Problem-Based and Computer-Assisted Learning of Pharmacokinetics[1]

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INTRODUCTION

The trend in pharmaceutical education is toward more involvement of the students in the learning process. The traditional approach called the teacher-centered approach has several shortcomings. It puts emphasis on transmission and memorization of information through lectures. Students are passive recipients of compartmentalized knowledge whose retention is low. They often loose the motivation to learn. In the student-centered, problem-based approach to education(1), students are more active and assume the responsibility to take appropriate measures to achieve learning objectives. This paper presents an application of a student-based, problem-based learning approach to pharmacokinetics through the use of workshops and of a computer-assisted learning tool consisting of a pharmacokinetic simulation software.

APPLICATION OF A STUDENT-CENTERED PROBLEM-BASED APPROACH

This approach was adopted on the premise that the students learn more pharmacokinetics when they have to solve problems. This approach increases motivation to learn, transfers the responsibility of learning to the students and develops autonomy and problem-solving skills. Retention and relevancy of acquired knowledge are improved. Furthermore, students develop the capacity to communicate and work with other students in a team.

Implementation of the Student-centered Approach. The pharmacokinetics course is attended by 100 students divided in four groups of 25 students further divided in subgroups of five students. A tutor, whose role is described below, is assigned to a group of 25 students. Each of the 12 workshops lasts two hours.

Role of the Teacher. The teacher defines the learning objectives in terms of action verbs so that the students can identify the skills they have to develop. He must identify the didactic resources either textbooks or softwares available to the students. He formulates problems in relation to the learning objectives for each of the 12 workshops. It is important to put emphasis on comprehension of concepts instead of calculations. Some of the problems are formulated so that the students must explain what they observe. To insure proper feedback to the students, the teacher gives solutions to the problems at the end of each workshop. Finally, examinations are prepared in relation the learning objectives.

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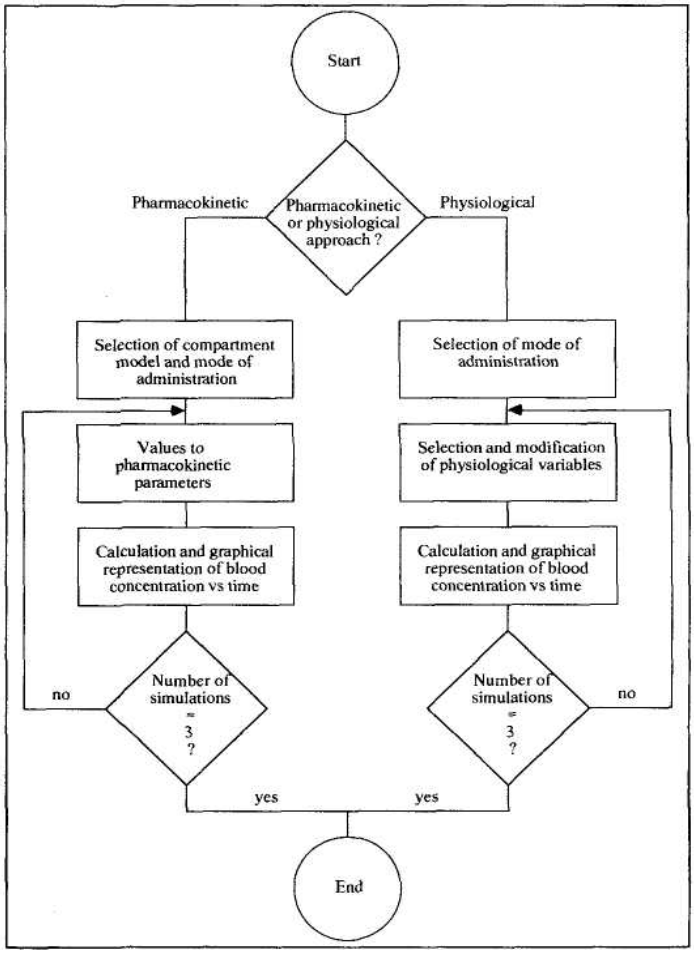

Fig. 1. A simplified algorithm of the pharmacokinetic simulation software.

Role of the Students. Students have to read and study the recommended learning materials in relation to the learning objectives one week before the workshop. At the workshop, they have to solve problems and discuss pharmacokinetic concepts during two hours under the super vision of a tutor. Students must participate actively in the discussion. The tutor can easily identify a student who does not participate. The students has to identify their weaknesses and take remedial actions. At the end of the workshop, copies of the solved problems are given to the students to provide them a positive feedback.

Role of the Tutor. The tutor is a learning facilitator instead of knowledge transmitter. He has to motivate and challenge

students. His role is to give clues not answers. In case of deadlock in a group, he will provide more information to restart the discussion within the group.

IMPLEMENTATION OF COMPUTER-ASSISTED LEARNING

A pharmacokinetic simulation software was develop to provide an additional learning tool to the students. To develop a computer-assisted learning tool, the teacher has to choose the appropriate hardware and the programming language or the authoring system. The latter offers the advantage that it does not require from the teacher elaborate programming skills. The authoring system used was Authorware Professional™ for Macintosh™. The learning skills to acquire will influence the type of software to develop either drill and practice or simulation software. A simulation software was preferred for learning pharmacokinetics. The construction of the algorithm presented in Figure 1 is a prerequisite to the development of the software. The screen layout consists of four windows: one graphical window for representing the blood concentration versus time simulations, the second, a table window, containing the values attributed to the various pharmacokinetic parameters or the physiological variables modified, the third a feedback window and the fourth a dialog window.

EVALUATION BY THE STUDENTS

Seventy-two percent of the student expressed satisfaction to the approach and preferred it to the traditional lecture approach, 21 percent were indifferent and seven percent did not like it. Forty-one percent of the students used the software and 81 percent of these were satisfied while 19 percent did not.

CONCLUSION

The student-centered, problem-based approach to learn pharmacokinetics was well accepted by the students. Motivation was higher and participation of the students was good. Many students are not enough computer literate to use the simulation software of pharmacokinetics. The majority of those who did use the software appreciated it.

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Reference

(1) Strand, L.M. and Morley, P.C., "A problem-based student-centered approach to pharmacy education," *Am. J. Pharm. Educ.*, **51**, 75-79 (1987).