Pharmacy Education, 2011; 11 (1): 91– 94

Incorporating an Educational Field Trip into the Teaching of Pharmaceutical R&D for Pharmacy Students: A Case Study

ERIC C.Y. CHAN[1], EDWARD R. BROWNE[2]

[1] *Department of Pharmacy, Faculty of Science, National University of Singapore, 18 Science Drive 4, Singapore 117543*

[2] *GlaxoSmithKline NCEDD Cognition & Neurodegeneration Centre, Biopolis at One-North, 11 Biopolis Way, The Helios, #03-01/02, Singapore 138667*

ABSTRACT

In the teaching of applied sciences such as pharmacy, it is important for the students to relate the acquired knowledge to practical applications in the work environment so as to enhance students' interest in the subject and promote deep learning. In the elective module PR4207 Applied Pharmacokinetics and Toxicokinetics, final year pharmacy students are taught the theory and concepts of early phase drug development, toxicological and clinical trial research. As some of the pharmaceutical research concepts are relatively new and remote to the students, various application-based examples are necessary to help connect the students to the potential applications of such concepts. As the class size is small, it provides the lecturer an opportunity to explore an educational field trip as a tool for experiential education of the subject of drug development. The organization of the field trip to a pharmaceutical laboratory and its pedagogical outcomes are discussed and elaborated in this paper.

Keywords: *Educational field trip; pharmaceutical R&D; experiential education*

INTRODUCTION

The role of pharmacists has changed significantly in Singapore over the last decade. From product-centered and supply-oriented roles, pharmacists have embarked gradually on to "clinical" roles that emphasize patient-centered cognitive services on the one hand, and safe and effective development, commercialization, regulation and surveillance of medicinal products on the other. These demands of the society challenge the education of pharmacists as it is not possible to manage change and new demands without proper education of the workforce.

In several studies conducted in Finland (Shivo and Hemminki, 1999: Shivo *et al.*, 2000; Katajavuori *et al.*, 2002), it was shown that many pharmacists and pharmacy students in Finland have problems in facing the challenges of working life and applying their theoretical knowledge in practical work situations. To meet these challenges, the Department of Pharmacy at the University of Helsinki, Finland, developed a new curriculum for the B.Sc. (Pharmacy) course that places emphasis on enhancing the metacognitive skills of the students (Katajavuori *et al.*, 2003). Metacognition, or thinking about thinking, plays a paramount role in life long learning, a trait that is essential for health-care professionals such as pharmacists. Metacognition plays a key role in developing students' critical thinking skill and expertise as it encompasses an intrinsic awareness of one's own cognitive processes and skills to assess, integrate and reflect one's knowledge and behavior (Cowan, 2006). Two important components of metacognitive behavior are the motivation and interest of the students in learning. While motivation is an on-going appraisal process between the teacher and the students, the students' interest towards learning is a good starting point for enhancing their metacognitive skills and for deep learning of the subjects. While no formal study has been conducted in Singapore to ascertain the competency of fresh pharmacy graduates at the workplace, one common comment made by the pre-registration pharmacists is that what they learned in university is appreciably different from what they are seeing in working life. This may be an indirect indication that for some pharmacy subjects taught in the University, there is a still a lack in the integration of theoretical knowledge with practice.

In the elective module PR4207 Applied Pharmacokinetics and Toxicokinetics offered by the Department of Pharmacy at the National University of Singapore (NUS), final year pharmacy students are taught the theory and concepts of pharmaceutical drug development. As some of the pharmaceutical development concepts are relatively new and remote to the students, various application-based examples and case studies are included in the lectures to help connect the students to the work life applications of such concepts. The integration of the theoretical knowledge with practice is important to enhance the interest of the students in learning and subsequently, their metacognitive skills. However, there is no approach to

*Correspondence: Eric C.Y Chan, *Department of Pharmacy, Faculty of Science, National University of Singapore, 18 Science Drive 4, Singapore 117543, Tel: (65) 65166137, Fax: (65) 67791554, Email: phaccye@nus.edu.sg*

ISSN 1447-2701 online

teaching that makes the education-life-society connection clearer than experiential education (Demartini, 1983). As experiential education involves active learning, it provides a platform for the students to acquire and retain knowledge for a longer period. In addition, experiential learning is hands-on in nature and highly motivating for the students. An educational field trip in particular may be seen as an example of short-term experiential education. In the teaching of applied sociology, field trips were reported in one paper to be an underused pedagogical technique in tertiary education that deserves more attention (Scarce, 1997). As the class size of the PR4207 module is small (14 students), it presents an opportunity to plan and implement an educational field trip to a pharmaceutical company to enhance the experiential learning experience of the students. In this paper, the planning and execution of a field trip to a pharmaceutical company and the outcome on experiential learning are presented and discussed.

