



The Use of a Virtual Learning Environment During the Internship of Final Year Pharmacy Students

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An assessment was designed using Questionmark Perception, one of the programmes embedded in the TOLEDO-platform, to evaluate students' progress in knowledge on 12 classes of OTC-medication. We investigated the use of the programme after one trimester of internship in pharmacy. Students do not use the programme intensively to monitor their progress, probably because of inadequate but requisite skill attainment prior to course enrolment. If we want to use the TOLEDO platform as a tool in guided self-study, we have to realise that demand for computer literacy, along with the need to identify computer skills of students prior to starting the course, would have to increase.

Keywords: TOLEDO; Questionmark; Internet; Internship; Pharmacy

INTRODUCTION

In 2001, the University of Leuven (Belgium) implemented TOLEDO as a web-based virtual learning environment. TOLEDO is short for "Toetsen en Leren Doeltreffend Ondersteunen," or efficiently support testing and learning (Cosemans and Roelants, 2002). We used TOLEDO as a platform to assess the evolution in knowledge on over-the-counter products of final year pharmacy students during internship. We analysed the respondents' answers three months after the introduction of the assessment on the internet.

We focused on following research questions:

1. To what extent is the test used?
2. Does the educational option of students have an influence on the frequency of use and the test results?

3. To what extent do former courses have an influence on the results?
4. How do students progress during internship?

ASSESSMENT OF OTC-DRUGS RELATED TOPICS DURING INTERNSHIP VIA TOLEDO

Besides making course material available on-line via *Blackboard*, TOLEDO allows linking to external sources and offers several opportunities for students and instructors to communicate with each other (Anonymous, 2002a). In addition, instructors can set up a test platform with *Questionmark Perception*, allowing students to evaluate their own progress. *Questionmark Perception* enables users to create tests, surveys, questionnaires and assessments for use via the internet or an intranet. *Questionmark Perception* contains two Window applications, "Question Manager" and "Session Manager." *Question Manager* enables instructors to create questions and to organise them in hierarchical item banks. *Session Manager* allows construction of tests and surveys using these questions. Created questions, tests and surveys are saved in databases. The *Perception Server* gains access to these databases and serves out the tests and surveys to authorized individuals over the web or an intranet. *Perception Server* also allows the student as well as the instructor to perform online security management and real-time analysis of respondents' answers to surveys and tests (Anonymous, 2002b).

All students registered at the University of Leuven automatically receive an intranet user-identification and password. With these they can

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TABLE I Classes of OTC-drugs covered by the assessment

Allergic rhinitis
Diarrhoea
Colds and flu (including sore throat)
The painful red eye
Cough
Headache
Heartburn, indigestion, nausea and vomiting
Mouth, lips and teeth problems
Constipation
Dysmenorrhoea
Motion sickness and its prevention
Musculoskeletal problems

access centrally-managed computer services, such as e-mail, PC-classes, dial-in, *KotNet* (internet in their home environment) and TOLEDO.

The test on OTC-drugs was designed in July, 2002 and was introduced to the students at the beginning of their internship in September, 2002. The test covers 12 classes of OTC-drugs (Table I). Various question types are used:

1. *Matching*: two series of statements or words are presented; the participant must match items from one list to items from the other list
2. *Multiple choice*: the participant selects one answer from a list
3. *Multiple response*: similar to multiple choice except that the participant is not limited to choosing one response; he or she can select none, one or more of the choices offered
4. *Matrix*: this question type presents several multiple choice questions together; the participant can select one choice for each statement or question presented
5. *Numeric question*: a participant is prompted to enter a numeric value; this can be scored as one value for an exact answer or another score if the response is within a range
6. *Pull down list (selection question)*: a series of statements are presented and the participant can match these statements with a pull down list
7. *Ranking*: a list of choices must be ranked numerically
8. *Select-a-blank*: the participant is presented a statement in which a word is missing; words can be selected from a pull down list to indicate the answer
9. *True or false*: the participant selects "true" or "false" in response to the question
10. *Word response*: the participant types in a single word or a few words to indicate his or her answer and
11. *Yes or no*: the participant selects "yes" or "no" in response to the question

The database contains about 10 questions for every class of drugs. During each assessment, two

questions from each drug class are selected at random (equivalent to h 24 questions-per-session). In other words, students can run the assessment several times without getting exactly the same test each time. After submitting their answers, students get immediate feedback. They are informed after each question whether they have answered appropriately; further explanatory feedback relevant to the answer is provided. For some questions, students are further asked to search for the right answer in textbooks or in the pharmacy environment.

