1999).

Portfolio

A portfolio consists of three independent sections: (i) A curriculum vitae which contains for each individual student name, background, previous education, prior knowledge, experiences, personal data, etc. (ii) The data collection part is identical for each member of the group (because of the group work) and contains a selection of all the obtained information (also a selection of the collected information, references, a journal, slides for the presentation and the poster). In this first bachelor year, students make a paper portfolio in the second and third year they create an electronic version (see Petit et al., unpublished). (iii) The analytical or reflection part contains for each student the replies (with verification to material in the record part) of a set of the self-reflection questions prepared by the project leader (Table I), the peer-assessment, a report of the interview with the project leader after the project week (see Size and

selection of group) and of the obtained competences, questionnaire with remarks.

Poster, presentation and slides

Students must make a poster (standardised format) about their topic and give an oral presentation at the end of the project. Students receive everything they need to make this presentation and the poster: computer with Internet access, print possibilities, coloured paper for the poster, etc. The goal of a poster/presentation is (i) to share information with others and (ii) to have the possibility to talk about it with other participants and share information about your investigation and thoughts.

With the poster and oral presentations the informative as well as the didactical-instruction part are important. A poster or presentation has to be clear and well organised. Using slides can be a useful guideline for the presenter and for the public.

The interview

Students take part in different forms of feedback: (i) self-assessment by the reflection questions; (ii) peer-assessment; and (iii) from the tutor and project leader (peer-assessment: see Petit et al., unpublished).

During the interview, students can discuss this feedback with the project leader and discuss the individual competence acquisition.

They must incorporate this feedback in the analysis part of the portfolio.

Questionnaire

At the end of the project, students must complete a questionnaire (see Table II). Here, there are two aims: (i) to compare the classical teaching method (teacher-centred) with the new education form, project-based learning (student-centred); and (ii) to optimise the line project by checking the remarks of the students.

The questionnaire consists of a series of questions, where students answer on a five point rating scale (Preston & Colman, 2000).

Table I. Reflections. Set of questions to be answered by each student and to include in the analytical part (part 3) of the portfolio.

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1. What did you expect from the line project (on the first day of the course in terms of goals and objectives)?
 2. Now you have finished the line project, do you think these goals and objectives were reached? Do you see now other goals or objectives covered in this course?
 3. How did the project start? Give examples and explain.
 4. By working on the project, what do you think are your strong points and what are your weak points? Give examples, explain and refer to material in your portfolio.
 5. Do you think you can further explore your strong points in order to acquire more competences? Give examples to explain it.
 6. Will you improve your weak points more in the line project next year? How do you think you can do that?
 7. Did you already see an evolution in your acquisition of (i) knowledge and of (ii) skills (e.g. working in group, oral and written communication, collecting and selecting the information, making of the poster/presentation) Give some examples and explain.
 8. How would you evaluate your tutor? Give examples and explain.
 9. What about the feedback you received? How was your impression of the interview? Give examples and explain.
 10. Do you have other remarks?
 11. What do you expect from the line project next year?
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Table II. Questionnaire Line project: set of questions to be answered by each student after the project week.

	Very negative	Negative	No difference	Positive	Very positive
I. In comparison with the classical educational methods, I experience:					
1. The line project as					
2. The gaining of knowledge as					
3. The absorbing of skills as					
4. The gaining of attitudes as					
5. The teamwork as					
6. The collection of information and data as					
7. The processing/selecting of data and information as					
8. The development of the portfolio as					
9. The preparation of the (powerpoint) presentation as					
10. The presentation itself as					
	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
11. This project is worthwhile					
12. What I learn in this project, I will use also in my further studies and in my profession.					
13. Peer-assessment is a good way to know more about my personal participation in the group					
14. The introductory course to the project is a necessity					
15. My relation with the tutor was good					
16. The goals of the project are clear					
II. Study time measurement.					
The average time that I've worked at the line project: . . . hours/day					
17. The time investment in the line project enables me to reach the goals and objectives of the course					
III. What are your remarks about the educational method, this course, the organisation, . . . ?					
IV. Give your suggestions to optimise this line project					

Results

Acquisition of goals and objectives

The introduction of this course “Line project I: from molecule to patient” in the first year of the Bachelor of Pharmaceutical Sciences has two main objectives:

- (i) to create an environment where the pharmacy student has a first contact with the profession of pharmacy and, in particular, pharmaceutical products
- (ii) to provide the pharmacy student early in the curriculum with competences essential to current practice which cannot be provided with classical educational methods. These are communication skills, teamwork, ICT and data presenting.

