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An evaluation of student response to changes in pharmacology teaching and delivery at an Egyptian School of Pharmacy

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Abstract

This study was designed to evaluate changes in student learning patterns and opinions following curricular and delivery changes to the pharmacology course at Suez Canal University (SCU).

A structured questionnaire was administered to final year students, including elements from a previous baseline questionnaire. Students still valued the traditional teaching methods. Their preference for using lecture handouts or their own notes for their learning was undiminished. However, the general increase in students' use of alternative learning resources reflected an increase in self-directed learning. Lectures were perceived to be the least demanding mode of learning. Newer practical classes provided a stimulating, interactive method to re-enforce lecture material. A large majority of students found computer-assisted learning (CAL), overall, to be a useful additional mode of learning and was beginning to be seen by many students as a viable alternative method of learning.

There were lessons to be learned for future curriculum development including evidence that students are adopting a more self-directed approach to their learning.

Keywords: *Computer-assisted-learning, curriculum, pharmacology, pharmacy, student evaluation*

Introduction

Changes in healthcare delivery in countries, worldwide, have prompted radical developments in pharmacy education. Most recently, this has been noted through curricular changes in a number of Eastern European countries (Antal, Matyus, Marton, & Vincze, 2002; Popa, Crisan, Sandulescu, & Bojita, 2002; Sramkova, De Jong-Van Den Berg, & Oerlemans, 2004). A similar pattern of change is beginning to emerge in the Middle East, where updates in pharmacy curricula are accompanied by a move to more appropriate methods of delivery in teaching and learning (Al-Wazaify, Matowe, Albsoul-Younes, & Al-Omran, 2006).

In Egypt, pharmacy education is provided by 13 schools of pharmacy, the majority of which are government sponsored (World list of pharmacy schools). Pharmaceutical education has been firmly based on the pharmaceutical sciences with little emphasis on pharmacy practice and has been taught, primarily, by traditional methods of lectures and practical classes.

The Ministry of Higher Education and Scientific Research in Egypt has proposed a strategic reform plan for all higher education in the country, known as the Higher education enhancement programme (HEEP) that includes proposals for improvement in teaching and learning methods (HEEP, 2005). Prior to this, in 2003, the faculty of pharmacy at Suez Canal University (SCU) had undertaken a plan to review and develop their pharmacy curriculum and to match international standards by applying more innovative methods to their teaching, with particular emphasis on student-centred learning methods such as computer-assisted learning (CAL) and problem-based learning (PBL).

SCU has collaborated with a number of faculties from European universities through a project funded by

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Table I. Comparison of course delivery before and after phase 1 curriculum revision.

Pre-phase 1		Post-phase 1 revision	
Year 3 semester 2	Year 4 semester 1	Year 3 semester 2	Year 4 semester 1
Lectures 48 h Practicals 60 h	Lectures 96 h Practicals 96 h	Lectures 48 h Practicals 40 h CAL workshops 20 h	Lectures 96 h Practicals 64 h CAL workshops 20 h Mini projects 12 h

Each semester is composed of 12 weeks of teaching and 3 weeks of exams.

The Joint European Project (Tempus), (Project reference—JEP-CD-30065, 2002) (European Commission (Tempus)). The project has been a three-year study whose main objectives were curriculum development and the application of modern teaching methods in pharmacy education. The use of existing learning resources avoids unnecessary and expensive re-invention of the wheel (Greenhalgh, 2001). The project therefore focussed on the application of existing CAL programs that had been developed by The pharmacy consortium for computer assisted learning (PCCAL). An evaluation of PCCAL was undertaken in Timmis et al. (1998). The benefits of PCCAL packages for teaching pharmacology to pharmacy students have been described (Sewell, Stevens, & Lewis, 1996; Wang, 2001) and it has been shown that introducing PCCAL packages into a medical school has had a significant impact on student examination performance in pharmacology (O'Donnell, 2005).

