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Skills development by project-based education in the food and diet course of a pharmacy program

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Abstract

Project-based education was introduced in the food and diet course of the Masters program in Pharmacy at the Vrije Universiteit Brussel. The students were divided into groups, each dealing with two projects. One was related to general food science and one to diet products available in public pharmacies. For each project the students prepared a report, an oral presentation and a publication (such as a poster, flyer, article or website) oriented to a broad public. The tutor of each group supervised the activities and evaluated the students both individually and as a team. The students also evaluated their fellow group members. Moderate to high correlations were observed between the evaluations of tutors and students.

Over the years it has been observed that the introduction of project-based education improves particular skills of students. Individual evaluation was somewhat problematic, but a suitable methodology was attempted.

Keywords: *Skills development, project-based education, food and diet course, student evaluation*

Introduction

Today's pharmacists should, (i) be able to tackle multidisciplinary problems, (ii) have good oral and written communication skills, (iii) be able to work in team and (iv) adapt to "life-long" learning (Hanson & DeMuth, 1991, 1992; Anonymous, 1998; Allison, 2006). The above items require mastery of modern communication technologies. Problem-based learning (Allen, Duch, & Groh, 1996; Wenzel, 1999; Petit, Vander Heyden, Nelissen, Massart, & Rombaut, 2000; Sibbald, 2000; Raman-Wilms, 2001) and project-based education (Sibbald, 2000; www.bie.org; Monk-Tutor, 2001) are examples of new teaching and learning strategies that have been introduced to cope with these skills.

At the Vrije Universiteit Brussel (VUB), Belgium, project-based education, was introduced in the food and diet course of the Masters program in Pharmacy in the second half of the 1990's (Vander Heyden, Vannecke, Van Gyseghem, and Massart (2001); Vannecke, Questier, Vander Heyden, and Massart (2001)). The course was scheduled in the fourth year of the 5 year Bachelor plus Master curriculum. The course's aims were to describe effects of diet on health and the role diet can play in preventing illnesses or curing diseases. Food products sold by Belgian pharmacies, such as infant nutrition, also were potential subjects to be studied. The course consisted of theoretical and practical components. The project-based approach (PBA) was introduced in the latter part, which takes 4 weeks in the academic year during which 60% of the activities are devoted to this course. In the PBA, the students worked in groups, each of which discussed two topics proposed by the teaching staff. One topic was related to general food science (e.g. beer or cheese), the other to food and diet products sold in public pharmacies (e.g. infant nutrition or vitamine supplementation).

Description of programme

Students in the fourth year of the program were divided into groups of between 8 and 10. Each

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group were given two topics to develop, which fitted into the general aims of the course.

A number of deliverables per item were required, such as

i) a written report in which the subject is discussed in a scientific way;
ii) a lecture to teaching staff and students; and
iii) a "publication", in which an (imaginary) target public is addressed. (The target audience and the form the "publication" took was chosen by the students. The form can, for instance, be a manuscript to be published in a (scientific) journal, a flyer (brochure), a poster or a website. The language used and the information given should be chosen as a function of the target audience.

The above requires students to develop communication skills towards the audience, and also to master desktop publication technologies.

The selection of the four groups of students was performed in a combined stratified and random way. It was stratified in the sense that students were ranked according to their general performance in the previous year of the curriculum, into groups of four (i.e. the four best students, followed by the four next best and so on). Then, from each of these groups, one of the students was randomly allocated to a group. This method ensured equality of ability and cooperation with less familiar students.

Within each group meetings were organised twice a week in the presence of a teaching assistant (tutor). During these meetings, where one group member acted as a chairman and another as secretary, students discussed their (acquired) knowledge on the topic, their progress and the information they still required. They then divided the unfinished tasks between them. The students also decided who would be responsible for the final editing of the deliverables. The secretary's report was distributed to the group members and the tutor. The functions of chairman and secretary changed within the group at each meeting. The meetings lasted between 60 and 90 min.

The students managed their work during the 4 week period. In order to make some evaluation possible each student was required to keep a diary. The diary included a short indication of daily activities, information sources investigated (references, web sites), companies contacted or visited, specialists consulted and so on. The references reported were accompanied by a (short) summary of the content, preferably in a form that later could be used in one of the deliverables.

The task of the tutor was to guide the students and to focus the attention on unexamined aspects of the project.

Each group received two topics. One was related to food chemistry in general ("culinary chemistry") and one was more pharmaceutically oriented and/or focussed on food products available in the Belgian pharmacies.

Typical topics belonging to the first class of items were, for instance, coffee, wine, meat and honey. The students were expected to collect information about: the manufacturing of the product; the processes from raw material to the release of the product on the market; the (quality) control of these processes and how this control is performed; and, the requirements of the final product according to the food legislation. It was also recommended that students contact manufacturers. The scientific literature and the food legislation documents were also consulted.

Topics belonging to the second class were, for instance, slimming products and protein supplementation products. Again, the students were required to search for information, but with a focus on the relevant products available in Belgian pharmacies. They were asked to prepare (i) for both topics, a report (between 50 and 100 pages) in which the topics are discussed scientifically and (ii) for one topic a deliverable, initially chosen by the students, in which an (imaginary) target audience is addressed. For example, a website on infant nutrition was created by some students where an overview was given of the nutritional requirements for children from birth until the age of 1 year (http://www.vub.ac.be/fabi/edu/3degraad/restricted/zuigelingenvoeding2002/index.html). The legal requirements for advising breast-feeding, when possible, were explained and an overview of infant food products available in the Belgian pharmacies was given, together with a list of the ingredients and a critical review of the intended use of the products. The site was positively received, and the pharmacists association Koninklijke Apothekers Vereniging Antwerpen (KAVA) provided a link from their website.

