USE OF ANATOMY MODULES IN SELF-DIRECTED EDUCATION

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ABSTRACT

McMaster University's Department of Anatomy and Experimental Morphology

has developed an extensive collection of self-directed learning modules in Anatomy

which are available in an open laboratory. How medical and allied health students use

this resource has never been adequately surveyed.

The rates, patterns and reasons for module use among first and second year

medical students were surveyed by questionnaire in late 1992. A similar questionnaire

was administered to students in Block 3 of the Physiotherapy programme in early

1993. Analysis was done using a standard computer-based statistical package.

Average module use among Unit 1 medical students (estimated by a weighted

average) is 1.39 hours per week, with a statistically significant increase reported by

Unit 4 medical students. Physiotherapy students, whose programme has a strong

emphasis on musculoskeletal anatomy, had lab use rates 140% greater than Unit I

medical students. Patterns of module use and student satisfaction with the modules

depend not only upon the medical student's level in the programme, but also upon

their previous backgrounds in biological/health science and problem-based learning

experience. The rates and patterns of use were much more consistent among

physiotherapy students, who were also far more satisfied with the organization and

content of the modules than the medical students were. Medical students who were tutored by research scientists rather than clinicians had different rates and patterns of module use.

The survey also indicates that students' use of the anatomy laboratory is not primarily driven by their tutor's suggestions; by a requirement for a detailed knowledge of anatomy for clinical skills purposes; or because module use saves time. The comparatively heavy use of the Anatomy lab and modules by physiotherapy students is clearly related to the demands of their programme. Students do believe that module use will help them contribute to their tutorial discussions and to the evaluations that occur in this setting.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1: STUDYING PROBLEM-BASED LEARNING AT McMASTER UNIVERSITY

1.1 The History of Problem-based Learning

McMaster University's Medical School successfully pioneered problem-based learning in the medical and allied health curricula. Saarinen and Salvatori (1994) write "In 1965, planning for a new medical school at McMaster University began with the conceptualization of an innovative educational approach. Now referred to as the 'McMaster Philosophy' or approach, the 'founding fathers' designed the medical curriculum on the principles of self-directed and problem-based learning in the milieu of small group tutorials."[1]

The rationale for problem-based learning (PBL) is the rapid expansion of knowledge in every field of endeavor and the necessity for professionals to develop life long learning habits that will keep them apprised of important changes in their discipline. Vaines explains "Education must aim for a more subtle goal: the facilitation of change and learning . . . In our fast changing world, reliance on process rather than upon static knowledge is the goal for education that makes sense."[2]

As the merits of the PBL approach became increasingly clear, other McMaster programmes chose to adopt this learning mode. PBL is now also used at McMaster for the education of health professsionals like nurses and physiotherapists, a choice ably defended by Barrows and Tamblyn. "As in medicine, problem-based, student centred learning is the most efficient method of simultaneously developing knowledge, reasoning skills and study skills. Disciplines will differ in the problem situations they select for their students and the goals and expectations for patient assessment and care, but the basic learning method can be the same."[3]

1.2 The Learning Experiences of Students at McMaster

Problem-based learning at McMaster has several distinctive features: 1) admission standards 2) the use of Health Care Problems in tutorial discussion and 3) the student evaluation scheme. While some of these are no longer unique to McMaster, the university deserves credit for pioneering and refining them. These atypical procedures will be described below so that a clear understanding of the survey's goals is possible.

McMaster's medical and allied health programmes have unusual entrance standards. It has been traditionally held that the most appropriate undergraduate

preparation for medical school and some allied health programmes (like physiotherapy) is a degree in biological science. Such a degree, earned with a high grade point average, is still the most common prerequisite for admission in most schools. This practice has come under increasing challenge by medical and health science educators.

A recent study by Hall and Stocks (1995) found no significant relationship between the quantity of undergraduate science education and the preclinical performance of medical students. In addition, Saarinen and Salvatori (1994) note that, while pre-admission academic grades were traditionally considered the best predictors of performance of health science students (particularly in occupational and physical therapy programmes) in traditional learning environments, there was no evidence that the same held true for PBL programmes.

This evidence supports the basic position taken by the founding fathers of the McMaster programme in 1965, when they decided to admit students who did not have the traditional science preparation to the new medical school. Saarinen and Salvatori (1994) explain how both the medical and allied health schools arrived at their admission policies. They write "There was also no evidence to support the commonly held belief that basic science prerequisites were necessary for admission to PBL education programmes. Therefore, it was decided that to be eligible to apply, students must have completed a baccalaureate degree (with a B-average or equivalent). In

addition, no prerequisites would be required and no preference would be given for any specific subject area in which the degree had been obtained."[4]

The second important feature is problem based learning (PBL). In PBL, subject material is covered as students discuss it in relation what is called a Health Care Problem. "Students are given a description of a patient or other clinical situation, and the tutorial group comes up with a number of questions concerning the situation. The students will then identify and retrieve educational resources which provide information relevant to the learning objectives which were identified, and will synthesize this information into a cogent explanation of the situation. Additional questions, suggestions and hypotheses for further steps in the evaluation of the situation follow."[5]

Once students have been presented with a Health Care Problem in their tutorial session, they are given a few days to research it. This self-directed research can take them into the Health Sciences library, to small group seminars, to the Anatomy faculty or clinicians and to the large Anatomy laboratory. The Anatomy lab is a novel facility which contains over 100 anatomy modules which has been described by Pallie and Brain (1978) and Pallie and Miller (1982). Each module consists of a script which guides students through charts, drawings, scans, models, wet specimens (including cadavers), prosections and plastinated material. These materials are organized by body

systems, organs and tissues so that students can find the morphological information they require to understand their Health Care Problem. Use of any or all of these resources and personnel is self-directed. A few days later, the students return to their tutorial group to share what they have learned from their research efforts.

The third distinctive aspect of the McMaster approach is that student learning and progress is primarily measured in the tutorial setting, though in 1992 progress testing of knowledge by examination was added. This unusual evaluative scheme has been described by Pallie and Carr (1987) and by Blake (1994), whose explanation follows.

> Student progress and performance is evaluated continuously through the program by the students themselves, their peers, the tutor, and the program. Self-evaluation is expected to be ongoing, and students are expected to self-evaluate briefly at the end of each tutorial, commenting on success of learning strategies, contributions to the group, and progress with respect to their objectives. At the midpoint and end of each unit, students self-assess following the categories of knowledge, skills and attitudes. Self-evaluation is followed by feedback from their peers and from the tutors. . . . 'Triple jumps'[self-directed learning evaluations] . . . are brief problem scenarios which assess problem

identification, information retrieval and synthesis, and problem

resolution skills. . . . In units 4 and 5 students [are asked] to make much

more extensive use of the library and its resources, and include

epidemiologic and critical appraisal skills.[6]

Some of these distinctive features of the McMaster programme are being

incorporated into medical programmes around the world. Because this interest is

comparatively recent, educational research on various aspects of PBL at institutions

other than McMaster is quite limited. A review of the literature showed that a small

number of medical schools are now using PBL as an alternative mode or as a

controlled experiment in medical education. Educational research efforts at these

schools usually focus on the effectiveness of PBL or the attitudes and effort involved

in switching to this mode and do not yield much information about the actual practice

of problem-based learning.

Studies done at these institutions have been reported by Moore (1991), Berkson

(1993), Eisenstaedt et al (1990), Edwards (1990) and Vernon and Blake (1993). At

other schools, only a few courses are offered in PBL mode. Accounts of these small

scale experiments are found in Usherwood et al (1991), Peplow (1992), Engel (1989),

Hill (1992) and Vernon and Blake (1993).

Only a few institutions have switched their complete curriculum to problem-based learning and most of these changes are quite recent. These include the Universite de Sherbrooke, (Des Marchaise et al 1992), the University of Toronto (Bernstein et al 1995), the University of Limburg (De Volder and De Grave 1989) and the University of Hawaii (McDermott 1991). Vernon and Blake (1993) mention the switches to PBL at the University of New Mexico, Michigan State University, Rush, Mercer University, the University of Newcastle, Arabian Gulf University and Gronigen. Useful and interesting comparisons may be possible in the next few years.

CHAPTER 2: SURVEYING SELF DIRECTED ANATOMY LEARNING

2.1 The Origins of the Survey

While research into the results of PBL is common, little work on the learning activities of problem-based learners has been reported in the literature. Williams et al (1995) have noted that "although much has been written on problem-based, self-directed learning in health sciences, very little has been documented regarding students' time utilization in self-directed learning activities in problem-based curricula."[7] My study of the ways and means medical and physiotherapy students use the Anatomy lab and modules focuses on this one aspect of this neglected area.

