

Development of a Sequenced Strategic Thinking Assignment Syllabus for a Senior-Level Professional Practice Course

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In order to develop and improve critical thinking and writing skills, a sequenced assignment syllabus was developed for a senior-level pharmacy practice course. Working in groups of eight, students completed a series of eight assignments, each becoming gradually more complex and progressively more demanding than the preceding one. Topics ranged from management of overdose situations to the design of continuing education units for pharmacists, and were all linked to contemporary practice issues. Within their groups, students selected a specific role: the primary writer, the secondary editor, or a contributing researcher. This incremental approach allowed students to extrapolate from previous assignments and incorporate lecture material and personal experience in creative, self-directed ways. Student feedback regarding this sequenced assignment syllabus was mixed. While students enjoyed the topics discussed and perceived the course to be relevant to practice, there were concerns expressed regarding the distribution of workload and the equity of group work forming the basis for an individual's final mark.

INTRODUCTION

In the early 1990s, the Commission to Implement Change in Pharmaceutical Education formally recognized the value of and desired educational outcomes associated with critical thinking in the pharmacy curriculum(1,2). In order to develop and improve critical thinking and writing skills, a sequenced assignment syllabus was developed for the senior-level Professional Practice course at the Faculty of Pharmacy, University of Toronto.

Before developing this syllabus, it was first necessary to clearly define critical thinking and elaborate upon its role in undergraduate education generally, in pharmacy education specifically, and within the domain of professional practice precisely. While numerous definitions exist, the Professional Practice Faculty had embraced the concept of "strategic thinking" to more accurately reflect the spirit of the Commission's recommendations: the leveraging of a broad and diverse repertoire of learning and thinking strategies necessary to acquire, assess and synthesize knowledge in a systematic and focused manner.

From this definition, it became apparent that strategic thinking was not simply a discrete entity, but rather a complex process which occurred at the intersection of a person's academic and nonacademic experiences, habits and dispositions. The mix of cognitive and affective strategies could not be overlooked; while strategic thinking could be taught, it would not necessarily be learned or demonstrated unless students perceive relevance and are actively engaged in the material being presented.

BACKGROUND

In the undergraduate pharmacy program (BSc Pharm) of the University of Toronto in the mid-1990s(3), problem-based learning was being introduced into the curriculum.

Several courses (pharmaceutics and self-medications in third year, and therapeutics(4) in fourth year) began using student-directed, case-based methods of instruction. With 160 students in each year of the program, time and resources were limited; nevertheless, students generally expressed satisfaction with this model of teaching, particularly when cases were deemed to be "relevant" to practice and where guest lecturers (who were pharmacists and experts in their fields) were involved as facilitators. Through these courses, students became more familiar with the process of independent thinking and the vocabulary of educational psychology. In particular, the undergraduate pharmaceutics course incorporated elements of Bloom's Taxonomy of Cognitive Abilities, and allowed students to experiment with process learning and reflect upon the variety of thinking and problem solving strategies that were utilized in interpreting, analyzing and resolving a given case. The self-medications and therapeutics courses utilized a structured, systematic therapeutic thought process. Students were encouraged to reflect upon ways in which real-life patient-based problems could be approached. In addition, demonstrations of the variety of thinking strategies (such as informal logic, formal deductive or inductive logic, reasoning dialogically or dialectically) which need to be employed in various circumstances to most efficiently and effectively address a problem were provided.

Due to time and resource constraints (e.g., 168 students and one course coordinator), students worked in semi-autonomous groups (of 5-8 students) and were assessed on group projects, with explicit guidance that each individual was responsible for the material covered by their group. Consequently, by the fourth year of the program, students had acquired some knowledge and experience in group-centered problem-based learning, and had established mechanisms for dealing with group conflict and workload, although the level of proficiency with

