

## Evaluation of a web-based course teaching information literacy to third year pharmacy students in the University of Kuopio, Finland

EWEN MACDONALD, & JARMO SAARTI

*Department of Pharmacology and Toxicology, Faculty of Pharmacy, University of Kuopio, P.O. Box 1627, Kuopio FIN-70211, Finland*

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### Abstract

We used the WebCT platform to develop a brief study credit (1.5 ECTS) on-line course entitled “Pharmacology on the Internet”. Though, one aim of the course was to make students aware of the wealth of pharmacological information available on-line. A second aim was to increase students’ critical awareness of web-based information, i.e. to teach information literacy.

We have found that this short course does provide students with a grasp of information literacy; after the course, they are less intimidated by databases like PubMed. Furthermore, the course was popular with students, they rate it as between very good and excellent and over 95% of students stated that they would recommend it to other students.

These findings demonstrate that web-based teaching can achieve quite advanced pedagogic goals in a student-friendly manner.

**Keywords:** *Information literacy, pharmacology, web-based teaching, WebCT*

### Introduction

Over the past ten years, we have witnessed an explosion in the amount of information available on the World Wide Web. Furthermore, according to a recent review, two thirds of all schools of pharmacy in the United States offer some internet-based courses, with four educational institutes offer complete degrees in pharmacy to off-campus students (Hunter, Deziel-Evans, Marsh, 2002). Finland is a small country of 5.5 million inhabitants and pharmacy is only taught in two Universities: Helsinki and Kuopio. A third University, Åbo Akademi, does provide a three year pharmacy course (farmaseutti), but students wishing to complete the five year degree (proviisori) must transfer to the faculties of pharmacy in Kuopio or Helsinki at an appropriate time. Each year, about 300 Finnish students graduate with the three year degree and 100 with the five year degree, essential for ownership of a pharmacy. Even though the Finnish system differs

from pharmacy education in much of Europe in terms of degree structures and student numbers, the problems faced by students and teachers of pharmacy in Finland are very similar to other pharmacy institutes throughout Europe.

In the University of Kuopio, pharmacology is taught in a traditional manner, with students attending lectures, small group exercises, tutorials and seminars. Towards the end of the third year, when the two degree courses (i.e. the three year and the five year courses) start to diverge, students must choose elective courses and four years ago, the Department of Pharmacology & Toxicology decided that it would offer an on-line brief course (1 study week = 40 h of student work = 1.5 ECTS) delivered via the WebCT platform for which the university had recently purchased user rights. We noticed an increasing trend that students often submit essays according web pages equal status as published articles in their

Correspondence: E. MacDonald, Department of Pharmacology and Toxicology, University of Kuopio, P.O. Box 1627, FIN-70211 Kuopio, Finland. Tel: 358 17 162400. Fax: 358 17 162424. E-mail: mcdonald@messi.uku.fi

reference lists. This suggested to us that they were unaware of the non-refereed nature of these pages. Therefore, the more recent versions of the course have emphasized the concept of information literacy; to help students appreciate the pitfalls and limitations of web-based information sources. We reviewed the literature to determine whether others had described a course based on teaching information literacy in pharmacology, and whilst there are several reviews on computer-assisted learning (Abate et al., 2000; Crouch, 2001, Hughes, 2002, 2003), there was a paucity of literature on this type of instruction.

We recently described the contents of the course in some detail (MacDonald & Saarti, 2003). In summary, the 2003–2004 version of the course contains 12 distinct exercises; the first two introduce the students to a selection of authoritative web pages (e.g. those prepared by the Finnish Medical Association; the Finnish National Agency of Medicines). In the subsequent three exercises, the students start to search databases (PubMed, patent agencies, search engines) to compare the amount of information available in English and in Finnish; and consider how much is being out-of-date (using the example of a drug removed recently from the market due to side effects).

In the third part of the course, they are asked to seek out information on new compounds (e.g. novel anti-cancer agents, anti-hypertensive drugs, analgesics), where they assess the novelty of the mechanism of action, how far the compound has progressed in clinical trials, how many published papers are in the literature, etc. There is also an exercise on herbal remedies, especially their interactions with prescription drugs, an area not covered in the pharmacology course taken by all students during their second year. In the penultimate exercise, they compare the information provided in an apparently scholarly article in a site sponsored by a private company with the facts taken from a pharmacology textbook. Then they try to assess the scientific qualifications of the author of the article. In the final exercise, the students are asked to nominate a web site to be included in the next year's course and to provide a critique of its academic reliability and its visual appeal.