The impetus for this research came from Dr. Rick Butler, who was then Chair of the Department of Anatomy and Experimental Morphology at McMaster. He was interested in knowing how the hundreds of medical and allied health students enrolled in problem-based education at McMaster actually used the various resources (specimens, AV materials and models) found in the Anatomy lab modules. The value of the lab was obvious: it was in constant heavy demand. But Dr. Butler wanted to know how much time students actually spent in the lab (and whether this rate changed over the course of their programmes), how they used lab facility/modules and what

they thought of the module system. A previous study in the 1970s by Pallie, Brain and McIntyre (unpublished) asked students to record their use of modules, a practice which did not yield reliable data.

After a series of interviews with various persons involved in anatomy education (including faculty members Dr. Hallie Groves, Dr. David Carr and members of lab staff), and with the expertise in testing instruments and sociological analysis supplied by Dr. Jack Richardson, I devised a questionnaire. After the questions were deemed both clear and non-threatening and the format of the instrument was declared both appropriate and easy to use, I asked a recent McMaster medical school graduate to beta-test it, add comments and make note of the length of time required for completion.

The final version was presented to approximately two hundred Medical Students in Units 1 and 4 (comparable to Years 1 and 2 in conventional programmes) by Dr. Butler, who explained the purposes of the study and asked for student participation. In addition to the survey, paper was provided for written comments. Students were not asked for identification, except to indicate their level in the programme. This careful preparation paid off in a fairly high response rate, especially for such a long survey (Adams and Gale 1982). 52% of students in Unit 1 and 27% of those in Unit 4 returned their questionnaires to the Department Office.

10

After the questionnaires from the medical students were analyzed, Dr. Hallie

Groves, suggested that a parallel study be run with the physiotherapy students, helped

me revise the questionnaire slightly to suit these students and enlisted their

cooperation. Robert Boardman entered data for all students and created data banks for

statistical analysis. I used the *Simstat* programme to make comparisons based on

frequencies and to perform $\chi2$ and contingency table analyses.

2.2 Aims and Methods of Survey Analysis

I designed the survey to answer simple questions about the use of the Anatomy

lab. After initial analysis, however, a number of intriguing potential correlations came

to light. The data suggested that comparisons between the Anatomy learning activities

of Unit 1 medical students (Meds) and those of Unit 4 Meds might prove interesting. I

also decided to compare Unit 4 medical students with physiotherapy students (PTs) in

Block 3 because these classes have both had significant experience with the McMaster

approach: this comparison had the potential to show me if programme organization

affected Anatomy learning habits.

The Unit 1 MD group were new, both to the McMaster PBL programme and to

medical school. I set up contingency table analyses of their responses in order to

determine if their Biology and/or PBL background affected their use of the lab and

modules. A slightly more complicated analysis was required to answer these questions; the Unit 1 and Unit 4 classes were subdivided by their Biology experience in order to determine if this background affected their Anatomy module use. These student groups were labelled Biology (+) and Biology (-). Students who have taken 5 or fewer courses in biology represent about one quarter of both Unit 1 and Unit 4 classes and classified as Biology (-). Most respondents had at least an undergraduate degree in Biology or Health Science and were considered the Biology (+) group.

A large fraction of the Unit 1 class (37%) claim to have participated in some PBL before entering. I defined PBL(+) as students who had taken equivalent to a half course in PBL format. Students with limited PBL experience (who described their work as mostly thesis writing, an essentially self directed, rather than necessarily problem-based activity) and those with current McMaster PBL experience (i.e. Unit 4 Meds and PTs) were not included in this comparison. In order to determine if PBL experience affects the use of Anatomy modules, the responses of Unit 1 students with no PBL experience (PBL(-)), were compared with responses from their classmates who had PBL experience (PBL(+)).

Contingency table analysis indicated that students with little biology experience (Biol(-)) were more likely to have PBL experience (PBL(+)). This finding was significant at $p \leq 0.14$.

Four additional groups were created by combining the categories described above for biology and problem-based learning experience. This reconfiguration was an attempt to determine which type of experience was more likely to affect student module use and satisfaction. Ten students had both biology and problem based learning experience (PBL(+)/Biol(+)); another thirteen students were considered PBL(-) /Biol(+)). There were seven students considered PBL(+)/Biol(-) and three who were both PBL(-) and Biol(-). It is important to remember that not all Unit 1 medical students are included in these subgroups because of the criteria used for PBL exposure. Does this mean that the Unit 1 class is not fairly represented? Comparisons of the subgroup answers with the total Unit 1 class suggest that the subgroups do give a reasonable sample of the larger cohort.

Questions from the survey were grouped by topic. Student responses to these groups are shown in two different tables for each topic. The first table shown and discussed in each section lists the responses of medical students (both Unit 1 and Unit 4) and those from the physiotherapy students in Block 3. The second table lists the responses of Unit 1 medical students who fit into the four subgroups.

Table I: Academic Background of Survey Respondents

STATEMENT from QUESTIONNAIRE	Med Unit 1 n = 52	Med Unit 4 n = 28	PT Blk 3 n = 17
A. I have at least an undergraduate degree in Biology/Health Science (Q15)	77%	78%	65%
B. I have a pre-admission grade average of A/A+ (Q 63)	79%	69%	18%
C. I have a half course of more of animal dissection experience (Q 19)	45%	36%	59%
D. I have a half course or more of cadaver dissection experience (Q 18)	12%	29%	24%

NOTES:

1. Med = Medical Student, PT = Physiotherapy Student
All numbers represent the percentage of the total group who agreed with the questionnaire statement.

2. Grade Averages are self recalled.

2.3 Academic Background of Survey Respondents

My first impression of Anatomy lab/ module use habits from the survey data was that considerable variation existed. Were differences in student background a plausible explanation? It was necessary to assess the homogeneity of the respondents in order to answer the question. Table I details the academic experience of the three major programme groups participating in the survey. In general, medical students (Unit 1 and Unit 4) and physiotherapy students have reasonably similar preparation in biological sciences.

Answers given to Statement A. show that in all three groups at least 65% of the class had at least an undergraduate degree in biology or health science. These rates were higher among medical students (Unit 1 77%, Unit 4 78%). Pre-admission grade averages (self-recalled) were dramatically lower among PTs, only 18% of whom had an A or A+ average. Corresponding rates for medical students were higher: 79% of the Unit 1 class and 69% of the Unit 4 class claimed an A or A+ average. Contingency table correlations of student grades with rates and patterns of module use did not uncover any statistically significant relationships.

The survey asked students about their experience with animal and cadaver dissection on the assumption that such familiarity might affect module use and

Anatomy learning. Neither the medical nor physiotherapy groups had much experience with cadaver dissection. (70% of Meds and 65% of PTs had none) While 45% of the Meds Unit 1 and 36% of Meds Unit 4 experience in animal dissection, the comparable rate for PT students was 59%.

I concluded that most respondents had comparable backgrounds in biology and anatomy in particular. If the three groups are considered relatively homogeneous in this respect, then any differences in Anatomy module and lab use brought to light by the survey must be caused by other factors, such as programme organization and problem based learning experience.

Many differences in Anatomy lab use were found. The tables and discussions that follow deal with various aspects of module use.

Table II: Use of Anatomy Lab and Modules
(Medical and Physiotherapy Students)

STATEMENT from QUESTIONNAIRE	Med Unit 1 n = 52	Med Unit 4 n = 28	PT Block 3 n = 17
A. Hours spent in Anatomy lab/week*	1.39 #	1.81	3.29 ##
B. Percent of total Anatomy study time spent in the lab **	20%	28%	38%
C. Increased hours in Ana lab since last session (Q66)	Not Applicable	68%	25%
D. Decreased hours in Ana lab since last session (Q66)	Not Applicable	14%	75%
E. I use the lab alone (Q20)	51%	47%	0%
F. I use the lab with a group (Q20)	37%	42%	100%
G. Tutorial group has extra sessions in the lab (Q23)	45%	67%	41%
H. I use all of the materials provided in a module (Q52)	42%	46%	59%
I. I use none of the materials provided in a module (Q52)	17%	29%	0%

NOTES:

1. Med = Medical Student, PT = Physiotherapy Student
   All numbers represent the percentage of the total group who agreed with the questionnaire statement.
2. * weighted average: calculation shown in Appendix C
   ** based on weighted averages: calculations shown in Appendix C
3. Differences in response rates are significant at the following levels:
   \# Med Unit 1 compared to Med Unit 4 $p = 0.05$
   \#\# Med Unit 4 compared to PT Block 3 $p = 0.025$

CHAPTER 3: The Use of the Anatomy Lab and Modules

3.1 The Use of the Anatomy Lab and Modules by Medical and Physiotherapy Students

An overview of Anatomy module and lab use is presented in Table II. The survey results shown indicate that use of these resources does vary significantly between medical students (Meds) of different units and between Unit 4 medical students and physiotherapy students (PTs). Patterns or features of module use are also different.

