A Problem-Based Student-Centered Approach to Pharmacy Education

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Contemporary pharmacy practice has moved away from an essentially product-orientation toward an approach where the patient is central to practice. Given such a clinical focus with greater demands made on clinical problem-solving abilities, it is timely for pharmacy educators to critically review both philosophical and technical issues related to pedagogic method. Traditionally, pharmacy education, with few exceptions, has been subject-oriented (content) and didactic in method. While this approach is a necessary component of the educational enterprise, it is not sufficient to meet the increasing complexity of proliferating therapeutic problems confronting today's practicing pharmacist. All too often the "authoritative" methods of education become "authoritarian" and the inculcation of facts, as immutable things in and of themselves, frequently reduces learning to a mechanistic process where memorization prevails and comprehension receives scant attention. This paper discusses an alternative approach to delivering the content disseminated in the pharmacy curriculum; the problem-based, student-centered approach. Its strengths and weaknesses are discussed as is the role this approach can and should play in pharmacy curricula. The purpose of presenting these concepts is to stimulate critical discussion of the methods used to prepare contemporary pharmacists for the ever expanding professional role of the patient oriented pharmacist.

INTRODUCTION

Pharmacy education continues to be the subject of serious reflection and much soul searching among those charged with the responsibility of transmitting highly specialized knowledge to those who will form the next generation of professional pharmacists. Certainly, there has been considerable debate. But, in the opinion of many educators, this debate has generated far more heat than light. Thus, while change in substance has occurred over time, and curricula design has undergone periodic revision, the main thrust of battle has been territorial. Indeed, one could fairly argue that a disproportionate amount of mental energy has been expended in acrimonious dispute on the primacy of one disciplinary area over another. Such territorial conflicts have now, in the midst of overcrowded curricula and the limits of time, reached the alarming proportions of negative entropy. It is not within the purview of this paper to inquire into the nature of existing curricula content. Nor is it our remit to pass judgement on the appropriateness of course priorities and their substance. Rather, we begin with the curricula status quo ante as a given, and turn our attention to the less widely discussed issues of the methods by which we disseminate the content of pharmacy curricula. This is not to say that pharmacy educators have failed to discuss these issues. On the contrary, as Brodie and McCone observe, there is a significant amount of literature available on the subject of pedagogical techniques (1,2). However, with the exception of experiential programs such as clerkships, the prevailing conceptualization of the teaching process found in this literature tends to be didactic wherein a one way information transfer becomes the primary modus operandi. Such didactic information processing, while to some extent essential, fails to address the increasing complexity of clinical pharmacy practice where independent clinical judgment demands a more rigorous preparation in the art and science of problem-solving in general, and therapeutic problem-solving in particular. This paper outlines both rationale and technique for an alternative approach to pharmacy education. It is our firm conviction that future trends in professional pharmacy, with its increasing emphasis on clinical practice, compel us to critically re-examine the philosophical underpinnings of pharmacy education, and to generate constructive debate on the essential fit between education and clinical practice.

THE 'CLINICAL' EMPHASIS IN PHARMACY EDUCATION

Clinical pharmacy is, at least one important sense, a paradox. While there are numerous programs offering specialized training in "clinical pharmacy" there is as yet no comprehensive implementation of definitional frameworks such as those offered through the Hilton Head Conference or the American College of Clinical Pharmacy. The clinical emphasis on pharmacy practice has evolved over a number of years. During the course of its development a number of general objectives concerning pharmacists' identity and role have been delineated(3,5). Indeed, Francke finds that pharmacist competencies include:

- educated to become the major authority on drug products and efficacious drug therapy;
- educated to be skillful communicators of pharmacetical knowledge to both patients and other health professionals;
- knowledgeable of, and sensitive to the physical, socioeconomic, cultural and psychological factors that contribute to illness and health, and the management of associated problems;
- taught skills of analysis and problem-solving, decision
TEACHING AND LEARNING METHODS

There are a number of teaching and learning methods which are, or could be, employed in pharmacy education. Barrows and Tamblyn conveniently categorize these options(8). First, there is the more autocratic allocation of teacher-centered fact and value, the teacher-centered approach associated with the rigors of didacticism. Knowledge is transmitted to the learner and the dogmatism of "I'm-the-teacher-you're-the-learner" sets the stage for the educational process. Frequently, the "one-way" of such one-way transmission preclude communicative exchange(9,10). When exchange does occur it often assumes the posture of students asking questions and the teacher providing the answer. Dialogical conflict over substance is all too frequently seen as dysfunctional and disruptive of much cherished didacticism. The transmission process within the social matrix of such pedagogic structures leaves little or no room for group participation in such areas as problem-solving, critical reasoning, decision making, and the development of sound, structured judgment. In contrast to the authoritative style of the teacher-centered approach, is the participative style of student-centered learning. The student plays an active role in determining appropriate ways of learning as well as the most optimal outcomes of learning.

