Contemporary health care in America is presently undergoing significant, some would say "revolutionary" change(1). Indeed, to paraphrase Paul Starr(2) the social transformation of American health care is nothing less than the "coming of the corporation." While the naïve continue to cling to the romantic notion of health care as, at worst, the professionalization of human compassion, and at best, a humanitarian "calling," the more politically astute and socially conscious, are painfully aware that health care is in reality a commodity to be bought and sold in the marketplace. While to a greater, or lesser extent, such transformations have evolved at a reasonably steady pace, more recently there has been noticeably more momentum. Practitioners of every ilk engage in serious discussions on such topics as cost-benefit analysis, cost-containment, marketing services, competitiveness, payment mechanism, and other "economics," which usually are the province of accountants, stock brokers and professors of business administration. The latest function of health, that is profit, has now become manifest.

Recently these dramatic changes have played havoc with all health care professions; but their effect on pharmacy is of special interest. Pharmacy has been in considerable flux, undergoing significant change over the past twenty years. Of special interest here, are the effects that a broadening clinical involvement and a competitive, profit focused practice environment have had on pharmacy education and practice, and more specifically, on the educational methods we should use to prepare students to practice under these conditions.

This discourse begins with a polemical proposition. The proposition is that society needs a pharmacist who is flexible and adaptable to dramatic changes occurring in the health care environment, and who is an expert problem solver, capable of functioning in various practice settings. This polemical is predicated on the assertion that for the most part, the primary teaching method used in pharmacy education (and elsewhere), namely didacticism, minimizes student participation in the learning process, and thereby retards the development of important problem-solving skills. Such skills are essential for an increasingly clinically oriented profession, and they provide a basis for professional judgment and associated costs. First, it is important to review the variables that play key roles in determining appropriate teaching methodology.

DETERMINANTS OF TEACHING METHODOLOGIES

The first determinant of teaching methodologies is the cognitive model of learning theory that is adopted. This will shape the structure of teaching method and its legitimization as a means of knowledge transmission.

Generally, there are two fundamental models that serve to organize and facilitate the presentation of subject material. The first of these is a psychomeric model, and the second is usually referred to as an epistemological model. The former is derived from an essentially mechanistic/behavorioristic psychology such as that of Skinner and Wolpert(3). The latter finds its paternity in the works of Piaget(4) and Bruner(5). These two models contain different assumptions about human nature, and each has quite different implications for teaching methods. The psychometric model emerges from the empiricist, individualist tradition and represents the student as object. On the other hand, the epistemological model explicates the means whereby the student "actively constructs and structures his knowledge of the world in his developing interpretational schema"(6).

Within the framework of the psychometric model, the student is defined as a passive Nova rana, one who must be inculcated with the knowledge teachers identify as essential. Within pharmacy there is such a corpus of knowledge, and it is usually assumed that the teacher's role and responsibility is to impart this and to necessarily garrote its assimilation by the student. Knowledge is thus very much a "contaminated substance," and the teacher is the legitimate gatekeeper of it. Such an approach, and teaching model, inevitably provides legitimacy to didacticism as the "method of choice" whereas the "good student" is at least cognitively deferential and responsive to the authoritative allocation of facts and values. More will be said on this subject later.

The epistemological model places considerable emphasis on the student's active participation in the act of knowing. Philosophically, this is a reflective act in which the student develops "a series of inferential chains which enable him to bring under control increasing quantities of data" (7). Central to this model is a dialectical relationship between the student's active engagement in the process of knowing, and the professionally approved, and the pedagogically distributed subject matter, i.e., knowledge itself. The development of the student's knowledge base is a direct result of the dialectical interplay between teacher and student as they reflect on knowledge. This brief overview of two models of educational methodology, provides a thumbnail sketch of what is in effect a set of complex issues influencing the selection of any teaching methodology.