MATERIALS AND METHODS

Before the Trip

In the module PR4207 Applied Pharmacokinetics and Toxicokinetics, the lectures are divided into 3 components namely, early phase drug development, toxicological and clinical trial research. For the first component on early phase drug development, students are taught the concepts and applications related to early candidate drug profiling. One of the topics covered includes preclinical *in vivo* pharmacokinetic (PK) study, a branch of biopharmaceutical science related to the measurement of the concentration of a drug in blood and tissue over time after its administration in a non-human animal model. Preclinical *in vivo* PK was selected to be the topic to be educated during the field trip. The chosen site for the field trip is the Department of Drug Metabolism & Pharmacokinetic (DMPK) of GlaxoSmithKline (GSK) NCEDD R&D Centre at Biopolis, Singapore. GSK is one of the leading pharmaceutical companies in the world and has established manufacturing, research and development facilities in Singapore. The site was visited and the locations for the lecture and laboratory demonstration were also discussed and designated. The field trip was planned to be taken during one of the lecture slots. No special transportation was arranged but the students were provided with clear information on the directions to the site. Before the field trip, the students were also given ample briefing to familiarize them on the topic which they would be exposed to during the visit. An evaluation form was also designed to solicit the feedbacks from the students regarding their experiential learning experience (Figure 1).

On-site

The field trip was divided into 2 consecutive sessions namely an in-house lecture and a laboratory demonstration. The lecture was delivered by Dr Edward Browne, team leader of the Department of DMPK at GSK. The content of the lecture was designed to be in line with the syllabus of the module focusing on the use of preclinical *in vivo* PK studies for the profiling of early drug candidates. The lecture was followed by a short break, following which was the laboratory demonstration where the students were taken on a guided tour in the DMPK laboratory. Three stations were set up in the

Figure 1. Student evaluation form for the educational field trip to GSK

Evaluation Form for Educational Field Trip to GSK

Please tell us about yourself

Name: _____

University: _____

Please tell us about your learning experience

The lecture has enhanced my knowledge in preclinical PK study.

Yes No Not sure

The field trip has increased my interest in the subject of early candidate profiling.

Yes No Not sure

The lecture is able to illustrate actual potential applications of knowledge covered in syllabus.

Yes No Not sure

The laboratory demonstration reinforced my theoretical concept and knowledge in this topic.

Yes No Not sure

Are you planning to explore the pharmaceutical industry as a career option?

Yes No Not sure

What other topics would you suggest to be presented in future field trip to pharmaceutical company?

_____

_____

Other Comments:

_____

_____

_____

laboratory where students were educated directly on the performance of experiments related to preclinical *in vivo* PK studies. The experiments comprised liquid chromatography tandem mass spectrometry bioanalysis of preclinical samples derived from the blood or urine of drug-dosed rats and biological sample preparation using protein precipitation and centrifugation. For both the lecture and laboratory demonstration sessions, opportunities were provided suitably for the students to interact with the DMPK scientists and ask questions to clarify any doubts.

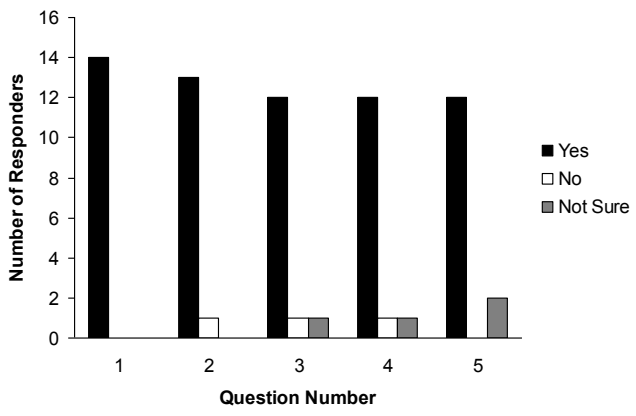
Evaluation of the Trip

At the end of the field trip, the students were requested to answer five "Yes-No-Not Sure" questions in the evaluation form related to the educational field trip (Figure 1). Qualititative comments on the field trip and suggestions on the planning of future field trip were also solicited in the questionnaire. Data were processed using Microsoft Excel.

RESULTS AND DISCUSSION

Before the start of the semester, the potential site of the field trip was first considered. As an educational field trip has not been conducted on the course before, a shorter excursion was preferred. With the development of Biopolis in Singapore as a biomedical research hub, Biopolis offers numerous educational field trip opportunities for biomedical related courses conducted at NUS. As there is an on-going research collaboration between GSK laboratory and the module coordinator of PR4207, GSK became a natural preferred site for the field trip. After discussion with the management team of GSK, the site was finally chosen. The GSK laboratory offers several advantages for the educational field trip for the elective module PR4207. Firstly, the laboratory comprises a DMPK facility where preclinical *in vivo* PK studies are routinely performed. This facilitates the teaching of the subject without compromising significantly the workflow of the partner company during the field trip. Secondly, GSK as a company is a strong corporate supporter of education in Singapore and has a strong track record in supporting student internship programs. This corporate culture of GSK facilitates the selection of the field trip site as the management is supportive of educational programs. Thirdly, GSK laboratory at Biopolis is located within close vicinity of the NUS campus. This facilitates the traveling of students to the site and return to the campus for other classes and activities.