All students of the final training year of pharmacy were enrolled in this assessment, which could be run at any time during their six months of internship. In August, students received a written instruction on how to use the programme. Afterwards, they were motivated once more during an evening session concerning their internship.

The instructors who designed the assessment had access to all the results and the time spent on the assessment. Through this access, they got an idea about how well students progressed during their internship.

USE OF THE ASSESSMENT INSTRUMENT AND TEST RESULTS DURING THE FIRST TRIMESTER

From October to December, more than a quarter (28.1%) of the 89 last-year students did not run the test at all. Meanwhile, 31.5 % did it only once, though they were reminded several times of the possibilities of the TOLEDO-assessment. On average, students submitted the test twice with a range from 0 to 25.

The students who choose the option "Pharmaceutical Health Care" ($n = 58$) attend an interactive seminar of one week where various kinds of pharmacotherapeutic topics were covered (Laekeman *et al.*, 2002; Leemans *et al.*, 2002). During this training week, it was demonstrated how to use the TOLEDO-programme. Several students were unable to log into the programme without help from the instructor or colleagues. Considering the fact that 62.1% of the attendees opened the programme for the first time during the seminar week, the instruction given during this seminar seemed to be necessary.

Students of the Pharmaceutical Health Care option scored significantly better on the assessment than their colleagues who followed one of the other two options (Fisher's Exact Test: $X^2 = 5.675$; $p = 0.039$). They also conducted the test more frequently (Pearson Chi-square: $X^2 = 8.082$; $p = 0.005$; Fig. 1) and more regularly between October and December (Pearson Chi-square: $X^2 = 29.055$; $p = 0.000$). Despite all publicity that was directed towards the students (concerning this assessment and the repeated instructions on the use of the programme)

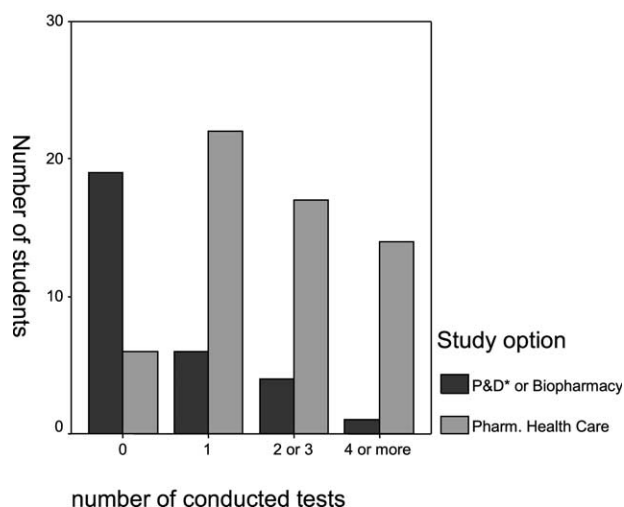


FIGURE 1 Frequency of assessment for "Pharmaceutical Health Care" and the two other study options. *P&D = Production & Development (one of the three options students can follow during their pharmacy studies, besides Biopharmacy and Pharmaceutical Health Care).

only eight students conducted the test every month (October–November–December) to follow up their progress during internship.

The more the test was conducted, the better the results were and the shorter the time needed to complete it. But no significance could be calculated due to the small number of students who actually completed the assessment at least once-a-month (Table II).

During the year before the internship, students received instructions and were tested on some of the OTC-topics. Surprisingly, topics studied before were not answered better than new topics (mean score of 50.8 against 50.4).

DISCUSSION OF THE FINDINGS AND IMPLICATIONS FOR THE FUTURE

New learning technologies, such as the TOLEDO environment, provide a very attractive tool for teaching and assisting the learning process. The particular value of e-learning is the ability to provide immediate, individualised feedback seldom available through other forms of instruction.