- a. Develop a framework for identifying tablets or capsules based on appearance only. Identify all commonly available drug information resources (textual, primary or secondary, in addition to CD ROMS, etc.) which could be used.
- b. Apply this framework to the identification of the tablets/capsules in your assignment.
- c. Consider your case scenario. What pharmacodynamic and pharmacokinetic issues are important for the patient described in your case scenario?
- d. How does the ingestion of each individual drug affect the person's health and well-being? What are the signs and symptoms FOR THIS PATIENT of acute overdose/poisoning for each drug identified?
- e. Now consider the influence of the various DRUG INTERACTIONS which may exist. What is the clinical significance of any drug-drug interactions. Consider effects in terms of clinical outcomes, antagonism or synergy of effects, etc.
- g. Based on (e), outline a probable course of overdose. What will THIS PATIENT'S signs and symptoms be immediately post-ingestion? 1 hr later? 4 hours later? 24 hrs later? 72 hours later? Assume the patient will be UNTREATED (*i.e.*, no interventions or antidotes will be given).
- h. Outline a treatment plan to deal with the overdose at time 0 (*e.g.*, immediately post ingestion) at time = 4 hours post ingestion and at time = 8 hours post ingestion.
- i. Include a detailed list of references consulted for ALL questions. Include a brief statement outlining the utility of the reference in answering these questions.

Fig. 1. "Identifying the Unknowns" Assignment (Assignment #1)

group work varied throughout the class.

The sequenced, strategic thinking assignment syllabus was used in the 1995-96 academic year, in Professional Practice IV. This senior-level pharmacy practice course was a compulsory course offered in the last year of the program. By the end of the course, students were expected to be able to apply knowledge, skills and values from jurisprudence, drug information, therapeutics (including self-medications) and pharmaceutical sciences to the daily practice of pharmacy. Lectures focused on a wide variety of topics, ranging from applied toxicology (in community pharmacy settings) to the role of pharmaceutical advertising. Given the breadth of material covered in the lectures and the compressed nature of the course (two hours weekly for 15 weeks) there was insufficient time to adequately develop each topic. Rather than delete material and devote more lecture time to each topic, it was decided that all topics would be retained, but that students would be required to assume more responsibility for learning outside the classroom. This workload management issue, coupled with the desire to incorporate strategic thinking strategies into the course, led to the development of a sequenced assignment syllabus.

COURSE IMPLEMENTATION

The sequenced assignment syllabus was developed in order to provide students with a structured method for improving critical thinking and writing skills. The syllabus

For any topic covered this semester in Therapeutics, identify a pharmacotherapeutic, socio-legal or ethical issue which has lead to disagreement among experts. In addition to your Therapeutics lectures, you may wish to consult with expert pharmacists in the field. Outline the nature of the controversy, the evidence on both sides and your conclusions. Provide justification for your conclusions and insight into the implications of your decision.

Fig. 2. Current Controversy in Practice Assignment (Assignment #7)

was designed to provide relevant assignments rooted in real-life practice situations. An accompanying lecture series was developed, providing students with two to four hours of introductory didactic material on each topic. An introductory lecture was also developed, outlining the course objectives, assessment methods and providing guidance for group work and dispute resolution mechanisms.

The Assignment Syllabus

The assignments were sequenced in order to assist students in acquiring and leveraging a broad repertoire of thinking skills. Fewer directions were provided with each subsequent assignment, the expectation being that groups would learn from previous work and be able to direct themselves in the design of their submission. For instance, in the first assignment ("Identifying the Unknown") students were given a prescription vial with eight capsules/tablets, and a brief case scenario dealing with a clinical situation (*e.g.* "A six-year old child, Sammy Green, has gotten into the family medicine supply and swallowed 50 of each of the tablets contained in this vial. Sammy is 35 kg, 3'2" tall, and had suffered from patent ductus arteriosus as a neonate. He is currently being treated for mild asthma with ketotifen syrup 1mg bid and salbutamol inhaler (via pediatric aerochamber) as necessary (rarely used)"). To walk students through a strategic thinking process, a detailed set of questions was asked (see Figure 1.)

In the later assignments, students were given a broad topic and were simply instructed to use their own judgment to determine the scope, length and format of the final report. Unlike Assignment 1 which provided prescriptive directions for completing the assignment, Assignment 8 required the group to define the parameters of the subject for themselves, based on their understanding of the topic, and to define for themselves the depth and complexity of response required in order to meet the assignment goals (see Figure 2).