After completing the last exercise, students fill in a web-based course evaluation where, in addition to giving their opinion on what parts of the course they had liked and suggestions for improvements, they are asked a question on whether they now view web-based material in a more critical light. When questioned most students (91%) reported increased criticism of web-based material. We wanted to determine objectively whether this was the case and thus conducted a pre-/post course questionnaire asking them to rate different sources of web-based information, forming the basis of this study.

## Methods

In the academic year 2003–2004, a total of 60 students enrolled in the course. A total of 48 students (4 males, 44 females). In the first exercise (i.e. before they did any of the web searches), they were asked to rate their first choice, second choice, etc. for solving four problems. The options were (a) the electronic version of *Pharmaca Fennica* (a guide to all pharmaceutical products on the Finnish market), (b) the web-pages of the regulatory authority (Finnish National Agency of Medicines), (c) an international database (like PubMed), (d) a search engine (like Google) and (e) some other site. They were also asked to justify their selections in writing (up to a maximum of 30 words). The four problems to which the students were asked to seek information were as follows;

- (1) Advising a customer who has come into the pharmacy with a press clipping, which states that a widely used antibiotic can interact with oral contraceptive medication;
- (2) Finding information on a new opiate-type analgesic which has recently been marketed in Finland but with restrictions on how it can be prescribed and dispensed;
- (3) Helping a customer to find reliable information on a herbal product, e.g. St John's wort;
- (4) Determining what is known about a novel molecule undergoing clinical trials; the new compound is still without a generic name and is known only by a numerical code.

At the end of the course, the same questions were asked again (i.e. after the last exercise immediately before they were transferred to the course evaluation form). On average, 42 days elapsed between the completions of the two questionnaires (range 2–150 days). Each individual student's response to the questions before and after the course was compared by Student's *t*-test for paired samples.

## Results

### *Students' opinions of the course*

This is the only on-line course provided to our students and it differs clearly from all other aspects of their pharmaceutical instruction, a traditional format of lectures, seminars and tutorials, etc. The students enjoyed the course—in the anonymous evaluation at the end of the course, they rated it on a seven point scale as 5.1 on a standard 7 point scale.

In addition, all but one of the 48 who completed the course stated that they would recommend it to future students. The major criticism was that students have to deal with so much English text. This followed the aims of the course, to demonstrate that the internet is overwhelmingly English-dominated and anyone

wishing to find information on-line cannot restrict their search to Finnish (a language spoken only by 5 million Finns). The same majority (47/48) also stated that the course made them more critical of web-based information.

#### *Changes in students' attitudes after the course*

We attempted to assess whether our students could be called "web-savvy" by asking them where they would seek information on a series of problems. Since we asked the same questions at the end of the course, we were able to determine whether any changes had taken place in their critical awareness at the level of each individual student. The majority of the statistically significant changes occurring during the course were centered on the use of PubMed. After the course, students were more willing to use this database (Figure 1). This was particularly evident in the question about a new drug undergoing clinical trials (Figure 1D). Initially students were confused on where best to start; 23/48 stated that their first choice would be the site of the Finnish National Agency for Medicines (NAM) and 20/48 selected PubMed. After the course 3/48 for NAM and 37/48 had changed corresponding values for PubMed. Six students stated they would also justify in writing a selection of their own, 6 students stated that they would start their search in the world wide patent data base (a site also utilized in the course), 2 students still believed (erroneously) that Pharmaca Fennica would represent the first choice information source.

#### **Discussion**

As described four years ago, our department decided to create an on-line course as a non-compulsory component of the three and five year degree courses in pharmacy. Since faculties of pharmacy all over the world now offer on-line instruction, we were interested in gaining experience in this novel educational medium, especially with the WebCT portal, which our university had recently selected. However, we were motivated more by the need to supply our students with a grasp of the true nature of web-based material.