The project has involved the establishment of a CAL laboratory at SCU and academic exchanges between the partner institutions. The project is being evaluated both in terms of the impact of changes to the curriculum and of the attitudes and perceptions of students. Results of a baseline analysis, which was conducted in March 2004, have been published (El-Awady, Moss, Mottram, & O'Donnell, 2006). The study concluded that students spent little time on self-directed study, which was reflected in the low frequency of use of library facilities and the preference for passively acquired information. Student perceptions on how to improve their degree course included an increase in the use of computers and the Internet, making the course more relevant to pharmacy practice and increasing their own involvement in learning. It therefore appeared that SCU students were aware of international trends in pharmacy education and practice.

Since that baseline study was undertaken, SCU have introduced curricular and delivery changes to their pharmacology course within the faculty of pharmacy. In November 2005, a second questionnaire was administered to final year students at SCU in order to ascertain whether there had been any changes in student learning patterns and opinions. Comparison of the results from these studies is the subject of this paper.

Materials and methods

First phase of the revision of the existing SCU curriculum in pharmacology

Pharmacology at SCU is taught over the second semester of the third year and first semester of the fourth year of study. Each semester comprises 12 weeks of teaching and 3 weeks of assessment. A comparison of the pre-project course delivery and that after phase 1 revision is shown in Table I.

The teaching elements in Table I comprise:

Lectures. Lectures involve two-hour sessions delivered to the whole year cohort of students.

Practicals. Practical classes are structured exercises, each carried out over 4 h. They are designed to re-enforce the theory taught in lectures and to develop laboratory skills. Students were required to write up practical reports on the work undertaken in the laboratory.

CAL workshops. CAL workshops are conducted in the newly appointed CAL Laboratory. Each session lasts for 2 h and involves 50 students, with tutor support from four teaching assistants. These postgraduate teaching assistants are an integral part of the academic team within the faculty. They have been closely involved in the project and received specific training in running CAL workshops. The workshop sessions are designed to explore selected CAL programs to enable students to expand their knowledge on subjects covered in lectures. Additionally, students are required to conduct assignments, based on the CAL programs, in order to develop skills in retrieval, synthesis and reporting of material.

Mini projects. Mini Projects are carried out in the pharmacology laboratory over three sessions each of 4 h. They involve designing and conducting pharmacological experiments on isolated tissues in order to identify the pharmacological properties of unknown substances, principally with an action on the autonomic nervous system. Students work in groups of

four. Each student produces a practical report, based on his or her mini project. The principal skills that are developed are experimental design, manipulative skills, literature investigation and teamwork.

The CAL programs that were introduced into the workshops (with a brief description of their content) were:

- The frog gastrocnemius muscle/sciatic nerve preparation. (The program examines the dissection of the preparation, the equipment used in the experiment and a number of nerve and muscle properties)
- Basic psychopharmacology. (This package introduces the neuroscientific foundation of psychopharmacology, clinical applications of psychopharmacology, research methods used in psychopharmacology, including laboratory techniques, use of animal models and some of the problems of clinical trials.)
- Simulated water maze. (The program teaches dementia and associated drug therapies. It explains the importance of memory defects, illustrates different types of maze and gives a detailed description of the nature and use of a water maze.)
- Pharmacological experiments on rabbit jejunum. (The package describes the experimental set-up, the role of the autonomic nervous system, adrenergic, acetylcholine, adenosine and histamine receptors and the effects of agonists and antagonists on the receptors)
- Pharmacological experiments on isolated guinea pig ileum. (The package includes experimental set-up and constructing and comparing dose–response curves for agonists and antagonists)
- Cardiovascular system/autonomic nervous system tutor. (The objective is to demonstrate the influence of autonomic nerves and transmitters on the cardiovascular system using a simulated trace of blood pressure and heart rate)

Evaluation of student perspectives after phase 1 revision

Year 4 students were questioned in November 2005. These students had received tuition using the revision to the curriculum in both years 3 and 4, as outlined in Table I. A structured questionnaire was designed, including elements from the baseline questionnaire, where relevant, but including new questions reflecting the changes introduced into the pharmacology curriculum.