The complexity of the assignments grew as the course progressed, roughly following the levels of Bloom's Taxonomy. The first assignment was focused heavily on information retrieval and recall, with some work in the level of comprehension and application, while the final assignment required students to make judgments about relevant social issues and their impact on pharmacists. In between, Assignment 4 required students to attend a pharmaceutical manufacturers' "trade show," solicit printed, promotional literature, then use critical appraisal skills to evaluate the studies which underlay the manufacturer's claims. Appendix A outlines the contents of the syllabus.

Table I. Final distribution of grades for PHM 416Y (1994-95)

Final grade	Number of students	Percentage of class ^a
A+ (90-100):	0	0
A (85-89):	0	0
A- (80-84):	17	10
B+ (77-79):	2	13
B (74-76):	59	35
B- (70-73):	49	29
C+ (67-69):	10	6
C (64-66):	7	4
C- (60-63):	3	2
FX (Fail):	1	1

^aRounded figures.

Composition of Student Groups and Evaluation of Students' Work

At the beginning of the academic year, an introductory workshop is offered to all senior students. As part of this workshop, the Myers Briggs Type Indicators (MBTI) test is given by a certified test provider. Students are informed that data from this test will be used to structure work groups in various courses; though participation is strictly voluntary, upwards of 95 percent of students do complete the test and participate in the accompanying discussion.

Based on the MBTI, heterogeneous groups of eight students were constructed, with specific attention paid to balancing introverts and extroverts, and perceivers and judges. Prior to distribution of the assignment syllabus, an introductory lecture was conducted, reviewing course objectives and principles of group work, including dispute resolution mechanisms. Following this introductory lecture, students work together on the completion of a group contract, outlining each student's role in each project.

During the course, eight group assignments were to be submitted, worth a total of 55 percent of the overall course mark, the remaining 45 percent being weighted for the final, written individual exam. Given timetable requirements, this meant, on average, each group would submit one assignment every two weeks. At least one lecture was given prior to the assignment due date which related directly to the assignment topic. For each assignment, there was one primary, one secondary and six contributors. Though not mandatory, it was suggested that the primary author take responsibility for the actual writing and coordination of research for the project, the secondary author take responsibility for collecting and collating research and input from contributors, and revising and editing the final report, and the contributors take responsibility for actually performing the research assigned by the primary and the secondary authors. During the course, each student would serve as primary once, as secondary once and as a contributor six times. A mark differential was also awarded: while the group project received one final mark, this mark was weighted differently, depending

upon the role a student assumed. If a student served as a contributor, the assignment mark counted as five percent of the overall course grade; if a student served as a secondary, it was weighted at 10 percent of the overall grade, and as a primary, the group assignment counted for 15 percent of that student's overall course grade. This mark allocation seemed reasonable given the workload differential of the various roles; it also served as an "incentive" to contributors, since 30 percent of their overall course grade was linked to their involvement in assignments for which they assumed neither primary nor secondary responsibility. In addition, the final written exam (worth 45 percent of the overall course grade) would draw on material from any of the eight assignments, providing a further incentive for "free riders" to make sure they remained engaged in the group's work.

Final Course Results

The final distribution of grades for the course is presented in Table I. The final course average was "B," which is similar to previous years. Average marks and the range of marks for each assignment are noted in Table II.

EVALUATION OF SYLLABUS

The Syllabus has been used only once, in the 1995-96 academic year. Subsequent changes to the pharmacy curriculum at the University of Toronto have resulted in the expansion of both pharmacy practice and social-administrative pharmacy courses; consequently, much of the material contained in the syllabus is now found distributed through all four years of the new 4+1 professional program.

Student feedback concerning the value of the learning opportunities presented by this course and this approach to assignments was varied. Throughout the year, students were asked to provide informal feedback regarding the structure of the course and the assignments. Generally, students enjoyed the diversity of topics and perceived a high degree of relevance to the practice of pharmacy. Lectures were thought to complement the assignments very well, and provide a starting point for subsequent research and thought. Students perceived value in the sequenced approach; while the workload demands of the earlier assignments were higher (in terms of research), the cognitive demands were higher in the later assignments. This stepped approach allowed students to "warm" up prior to attempting the more difficult assignments. Goals and objectives for each assignment were well understood, and students felt they were able to demonstrate their abilities without feeling there were secret criteria for evaluation.