In the Finnish higher education system, courses are classified according to study weeks, with one study week requiring 40 h of effort (= 1.5 ECTS). Apparently, our course was somewhat generous, as two students have successfully completed it in two days, admittedly working longer than the 8 h envisaged as the norm. Most students take a more leisurely approach to the course, completing two or three exercises each week (median time to complete course 3 weeks). The course is entirely on-line; there is no face-to-face contact between the course designer and the students and all students submit their reports

via the WebCT system with the designer's responses being appended at the end of their reports and returned via the same portal. Most students complete the course on-campus, using the computers situated in the university's common computer bays. However, the course can be accessed from anywhere at any time. Since the tracking system on WebCT records when the reports are submitted, we have been somewhat surprised to receive reports dated Christmas Eve or New Year's day.

The course has been well received by the students, approximately half of the third year students enroll and of these, about 80% complete this non-compulsory course. There are probably several reasons why the remaining 20% never complete the course. One common reason is that students do not need the single study week credit to gain their degree and their motivation dissipates. One other reason, and a commonly stated criticism of the course, is the amount of English text to be digested. Most students would prefer the information in their native language, Finnish. However, several students have written that the continual need to read English acts as an informal but nonetheless welcome, language course.

We wished to test whether students' attitudes were truly changing and thus for the past two years, the course comprised a questionnaire component, with the same questions posed at the start and end of the course. In 2002, our questions were rather general, enquiring about ease-of-use, reliability, etc. of different types of web-based material. There were few statistically significant changes, which could be identified (MacDonald & Saarti, 2003). After the course, they were slightly, but significantly, more critical of the reliability of sites run by private companies. This probably reflects the experience gained in one of the final exercises where the material provided by a mail-order drug company was compared with the information available in a Finnish pharmacology textbook (also available on-line).

In 2003, we changed the nature of the questionnaire, setting more specific questions and asking the students where they would first set out to seek information, then the next site, etc. The first two questions posed were on areas where we anticipated our students would have background knowledge; a question on an interaction between two widely used drugs and a question on restrictions associated with a newly marketed opiate analgesic. In both cases, they were aware of the appropriate site even before starting the course and thus there were no changes after course completion. With the question on a herbal remedy, they were less certain where to start, but there was a trend after the course to select PubMed. This was even more evident in the final question which involved a drug undergoing clinical trials but which had not been accorded a generic name. Several exercises in the course involve seeking information on novel products,

and we emphasize the benefits of PubMed as a source of reliable information on novel drugs.

It could be argued that for a compound in the initial phases of clinical trials, there may be little published information in PubMed, but it is our opinion that a search would be more revealing than accessing the patent data bases. On other data bases, which list drugs undergoing clinical trials are run on a pay-for-access basis and thus are inaccessible to students. Thus, it was gratifying that after the course, the majority of students chose PubMed as their primary source of information with the next popular first choice being the Finnish patent agency database. In a recent study of US students, it was noted that students have a preference for drug information sites with comprehensive coverage rather than more restrictive sites (Hailemeskel, Dutta, Root, 2002).

Students also expressed in writing their changed attitudes to PubMed. Prior to the course, their comments tended to be negative “Can be difficult to use and even obtaining references is of little use if the actual publications are not in the library”. Many simply stated that they had never used the PubMed (Medline) facility, apparently having forgotten the content of the compulsory first year course on information technology and the use of the library where they are shown how to use PubMed. After the course, their comments were generally positive, stressing the ease of use, especially with the “limits” options—“no doubt about it Medline first; there you can find reliable information about drugs in clinical trials, probably Google would reveal something as well”. Some students were more skeptical about finding relevant information—“I am not sure how easy it would be to find information about experimental drugs on Medline, but that’s where I would first look, then I’d try Google” or even more pessimistically “Medline is probably the “least hopeless” of the alternatives—at least in the exercises I found what I needed there”.

From a pedagogic point of view, we were pleased that this on-line course could change students’ attitudes in a favourable direction. Our aim at onset was to make students more critical of certain forms of web-based information and to steer them towards

using source articles published in the refereed scientific literature. We conclude that on-line instruction can be effective; in fact it is difficult to envisage teaching students on the pitfalls and perils of the internet in any way other than via that medium. In particular, though web-based teaching is normally reserved for students in distance learning courses, on-campus students can also benefit from this kind of teaching. Students graduating in pharmacy today will rely more and more on the World Wide Web and it is our duty as pharmacy teachers to provide a sound foundation in information literacy—the ability to assess as well as digest information (Brown & Krumholz, 2002).

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