A second determinant of teaching methodologies concerns the view that education is, in large part, a socialization process and as such is not an end in itself. This is true of the liberal arts as well as professional education such as pharmacy. Education serves as the means to socialize individuals into a professional role and provides them with a social identity (pharmacists, pharmacologist, etc.). It also serves to shape values and to foster the dimension of behavior that are appropriate to the group(E). Even though the educational system's function as an agent of socialization can hardly be doubted, scant research has been conducted, particularly in professional schools, to validate this or to evaluate alternative methods. This is especially true in pharmacy in the teaching of clearly defined conceptual and theoretical frameworks and a clear definition of the clinical practice of pharmacy. There is not a legitimate mean of recording and validating clinical activities and thus set basic standards of practice in the area of clinical pharmacy.

Perhaps these observations help to explain why pharmacy educators, along with other professional school faculty, have so readily accepted didacticism as their methodology for teaching. Figure 1 represents an initial attempt to describe the role of education in socializing the nascent student into a capable practitioner. Although the specific values, attitudes and broader dimensions of behavior that are appropriate...
Table I. Components of praxis relationships in education and practice

<table>
<thead>
<tr>
<th>Framework for Practice</th>
<th>The Educational Process</th>
<th>The Practice Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics of Practice</td>
<td>Educational Concepts</td>
<td>Deductions (Synthesis)</td>
</tr>
<tr>
<td>Practice</td>
<td>In Site</td>
<td>Evaluation Process</td>
</tr>
<tr>
<td>Performance Outcomes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1. Model of the relationship between practice and the educational process.

Table I. Components of praxis relationships in education and practice

Framework for Practice
1. Conceptualize the frame of reference that shapes the boundaries of the practice of pharmacy.
2. Develop a methodological organizational framework for the assumptions and concepts that support the practice of pharmacy.
3. Clarify and distinguish those characteristics that set clinical pharmacy apart from medicine and other health professions.
4. Provide a framework to structure research.
5. Provide a framework that is flexible enough to accommodate change and the incorporation of new knowledge.
6. Generate alternatives, i.e., other theories of practice.

Educational Concepts
1. Organize knowledge in the problem-based format.
2. A demonstration of understanding and comprehension of concepts, etc.
3. The development of “thinking skills.”
4. An understanding of the complexities of the relationship between content and application of knowledge.
5. A consistent, constant presence of feedback and modification of knowledge.

Deductions/Synthesis
1. Validation of the dialectical relationship of theory-practice-theory.
2. Reflexivity.
3. Logic and critical thinking.
4. Transformations.
5. Dialogical process.

Practice Processes
1. Observation (“data consciousness”).
2. Interpretation.
3. Definition of the problem.
4. Hypothesis generation.
5. Application of theoretical constructs (knowledge base) to solve the problem.
6. Modified hypothesis.
7. Reinterpretation of data.
8. Solution.

Performance Outcomes
2. Documentation of activities and results.
3. Objective measures.
4. Effect on patients.
5. Resulting effect on student education (additions, changes, etc.).

Evaluation
1. Knowledge and understanding.
2. Interpersonal attributes and communication.
3. Problem-solving and clinical judgment.
4. Technical skills.
5. Patient and therapeutic management skills.

For the pharmacist are not identified in this Figure. Table I suggests key components of the process described in Figure 1. Much discussion can and should occur over time of commission or omission, but without establishing a framework within which to evaluate teaching methodologies, little value can be derived from such a critique.

A cursory glance at Table I suggests that the skills of deduction and synthesis are considered very important to the pharmacy student. It also suggests that pharmacy practice contains a problem-solving process, and that desired performance outcomes require critical reflection and self-evaluation. These goals of the educational process bring into question one traditional preocupation with the didactic method of education.

DIDACTICISM: A LONG-STANDING TRADITION

Didacticism is essentially a one-way transmission of little or no feedback or participation on the part of the student. The authoritative teacher provides expert knowledge to be absorbed by a non-participatory, passive student. Second, the student is not only a passive recipient of selected knowledge, but also is exercising very little control over the educational process. Feedback from the student is usually provided through periodic examination, and the quality judged accordingly. Such passive educational experience may be inappropriate to test the metacognition of professionally self-regulating experts (pharmacist), but it is highly questionable that such tests determine comprehension, or an individual’s ability to use content as the exercise of the problem-solving approach is all too often even as less important than retention.