The report was required to be a logical and clear text written in a scientific manner. After submission the text was read by the teaching staff as part of the evaluation procedure.

The students also presented their work orally. Each group gave a presentation of 20 min on each topic to the teaching staff and the other groups. After the presentation, all group members were subjected to an oral examination by the teaching staff.

Evaluation

By the teaching staff. The tutor evaluated the quality of the work both on an individual basis and as a team after each meeting. The students were evaluated during group meetings, on meeting reports, on the final report about the studied topic and on the oral presentation. To determine an individual final score

for each student corrections are made, firstly to eliminate the "tutor" effect from the scores of the different groups, and secondly to increase the variability in the scores between individual students, so that the better students have a clearly higher score. The latter is necessary in the Belgian system in which some PhD research grants and teaching staff appointments are based on the scores obtained during the studies. To eliminate the tutor effect, scores were corrected in such a way that the group means become equal to a teacher-defined average. To increase the variability, the students' scores with a value above the average was linearly stretched in such a way that the highest score is corrected to a teacher-defined maximum score. More details on this evaluation are given elsewhere (Vander Heyden et al., 2001, 2007).

Students' self evaluation. The students gave a score out of 20 to the peers in their group including themselves. The latter was done to guarantee as much as possible the anonymity of the evaluation. On the student scores similar corrections to those of the tutors were made. Correlation coefficients between the scores from the supervisors and students are shown in Table I, over two cohorts. In the first cohort the overall correlation ($r = 0.452$, $p < 0.01$) between student and supervisor scores was less strong than in the second year ($r = 0.747$, $p < 0.01$). The reason may be that students from the first cohort were informed of the need to provide evaluations at the end of the course. In later years the requirement to evaluate each other was announced at the beginning of the course. This announcement possibly emphasized the importance of the evaluations. The second cohort has a stronger overall correlation between tutor and student evaluations ($r = 0.747$, $p < 0.01$).

In some cases the student scores provided additional information. For example, students that were hard-working but not so communicative were often penalised by the supervisors through lower scores whilst awarded higher scores by their fellow students. The opposite was also true: communicative students that are lazy outside the group meetings were penalised by the students.

Table I. Correlation between tutor and students scores (after data corrections).

Group	Correlation coefficient (r)	p-values
Year 1		
1 ($n = 10$)	0.383	0.26
2 ($n = 10$)	0.800	<0.01
3 ($n = 10$)	0.598	0.06
4 ($n = 11$)	0.059	0.86
Total	0.452	<0.01
Year 2		
5 ($n = 9$)	0.930	<0.01
6 ($n = 9$)	0.323	0.37
7 ($n = 8$)	0.797	0.02
8 ($n = 8$)	0.819	0.01
Total	0.747	<0.01

Final evaluation. The lecturer decided on the final score for each student. In general the corrected scores from the tutors were chosen. However, if students were awarded clearly higher scores by their peers, the tutor's mark was slightly increased.

Limitations and refinement

The initial aim of developing students' skills was initially fulfilled in a traditional curriculum with a lack of new learning activities. The curriculum has since changed and some skills are developed earlier in the program. For instance, project-based education has been introduced in the first 3 years of the program where oral and poster presentations are prepared. Problem-based education as well has been introduced in a number of courses. Other items, such as the writing of papers or flyers are less frequently required.

The skills development as such was not scientifically measured. The course provided possibilities to develop certain skills. Their application was evaluated based on the deliverables provided, while their development was subjectively appreciated from personal experience and discussion with tutors and other lecturers. For instance, the quality of the presentations of the Masters thesis defence later in the program is considered to have improved over the years since the introduction of problem-based education items, which require similar skills.

Some drawbacks of project-based education include the equal contribution of all students to the project and evaluation of each individual. It is often the case that some students work harder than others. In the present study evaluation by teaching staff and students' self evaluation aimed to reflect the observed activities. However, based on student feedback the evaluation system was altered.

Student feedback indicated that groups were considered too large, the number of topics too many, and the evaluation was considered unclear and unfair because the best students were thought to be favoured. To meet the objections of the students, changes to the projects and their evaluation were made. For instance, the size of the groups and the number of topics was reduced.

Several changes were also made to the individual evaluation process. First, the explanation to students about how the final score was obtained was improved, including the influence of the self evaluation scores, which was generally largely overestimated by the students. Secondly, the weighting of the individual objective evaluation to the total score was increased in order to enlarge the variability in the scores. Therefore

the oral examination after the presentation was removed and replaced by an informal discussion session on the one hand and a written examination on the other. This meant that all students answered the same questions and were scored on an equal basis.

Finally, if the highest scores were considered too low, due to the influence of group marks a linear constant correction was applied instead of a linear stretch. This does not increase the variability in scores, but it deals with the argument that better students are favoured. However, since the introduction of the increased weighting of individual evaluations, these corrections were no longer considered necessary.

The introduction of project-based education in the food and diet course required students to develop particular skills. Recent changes to the program mean that some skills are developed or applied earlier on in the curriculum whereas others are almost exclusively related to this project, e.g. website building. The project-based education also allows students to learn about current food science topics. Individual evaluation of students was somewhat more complex, but a suitable methodology was attempted.

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