An additional category focuses on the way in which both the body of knowledge and learning skills are organized. For example: does the knowledge center on subject areas (subject-based) or problem areas (problem-based)? Therefore, a curriculum can be: teacher-centered, subject-based; student-centered, subject-based; teacher-centered, problem-based; or student-centered, problem-based. The advantages and disadvantages of these educational approaches will be discussed in detail in the next section.

Clearly, these categories are not mutually exclusive, rather they should be seen as somewhat complementary. Teachers must engage in some measure of authoritative pedagogy, and knowledge must be presented to students for their critical examination. But, a curriculum must contain sufficient organizational flexibility to permit critical reflection on both subject matter and its attendant problems. In essence, both curriculum and professional style should reflect the dialectical realities of a learning process. This means that the teacher presents a thesis, students provide an antithesis, and all engage in the critical reflexive process of discovering a meaningful synthesis. While this brief overview fails to do justice to the logical it serves to introduce the logical properties to be employed in our more detailed discussion of an alternative approach to pharmacy education, namely a problem-based, student-centered approach.

CONTEMPORARY PHARMACY EDUCATION

In order to move toward an effective method for preparing clinical pharmacy students, it is necessary to present an overview of contemporary approaches to pharmacy education.

The Teacher Centered Approach. Most if not all colleges of pharmacy give priority to a teacher-centered approach to teaching pharmacy concepts. Within the context of this method, the teacher makes a unilateral decision concerning the nature of both the knowledge and skills to be imparted during the structured learning process. Moreover, we find that this method has retained widespread acceptance at all levels of education and throughout all disciplines. The usual role or technique for the instructor in the teacher-centered method is to transmit information through lectures, assigned readings, self-study, or demonstration. The essential characteristic of this approach is the diminution of student responsibility for their own education and development. Indeed, students are all too frequently passive recipients of knowledge rather than active participants in a broader educational experience. Barrows and Tamblyn have observed that this method does have certain "perceived" advantages, advantages teachers proclaim with great vigor(11).

First, it is frequently efficient from the vantage point of the teacher. Moreover, it is seen as most cost-effective in that the transmission of knowledge is infrequently interrupted or challenged therefore rarely requiring the expansion of time to accommodate dialogue. Didactic methods do meet the perceived need of transmitting voluminous quantities of information with the constraints of time and an overburdened curriculum. It should come as no surprise that a curriculum that is preponderantly scientific in nature resists to the more convenient conveyance of the didactic method. Also, it is somewhat difficult to present a persuasive case for a structure that necessarily facilitates critical dialogue on ideas that are in essence often believed to be immutable scientific facts. Dr. would surely expect to find heated debates on the structure of an atom or a parasite. This is not to say that there are no elements of controversy surrounding the above, but rather, within the present context of prevailing pedagogical approaches to basic sciences (some would also add the applied dimensions found in clinical pharmacy) the main emphasis is on the ontological dimensions of the observed phenomena rather than on more epistemological issues.

A more regular, pervasive, defense of the teacher-centered approach to education has much to do with the exigencies of the professional role. It is a commonplace that teachers must assume numerous responsibilities among which we find research, service, and clinical practice. While the virtues and rewards of teaching may reach the exalted levels of articulated excellence, rarely is teaching afforded the legitimation and acceptability assigned to research in major academic institutions. Within the present university system, there can be little doubt that research has achieved ascendency over teaching. Research is afforded maximum legitimation and teaching all too often becomes a necessary ritual to be engaged in more for "professional balance" than for the more positive dimensions of intellectual discourse. In essence, the teacher-centered approach, through maintaining control, facilitates, and energizes the student as both a fundamental value and a legitimate profession of expert knowledge. Didacticism maintains control and centrality, hence perpetuating the notion that the teacher and subject matter from their central place appear to further threaten the value of teaching and the teacher.