Table III summarises the goals and objectives which should be acquired after the course regarding the pharmaceutical products. After three years of experience, we can state that these requirements are easily reached by at least 90% of the students. Examples of posters, portfolio's and presentations can be found on <http://gf.vub.ac.be/~zscj>

Student evaluation of the Line project I compared to other courses in the first Bachelor of Pharmaceutical Sciences

In order to evaluate the introduction of a new course into the curriculum the evaluation of Line project I was compared with the student evaluation of all courses in the first year of the bachelor degree.

The course evaluation is conducted on-line after each semester and covers all courses. Responding to the survey is optional and the participation is anonymous. Table IV shows the student evaluation for three consecutive academic years. The Line project I, scores higher than the overall rating of all courses in the first year of the Bachelor programme. This means that the Line project I, was well accepted by the students.

Another interesting aspect is that the scores of the students (scores given by the professors and examination) for this course was also consistently higher than the average of the students for all the courses in the first year of the Bachelor programme (results not shown). This means that the Line project I is not only accepted by the students, but also that students acquire more easily the goals and objectives of this course.

The tutors were also very impressed by the cooperation of the students during the project week. Also, members of the judging panel were impressed by the quality of the presentations and the posters at the end of the project week.

Table III. Minimal requirements for each pharmaceutical product at the end of the course.

Find information so that you are able to:

- describe the composition of your pharmaceutical product (active substance, excipientia, etc.)
- indicate the galenical form and give an overview of possible alternative galenical forms of this pharmaceutical product
- give the function(s) and application(s) of the active substance(s) of the product
- what is the target group of the product? What is the dosis and the regime of the pharmaceutical product used?
- Are there any specific advices for this product
- Stability of the product. Is preservation necessary?

If relevant for the product: be able to formulate an answer to the following questions:

- what is the chemical structure and give the most important physical and chemical characteristics of the active substance of the product
- is the product of natural or synthetic origin? Are there synthetic or natural equivalents?
- can there occur allergic reactions with this product? can there occur poisoning symptoms with wrong use of this product?
- is sterile preparation or delivery necessary? Why?

After this project every student has to be able to:

- collect on an independent way relevant information about the product and the patient from different sources and resume it in their own words
- use the ICT-technology to search information and to make a report
- select the essence from the collected information, resume this; make a poster with this information; give an oral presentation and answers to the questions of the discussion

Further evaluation of Line project I by use of the questionnaire

In order to get a better insight into how students perceive the line project, which included new educational methods such as project-based learning and portfolio handling and how they compared these methods with classical teaching methods, they were asked to complete a questionnaire after taking the course (see Material and methods). This questionnaire (see Table II) consisted of closed questions, which could be answered with a five point rating scale.

In Figure 1, we compare the answers to some significant questions. We compare results from the start of Line project I in the academic year 2001–2002 until the academic year 2006–2007.

Table IV. Comparison of average evaluation of all topics and average evaluation of Line project I during 3 academic years.

Academic year	Student evaluation of courses marks (.../20)*	
	Line project I	Mean of all courses in first Bachelor
2003–2004 [†]	17.7	15.3
2004–2005 [‡]	15.9	14.4
2005–2006 [¶]	17.0	15.4

* The course evaluation survey is conducted on-line and covers all courses. The survey is held after each semester. Thanks to this frequency, the quality signals of the students are always up-to-date, and action can be taken swiftly where necessary. The survey also gathers information on the time the students really spend on their studies, compared to the study time indicated in the course programmes. Students are obliged to log into the site in question, using their free VUB-e-mail account. However, responding to the survey is optional, and evidently their participation is anonymous;

[†] Academic year 2003–2004; participation: 19 of 32 students (59.4%); [‡] Academic year 2004–2005; participation: 35 of 48 students (72.9%); [¶] Academic year 2005–2006; participation: 36 of 48 students (75.0%).