Hours of module use per week (statement/line A) have been estimated by a weighted average: a detailed explanation of this calculation is given in Appendix C. Unit 1 Meds used the lab an average of 1.39 hours a week while their Unit 4 colleagues spent 1.81 hours a week in the lab. This difference is significant at $p = .05$. This finding is consistent with results shown for statements C. and D. - here 68% of Unit 4 Meds claimed that the amount of time they spent in the lab had increased since the last academic unit. In addition, hours of Anatomy lab use as a percentage of total Anatomy study time (see calculations, Appendix C) rises from 20% in Unit 1 to 28% in Unit 4. An explanation for these changes cannot be offered from survey information

but it seems likely that, as students become more familiar with problem-based learning, they will use available resources differently.

The organization of the medical training programme probably accounts for the increase of lab use by Unit 4 students. The major learning objectives of Unit 1 are described in the Faculty of Health Sciences information booklet: Medicine at McMaster. These objectives include the global determinants of health and illness, learning and critical appraisal skills and the three perspectives (biological, behavioural and population) used to analyze Health Care Problems (HCPs). The systematic study of human body structure and function begins in Unit 2 with Cardiovascular, Respiratory and Renal systems, continues in Unit 3 with Haematologic, Gastroenterologic and Endocrine systems and concludes in Unit 4 with Neurologic, Locomotor and Behavioural systems. Clinical skills are the major focus in Unit 5.

Commitment to Anatomy lab use amongst physiotherapy students is dramatically higher than that demonstrated by Unit 4 medical students, with whom PTs are most properly compared. PTs averaged 3.29 hours of work in the lab per week while Unit 4 meds only spent 1.81 hours per week in the lab. This difference is significant at $p = 0.025$. Physiotherapy students also spent a much larger fraction of their total Anatomy study time in the lab than Unit 4 medical students do. (38% PTs, 28% Meds) It is likely that the particular content demands of the physiotherapy

programme and its organization motivate PT students to learn anatomy and to use modules to do so.

Saarinen and Salvatori's description (1994) of the PT programme clearly identifies the early emphasis on musculoskeletal systems - this is the major topic in each of the first three blocks. PT students also have clinical skills labs (CSLs) for seven hours a week - something not required of Meds until Unit 5. In the CSLs, learning in tutorials is supported by experiential learning. (Groves et al, 1993) Saarinen and Salvatori write "Here students learn the skills of assessment, treatment, patient education and health. .. The CSLs reinforce the learning of human biology as students are encouraged to refer to anatomical specimens while learning assessment and treatment skills."[8] This required integration of anatomy and professional practice must exert an important influence on PT students motivation to learn Anatomy.

There are also dramatic differences in the Med Unit 4 and PT responses to Statements C. and D. When asked to compare their anatomy module use in the current academic session with the previous one, 68% of Unit 4 medical students said that their use rose significantly - only 14% said that their use had declined. These responses are reasonable when one considers the organization of the medical programme, as outlined above. Increases in the number of students whose tutorial group held extra sessions in the lab (Statement G.) to 67% in Unit 4 from 45% in Unit 1 support this explanation.

In contrast to the increase of module use among Unit 4 Meds, only 25% of the Physiotherapy students indicated that their use of the lab since the last block (academic session) had increased, while 75% claimed that their use had declined. Our findings are consistent with the recent work of Williams et al (1995). Their study of time allocation in allied health programmes at McMaster (including physiotherapy) demonstrated a general decrease of time spent in educational activities as students progressed through their programmes. They believe that familiarity with the expectations and efficiency developed in using learning resources allowed the more advanced students to save time.

Table II also shows some interesting differences in the ways students use the lab. As medical students progress through the McMaster programme (and presumably become more experienced with problem-based learning) they are slightly more likely to work as a group. 51% of Unit 1 Meds used modules alone and only 37% of them worked in the lab with a small group. These responses changed somewhat for Unit 4 Meds - only 47% of these students worked alone and 42% of them went to the lab with a group. (Note that these values do not always total 100% because some students chose various combinations of answers: their responses are not included here.) Unit 4 students (experienced PBL's by this time) were much more likely to visit the lab with their entire tutorial group than Unit 1 students (p ≤ 0.002). Note that this latter

response is not identical with Statement F ("I work in the lab with a small group of others").

These findings are consistent with the impressions garnered by Albanese and Mitchell in their meta-analysis of problem-based learning (1995). They note that students in PBL programmes quickly learn to share the workload with their classmates. J. Blake (1994), from the McMaster Health Sciences library, describes this phenomenon "McMaster students can always be recognized because they travel in packs . . . Students [want] and need to work, share and debate as a group." [9]

Familiarity with problem based learning, which may account for some group work among medical students can hardly explain the complete avoidance of solo work in the lab by physiotherapy students. 100% of those who responded said that they worked in the lab as a group. The exact explanation for this pattern is unknown.

Is the use of various module resources related to the size of the group using that particular module? Evidence from the survey suggests that there may be a weak negative relationship between the two. While the number of medical students who say they use all of the materials available rises from 42% in Unit 1 to 46% in Unit 4, the number of students who say they use none of the materials provided rises even more dramatically from 17% in Unit 1 to 29% in Unit 4.

It is impossible to determine from a questionnaire what students who use none of the materials in a module actually do when working in the Anatomy lab. Contingency table analysis of this statement with several others, including the statement "I never visit the lab" showed no significant correlations. There was also no statistically significant correlation between the number of people who use the lab alone and those who use none of the materials. It is possible that these persons serve as note-takers or organizers for their tutorial group or that time pressures make it difficult for every member of a group to work with each item.

There are some other factors (not listed in Table II) that may affect a student's choice of module materials. There is a significant connection between previous dissection experience and the willingness to use all module materials. Students with no experience in animal dissection (55% of Unit 1) are more likely to use all of the materials and to use cadavers and wet specimens than their classmates with dissecting experience (p = .09)

Discomfort with human cadavers and plastinated or preserved human specimens may also be a factor in module material use. 56% of Unit I Meds say that they did find or still find human materials in the anatomy modules disturbing. There is a surprising increase in the rate of this response in Unit 4 medical students, 73% of

whom agreed with the statement above. Only 35% of the PT students feel the same way: the explanation for their relative comfort is unknown.

Written comments about cadavers and wet specimens appended to the survey suggest that some students find them "intimidating." The use of cadavers requires a certain confidence and can also be time-consuming. These requirements may limit most cadaver use to sessions where tutors or anatomy faculty or staff members are present.

Table III: Use of Anatomy Lab and Modules
(Unit 1 Medical Students)

STATEMENT from QUESTIONNAIRE	BIO (+) PBL (+) n = 10	BIO (+) PBL (-) n = 13	BIO (-) PBL (+) n = 7	BIO (-) PBL (-) n = 3
A. Hours spent in Anatomy lab per week*	1.35	1.57	1.58	1.50
B. Percent of total Anatomy study time spent in the lab **	20%	23%	22%	18%
C. I use lab alone (Q20)	44%	69%	33%	67%
D. I use the lab with a group (Q20)	50%	31%	67%	33%
E. I use all of the materials provided in the module (Q 52)	60%	31%	43%	67%
F. I use none of the materials provided in a module (Q52)	0%	15%	29%	0%
G. My tutorial group has extra sessions in the Anatomy lab (Q23)	60%	31%	43%	67%

NOTES:

1.   All numbers represent the percentage of the total group who agreed with the questionnaire statement.

2.   * weighted average: calculation shown in Appendix C
     ** based on weighted averages: calculation shown in
          Appendix C

3.2 Use of Anatomy Lab and Modules by Unit 1 Medical Students

Unit 1 medical students have been subdivided into four subgroups by their background in biology and problem-based learning backgrounds: the basis of these divisions is described above. Their responses to survey questions about hours and patterns of Anatomy lab and module use are shown in Table III. This data will be interpreted conservatively: not only are the categories are too small for meaningful statistical comparision but the BIO(-)PBL(-) group has a sample size of three. A few general trends can be identified, however, and these may suggest avenues for further research.