Overall, groups performed very well on Assignments 1, 2 and 3, which focused mainly on knowledge, comprehension and some level of application and analysis. The average group mark for these assignments was an A-, with a range of B to A+. Assignment 4 proved to be the break point, where groups began to falter and substantial differ-

Table II. Performance on each assignment

Assignment	1	2	3	4	5	6	7	8	Final exam
Average mark	A-	A-	A-	B+	B	B	B-	B	B
Range of marks	B to A+	B-to A	B-to A	D to A+	C+ to B+	C to B+	D+ to B+	B- to A-	D to A

Table III. PHM 416 Student evaluation summary^a

	SD	D	N	A	SA
1. Learning objectives for this course are an important	0	2	2	61	61
2. The course was well organized.	0	0	0	48	82
3. Compared to other courses with similar weighting, the workload for this course was reasonable.	42	70	18	0	0
4. The assignments for this course were relevant and helpful in achieving course objectives.	12	31	20	64	3
5. The structure of the course facilitated group learning and participation.	31	39	20	38	2
6. Group assignments are an effective way to learn material	47	20	24	35	4

^aClass size = 168; Number of completed surveys = 130.

SD= Strongly Disagree; D= Disagree; N= Neutral; A= Agree;

SA= Strongly Agree.

ences between groups began to emerge. For this assignment, several groups received Ds, while others received A+. The range of marks began to grow, while the average dropped to a B. This difference persisted until Assignment 8, and a wide variation in final course marks resulted. This was not unexpected; the cognitive demands of the first three assignments are more traditional, requiring students to work hard and apply knowledge at a fairly rudimentary level. The demands of Assignments 4 through 8 are much higher, especially for undergraduate students unaccustomed to the degree of latitude given for these assignments.

Though not unexpected, this variation in marks resulted in a substantial amount of friction. Students who had negotiated with their groups to complete primary and secondary responsibilities for the assignments by Assignment 4 felt "lucky;" those who had not felt "cheated," since they had not completely understood the implications of the work for which they would be taking primary or secondary responsibility. This was compounded by the marking scheme for the course; since 55 percent of an individual's mark was based on the work of group members, students felt considerable anxiety regarding other group member's roles and responsibilities.

Unfortunately, this focus on marks may have deflected energy and attention away from the original intention of the Syllabus. Towards the end of the course, students felt the heavy emphasis on group work was fundamentally unfair and ultimately may have compromised the academic value of the projects. In formal course evaluations and in informal discussions with the course coordinator, it became apparent that the overall concept of the course was interesting and innovative, but the contrivance of the group project element (as a workload distribution mechanism) made it difficult to derive maximum benefit from this approach, mainly due to "mark anxiety." Students suggested retaining as many of the assignments as possible (since they do illustrate many facets of practice beyond direct patient care functions), but distributing them among several years' worth of courses in order to manage the workload and obviate the need for group work.

In the initial planning for the course, it was thought that the final, written exam for the course would provide students with an opportunity to demonstrate mastery of a

wide repertoire of thinking strategies which had been practiced while completing the assignments. The final exam for the course was a combination of short answer type questions which emphasized straight recall of relevant facts (e.g., "Develop an algorithm for identifying unlabelled pharmaceuticals. Identify at least three resources which could be consulted and compare and contrast these references using five structured criteria."), practice application problems (e.g., "Read the attached ad for [DRUG XYZ]. The major claim for this ad is based on the following reference (attached). Evaluate the value of this claim for pharmacists in community practice."), and one essay question which required students to identify stakeholders' positions and take a stance on a controversial issue (the move, in Ontario, Canada, of H₂-blockers to over-the-counter status). Performance on this final exam was highly variable, and there was little correlation between performance as primary on a group assignment and performance as an individual on the exam. At the conclusion of the course, a formal survey was completed by students; the results related to course objectives and the assignment syllabus are listed in Table III.