In Figure 1(A), students give an answer to the question of how they experience the gaining of knowledge in project-based learning compared to the gaining of knowledge in classical teaching methods: students experience the contribution to their knowledge every year as better (58–86%) compared to classical teaching methods or even much better (7–31%).

In Figure 1(B), students experience the contribution of project-based learning to absorb skills every year as better (51–86%) or even much better (11–40%) than using classical teaching methods.

Students were also asked how they experience the contribution of project-based learning to gain professional attitudes (see Figure 1(C)). Students of the first bachelor have more difficulties in answering this question: they experience no difference (10–54%) or better (43–72%) as compared to the classical teaching methods. They do not have a good idea of the term “attitudes”.

Students had to give their opinion about how they dealt with the gaining of teamwork (Figure 1(D)). Here, it is shown that project-based learning is contributing to teamwork better (38–61%) and much better (26–59%) than classical educational methods. Although, students are used to working in groups during practicals (average of two students), in this new situation, they must work in a larger group (average of six students): they have to work collaboratively, discuss and agree with each other, take responsibility over their work, and present.

Students also had the opportunity to provide comments (see Table II) when completing the questionnaire. The main conclusion from these comments was that students were very motivated to perform this course (Table V).

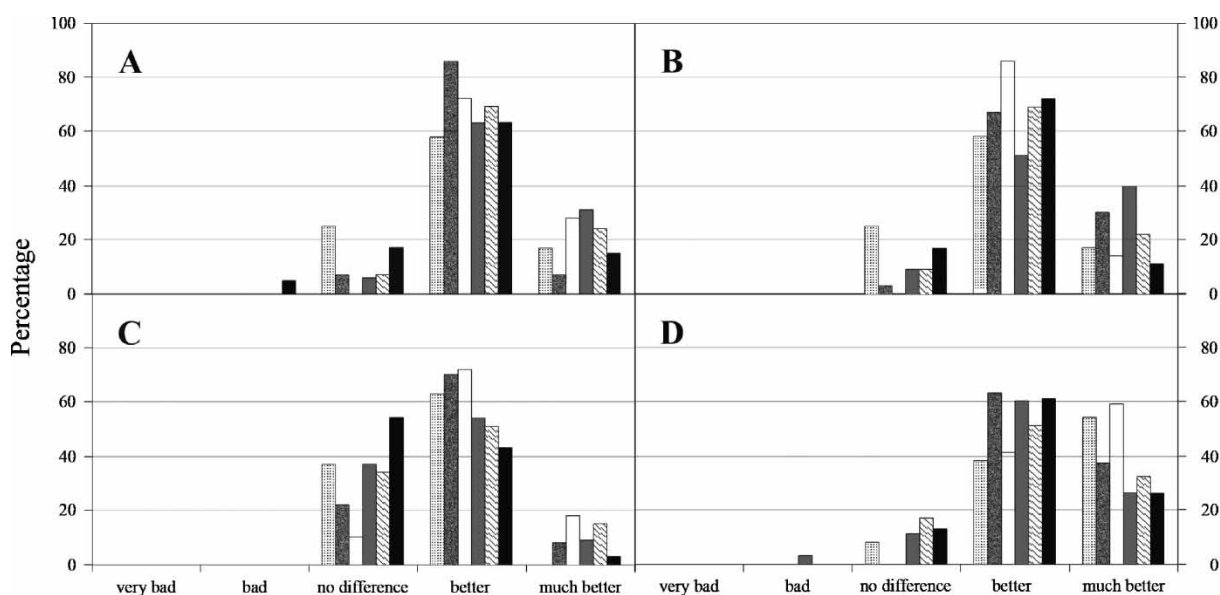


Figure 1. Evaluation of Line project I during six academic years (▨ academic year 2001–2002; ▩ academic year 2002–2003; □ academic year 2003–2004; ■ academic year 2004–2005; ▤ academic year 2005–2006; ■ academic year 2006–2007). (A): How do you experience gaining knowledge in Line project I (due to project-based learning) as compared to classical teaching methods? (B): How do you experience absorbing skills in Line project I (due to project-based learning) as compared to classical teaching methods? (C): How do you experience gaining professional attitudes in Line project I (due to project-based learning) as compared to classical teaching methods? (D): How do you deal with gaining teamwork in Line project I (due to project-based learning) as compared to classical teaching methods?.