While we do not recommend the contempt of didacticism to the “trash can” of history, for there are doubtless merits in the method, we urge caution in the adoption of a teaching methodology that moves dangerously close to creed or dogma. At best we would concede that didacticism is a necessary, but not sufficient, methodological approach to pharmacy education.

Thus far, we have argued that the most commonly used educational methodology, namely didacticism, generally derives from the mechanistic, behavioristically inspired paradigm of psychometric psychology. The evidence of the last ways of thinking in pharmacy, particularly by those who hold the view that the purpose of pharmacy education is to train professional pharmacists, is seen in the common curriculums and objectives that prepare students for assorted job descriptions and licensure in various states. It is all quite straightforward! Current pharmacy education is designed to educate/train individuals not so much to become agents of change, but rather to fit into the prevailing status quo. Of course, pharmacy is not alone in this conservative commonplace. However, it is our contention that, within the context of a changing health care system, pharmacy in particular does not produce enough critical thinkers who will initiate change and become active participants in setting the national health agenda. It is also our contention that in order to produce critical thinkers and proficient problem solvers it is absolutely essential to begin with a critical examination of the educational process itself. Nor only is it a current concern, but so too is the manner whereby we communicate with and explore the subject matter deemed necessary to prepare students for their role as professional pharmacists.
A "NEW" APPROACH TO TEACHING IN PHARMACY EDUCATION

We have identified two educational models, the psychomnemonic and the epistemological. Also, we have argued that the former has led to a preoccupation with control, authority, and passivity, leading to the didactic method. It is our position that the epistemological approach to knowing (and thus, learning), combined with an appropriate participatory problem-solving teaching methodology, offers a more creative, realistic, and effective educational process for pharmacists committed to change and a leadership role in creating change. In this sense, if we choose to become active agents of change then we must move beyond didacticism and embrace the more egalitarian principles of teacher-student interaction. The student-centered, problem-based approach is an attractive alternative to didacticism(10).

Hence we do not disregard the comfort of tradition and pursue the approach of student-centered, problem-based education, we would be in good company. Brandes and Goettl(11), for example, identify nine major philosophical frameworks that essentially prescribe what is generally referred to as student-centered education. Although one thinks of student-centered, problem-based education as "new," it is at least as "old" as "Socrates," and thus far has not by any means shared the same fate.

Bennett(12) terms student-centered learning "progressive," and compares this method with what he terms the "traditional" method (i.e., didacticism) as shown in Table II. Clearly, there are a number of controversies(13) found in this conceptualization. It is not likely, for example, that any profession, particularly pharmacy, would show little regard for professional acolyte standards. Nor should it. Our conventional obsession with testing is also likely to go unchallenged. Even so, there are many differences between "progressive" and "traditional" teaching methodologies that deserve critical attention and imaginative debate. Looking more closely at the dimensions of the progressive approach, the following propositions are offered for the purpose of designing a problem-based, student-centered teaching methodology:

1. An integrated subject matter is essential to the task of efficient problem-solving. Fragmented knowledge results in piecemeal and disjointed problem-solving processes.

2. The effective teacher functions as a guide, as a resource person, who assists with the development of cognitive maps whereas theory and practice, knowledge and applications, are integral "vis-à-vis" of the dynamic.

3. Students who must adopt an active role in their own education, and not rely solely on the "omniscience" of teacher distributed knowledge, learn more, learn faster, and are able to utilize this knowledge.

4. Student input is a positive factor in curriculum development in that flexibility is essential to allow for individual needs. Students should also actively participate in the design of their personal education, in particular in the area of specialization through electives.

5. Discovery, the result of intellectual exploration, is a more constructive approach to comprehension than the sacrosanct ennui of rote memory as the method of learning.