As the survey results illustrate, there was considerable disagreement concerning the value of the sequenced syllabus as a teaching tool. Students appeared to be supportive of the concept of assignments to allow an in-depth examination of topics discussed in class; however the workload and the structure and functioning of groups may have been detrimental to individual's learning and performance in the course overall. As discussed previously, this may have been a function of assessment, the fact that a large portion of an individual's mark was linked to performance on group-based projects.

CONCLUSIONS

Though definitive conclusions regarding the value of this syllabus are difficult to make, considering it was used for only one year, some key points do appear. First, student acceptance of this format is mixed. While they generally appreciated the interesting assortment of topics, and perceived relevance to practice, there was significant anxiety related to the emphasis on group-based evaluation. This anxiety may have been conspired to undermine the initial objectives of the course. Students' feedback regarding use of individual assessment (retaining the topics and assignments, but distributing them over several courses and over several years so that each student can complete each assignment on an individual basis) must be accepted. Second, student performance on the final exam did not seem to correlate with groups' performances on assignments. Whether students can actually "learn" to leverage a variety of thinking strategies as a result of completing these sequenced assignments remains unproven. In retrospect, administration of a pre-test, to determine students' level of critical thinking and writing before the course, should have been administered, and compared to a post-test, in order to more clearly define any improvements made over the course of the year. This was not done, and so quantitative learning outcomes associated with use of this syllabus cannot be measured or defined.

The experiences of students prior to entering this course would likely influence their perceptions of the syllabus, and the shift from teacher-centered to student-cen-

tered learning. At the time of this course, the majority of the pharmacy curriculum was traditional didactic lecture based. For some students, the emphasis on formal reading and writing and on collaborative work may have provoked anxiety and some mistrust, since they did not have a clear idea of what was necessary in order to achieve good marks. In this way, the sequenced approach may have been counterproductive. By beginning with more familiar, straightforward assignments, students may have felt they had figured out how to do well in the class, when in fact they were still relying on the traditional rote learning and performance methods they had used in the past. When more ambiguous, less structured assignments were given, the students were less secure in knowing how to perform, leading to heightened anxiety and lower marks. The structure of the groups did not permit students the time or latitude to overcome this anxiety; the primary, secondary and contributor roles changed too frequently for students to practice and learn from their mistakes. As a result, only a few students truly seemed to benefit from this sequenced approach to improving critical thinking and writing skills.

Overall, despite some operational difficulties associated with this sequenced assignment syllabus, there appears to be some value in using this step-wise approach

to developing thinking and writing skills. The main benefit appears to be in providing students with an engaging set of relevant and interesting tasks which require a variety of different approaches. If time and resources were available, using this Syllabus as a series of individual assignments may prove more beneficial in the long term for students' development of thinking skills. In order to quantify this benefit, administration of pre- and post-tests (or another similar method) should be considered to establish the value of this tool in student learning and development.

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APPENDIX A. SYLLABUS OF ASSIGNMENTS