The questionnaire was designed to ascertain:

1. Whether the time spent on pharmacology was sufficient for pharmacy graduates;
2. How many hours per week students currently spent on being taught, doing coursework-related homework and on their own learning related to the course;
3. Which types of teaching they preferred and why;
4. How often they used their library facilities;
5. What methods they used as study aids;
6. What type of practical class they preferred and why; and
7. How useful they had found computer assisted learning and their preferences for particular packages.

Elements 2, 4 and 5 had been used in the baseline questionnaire. Where elements were the same, comparisons were made with the responses from the equivalent cohort of year 4 students at the time of the administration of the baseline questionnaire (March 2004).

Most of the questions were quantifiable. The responses from the open questions were subjected to thematic analysis. The number of student citations for each of these themes was then recorded. Data from the questionnaires were analysed through the software program Statistical Package For The Social Sciences (SPSS v.12). Results were subjected to frequency analysis, non-parametric Mann–Whitney test or cross-tabulation with contingency chi square analysis as appropriate.

Results

The total number of students completing questionnaires from the November 2005 cohort was 152. Results, below, are presented by each question posed and the response obtained. Comparisons with the responses from the year 4 students who completed the baseline study in March 2004 are given, where appropriate.

Is the time that you spend learning pharmacology enough for pharmacy graduates?

None of the students considered that the time spent learning pharmacology was more than enough. Seventy-three (48%) of respondents thought that it was about right and 79 (52%) considered it too little.

On your pharmacy degree course, on average, how many hours per week do you spend being taught by your teachers/on homework/doing your own learning related to your degree course?

Students were asked to specify how many hours they spent per week on each of the activities specified, above. Around half their time (48.9%) was spent being taught, 27.1% completing homework and 23.9% on their own learning. Comparing responses with results from year 4 students in 2004, there had been a marked increase in the percentage of time spent on their own learning, from 12.5% in 2004 to 23.9% in 2005. This trend was emphasised by the fact that 32.7% of the 2004 cohort of students claimed to do no

Table II. Opinion on the usefulness of various types of teaching. Figures represent the number (%) of citations for each type of teaching.

	Most useful	Next most useful	Least useful
Practical classes	40 (26.5)	74 (49.0)	37 (24.5)
Lectures	99 (66.0)	40 (26.7)	11 (7.3)
CAL	16 (10.7)	39 (26.0)	95 (63.3)

learning on their own whereas only 2.1% of the 2005 cohort did no own-learning.

Which type of teaching do you find useful? (1 = most useful, 2 = next most useful, 3 = least useful) and why?

Respondents were asked these questions with regard to three types of teaching: Lectures, practical classes and CAL. Results are shown in Table II.

Clearly, students prefer the more traditional teaching methods as their primary mode of delivery. Students were asked to give their reasons for making their selection. Responses were subjected to thematic analysis. Results are shown in Table III.

The number of citations reflects the order of most usefulness for the respective methods of teaching.

On average, how frequently do you visit your university library during term time?

Table III. Results of a thematic analysis of comments provided by students on their reasons for selection of favoured teaching modes.

Theme	Number (%) of citations
Lectures provide all the knowledge needed to pass exams and for work in pharmacy	30 (19.7)
Lectures are interesting and easier to understand than other forms of teaching	24 (15.8)
Lectures provide more interaction with the teachers and allow questions to be asked	31 (20.4)
Practical classes teach skills and allow you to do experiments yourself	12 (7.9)
Practical classes reinforce theory and allow you apply the science in practice	10 (6.6)
Practical classes give information in an interesting way	3 (2.0)
CAL exercises teach you how to search for knowledge and depend on yourself	7 (4.6)
CAL gives you more freedom in learning and to work at your own pace	4 (2.6)
CAL complements lectures and allows you to apply the science learned	7 (4.6)

Table IV. Comparison of library use between year 4 students in 2004 and 2005.