TABLE II Mean test score and mean time needed to run the test (minutes:seconds) for those students who completed the assessment at least once a month ($n = 8$)

	Mean test score (range)	Mean time (range)
October	56,46 (34–74)	20:23 (9–51)
November	58,58 (49–72)	16:56 (6–48)
December	64,30 (54–80)	11:58 (5–21)

Frequently, when students practice skills on paper they do not know until much later if they did the task correctly. When this is the case, students may actually be memorising the wrong facts and skills. Therefore, computer-assisted learning helps the student in two ways: "debugging" and retention (Barzak *et al.*, 2001).

Moreover, computer-assisted learning is better adjusted to individual variations in students' learning skills and behaviour than lectures or textbooks, making it a very valuable tool for guided self-study. Indeed, they allow the learner to control an important part of the learning process. Students can make the learning process more flexible and self-directed by choosing the time of practice and the amount of repetitions. Above all, computer-assisted learning promotes lifelong learning behaviour, one of the most important challenges of higher education (Clarck, 2001; Dawn *et al.*, 2002).

The programme further keeps records of the students' answers to every question solved; this is another major advantage of the TOLEDO environment in that it gives instructors feedback regarding students' progress and understanding of topics, thereby allowing appropriate and timely intervention (Barzak *et al.*, 2001).

Yet, after reviewing the results after one trimester of internship, we see that students do not use the programme intensively to monitor their progress. Several reasons for these findings can be postulated. First, students are not experienced with the TOLEDO-programme. Second, students lack general computer skills. Third, students do not see the importance of training unless they are scored for the specific task. Finally, students are unable to run the test because of lack of hardware or software in their home or pharmacy.

Galt and colleagues evaluated the preparedness for computer use throughout a Pharmaceutical Care course. Students' computer knowledge and skills improved significantly upon course completion. Nevertheless, many problems were encountered as a result of inadequate but requisite skill attainment prior to starting the course (Galt *et al.*, 2002).

If we want to incorporate more independent computer-assisted learning into the curriculum, we have to realise that the demand for computer literacy, along with the need to identify computer skills of students prior to starting the course, would have to increase.

Our assessment tool made within Questionmark Perception creates only a one-on-one relationship between the computer and learner. However, TOLEDO offers more possibilities to engage students in computer-assisted problem-based learning. The Blackboard web utility, embedded in TOLEDO, makes it possible for students and instructors to retrieve handouts and inquiries

and to create a discussion forum from wherever the internet is available.

We intend to use the Blackboard facilities to develop a computer-assisted and problem-based course on pharmaceutical care and project working. In this way we hope to engage students' interest in course content and encourage them to take responsibility for their education now and, above all, in their professional life.

References

- Anonymous (2002a) (Blackboard, Inc., Washington, DC), Available: <http://blackboard.com>.
- Anonymous (2002b) (Question Mark Computing Ltd., US), Available: <http://www.questionmark.com>.
- Barzak, M.Y., Ball, P.A. and Ledger, R. (2001) "The rationale and efficacy of problem-based learning and computer-assisted learning in pharmaceutical education", *Pharmacy Education* **1**, 105–113.
- Clarck, G.T. (2001) "Education problems and web-based teaching: how it impacts dental educators?", *Journal of the American College of Dentists* **68**(3), 25–34.
- Cosemans, D. and Roelants, P. (2002) *TOLEDO manual* (K.U. Leuven, Belgium), Available: <http://toledo.kuleuven.ac.be>
- Galt, K.A., Barr, C.C., Young, W. and Royeen, C. (2002) "Are doctor of pharmacy students prepared for high technology learning?", *Pharmacy Education* **1**, 145–157.
- Dawn, F., Lovemore, N. and Terry, R. (2002) "E-learning and educational diversity", *Nurse Education Today* **22**(1), 76–84.
- Laekeman, G., Leemans, L. and De Vriese, V. (2002) "L'introduction de sciences 'douces' à la faculté des sciences pharmaceutiques de Leuven: une expérience de cohabitation (Introduction of 'soft sciences' in the faculty of pharmacy of Leuven: an experience of 'Living Apart Together')", *Journal de Pharmacie de Belgique* **57**, 103–106.
- Leemans, L., Beullens, J., Aubry, C., Laekeman, G. and Jaspert, H. (2002) "Basic communication skills of pharmaceutical students", *Pharmacy Education* **1**, 223–229.

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