#	Title and Description	Thinking Strategies Emphasized	Criteria for Assessment
1	<p>"Identifying the Unknown"</p> <ul style="list-style-type: none"> • each group given Rx vial with 8 unlabelled pharmaceuticals - required to correctly identify each drug and component of each drug if a combination product • document search strategies • apply to a poisoning/overdose case 	<ul style="list-style-type: none"> • Knowledge: recall of specific facts necessary to identify unlabelled pharmaceuticals • Comprehension: understanding the impact of deliberate/accidental overdose on health • Application: use concepts of clinical toxicology in making recommendations 	<ul style="list-style-type: none"> • accuracy: correct identification of products • completeness: all individual components identified • efficiency: in documenting a reasonable search strategy • effectiveness: in dealing with overdose situation (correctly applying principles covered in "Overdose" lecture)
2	<p>"Ages and Stages of Life"</p> <ul style="list-style-type: none"> • research and describe the bio-psycho-social maturation process, its impact on drug use and the ways in which pharmacists can best address needs of different generations 	<ul style="list-style-type: none"> • Comprehension: understanding the impact of biology, sociology, and psychology to health • Application: extending this understanding to describe impact on drug use • Analysis: identifying the relationship between pharmacists and individuals in various life stages 	<ul style="list-style-type: none"> • Identification of developmental hallmarks • Systematic description of biological, psychological and sociological milestones • Insightful application to drug use issues • Articulates limitations of generalized theories • Develops relevant role for pharmacist
3	<p>"Patient Pamphlet"</p> <ul style="list-style-type: none"> • identify a common medical condition • compare and contrast two currently available patient education pamphlets • define critical success factors • design an original patient pamphlet for this condition 	<ul style="list-style-type: none"> • Comprehension: understand material presented • Analysis: deconstruct material to identify critical success factors • Synthesis: use critical success factors to reconstruct "ideal" patient education material 	<ul style="list-style-type: none"> • Compare/contrast pamphlets using structured criteria • articulate and define critical success factors • prioritize critical success factors for a defined population • use factors to design an "ideal" pamphlet
4	<p>"Manufacturers' Assessment"</p> <ul style="list-style-type: none"> • attend a "trade show" 	<ul style="list-style-type: none"> • Comprehension: understand material presented and practice environment 	<ul style="list-style-type: none"> • identify manufacturers' claims and articulate clinical significance

#	Title and Description	Thinking Strategies Emphasized	Criteria for Assessment
	<ul style="list-style-type: none"> collect promotional information critically assess referenced claims define a mechanism for future evaluation of promotional information 	<ul style="list-style-type: none"> Analysis: use critical appraisal skills to deconstruct material Evaluation: assess value of claims made based on structured critical appraisal process and understanding of practice requirements 	<ul style="list-style-type: none"> use structured critical appraisal process to evaluate validity of referenced claims reflect upon this process and articulate a systematic method for future evaluation
5	<p>“An Article for the Lay Press”</p> <ul style="list-style-type: none"> write an article (at the level of TIME magazine) dealing with a scientific topic of current media interest (e.g., recombinant technology, gene therapy) 	<ul style="list-style-type: none"> Comprehension: understand relevant scientific concepts Analysis: deconstruct concepts to level of lay understanding Synthesis: use a variety of descriptive techniques to explain complex concepts to the public 	<ul style="list-style-type: none"> Accuracy of information Timeliness of information Relevance of information Adherence to conventions of good writing Use of supporting data (pictures, graphs, charts, etc.) Written at appropriate level for audience (c.f. TIME)
6	<p>“Design a CE Module”</p> <ul style="list-style-type: none"> define critical success factors for Continuing Education produce a CE Unit for practicing pharmacists, with assessment instrument prototyped by a “real” pharmacist 	<ul style="list-style-type: none"> Comprehension: understand material to be presented Analysis: identify relevant material for presentation Synthesis: use a variety of techniques to address audience’s needs Evaluation: judge success of module using a structured mechanism 	<ul style="list-style-type: none"> Accuracy of information Timeliness of information Relevance of information Adherence to conventions for CE development (covered in lecture) Use of supporting data (pictures, charts, graphs, etc.) written at appropriate level
7	<p>“Current Controversy”</p> <ul style="list-style-type: none"> choose and define a current controversy in practice identify various stakeholder’s perspectives, take a position and defend it 	<ul style="list-style-type: none"> Knowledge: relevant facts Comprehension: understand impact on various stakeholders Application: apply to practice situations Analysis: deconstruct constituent parts of argument and counter-argument Synthesis: of group’s position Evaluation: judge value of position 	<ul style="list-style-type: none"> Accuracy, timeliness, relevance of information Evaluation of credibility of sources Deep questioning evident clarifying and questioning of underlying beliefs, values reasoning dialogically: comparing perspectives, interpretations and theories
8	<p>“In Class Debate”</p> <ul style="list-style-type: none"> only Primary and Secondary participate; contributors provide research support topic to be agreed upon by debating groups and course coordinator 	As above, while thinking on one’s feet	<ul style="list-style-type: none"> As above in addition, engaging in dialectical discussion: evaluating perspectives, interpretations and theories