6. Intrinsic motivation has greater potential than extrinsic-motivation.

7. Conventional academic standards (i.e., test results and exclusive qualitative scores) when critically evaluated, have less validity than based on comprehensiveness and the application of knowledge to the resolution of problems.

8. Although regular testing is essential to evaluate the acquisition of facts and certain competence, other methods of testing are better for evaluating comprehension, integration (synthesis), and application competencies. This means more essays, less multiple choice, more dialogue and verbal defense of ideas, and fewer computer programmable check marks. More items do provide increased reliability.

9. While the term competition appears as a popular current "buzzword" in the market place, education for social change requires an emphasis on cooperation and teamwork. An educational system based on a competitive ethos alone does not prepare its students for the task of building a cohesive profession. On the contrary, "individualism," nagged or otherwise, leads to a form of professional interfunctional conflict that inhibits growth and development.

10. Teaching beyond the classroom and lecture format, including preceptorship as an integral element of the educational process, provides a creative alternative to classroom teaching and develops competencies such as those detailed above.

11. Attention given to the development of creativity(3) will further aid in the development of competencies. The creative imagination is often too stifled by an order, or simply in ordination by facts, with little emphasis on meaning and application.

12. Cognitive and affective dimensions are essential to personal growth and development. Scientific detachment, ethical neutrality, objectivity and other myths of science clearly have their limitations within a caring occupation.

It is axiomatic that pharmacy education focuses on process, particularly in the area of problem solving. Working through knowledge, reflectively addressing how we know is to be seen as a major educational task, and is to be considered as important as what we know. The preceding propositions are essentially philosophical. They serve to provide a rationale for a student-centered, problem-based approach to pharmacy education. An earlier article(14) details the substance of such an approach to pharmacy education. Here, for the sake of brevity, we will provide a less discursive summary of the central issues.

STUDENT-CENTERED LEARNING

The student-centered approach to pharmacy education is in opposition to the notion that the teacher is the center of the educational universe.

The student-centered approach requires that the student determines what his/her educational objectives are, what he/she needs to achieve these objectives, and what facilitates the discovery of an appropriate methodology for their realization. With such an approach the teacher guides the learning process and assumes the role of facilitator in the development process. The teacher does not rigidly set the parameters or the limits of course content; nor are the "syllabi" of the learning process dictated to the student. The teacher is a guide, or as Schon [3] prefers to define this role, he is a "coach." Of course, before such a relationship can be established, a student, a self-managed learner must be formed with the teacher and with peers, as well. Should the element of trust be missing then to a considerable extent the assumption of any meaningful responsibility becomes impossible. The student-centered method does have at least three serious limitations: (1) First, it implies that the student has access to numerous learning resources. However, this should not be an overwhelming obstacle within a University where medical libraries, research and clinical faculty, and patients are readily available. Second, the student must be evaluated in an individual basis, against self-determined objectives (7). Consists with the notion of self-directed learning (the student sets both the pace and criteria of learning) is the creation and adoption of evaluation methods which evaluate higher level cognitive processes in an individual manner. Finally, this method can create insecurity for both students and faculty. This method works best with self-motivated, mature, and disciplined students with a clear sense of purpose and direction. Experience with this method has indicated that these characteristics necessarily apply to faculty as well. Although faculty that have every confidence in their own abilities, they may not be convinced that students have the necessary maturity, intellectual skills, motivation and dedication, to obtain the requisite knowledge without directive, direct supervision. Also, faculty may have difficulty accepting the notion that students are capable of identifying the appropriate substantive knowledge base required for the accomplishment of profession. These problems can be resolved through the development of an educational culture that is conducive to the student-centered method.