Table V. Selection of remarks found in the filled questionnaires. Students receive this questionnaire after Line project I (see Material and methods).

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- (a) Remarks in academic year 2001–2002:
- students do not have special remarks: everything is good
 - one negative remark: period of the project is organised to late in academic year (project education: in week 11 of 2nd semester)
- (b) Remarks in academic year 2002–2003:
- students ask for more project-based learning (also in other courses) because they enjoy it
 - they are now more positive about the period of the project in the 2nd semester (week 7 of 2nd semester)
 - some students ask to be informed earlier of the pharmaceutical product (before the start of the project), so they can start to assemble information on their product
- (c) Remarks in academic year 2003–2004:
- Project-based learning is very interesting and instructive. It promotes interaction between students
 - Suggestion: project to be run twice a year
- (d) Remarks in academic year 2004–2005:
- Students enjoy the experience of more practical aspects of the profession.
 - Students have to work more actively. By doing so, they can absorb the knowledge over a longer period
 - Due to the interaction in the group, they learn how to deal with other opinions.
 - the number of students in each group is too large. The ideal numbers is five students.
- (e) Remarks in academic year 2005–2006:
- Students learn how to work with a sense of team spirit
 - Students are free to do what they want, when they want. There is no real steering, but they frequently receive feedback from the tutor and the project leader
 - Students get more insight into the working of a pharmacy. This is very constructive and stimulating.
 - Students absorb knowledge more, better and for a longer period, because they search for relations and connections between different topics
 - Students see an evolution in their skills
 - The number of students in a group should be restricted to 6.
- (f) Remarks in academic year 2006–2007:
- It is more constructive compared to a classical course: they learn more
 - Their attitude towards thinking has changed: they become more curious about medicines
 - Some students chose this School of Pharmacy because they have contact with the profession and pharmaceutical products during the first year: they learn skills that they otherwise would only obtain later in the course.
 - The number of students in a group should be restricted to six.
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Table VI. Selection of significant findings from interviews with the students.

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- Students learn about pharmaceutical products in a different way; they know what happens in a pharmacy and what the profession of a pharmacist is; now they really feel they are a pharmacy student.
 - Students learn other important skills, such as searching for information, teamwork (social skills: listening, discussing, division of tasks, taking consideration with others, etc.) working independently, planning, communicative skills (during the project and the presentation), performing under pressure, being creative, etc.; they are free to plan as they want, there is no steering, they explore step by step
 - Knowledge will be better and it will last longer: because students are more actively involved: they have to search for information independently, think about it, search for relations with previous knowledge, discuss, make and give a presentation, answer questions, etc.
 - It is very specific: students work with only one pharmaceutical product
 - Students learn from others (especially skills, but also knowledge); they have a better view of their own skills; peer-assessment is difficult, but now they know how others perceive them and what they have to do to improve.
 - Students become more independent: “I did not like to give a presentation: I was very nervous and was afraid of failure: but I tried and now I have learned a lot: it was a victory to myself!” [Student].
 - It is good preparation for future presentations; presenting for a jury is very stressful, but they have to do it once for the first time, they hope it will be better and better during next years
 - “I did not know most of the students from my group very well: now I had the opportunity to get to know them better: so it’s good that we did not have the possibility to choose our own group.” [Student]
 - Now students learn a lot immediately: with the classical educational methods they just listen and only study before the exams: now they learn a lot during the project week a lot and think more about the topic.
 - “I was very enthusiastic!” [Student]
 - Students find the project more dynamic.
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Evaluation of the line project by interviews

Finally, at the end of the project week, every student was interviewed by the project leader. The aim of this interview was to detect underlying problems (due to the one-to-one situation and to ask other opinions) or give more specific comments. In Table VI, an overview of the most important findings from these interviews is given. Most of the comments are comparable with the outcomes of the questionnaires (see Table V).

Discussion

As explained in the Introduction, the main goal of the implementation of a new course in the first year of the Bachelor in Pharmaceutical Science, was two-fold: (i) allowing students to have contact with the profession in their curriculum, and (ii) presenting to the students new competences, such as teamwork, communication skills etc, which are difficult to deliver with classical educational methods. These two different aspects of the education of pharmacists are rather difficult to integrate in one course and our first attempts to do so were not successful (Petit et al., in press).