Rates of Anatomy lab use per week (Statement A) are surprisingly consistent among the 4 subgroups of Unit 1 med students. All groups spent less than 1.6 hours a week in the lab. BIO (+)/PBL(+) students, presumably the best prepared for the medical school experience, spent the fewest hours in the lab (1.35 hours/week), though this useage rate hardly differs from the 1.5 hours/week of use claimed by the BIO(-)PBL(-) group. Students with either BIO or PBL experience but not both, spent about the same amount of time in the lab (1.57 hours/week for BIO(+)PBL(-) and 1.58 hours/week for the BIO(+)PBL(-) group. It seems that previous learning experiences don't have a great effect on lab use among Unit 1 students. In addition, the percentage of total Anatomy study time spent in the lab (Statement B) is relatively consistent over

the four groups, ranging from a low of 18% for BIO(-)PBL(-) to a high of 23% by the BIO(+)PBL(-) students.

There are some unusual patterns indicated by the responses to Statements C. and D. BIO(-)PBL(+) students are more likely to go to the lab with a group (67%), while the 69% of the BIO(+)PBL(-) and 67% of the BIO(-)PBL(-) cohorts chose to go to the lab alone. This data is reminiscent of that reported above and suggests that prior exposure to PBL does increase the amount of group work among medical students.

The answers given to Statements E. through G. are quite similar for the two most dissimilar groups. Large portions of both BIO(+)PBL(-) AND BIO(-)PBL(-) students said that they used all of the materials provided by the modules (60% for the former and 67% for the latter): no members of either group said that they used none of the materials. At least 60% of both groups said that their tutorial group had extra sessions in Anatomy lab. Why these particular groups of students felt that extra sessions would be useful cannot be determined from this survey.

In contrast, fewer students with experience in either PBL or Biology (but not both) used all of the materials provided in a module (31% for BIO(+)PBL(-), 43% for BIO(-)PBL(+)) and more members of these groups said they used none of the material. Why 29% of the BIO(-)PBL(+) used none of the materials is hard to determine. Did

they lack the biology background to make confident use of the materials or did they believe that the information required by the Health Care Problem could be gathered more efficiently in another way? Both of these groups were less likely to have extra resource sessions in the Anatomy lab than their BIO(+)PBL(-) or BIO(-)PBL(-) cohorts.

Few conclusions can be drawn from these small Unit 1 subgroups. Contingency table analysis of slightly simpler but larger Unit 1 groups,BIO(+) (those with an undergraduate degree in biology or health science) or BIO(-) (those with less than 3 courses in biology) showed that students with less biology experience spent significantly more time in the lab than their BIO(+) counterparts.($p \leq 0.10$)

Contingency table studies of a second simplified data set supported my hypothesis that PBL experience promoted group learning activities. Unit 1 students were classified as PBL(+) if they had considerable problem based learning experience before entering McMaster medical school and PBL (-) students were those who had no significant exposure to the learning mode before their entrance into the programme. Students without problem-based learning exposure (PBL(-)) spent more time in the lab than PBL(+) students: this finding was significant at $p \leq 0.10$. PBL(-) students were also more likely to visit the lab alone or with only one or two others than their PBL(+) counterparts ($p \leq 0.14$), a confirmation of the Unit 4 results described in Section 3.1.

These simplified groups (BIO + or -) and (PBL + or -) may account for some of the trends shown in the small Unit 1 subgroups. If the characteristics of these simplified groups are informally combined the expected results can be compared to the actual values estimated. These predictions suggest that subgroup BIO(+)PBL(+) would spend much less time in the lab than their counterparts, (actual value is 1.35 hours of use/week), that subgroups BIO(+)PBL(-) AND BIO(-)PBL(+) have hours of use that are approximately the same (actual values are 1.57 and 1.58 hours of use per week respectively) and that BIO(-)PBL(-) students would spend much more time in the lab than the other three groups (actual value 1.50 hours per week).

The predictions seem generally useful, though not definitive, for the first three groups but shows a wide margin of error for the BIO(-)PBL(-) group. This cannot be explained by the survey. It is important to remember, however, that these students have just begun their medical studies and further research is needed to discover how well they learn to cope with the demands of the programme.

Table IV: Self-Directed Learning in Anatomy using Other Resources (Medical and Physiotherapy students)

STATEMENTS from QUESTIONNAIRE	Med Unit 1 n = 52	Med Unit 4 n = 28	PT Blk 3 n = 17
A. Estimated Hrs/wk spent learning Ana from texts *	5.71	4.77	5.33
B. % of total estimated Anatomy study time spent using texts **	80%	72%	62%
C. Library books are more difficult to use than a module. (Q 16)	31%	37%	71%
D. Working through the modules first helps me understand the text. (Q 12)	52%	44%	82%
E. Books contain too many details. (Q 4)	39%	43%	6%
F. I spend between 1 and 3 hours per week learning Anatomy from video/audio tapes. + (Q 66)	39%	43%	19%
G. Video tapes are more useful than modules (Q 44)	25%	34%	25%

NOTES:

1. Med = Medical Student, PT = Physiotherapy Student

2. Answer percentages given for statements C.- G. represent students who agree.

3. * and ** are calculated from weighted averages: see Appendix C

4. + Other members of the class spent less than one hour using tapes.

CHAPTER FOUR: USE OF OTHER RESOURCES TO LEARN ANATOMY

4.1 Self Directed Learning in Anatomy using other Resources (Medical and Physiotherapy Students)

In addition to the Anatomy lab, students at McMaster have a wide selection of learning resources available to them. Responses to questions about use of these other resources are shown below in Tables IV (Med and PT students) and V (Unit I Med students).

Table IV indicates that Meds in Unit 4 spent fewer hours using textbooks to study Anatomy than their fellows in Meds Unit 1. There may be several reasons for this change. Are journal articles used more often by Unit 4 students ? This possibility was not listed in the questionnaire. Unit 4 students may also be spending more study time using texts but may be using them to learn the physiology, pharmacology, pathology and therapeutics required for their Health Care Problems. These disciplines would not be considered a part of Anatomy per se, which may be reflected in this particular statistic. PTs spend a smaller proportion of their Anatomy time with texts, a fact consistent with their significantly higher hours of Anatomy lab use previously discussed.

These results are consistent with those of Blake (1994) who calculated the library use rates of McMaster medical students to be 54 visits per student each month, for an average of period 157 minutes per visit. She estimates that PBL students were in the library twice a day for 2.5 hours each trip, though not all of this time is spent simply using library books or databases: these long periods are partly spent in group study.

While PT students appear to be more positive about module use, medical students are more positive about the usefulness of books. 71% of PTs said that library books were more difficult to use than modules, while only 37% of Meds in Unit 4 and 31% of Meds in Unit 1 concurred. Medical students were, however, more likely to agree that that texts have too many details (43% of Unit4 and 39% of Unit 1 compared with only 7% PTs). This difference may be related to the larger number of body systems and disciplines required to solve the Health Care Problems given to medical students. HCPs presented to PTs, (particularly in Blocks 1 - 3) focus on musculoskeletal systems: for these topics, anatomy modules can give a clearer, more immediate and three dimensional answers to questions than texts can.

The use of video and audio tapes shows considerable variation between the medical and physiotherapy students. While 39% of Unit 1 Meds and 43% of Unit 4 Meds said that they spent between 1 and 3 hours a week using videos, only 19% of

the PT group spent as much time with videos. This difference may be related to the topics covered by the videos currently available.

Overall, a third of the medical students and a quarter of the physiotherapy students report that videos are more helpful than modules. I believe that this approval is very directly related to the quality and perceived usefulness of specific videos. Unit 4 students commented that, for instance, a programme produced neurology video was much more helpful to them than the modules on neurology. PT students in Block 3 have had limited exposure to problems related to the nervous system.

The obvious preference among McMaster medical students for texts over anatomy modules, is not hard to understand or explain. Health Care Problems are not simply exercises in anatomy but real clinical situations involving all of the medical disciplines (physiology, pharmacy etc) The anatomy modules have limited usefulness in research here, so it may be easier for students to look up all of the information that they require (including the relevant anatomy) in texts and journals, thus saving themselves a trip to the Anatomy lab.