PROBLEM-BASED TEACHING

The problem-based dimension of this method assumes that the student will take responsibility for a problem (e.g., patient compliance with drug regimen), which are not a stimulant but have the acquisition of the multifaceted knowledge and skills necessary for the solution of the problem. The essential focus of this method of learning is not a subject, but the problem itself. Problem-based education has two primary educational objectives: (i) the acquisition of an integrated body of knowledge relevant to the problem; and (ii) practice which improves the student's problem solving skills. Present course content does not necessarily require change. Rather, it is the teaching method which requires revision. The problem-based method has numerous advantages for pharmacy education. It is generally accepted that for development of consistent, systematic problem solving skills is an essential part of preparation for practice. Theories, concepts, and skills are best understood in relation to contexts that are relevant to the problems, the situations of a particular patient's needs. Abstractions and reification can minimize. Continuity and experience are maximized as the student encouters "similar problems" that form a systematic profile of aggregate data which are meaningful and amenable to solving problem-solving techniques. Systematic problem-solving is not only the typical undergraduate student, and is reinforced by subsequent work with other related problems. By working through specific problems, the student gathers information, looks for clues, and analyses and synthesizes available data, develops hypotheses, and applies the logic of deductive and inductive reason in an attempt to interpret and understand the problems. The key in this process is the resolution of the problem or the development of an acceptable solution. Of particular importance here is the question of relevance. The student moves from abstract knowledge, often considered at be of questionable relevance, toward a more pragmatic context, hence relevant level of knowledge acquisition and application. It follows that the problem-solving (context) of basic science now emerges as a functional prerequisite to meaningful, understanding, explanation and interpretation in the practice.
GUIDELINES FOR ACHIEVING PROBLEM-BASED TEACHING

There are specific guidelines which should be followed to facilitate problem-based teaching:

1. The educational objectives for each student-teacher interaction must be clearly identified.
2. The educational objectives must be placed in the context of the problem identified for the specific session.
3. The student must be allowed to identify the questions which need to be addressed when working with a specific problem.
4. The student must be allowed to pursue answers to questions through self-directed study (answers from faculty, fellow students, books, references, and other available resources).
5. Acquired information (answers, however tentative) must be relaxed back to the problem.
6. The answers (information) obtained should be reviewed, integrated, synthesized in order to be more productive.
7. Information/knowledge learned in the problem solving process must be evaluated, as with any type of learning.

It is important to regard these guidelines as sequences of activities. Before students and teachers can begin a session using the problem-based method, both must understand why the particular problem is studied.

Successful implementation of the student-centered, problem-based approach to medical education requires change on the part of both students and faculty, that to a large extent, is philosophical. For example, faculty must move from a controlling to an open, reflective, and critical approach to teaching and learning. Such an "epistemological breach" would require the following of the faculty: (i) help the student understand that there are relatively few irrefutable answers; (ii) not censure, criticize, or "mark down" a student for proposing questionable solutions to problems; (iii) not attempt to deny areas of personal ignorance, but rather move toward a cooperative teacher-student exploration to discover the "facts"; (iv) permit the student to assertively propose a variety of possible hypotheses to explain a problem; and (v) avoid "spoon-feeding" the student and transfer responsibility for learning to the student.

CONCLUSION

This paper began with a premise, and we end the same way. The view that education should play a major role in social change is presented. Change, however complex, should be addressed through educational design, scrutiny and application. Unfortunately, at present, there is evidence that education, in general, and professional education in particular, while dedicated to the provision of knowledge, is less than critically reflective.

In order to meet the challenges of the times, we as educators must question our faith that didacticism should be the primary mode of knowledge transmission. The periling of imperative facts before student audiences, unquestioned, passively received, produces a "theology" of pharmacy, but fails short of meeting the needs of an autonomous, goal setting profession. It is time to take risks and explore alternative teaching methods. Problem-based learning is but one of several options. The critical point is that we must, at the very least, explore the possibilities, and adopt teaching methods that optimize the educational process.

Acknowledgement. The authors wish to acknowledge the assistance of Dr. Harry Smith, professor of pharmacy administration, University of Florida, with the preparation of this manuscript. The authors also wish to acknowledge the financial support of the Pew Memorial Trust.


References