Therefore, we had a close look at learning innovations introduced in other Schools of Pharmacy. We chose a combination of two learning innovations which had been introduced by two Schools of Pharmacy previously.

Some years ago the School of Pharmaceutical Sciences of the University of Leiden (The Netherlands), introduced a course in the first year of the Bachelor, which was called “Introduction to pharmacy”. Students had to find out information about a drug and the disease it treated. They also had to make a poster and give an oral presentation (Scheffer & Kruijer, 2005). The Pharmacy department of the University of Malta (Faculty of Medicine and Surgery) introduced a

comparable project, called: Pharmacy Practice Project (Serracino-Inglott, Azzopardi, & Zarb Adami, 2004). Students start with this project in their first year of studies and they proceed with it during the following five years of their studies. In Leiden, the project is a group work, whereas, in Malta, the project is studied individually. We decided to take the best of both these innovations and to combine them. The practical settings of our course are described in the Materials and methods section. The most important elements of this course are teamwork, critical reflection, communicative skills, developing an attitude of lifelong learning, taking responsibility for their own learning.

Here, we have described in detail and will discuss the function of this line project in the first year of the Bachelor programme. But it must be emphasised that in the following two years (the second and third year of the Bachelor programme), students were invited to use their new competences from the Line project I, and the competences acquired during other courses to increase and complete the goals and objectives for their pharmaceutical product. This will be published elsewhere (Petit et al., unpublished).

Discussion of the remarks after Line project I

After the project was completed, students received a questionnaire (see Table II). They also had the opportunity to provide remarks and suggestions. Table V gives a brief overview of these remarks.

A lot of the student remarks are appropriate and useful. The main reason we evaluate the project every year is to be able to react to suggestions and remarks given by the students and to adapt the project when and where necessary. Such a project should be always dynamic. Since, the implementation of the project, the following changes were made to improve the value of the project:

- Students indicated that the time period in which the project was organised, was not convenient (week 11 out of 13 of 2nd semester). We also came to the conclusion that it would be better if the project took place earlier in the 2nd semester. Therefore, we have re-scheduled the project (week 7 of 2nd semester) and in the subsequent academic years, students evaluated the schedule as ideal.
- Another suggestion was that the size of the groups was too large. Every year, we try to have enough different pharmaceutical products so that the groups are not too large.
- Students ask for more comparable projects. This is anticipated in the following years of the Bachelor programme. The line project proceeds in Years 2 and 3 of the Bachelor programme. Moreover, other projects and problem-solving learning is introduced in three years (Petit et al., unpublished).

Another remark of both students and teachers was that this new educational method requires more work (both from students and teachers), but that the benefits resulting from it compensate for this problem.

Conclusion

As a result of the introduction of this project-based learning with a portfolio, students gain new competences, which are difficult to acquire with the traditional educational methods. Although, we have only a few years experience, we see that after one course of Project Based Learning, students already have acquired some important competences:

- Students show a sense of responsibility in their learning process. The reason for this is that the teaching method is based on a self-learning approach: students become more engaged in the learning process. They have the freedom to choose their own strategies and approaches to solving problems. Students gain valuable experience in setting their own goals, get a sense of ownership and control over their own learning, have a say in how and what they learn, and build intrinsic motivation towards problem-solving. This is in agreement with previous findings (Dekeyser & Baert, 1999; Duch, Groh, & Allen, 2001).
- Students also talk and discuss more during the project as compared to the classical lectures approach. As a consequence, students acquire communication skills.
- By using project-based learning, students start to study immediately (because the project ends after one week). This is in sharp contradiction with classical lectures; where students listen and tend to study just before the start of the exams.
- An increase in student motivation cannot be denied. Students will work cooperatively with

peer-students and tutors. Projects challenge students and motivate them towards gaining competences. The fact that there is now closer contact with several aspects of the profession, is also a main motivation for the students in their study.

- Due to project-based learning, students approach other problems in other professional situations with an open mind. Moreover, they acquire communication, collaboration, planning, and self-evaluation skills.
- Students also reflect about the evolution of their competences.

Finally, as discussed earlier, Line project I in the first year of the Bachelor programme is the starting point of a larger project, which will continue in the following years of the Bachelor programme. It is also the starting point for the introduction of other new educational methods, which will be presented elsewhere (Petit et al., unpublished).

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