These results are consistent with those of Peplow (1990). He found that medical students in a traditional curriculum who participated in a problem-based learning exercise, reported a greater use of library books during the exercise. These

students believed that their texts were the most useful resource and models in the anatomy museum the least useful resource. Though this situation is not directly comparable (independent specimens in a museum are not the same as the carefully collected and organized variety of materials and resources in an anatomy module), it is another indication of how dependent most students are on textbooks.

Table V: Learning Anatomy from Other Resources (Unit I Medical Students)

STATEMENTS from QUESTIONNAIRE	BIO(+) PBL(+) n = 10	BIO (+) PBL (-) n = 13	BIO (-) PBL (+) n = 7	BIO (-) PBL (-) n = 3
A. hours/wk spent learning Anatomy from texts*	5.55	5.13	5.72	6.77
B. % of total estimated Anatomy study time spent using texts**	80%	77%	78%	82%
C. Library books are more difficult to use than a module. (Q16)	40%	54%	33%	0%
D.Working through modules first helps me understand the text. (Q12)	60%	54%	50%	0%
E. Books contain too many details. (Q4)	22%	25%	43%	0%
F. I spend between 1-3 hrs/wk learning Anatomy from video/audio tapes + (Q66)	60%	23%	29%	67%
G. Video tapes are more useful than modules. (Q44)	10%	25%	14%	67%

NOTES:

1. Answer percentages given for statements C.- G. represent students who agree.

2. * and ** are calculated from weighted averages: see Appendix C

3. + Other members of the class spent less than one hour using tapes.

4.2: Self Directed Learning in Anatomy by Unit I Medical Students

The results shown in Table V (for Unit 1 Med subgroups) are quite similar to those in Table IV (Meds and PTs). These students have comparable rates of response to questions about the use of other resources such as books and videotapes and spend roughly the same amount of time learning Anatomy from textbooks.

The BIO(-)PBL(-) group is unfortunately too small to be statistically significant but a number of their response rates look dramatically different from those of the other Unit 1 subgroups. These students spend more hours using texts than their counterparts in Unit 1: their average of 6.77 hours per week is 24% higher than the average of the other three Unit 1 subgroups. It is interesting to note that the percentage of Anatomy total study time that they spend with textbooks is about the same as the other groups. This is not surprising in view of their impressions of Anatomy modules: they find the modules more confusing and more difficult to use than textbooks. Sizeable portions of their classmates (33-54%) felt that library books were more difficult to use than modules.

None of the BIO(-)PBL(-) group agreed that using modules first helped them understand their textbooks, though over half of all the others found this to be true. These same students do not believe (0% agree) that books contain too many details - a

rate that is dramatically different from every other group, including the much more experienced students in Meds Unit 4 and PTs. (see Table IV). Two thirds of the members of this group feel that videos are more useful than Anatomy modules while most of their classmates are inclined to disagree.

Table VI: Module Satisfaction Scores (Medical and Physiotherapy Students)

STATEMENTS from QUESTIONNAIRE	Med Unit 1 Satisfaction Score *	Med Unit 4 Satisfaction Score *	PT Block 3 Satisfaction Score *
I am sometimes unclear how to use a module (Q26)	- 75	- 88	- 41
I don't always know which module details are important (Q17)	- 22	- 32	- 12
Modules offer only the most important information (Q46)	+ 32	+ 46	+ 47
Modules assume too much knowledge of human anatomy (Q13)	- 21	- 15	0
I follow the module script (Q3)	+ 75	+ 96	+ 60
I use all of the specimens and materials in the module (Q52)	+ 42	+ 46	+ 59
I use none of the specimens and materials in the module (Q52)	- 17	- 29	0
I want more complex information in modules	- 35	- 27	- 31
Modules are the right length (Q42)	+ 78	+ 73	+ 88
Modules contain too much information (Q9)	- 6	- 15	0
Modules are boring (Q32)	- 12	- 36	- 12

STATEMENTS from QUESTIONNAIRE	Med Unit 1 Satisfaction Score *	Med Unit 4 Satisfaction Score *	PT Block 3 Satisfaction Score *
Percent of total Anatomy study time spent in the lab	20%	28%	38%
Total Relative Satisfaction Score	+ 39	+ 19	+ 158

NOTES: 1.   Med = Medical Student, PT = Physiotherapy Student All numbers represent the percentage of the total group who agreed with the questionnaire statement.

            2.   * Determination of this score is described in the text, pg 39.

CHAPTER 5: ASSESSING THE STUDENTS' APPROVAL OF ANATOMY MODULES

5.1 Approval Ratings from Medical and Physiotherapy Students

A number of questions in the survey asked the participant to respond to statements regarding the modules. Patterns of responses to these individual statements were difficult to discern but I was convinced that the three student groups had collective opinions about the modules.

Dr. Jack Richardson helped me devise an informal module approval scale. In this scale, survey statements were rated as positive or negative. Agreement with a positive statements such as "Modules are the right length" is interpreted as approval of the module and assigned a positive (+) score. Agreement with a negative statement such as "I don't always know which details in a module are important " is taken to indicate relative disapproval and given a negative (-) score.

To gauge the relative ratings of modules by various groups, the percentage of the group that agreed with these statements was factored into the score. If, for instance 35% of Class A agreed that modules are the right length, that group would be assigned

an approval rating of +35 for that question. If only 13% of Class B agreed with the same statement, they would be assigned an approval rating of only +13. When the scores of many questions of this type are totalled, these informal measures of relative approval of various groups can be compared. This informal scale seemed to be more useful in interpreting the results of such questions than an item by item analysis of individual questions.

The results for medical students (Units 1 and 4) and for physiotherapy students are shown in Table VI. While it is inappropriate to make definitive statements based on these scores, I believe that their values are related more to the demands and requirements of the three different programmes than to the Anatomy lab or modules themselves. The highest satisfaction score by far originated with the physiotherapy students. Their satisfaction score of +158 was much higher than both the Unit 1 medical students (+39) and the Unit 4 meds (+19).

Explaining the differences between Unit 1 and Unit 4 medical student responses may be straightforward. The curriculum outline mentioned above reminds us that, while Unit 1 students are working on a general overview of health care, the Unit 4 students have covered almost every body system, with a resulting enormous increase in Anatomy learning required. In addition, the Unit 4 students are expected to cover three times as many Health Care Problems in the same time period as the Unit 1 students.

Unit 4 students must also manage each module in much less time than Unit 1 students. This pressure and the corresponding decrease of attention to individual modules probably explains the relative dissatisfaction of the Unit 4 students.

The physiotherapy students who participated in the survey had spent most of their time for three academic units (blocks) dealing with musculoskeletal systems. This concentration on one aspect of Anatomy, to the relative exclusion of the many other topics allotted to the medical students, makes it more likely that the modules used by PTs are given careful and repeated attention. This may engender a more relaxed attitude toward the modules, which probably in turn, increases the physiotherapy students' satisfaction scores.

It is also important to note that the quality/usefulness of the modules varies widely and this can affect the perceived value of the entire Anatomy lab for students who may be frustrated by certain modules. Unit 4 Med students complained about the neurology modules, which they found harder to use than others; the physiotherapy students do not use these modules extensively until Block V of their programme. One respondent's comments follow:

[Dr. Butler's] neurology tapes were SO very amazing, ... Sometimes the content in the modules is too demanding and yet also leaves out the very basic concepts. It's frustrating. Could be more systematically approached, like you do in your tapes.

Another Unit 4 student had similar views:

I was particularly disappointed with the neuro modules this unit. I, as well as other members of my group, thought that they were very oversimplified and because they left out quite a lot of relevant details they were not useful. After finding many of the other modules (cardio, resp, etc) very useful I was very disappointed.

The satisfaction ratings for questions 26, 17, 46, 13 and 9 (Table VI) are rather low. Apparently most Anatomy lab users have some difficulty organizing, recognizing or appropriating the information in a module. I believe these responses are not unusual given that the module script may not necessarily show a student the fastest and most efficient way to answer specific questions that may be raised in the discussion of a Health Care Problem (HCP). A busy student is far more likely to find a direct answer to a simple anatomical question in the index of a library book than he/she is to figure

out the answer by careful and time-consuming examination of a variety of module

materials.

Table VI shows that PT students have by far the highest approval rating and

also spend a larger percentage of their total Anatomy study time in the lab than

medical students. Does a cause and effect relationship exist between these two

phenomena? If so, which is the cause: do more hours of Anatomy module use raise the

relative satisfaction of such committed students or does the relative satisfaction with

the modules motivate students to spend more time in the lab? A definitive answer to

these questions will require further study.