	2004 Number (%) of citations ($n = 108$)	2005 Number (%) of citations ($n = 151$)
At least once a day	1 (0.9)	3 (2.0)
A few times a week	8 (7.4)	14 (9.2)
About once a week	9 (8.3)	15 (9.9)
Less than once a week	90 (83.3)	119 (78.3)

Comparison was made between year 4 students' responses in 2004 and 2005. Results are shown in Table IV.

There was a small, but statistically insignificant ($p = 0.789$) trend towards a greater use of library facilities from 2004 to 2005.

Which of the following methods do you use *regularly* to help you to study for your degree? (Table V)

Clearly, lecture handouts and students' own notes remained the most frequently used methods for learning. Apart from Journals, there was a general increase in the percentage of students using each type of learning resource.

Which type of practical class do you prefer and why?

A new type of practical class, mini projects, had been introduced into the year 4 pharmacology course. Students were therefore asked to choose which type of practical class they preferred and the reasons for their choice. There were advocates for both types of practical class, with mini projects being preferred by 57.2% of respondents.

The reasons given for choosing the respective type of practical were subjected to thematic analysis. Results are shown in Table VI.

There were relatively few citations from those students who preferred traditional practical classes (42 comments from 65 students compared with 104 comments from the 87 students who preferred mini projects). The reasons given tended to reflect the key skills that mini projects are designed to develop.

How useful have you found the Pharmacy Computer Assisted Learning (CAL) programs?

Table V. Comparison of the methods of learning used between year 4 students in 2004 and 2005.

Study method	2004 Number (%) of students using the method ($n = 120$)	2005 Number (%) of students using the method ($n = 152$)
Your own notes	54 (45.0)	102 (68.0)
Text books	20 (16.7)	44 (28.9)
Scientific journals	6 (5.0)	3 (2.0)
Internet sites	11 (9.2)	21 (13.8)
Lecture handouts	83 (69.2)	124 (81.6)

Table VI. Reasons given for selecting the type of practical class preferred ($n = 152$).

	Reason given	Number (%) of citations
Students preferring traditional practicals	You can evaluate your own results and methods	8 (5.3)
	Traditional methods are easier than mini projects	17 (11.2)
	Not enough help is given by tutors in mini projects	5 (3.3)
	More information is obtained by traditional methods	6 (3.9)
	Students do not have enough experience in team work	6 (3.9)
Students preferring mini projects	You learn to get information for yourself and it trains you for information retrieval and future work as a pharmacist	31 (20.3)
	It is useful having information from different sources and encourages use of learning resources	26 (17.1)
	Results are interesting, immediate, easy to obtain and accurate	10 (6.6)
	It is useful working in groups and encourages team work and cooperation	30 (19.7)
	It helps in understanding theory	7 (4.6)

Six CAL programs had been introduced into the curriculum. Few students (17.8%) had found them "Not Useful At All", 28.9% "Very Useful" with the majority of students (53.3%) finding them "Fairly Useful".

List the *two* Pharmacy Computer Assisted Learning (CAL) packages that you have found to be the most useful and the two you have found the least useful for learning pharmacology

The number of citations regarding the usefulness of the available CAL packages is shown in Table VII.

Students experienced these packages in a variety of ways, but mostly in structured workshop sessions. All packages received some degree of endorsement. The rabbit duodenum package was clearly perceived as being the most useful.

Discussion

In phase 1 of this project, changes were made to the curriculum and methods of teaching of pharmacology within the pharmacy degree course at SCU. These changes were made to give students a wider exposure to information sources related to their course and to encourage a more self-directed approach to their studies. Information was provided through CAL programs that had been produced externally, thereby rationalising on effort by utilizing existing resources (Greenhalgh, 2001). The more self-directed approach to learning was achieved through running workshops involving CAL material and through laboratory-based mini projects.