While the above concerns are real, and impinge upon our collective consciousness, they obscure the realities of alter-
native teaching methods and roles. Indeed, it is our view that the disadvantages of the didactic teacher-centered method far outweigh the advantages. For example, the teacher-centered method rarely accommodates individual differences in needs, rates of learning, motivation, cognitive style, information processing, problem-solving abilities and other factors that pervade the learning process (12). In a less charitative vein, the primary purpose found within this system is more than likely to be an uncritical regurgitation of complex material. Certainly, in its more extreme form the Pavlovian nature of didacticism frequently precludes what may arguably be the most important aspect of the educational process: comprehension. The somewhat authoritarian nature of the didactic method, a method initiated at the elementary level of education and its perpetuation expected by students at the college level, generates its own current and functions as a "pelican" to reward those who "pass the correct letter." That is to say, rewards are given to those who provide evidence that they have the "correct" answers to questions.

In a concerted attempt to cover content, didactics rarely facilitate in-depth exploration, but rather chart a course that circumvents substance, and all too frequently offers the student a superficial tour of professionally arrogant terrain. The nature of the student-teacher relationship generated within the context of this method can loosely be described as that of structured insecurity. Imbued with the conviction that the correct knowledge has been transmitted to, and absorbed in some measure by the student, the teacher is able to conclude that the professional teaching task has been accomplished.

The Subject Based Approach. The second dimension of teacher-centered education is that it is almost always subject-based. Here, courses are organized around a subject area or field of learning. In pharmacy education, the predominance of this structure is often related to perceived demands for an educational experience directed toward professional competency. Thus, students are expected to be exposed to specific information determined by curriculum builders to be a true qua non of professional pharmacy education. Competency-based curricula negotiate debate on how such essential information is to be transmitted.

Subject-based learning has three distinct advantages (13). First, the limits of student learning are defined by the subject area itself (e.g., morphology) and are therefore easily understood by both faculty and students. Second, resources for learning in a specific subject area are more easily identified and made available for student use, as are evaluations of a single subject area. Third, students and teachers have little difficulty understanding the "rules-of-the-game" knowing that specific information is to be presented, memorized and manipulated. An additional "advantage" may well be the degree of control exercised by faculty. Tasks are specific, goals clearly defined, and mechanistic solutions to evaluation become a measure of teacher confidence. Hence, multiple-choice, true-false, and short fill-in tests become identified with certain precision, and sound academic judgment.

Earlier we argued that the disadvantages of the teacher-centered approach far outweigh the advantages. We also find this to be the case with the subject-based focus. The most important criticism is that the knowledge learned is retained in a format whereby only subject recall (identical situations) re- inforses the material learned. Unfamiliar problems, problems that deviate from the standard patterns presented in the classroom, frequently leave the student struggling for order. In a real sense, the student seeks pattern recognition rather than problem re-cog... of such activity ultimately leads to knowledge fragmentation rather than the integration of material across subjects. Indeed it is difficult to engage in what de Bono terms "lateral thinking" in a world of hierarchically organized knowledge (4,15). When we consider that most of the therapeutic problems confronting the pharmacist involve patients, such fragmentation can, and often does become, problematic in its real-world application, and the leap from categorical fragmentation to an integrated whole is nothing less than "quantum" in magnitude.

Shortcomings in the Traditional Approach To Pharmacy Education. Given that the clinical pharmacist is responsible for identifying, solving and monitoring therapeutic problems, it may be argued that the teacher-centered, subject-based method of education does not develop problem-solving skills considered essential for the application of sound knowledge base required for further refinement and development in the clerkship experience. It would appear therefore, that a more cognitively-based alternative to technique-focused methodology must be developed in order to bridge the nexus between clinical pharmacy education and practice. Cognitive skills must be developed rather than perpetuating dependence on memory and rote memorization. In the light of this argument our central thesis is that the student-centered, problem-based method is such an alternative, and it is on this approach that we now focus attention.

THE STUDENT-CENTERED, PROBLEM-BASED APPROACH TO EDUCATION

The Student-Centered Approach. By definition, this approach legitimizes the transfer of some measure of responsibility for the learning process to the student. Of necessity the student must assume more responsibility for establishing personal educational objectives, what is needed to achieve these objectives, and initiates an appropriate methodology for their realization. In this transformation, the development and refinement of cognitive skills, and problem-solving abilities become the student's methodological raison d'être. Within such a framework of expectations and activities the teacher continues to direct the overall learning process and assumes the role of facilitator in that process. However, faculty do not set rigid parameters, or limits of course content, nor do they dictate the styles of the learning process.

There is a significant advantage to this method. The student is expected to identify and achieve personal learning objectives. This does not occur in isolation, but rather emerges through dialogue with, and under the guidance of, the teacher. In this sense the teacher still provides the student with a set of priorities, general course objectives, but in addition, the student is responsible for generating personal educational objectives within the framework of the course objectives. There is evidence to suggest that the active participation of the student contributes to motivation and engenders a considerable measure of responsible autonomous behavior (7,18).