It is interesting to note that there does not seem to be a positive relationship

between high approval ratings and increased Anatomy module use (as a percentage of

total study time) among medical students. Though statistical analysis is not possible, it

seems possible that Unit 4 students spend more time in the lab despite their low

satisfaction with the modules.

A question not shown on Table VI suggests some dissatisfaction with problem-

based learning itself. A large fraction of all three groups report that they would learn a

lot more if they did a lab with a preceptor or instructor. (48% agree in Unit 1, 50% in

Unit 4 and 40% of PTs concur) One survey respondent in Unit 1 added these comments to his/her questionnaire:

> When I tried doing modules on my own I found that I had to know most of the anatomy I was after before beginning the module in order to get anything out of it. Now, our group has begun weekly sessions with an anatomist and we wish we had started sooner because the increase in understanding is enormous. When doing a module alone, it's hard because you can't really ask questions unless you write them all down and seek out an anatomist later; also you can be deceived into thinking you understand something when you really don't because no one in the group may be sure either.

Table VII: Module Satisfaction Scores
(Unit 1 Medical Students)

STATEMENTS from QUESTIONNAIRE	Bio (+) PBL (+) SatScor*	Bio (+) PBL (-) SatScor*	Bio (-) PBL (+) SatScor*	Bio (-) PBL (-) SatScor*
I am sometimes unclear how to use a specific module (Q26)	- 80	- 82	- 86	- 100
I don't always know which module details are important (Q17)	- 33	- 57	- 15	- 33
Modules offer only the most important information (Q46)	+ 30	+ 54	0	+ 33
Modules assume too much knowledge of human anatomy (Q13)	- 20	- 57	- 8	- 33
Modules are boring (Q32)	0	- 14	- 15	0
I use all of the materials and specimens in the module (Q52)	+ 60	+ 31	+ 43	+ 67
I use none of the materials and specimens in the module (Q52)	0	- 15	- 29	0
I follow the script in the module (Q3)	+ 80	+ 85	+ 71	+ 67
Modules are the right length (Q42)	+ 70	+ 75	+ 67	0
I want more complex information in modules (Q10)	- 50	- 14	- 31	- 100
Modules contain too much information (Q9)	0	- 29	0	0
Relative Satisfaction Score	+ 57	- 46	- 3	- 99

STATEMENTS from QUESTIONNAIRE	Bio (+) PBL (+) SatScor*	Bio (+) PBL (-) SatScor*	Bio (-) PBL (+) SatScor*	Bio (-) PBL (-) SatScor*
I am sometimes unclear how to use a specific module (Q26)	- 80	- 82	- 86	- 100
Percent of total study time spent in Anatomy lab	19.5%	23%	22%	18%

Notes:

1.   All numbers represent the percentage of the total group who agreed with the questionnaire statement.

2.   * SatScor represents student satisfaction with the modules, determination described on page 39.
* weighted average: calculation described in Appendix C
** calculation described in Appendix C

5.2 Approval Ratings from Medical Students, Unit 1

The satisfaction score rating system use to create Table VII has been described in section 5.1.

Only 49% of the combined group believed that they would learn more when doing a module under the supervision of an anatomy preceptor. The Biol(+) group is more likely to disagree with this than Biol(-) students ($p \leq 0.015$).

The results shown in this table clearly suggest that previous exposure to problem-based learning is a more significant factor in student "satisfaction" with modules than biology training. It is not suprising that Unit 1 students who had both biology and PBL experience were most satisfied with the modules (relative satisfaction of + 57). Those students who had biology experience but not previous exposure to PBL had satisfaction scores much lower (rating = -46) than those who had PBL exposure with little biology experience. The three students who had no background in either biology or PBL had the very low satisfaction rating of -99. While the statistical significance of this informal rating system is unknown, it seems likely that PBL experience increases the medical student's satisfaction with modules. Whether this is due to a particular skill used in problem-based learning or caused by

other factors (like simple familiarity and confidence with the learning mode) cannot be determined from this survey.

There does not seem to be any causal relationships between the satisfaction ratings and the percentage of total Anatomy study time spent in the lab. The BIO(+)PBL(+) group, which had the highest rating had the second lowest percentage of study time spent in the lab. Differences in these percentages among the four groups listed in this table are not statistically significant.

Do these Unit 1 students believe,(like the Unit 4 Meds and PTs mentioned earlier), that having an instructor or preceptor work through the modules with them would help them learn more anatomy? 75% of the BIO(+)PBL(-) students and 67% of both the BIO(+)PBL(+) and the BIO(-)PBL(-) groups agreed that such help would be useful. The only surprise comes from the BIO(+)PBL(-) students, only 29% of whom feel such expert assistance would be welcome.

Chapter 6: THE EFFECT OF TUTOR PROFESSION ON MODULE USE

6.1 Introduction: Tutors and the Tutorial Process

The most important activity in problem-based learning in McMaster's medical schools is attendance at twice-weekly tutorials. Each Health Care Problem (which has been carefully designed to meet the objectives of the Unit) is presented and discussed twice in this setting. Between the first and second tutorial, students are expected to use any and all appropriate resources (texts,journals, anatomy modules, faculty members, etc) to help them determine and understand the problem.

A tutorial group consists of 5 or 6 randomly selected students who meet with designated faculty members. These persons have agreed to serve as tutors and have been trained for their role. Tutors are not necessarily experts in the content of the Health Care Unit under study. Though most tutors are medical practitioners, some are research scientists and a few are considered both practitioners and researchers.

There have been a number of studies involving the tutor attitudes and opinions (Vernon 1995) and approaches of the tutors in PBL schools (Eagle et al, 1992 and

Silver and Wilkerson 1991). These papers focused on the actual interactions in the tutorial gathering, not the results or the self-directed activities that follow the tutorial.

The response of medical students to tutorial direction and the effect of tutors' suggestions on self-directed learning outside the tutorial is relatively unknown, though Chang et al (1995) remind us that students prefer "expert" tutors. The term "expert" is used here to denote a tutor with content expertise and though this term is not synonymous with clinician, there may be some parallels. This finding raises an important question: what facet of the tutor's professional experience makes students prefer experts? Monkhouse (1992) suggests that the ideal learning in Anatomy is clinically oriented. Do medical practitioners who tutor somehow direct students toward the certain aspects of modules?

I used survey questions to examine ways the tutor's clinical experience might influence the learning activities of students in PBL courses and whether tutor's profession had somehow affected their opinions about the Anatomy lab. The survey responses were not designed to answer the questions raised above but they may shed some light on the complex interactions between group members' self-directed learning and their tutors' views.

Most medical students who responded to this survey belonged to tutorial groups led by a clinician but 17.5% of the entire group were tutored by research scientists. Responses from those students who identified their tutors as both clinicians and research scientists were not included in this analysis. The number of tutors in the physiotherapy programme who were classifed as research scientists was too small to permit comparision.

The questions in Table VIII below were analyzed by comparing the answers of those in the Research Tutor group (Unit 1 + Unit 4 med students) with the Clinician Tutor.

Table VIII: The Effect on Module Use and Attitudes toward Modules by Profession of Tutor (Medical Students Unit 1 and 4)

STATEMENT from QUESTIONNAIRE	Med Students with Clinicians as Tutors n = 63	Med Students with Research Tutors n = 14
A. Hours of Anatomy lab use per week*	1.50	2.31
B. Percent of total Anatomy study time spent using modules**	22%	30%
C. I go to the Anatomy lab with my entire tutorial group (Q20)	4%	22%+
D. Tutor believes Anatomy modules are important or very important (Q64)	41%	64%
E. I do not know what my tutor thinks of the value of Anatomy modules (Q64)	38%	21%
F. My tutor encourages module use (Q22)	50%	64% ++
G. My group always or frequently has extra sessions in the Anatomy lab (Q23)	11%	14%
H. I learn more when I do a module with preceptor or instructor (Q21)	43%	90% +++
I. I want more complex information in modules (Q10)	35%	21%
J. It's hard to determine which module details are important (Q17)	23%	43%
K. I follow the module script (Q3)	80%	92%

STATEMENT from QUESTIONNAIRE	Med Students with Clinicians as Tutors n = 63	Med Students with Research Tutors n = 14
L. Modules assume too much previous knowledge of Anatomy (Q13)	15%	43% ++++
M. If I complete the module, I can make a useful contribution to the tutorial (Q61)	60%	79%
N. I always have an adequate understanding of HCPs when I am finished (Q 30)	27%	7%
O. My ability to think through HCPs is better or much better than that of my peers (Q 31)	29%	29%

NOTES:

1. Percentages shown in C.- O. indicate the students who agree with the statement.

2. * is a weighted average: calculation described in Appendix C
    (+ significance level $p = 0.015$)
    ** is based on weighted averages: calculation described in Appendix C.