Table VII. Most and least useful PCCAL packages used to date.

PCCAL package	Cited as most useful (%)	Cited as least useful (%)
Frog gastrocnemeous	19 (12.5)	70 (46.1)
Psychopharmacology	15 (9.9)	19 (12.5)
Water maze	10 (6.6)	24 (15.8)
Rabbit duodenum	105 (69.1)	10 (6.6)
Guinea pig ileum	35 (23.0)	18 (11.8)
CVS/ANS tutor	58 (38.2)	2 (1.3)
Total citations	242	143

The pre-study pharmacology curriculum had emphasised the action of drugs exclusively using animal models to illustrate the pharmacological principles. In the phase 1 change to the curriculum, some "wet" laboratory practicals were retained but largely converted to mini projects, in which students worked in groups using a problem solving approach over a number of linked practical classes. In addition, six CAL packages were introduced, principally involving simulations of animal studies. This allowed students to experience concepts of which they were familiar but introducing a broader, more interactive experience than that previously provided in the laboratory. The high rating that the rabbit duodenum CAL package received in the student survey reflected the students' familiarity with its basic principals and its value in supporting the mini projects.

The baseline study for this project (El-Awady et al., 2006) had shown that students, at SCU, spent little time using library resources and relied heavily on lecture handouts written by their tutors. It has been suggested that active learning is diminished when students are provided with all the information that they require (Brazeau, 2006). The results from this study show that there has been little significant change in students' preference for lecture handouts or their own notes for their learning. However, the general increase in the percentage of students using alternative learning resources reflects an increase in self-directed learning. Although students had shown an increased tendency towards self-directed learning, the extent was relatively small. Students still valued the traditional teaching methods, with which they are familiar. Lectures were perceived to be the least demanding mode of learning, whilst providing the necessary material to complete the

course, successfully. Practical classes provided a stimulating, interactive method to re-enforce lecture material. For some students, CAL provided an alternative to practical classes, to achieve the same end. Despite CAL being perceived as inferior to lectures and practicals as the *most useful* method of teaching, a large majority of students found CAL, overall, to be a useful additional mode of learning and CAL was beginning to be seen by some students as a viable alternative to practical classes as a stimulating, interactive method to re-enforce lecture material.

In phase 1 of the project, access to CAL was restricted to timetabled sessions. Some student comments had expressed the desire to search for information in their own time and at their own pace. These views are consistent with the philosophy of CAL usage as a flexible medium (Lewis, 2003). It is intended, in phase two, to make CAL packages more widely available to students for self-directed learning.

The mini project approach to practical work was perceived to be advantageous by just over half of the cohort of students. Those students preferring mini project type classes provided a significant number of interesting observations. Generally, these reflected the advantages associated with this type of practical work involving a more self-directed, team-led approach to practical work. Comments regarding the lack of experience in using this type of practical exercise emphasis the need for training and support in the techniques required, not only for students but also for staff (Greenhalgh, 2001). Such training should begin at the start of the course of study (Sosabowski, Herson, & Lloyd, 1998). Students' preferences from the group of CAL packages made available to them at the time of this study showed that all packages had some degree of favour but that the rabbit duodenum package was, by far, the most popular.

In future phases of this project, further CAL packages will be introduced to students, particularly those that will expose students to a more therapeutically orientated approach to drug action. This will provide students with a more clinical and patient-directed approach to drugs (Shankar, Mishra, Shenoy, & Partha, 2003). PCCAL embraces a wide spectrum of subject areas, therefore, CAL will also be introduced to other departments within the Faculty of Pharmacy.

The limited changes that have been made to the teaching within the pharmacology curriculum have produced a mainly positive response from students. Clearly, there are lessons to be learned for future curriculum development. There is evidence that students are beginning to adopt a more self-directed approach to their learning. This is to be encouraged.

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