In order to achieve balance it is necessary to examine the limitations of the student-centered approach to education, as identified by Barrows and Tamblyn (9). First, this approach demands that the student has access to numerous learning resources. Also, the student must be highly motivated to seek these resources. The first consideration should not be insurmountable within a college of pharmacy where libraries, laboratories, and faculty are reasonably available. Second, the student must be evaluated individually against self-defined objectives. It is to be remembered that the student has been encouraged to
set both the criteria and pace of learning, and thereby meet the requirements of the institution in general, and the program in particular. This requires the creation and adoption of evaluation methods not yet commonplace in colleges of pharmacy. Finally, this approach clearly is most successful when utilized by self-actualized, self-motivated students. This method can create insecurity for both faculty and students. The student may lack the maturity, motivation and confidence necessary to determine personal educational needs and objectives, and faculty may not be convinced that students are capable of obtaining the requisite knowledge without direct authoritative supervision. Moreover, faculty may have difficulty accepting the notion that students are capable of identifying the appropriate substantive knowledge base required for the accomplishment of professional goals. But, these are problems to be seen as a central part of problem-based learning, and as such the development of an educational culture conducive to the student-centered approach is to be seen as an essential pre-condition of attempts at conflict resolution.

The Problem-Based Approach. The problem-based approach requires the student to assume primary responsibility for the identification of a particular problem and "ground" this problem in the context of a relevant, sound, integrated knowledge base. The essential focus of its approach is not the content of a particular subject area (e.g., physiology), but the problem (e.g., drug absorption rates in gastric secretions through a wide range of ages). Problem-based education places considerable emphasis on: (i) the acquisition of an integrated body of knowledge related to a specific problem, and (ii) practice which improves the student's problem-solving skills. It is essential that the student demonstrates the problem at the outset. This problem then serves as a "cognitive map" for seeking relevant background and posing successful solutions.

The problem-based method has numerous advantages for pharmacy education in which the systematic development of problem-solving skills must be seen as essential preparation for pharmacy practice. Theories, concepts and skills are best understood in relation to concrete health problems that are grounded in the realities of a particular problem. Abstraction and misification are minimized. On the other hand, breadth, diversity and experience are maximized as the student encounters "similar problems" that form a systematic profile of aggregate data that are both meaningful and amenable to improving problem-solving techniques. Recall is constantly reinforced and elaborated by subsequent work with other problems. By working through specific problems, the student gathers information, looks for clues, analyses and synthesizes available data, develops hypotheses, and applies the logic of both deductive and inductive reason in an attempt to interpret and understand the very essence of the problem(s) in question (20). Of particular importance here is the notion of relevance. The student moves from abstract knowledge, often considered by the student to be of questionable relevance, toward a more pragmatic contextualized, and very relevant, level of knowledge acquisition and application. The substance of basic science now emerges as a functional prerequisite to meaning and understanding in the clinical context. Brust has argued convincingly that it is "only through the exercise of problem-solving and the effort of discovery that one learns the working heuristics of discovery; the more she has practiced, the more likely one is to generalize what one has learned into a skill of problem-solving or inquiry that serves for any kind of task encountered." Moreover, "the organization of information that reduces the aggregate complexity of material by embedding it into a cognitive process as a person has constructed for himself, will make that material more accessible for retrieval." (21)

A perceived weakness of the problem-based method is that within "mainstream" pharmacy, this approach places too much emphasis on clinical concepts to the detriment of the basis sciences. Of equal concern is the argument that this method appears to minimize the importance of the student's knowledge of facts. Both of these concerns are unwarranted if problem-based learning is correctly implemented. Indeed, prior experience with this approach has demonstrated that when students are appropriately oriented, and faculty guidance achieves high priority, the learning of "facts," diagnostic and therapeutic skills, decision making and cognitive problem-solving skills, are significantly enhanced (22). Problem-solving methods, when developed by the student, do not necessarily confuse their focus to such areas as the clinical determination of drug of choice, strength or formulation, but rather extend into the complexities of biochemical, anatomical and physiological (to name a few) functions. In short, the epistemological, ontological and cognitive dimensions of problem-solving activities are limitless.