Figure 2. Plot of number of responders to Questions 1-5 of



In brief, the field trip was conducted smoothly. All the fourteen students of the module participated actively in the field trip. The students arrived punctually at the meeting area and the on-site activities were conducted efficiently as planned. One reason of the successful organization of the field trip was the early and ample planning of the exercise. The other reason was the small size of the class which rendered it easier to manage. The key reason however was the good partnership between the site and module coordinators which resulted in clear and efficient communication between the two parties during the planning and implementation of the field trip.

The results of the student evaluation are illustrated in Figure 2. From the results related to Question 1, it was clear that all the students recognized the enhancement of knowledge in preclinical *in vivo* PK studies after attending the field trip. Although enhancement of knowledge might be similarly achieved in a classroom setting, our results confirmed that educational field trip as a pedagogical tool can also provide similar cognitive outcome. As for Question 2, except one student, all other students (> 90% of the class) agreed that the field trip increased their interest in the drug development subject. This was an important finding as increasing the students' interest in the subject was one of the targeted pedagogical outcomes of experiential learning. One of the other aims of the field trip was to bridge the gap between theoretical concepts and its practice. To connect the working life applications to the theoretical concepts taught during the lecture of the field trip, a laboratory demonstration was incorporated to reinforce the acquired knowledge. As shown in the results pertaining to Questions 3 and 4, twelve students (> 85% of the class) agreed that the lecture was able to illustrate potential applications of the knowledge covered in the syllabus and that the laboratory demonstration reinforced their theoretical concept of the subject. These latter results confirmed that field trip was a suitable tool for short term experiential education of students on the pharmaceutical drug development subject. As shown in the results related to Question 5, twelve students indicated interest to explore the pharmaceutical industry as a career option. While this observation might not be unexpected as the students might have selected to read the elective module due to their intrinsic interest in the pharmaceutical industry, the results indicated that the field trip was targeted fittingly at those students who would most probably end up working in the industry. This might also explain partially the positive experiential learning experiences reported by majority of the students. A small number of students contributed new ideas in the evaluation form for the planning of future field trip such as consideration of other pharmaceutical sites and inclusion of a case study of drug development in the lecture.

CONCLUSION

Similar to many professionals in other discipline, pharmacists need to relate the subject matter of their courses to the practicing world around them. In the education of pharmacists, lecturers are relying on more novel pedagogical approaches of bringing the working life connection to their classrooms. Some of these approaches include role play, small

group projects and case studies. While such classroom approaches are laudable and necessary, one should not neglect the fact that the real world is out there for the students to explore. As shown in this study, an educational field trip when planned in detail can result in rewarding experiential learning experiences for the students and lecturer alike. The experiential learning experience enhances the students' interest in the subject matter and may subsequently elevate their metacognitive skills.

Acknowledgements

The author would like to thank Aveline Neo, Catherine Goh and Jean Lim at the Department of DMPK, GlaxoSmithKline NCEDD Cognition & Neurodegeneration Centre, for their kind assistance in the laboratory demonstration.

References

Cowan, J. (2006). On Becoming an Innovative University Teacher – Reflection in Action (The Society For Research into Higher Education & Open University Press, London), pp 186-188.

DeMartini, J.R. (1983). Sociology, applied work, and experiential learning. *Teaching Sociology*, 11, 17-31.

Katajavuori, N., Valtonen, S., Pietilä, K., Pekkonen, O., Lindblom-Ylänne, S. & Airaksinen, M. (2002). Myths behind the patient counseling; a patient counseling study of non prescription medicines in Finland. J*ournal of Social Administrative Pharmacy*, 19, 129-136.

Katajavuori, N., Hirvonen, J. & Lindblom-Ylänne, S. (2003). The development of excellence in pharmaceutical knowledge: new curriculum for the B.Sc. (Pharmacy) studies. *Pharmacy Education*, 3, 149-160.

Scarce, R. (1997). Field trips as short-term experiential education. *Teaching Sociology*, 25, 219-226.

Shivo, S. & Hemminki, E. (1999). Self medication and health habits in the management of upper gastrointestinal symptoms. *Patient Education and Counselling*, 37, 55-63.

Shivo, S., Ahonen, R., Mikander, H. & Hemminki, E. (2000). Self-medication with vaginal antifungal drugs: physicians' experiences and women's utilization patterns. *Family Practice*, 17, 145-149.