3. Response rates for statements F, H and L are significant at the following levels:
    + (A) $p = 0.07$
    ++ (F) $p = 0.0865$
    +++ (H) $p = 0.015$
    ++++ (L) $p = 0.0409$

6.2 Results and Conclusions: The Effect of Tutor Profession on Anatomy Lab and

Module Use Among Medical Students

Results show that students who have research scientists as tutors (RT group)

spend more time in the Anatomy lab than their colleagues in clinician-run groups (CT

group): the former spent an estimated average of 2.31 hours per week in the lab

compared to 1.50 hours per week for the later group. Members of the RT group spent

30% of their total Anatomy study time in the lab, while CT students spend just over

one fifth of their total time in the lab.

Research scientist led tutorial groups seem to deal with the Anatomy lab

differently than CT groups. RT students are more than 5 times more likely than CT

students to visit the lab with their entire tutorial group, possibly because they believe

that their tutor has a very positive view of module use. RT students are more likely

than CT students to know what their tutor's views on this matter (only 21% do not

know their tutor's views, compared to 38% do not know). 64% of the group describes

the tutor's opinion of modules as "very important" or "important". The RT tutors are

also more likely to encourage module use than CT tutors.

Though the RT group have about the same number of extra resources sessions

in the Anatomy lab as the CT group, they are significantly more convinced that they

would learn more Anatomy under the supervision of a preceptor or instructor. (90% agreement for RT, 43% agreement for CT, p = .015) This suggests that they have more experience actually working through modules with their tutorial group and their tutor.

Despite this encouragement and support, students in research scientist led tutorial groups do not seem to find using the modules easier than their peers in clinician led groups. They are less likely to want more complex information in modules, more likely to have difficulty determining the important details in modules and significantly more likely to believe that modules assume too much previous knowledge (43% of RT students agree, 15% of CT students agree, p = .0409). 92% of RT students and only 80% of CT students use the script in the module: whether these rates are an affirmation of the script's utility or an unwillingness to use the module resources independently cannot be determined from our survey.

Students in RT groups are no less confident than their peers: 29% of them describe their ability to think through HCPs as better or much better than their peers. This response rate is identical to that shown by the CT students. RT students are even more convinced than their CT group colleagues that working through modules will help them make useful contributions to tutorials (79% agree compared to 60% of CT students), probably because of their tutor's encouragement for module use. They are

not as positive about the fruits of their labours as CT students are: while 27% of this latter group say that they always have an adequate understanding of HCPs after the group has finished with them but only 7% of the RT group express this same confidence.

While these mixed results cannot be explained by the survey, they are congruent with other studies dealing with the backgrounds and leadership styles of tutors. Silver and Wilkerson (1991) showed that tutors with subject expertise provided more direct answers to students' questions and suggested more topics for discussion than did tutors who were not experts in the field under discussion. This may explain the finding in Chang et al (1995) that students prefer expert tutors.

The results suggest that clinician tutors do not promote Anatomy lab use as much as their research scientist colleagues but that these clinicians (or their tutoring style) somehow give the students more confidence in their ability to sort through modules. It seems clear that students also feel more confident under the tutorial direction of clinicians, at least in their understanding of Health Care problems, the central learning and evaluative activity at McMaster. Tutors are expected to allow students to sort through the issue in HCPs on their own, but it is possible that clinicians clarify details in HCPs and point their tutorial groups to the central issues more readily than research scientists.

Table IX: Reasons for Anatomy Module Use (Medical and Physiotherapy Students)

STATEMENT from QUESTIONNAIRE	Med Unit 1 n = 52	Med Unit 4 n = 28	PT Block 3 n = 17
A. Tutor insists on module use (Q65)	4%	4%	6%
B. Tutor encourages module use (Q22)	54%	44%	59%
C. Tutor sees module as essential/important (Q64)	54% agree DNK* = 33%	46% agree DNK = 46%	59% agree DNK = 41%
D. Knowledge of Anatomy essential to profession (Q37)	79%	74%	94%
E. I'm not sure I've learned enough Anatomy (Q47)	76%	71%	50%
F. Personal knowledge of Anatomy rated excellent or adequate by CSP** (Q25)	34% agree 64% DNK	39% agree 54% DNK	47% agree 53% DNK
G. I think through an HCP+ better/much better than others.(Q31)	33%	21%	35%
H. I always have an adequate understanding of an HCP+ after tutorial (Q30)	21%	29%	13%
I. If I complete the module, then I can make a useful contribution to the tutorial (Q61)	64%	69%	81%
J. Relative Module Satisfaction Score++	+39	+19	+158
K. Hrs of Anatomy lab use per week #	1.39	1.81	3.29
L. Percent of total Anatomy study time spent in the lab ##	20%	28%	38%

NOTES:

1. Med = Medical Student, PT = Physiotherapy Student
    All numbers represent the percentage of the total group who agreed with the questionnaire statement.

2. * = Do Not Know ** = Clinical Skills Preceptor
    + = Health Care Problem
        ++ = This score is described in Section 5.1
        # and ## = calculations described in Appendix C

CHAPTER 7: REASONS FOR ANATOMY LAB AND MODULE USE

7.1 Possible Motivation for Anatomy Lab Use

Five hypotheses about the reasons McMaster medical and physiotherapy students use the Anatomy lab and modules arise from an examination of the survey results. Questions relating to each hypothesis are grouped in Tables IX and X. While this study cannot show statistical support for any of these hypotheses, the impressions gained may be useful for further research.

Statements A.- C. deal with the first hypothesis that students use the Anatomy lab because their tutors require or expect them to, while statements D. - F. explore the second hypothesis that students use the lab because they have a serious commitment to learning Anatomy. Do students who use the lab have more confidence in their tutorials which are the centre of learning in the McMaster system ? This third hypothesis is tested with statements G.- I. The possible relationship between the satisfaction ratings given to the modules by students and those students' rates of module use (hypothesis four) is examined with statements J. and K. The last hypothesis tests the possible relationship between high rates of module use as a way of saving study time for busy students: data is shown in statements K. and L.

1)   Hypothesis I: Students use the lab because their tutors expect them to do so.

Because the tutorial group is the focus of medical and physiotherapy education at McMaster, a tutor's suggestions regarding module use might be expected to be influential. Because problem-based learning engenders very different relationships between learners and tutors, the assumption mentioned above may be entirely false. There is little information available in the literature about the relative independence PBL students in general exhibit with respect to their tutors' views. Vernon and Blake (1993) found that PBL students in seven different PBL situations were more likely to use self-selected reading materials than faculty selected ones.

It is difficult to determine how seriously McMaster students take their tutor's suggestions because most tutors do not direct the learning habits of the students. Very few students in any class agreed with the statement "Our tutor insists that we use modules to prepare for HCPs." (Q65), though at least 40% of each group felt that their tutor "encouraged" module use. PT students had the highest response to this statement, with Med Unit 1 responses higher than Med Unit 4 answers. When asked if the tutor would describe the module as essential or important, the same pattern of response showed up: 59% of PTs agreed, 54% of MD Unit 1 agreed and 46% of MD Unit 4 agreed. Are tutors in the Physiotherapy programme really more directive concerning

module use or is this response an artifact of PT student commitment - no answer can be determined from this survey. It may also be possible that while tutors of Meds Unit 1 are more likely to make suggestions and guide the self-directed learning of students new to PBL, the tutors of Unit 4 Meds do not see such direction as appropriate.

It is interesting to note that, even in the PT cohort, there is a large number of students (41%) who do not know what their tutor thinks about module use. The fact that PT students have the highest rates of use despite ignorance of their tutor's view suggests that truly self-directed learning may be occuring. This same phenomenon shows up in the comparison between the Unit 1 and Unit 4 Meds: while 46% of the latter group do not know what their tutor thinks of modules, their rates of use are higher than Unit 1 Meds, who are more likely to know their tutor's opinion.