From an administrative stand point this method is frequently seen to be inefficient, time consuming, and therefore less cost-effective in the broadest sense. In response to this concern it should be emphasized that the largest part of a student's time provides a foundation for the understanding of other problem(s) (23,24). As the student becomes more efficient with the process, and problem-solving skills develop, the demands on the teacher's time correspondingly diminish. Reinforcement of previously acquired knowledge and skills emerges as a constant part of a dynamic dialogical learning experience. The pervasive nature of a problem-solving approach to learning gives emphasis to the interconnectedness of phenomena and moves away from the fragmentation and compartmentalization of knowledge. Poliomyelitis replaces the more segmented, mechanistic approaches to the learning process. This interconnectedness suggests an additional advantage accompanies this approach, which is the linkage that is formed between all aspects of intellectual activity. Thus we find a minimization of the discontinuity frequently found between teaching, clinical practice (service) and research. This becomes apparent when we acknowledge the importance of problem-solving as a central cognitive activity of all three functions.

EXPERIENCE WITH PROBLEM-BASED TEACHING IN PHARMACY EDUCATION

A limited number of attempts have been made to introduce problem-based learning in the clinical pharmacy curriculum. One successful attempt was made by Love and Shumway at the University of Kentucky (25). A patient-oriented problem-solving module (POPS) was prepared in the subject area of hypertension treatment. Both content and construct validity were upheld in the study and results indicated that the POPS technique of small student-led group discussions improved problem-solving skills and improved the use of student's referential materials. Fish and colleagues developed a series of lesson plans to assist the student engaged in clinical pharmacy orientation to investigate basic components of clinical pharmacy practice and the health-care system (26). The purpose was to teach process at both inquiry and proof levels. The use of the self-directed tasks changed the role of the teacher from that of a dispenser of information and "facts" to that of a facilitator, motivator and collaborator in the learning process. Following a four-year
exposure with this "process approach" students reported that they learned and retained more information than they experienced through exposure to didacticism pure and simple(27). Instructors expressed the unanimous opinion that students had improved their written and verbal communication skills as a result of the process approach. Other advantages included a distinct improvement over the isolationist attitude previously observed in many pharmacy students. Students were more willing to interact with other health professionals and seemed more confident in their roles in patient care.

Students of pharmacy law and ethics have been challenged to apply their newly acquired knowledge to practice situations, to develop clinical decision making skills, and to promote self-assessment of personal and professional values and values systems(28). Case study methods, role-playing, and small group discussions have been instrumental in accomplishing these educational objectives. Evaluation of this experience revealed that students prefer smaller group discussions rather than lectures. However, students did express dissatisfaction with techniques used to evaluate their performance.

A more global attempt by college of pharmacy to introduce practical application of pharmacy curriculum content has been through the experimental programs which include externships, internships and clerkships. Programs of this nature have provided the pharmacy student with the opportunity to see the practice of pharmacy while establishing his/her knowledge base. These programs represent the college's attempt to provide the practical necessity to refine the knowledge base developed in coursework. It must be noted, however, that these programs, for the most part, were introduced without a critical, systematic determination of appropriate methods by which to train students in the practice settings. In addition, these programs are being maintained with tremendous variation in goals, outcomes and evaluative measures of competency. In light of the discussion presented in this paper, it is reasonable to suggest that the expectations for the experimental programs in our colleges are unrealistic.

When coursework, the student's knowledge base, is acquired by didactic methods (subject-based and teacher-centered) it may be unfair to expect students to successfully solve problems through the integration of knowledge in the practice setting. The methods of problem-solving and critical thinking must be taught overtly in the learning process, preferably as soon as the student begins a particular pharmacy curriculum. It is not safe to assume that experimental programs, by definition, represent the successful integration of knowledge bases and the development of problem-solving skills. A cursory review of many experimental programs suggests that didactic methods from the classroom (subject-based, teacher-centered) have been relocated to the practice setting. A systematic critique of our experimental programs is as important as a critique of the classroom setting.

In addition to the above examples of the application of problem-solving approaches to the curriculum, Chisel and Whitcomb have outlined a systematic process which can be used by the pharmacist in rational therapeutic decision making(29). Through the application of Ward's Problem Oriented Medical Record (POMR) to the pharmacist's responsibilities, students have developed improved rational therapeutic decision making skills. This successful application of the POMR model led to a somewhat improved patient care program in the pharmacy.

CONCLUSIONS

Dramatic changes in a pharmacist's responsibilities have forced a critical review of the traditional educational methods used in colleges of pharmacy. Although significant changes have occurred with regard to curriculum content, a review of the methods employed to disseminate the content suggests that most colleges employ a teacher-centered, subject-based approach to educating pharmacy students. Given the needs of contemporary pharmacists to solve therapeutic problems and make clinical judgments, this approach has been shown to be less than adequate. Moreover, these necessary functions suggest that an alternative educational method is more appropriate for contemporary pharmacy practice—namely the student-centered, problem-based approach to education.

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