An interesting and statistically significant correlation was brought to light by contingency table analysis. Respondents whose tutors suggest that module use is important (Statement C.) were more likely to agree that module completion enhanced their tutorial performance (Statement I.) than students who did not know their tutor's opinion on the matter.(p = .08) Are there group learning practices or tutor expectations in certain tutorials that foster module use? Further research is required to answer this question.

Is there a relationship between the tutors' attitude toward module use

(Statements A.- C.) and the hours a student spends in the Anatomy lab? Response

rates to the statements indicated are almost the same for Meds Unit 1 and PTs but the

physiotherapy students spent almost 140% more time in the Anatomy lab than the Unit

1 students. (The much more demanding Anatomy content in the physiotherapy

programme is likely responsible for this difference.) Even Unit 4 Meds, whose tutors

seem to have a slightly less positive view of the modules spend 30% more time in the

lab than their Unit 1 counterparts.

Data noted above suggests that students use the Anatomy lab rather

independently of their tutor's opinion of the facility. There may, however be an

expectation of module use in certain groups that increases a students' confidence in his

or her contribution to the tutorial discussion. In general Statements A.- C. do not seem

to support the first hypothesis.

2)   Hypothesis II: If students consider Anatomy important, they will spend more

        time in the lab.

While sizeable fractions of both medical student groups believe that a detailed

knowledge of anatomy is vital to their professsional practice, (Statement D.) the

physiotherapy students had a much higher positive response, as one might expect from

an examination of their programme content objectives. Unit 4 medical students, who use the lab more than their Unit 1 counterparts are significantly more likely than Unit 1 students to disagree with this statement. (p = .03)

It is interesting to note that, though most students say Anatomy is important to them, large fractions of each group do not seem to know if their knowledge of Anatomy is adequate. Physiotherapy students are surprising less confident that they've learned enough Anatomy than their medical student counterparts. Only 50% of the PTs agreed with Statement E. while over 70% of the medical students in any unit felt that this was true. This may be related to differences in programme objectives.

In addition, many students do not know what their clinical skills preceptors (CSPs) think of their Anatomy knowledge. It is not unexpected that Unit 1 Meds are more likely to say that they do not know what their CSP thinks of their knowledge of Anatomy (64% agree). More experienced students (both Meds and PTs) may be picking up informal cues from their clinical skills preceptors/ instructors better than Unit 1 students do. The responses to this statement given by Unit 4 Meds and PTs are somewhat more difficult to interpret. Only 39% of Unit 4 Meds thought their knowledge would be rated excellent or adequate. The corresponding response for the PTs was again, surprisingly low - only 47% of these students thought that their knowledge base would be rated in the same way. 53% of the PTs and 54% of the

Meds Unit 4, both of whom might be expected to notice and act on feedback, did not know what their CSP thought of their Anatomy knowledge. This lack of information might only suggest that feedback from their peers is much more common.

The physiotherapy students use the Anatomy lab the most and are more likely to agree that Anatomy is important to them. This evidence might be enough to suggest that student commitment to Anatomy increases hours of use - that hypothesis II is supported, at least for the PT students. The evidence suggests that the hypothesis would not hold up for the medical students.

50% of PTs feel that they've learned enough Anatomy and almost 50% (47% actual) feel that the CSP would rate their knowledge as adequate or better. This data is reminiscent of the dose-response curves used to determine the effectiveness of pharmaceuticals. An informal prediction could be made that 3.29 hours of Anatomy lab use is the minimum amount required for to satisfy the learning needs of half of the physiotherapy class. No such estimate can be made for the medical students from the data available.

3)   Hypothesis III: Anatomy module use increases "success" in the problem based learning programmes.

The willingness of students to use the Anatomy modules, without being

required to do so, may be related to the perceived results of module use. Success at

McMaster means being able to contribute positively to the discussion of Health Care

problems in tutorial meetings and getting good evaluations from their peers in this

setting every week.(Paillie and Carr, 1987) Hypothesis III suggests that if students are

convinced that module use improves their performance and their confidence in these

tutorial activities, then they may increase their hours of Anatomy lab use.

Students are required to think through the issue involved in Health Care

Problems every week in their tutorials. Statement G. is a self evaluation of their ability

to perform this task better than their peers. About one-third of both the Unit 1 Meds

(actual = 33%) and physiotherapy students (actual = 35%) believed that they could do

this better than their peers. This "confidence index" drops among the Unit 4 Meds,

only 21% of which believe they can do this better than their peers. Perhaps the greater

variety of body systems, the amount of interdisciplinary work (pathology, physiology

and pharmacology) and the shorter amount of time available for each HCP accounts

for this change in Unit 4 self-assessment.

No significant relationship was found among medical students with high PBL

(PBL+) and better understanding of HCPs, though there was a significant correlation

for this relationship among PTs. Those with low PBL experience were more likely to

say that they had a better understanding of HCPs (p=.062). Among medical students in both units there were no significant correlations between the students' self rated ability to solve HCPS and their previous Biology or PBL experience, type of tutor or unit.

A recent psychological comparison of students in PBL or traditional curriculum medical school by Camp et al (1994) showed that students who chose to study in the PBL format were more likely to have higher ratings on self actualization scales. The researchers note that these students saw themselves as reflective, capable and resilient. The self perceptions noted in Statement G might be an artifact of the McMaster admission process or (more likely) the self selection of students who apply to a PBL school, rather than having any relationship to learning activities chosen by these students.

Though the students' confidence in analysing HCPs during the tutorial may not be related to their background, their responses to Statement H.(ability to understand HCPs after the tutorial) clearly were. Contingency table analysis showed that medical students who had at least an undergraduate degree in Biology were more likely to say that they always or usually understood the Health Care problems when their tutorial group was finished discussing it. This finding was significant: p = .0088. Physiotherapy students showed the same correlation: those classified as BIO (+) were more likely to say that they always or usually understood the HCPs. (p=.045)

The students' responses to Statement H. discussed above were not significantly correlated with their hours of Anatomy lab use, so it is tempting to suggest that previous Biology training has a more important effect on the understanding of Health Care problems than hours of module use does.

Statement I asks students if module completion helps them contribute to tutorials. Why should this matter so much? The shift in PBL schools from evaluation by examination or by faculty to frequent evaluation in the tutorial makes a profound difference in students' learning priorities. Jennifer Blake (1994), a librarian at the McMaster Health Centre Library, describes the effect that this system has on student attitudes and habits.

> No longer does it matter what the professor thinks, or wants to put on the exam. What counts is that twice a week you contribute in a useful way to a discussion with peers in front of faculty. What matters is that during the week you work well and help one another. It is a system which drives you to learn from a desire to know, and backs it up with peer pressure.[10]

It is noteworthy that 64% of Meds Unit 1, 69% of Meds Unit 4 and 81% of the PTs believe that if they completed the relevant modules, they would be able to make

useful contributions to the tutorial sessions. This relationship between such agreement and hours of use was statistically significant. Medical students who spent at least 1-3 hours per week using Anatomy modules were more likely to agree with the statement above than students who spend less time in the lab (p = .03). Physiotherapy students showed the same significant correlation between agreement with the statement and hours of lab use (p = .055). Unlike some of the responses analysed above, agreement with this statement (I.) was not significantly related to the students' biology experience. Here time spent in the Anatomy lab is the most significant factor in tutorial confidence.

Some of the responses noted above to Statements G.- I. have some statistically significant correlations with hours of Anatomy lab use. While some of the confidence noted here may come from the personalities of students who choose to enroll in PBL programmes and from their backgrounds in biology, at least part of the confidence students express in their tutorial contributions is related to Anatomy module use. This suggests that hypothesis III has some statistical support.

4)   Hypothesis IV: Students who are more satisfied with Anatomy modules make greater use of them.

The module satisfaction scores shown in Statement J. are discussed on page 39. Physiotherapy students who had the highest satisfaction scores also used the lab the most. Reasons for this finding have been previously discussed. The experience of the PT students suggests that the more time students spend using the modules, the higher their satisfaction with these resources. Does each module take a certain minimum time commitment to be most useful to the student ? If this is so, do students who just browse through the modules waste most of their effort. Further research on these extrapolations of hypothesis IV might be useful.

5)   Hypothesis V: Module use saves time.

The use of anatomy modules could be easily explained if this practice saved the student time. Statements K. and L. show that students who use the lab most do not reduce their use of other resources. Physiotherapy students with the highest rate of lab use also spend much more time than medical students using other resources to learn Anatomy.

Contingency table analysis showed that the hours of module use are not not significantly related to time spent with textbooks, to previous Biology or PBL experience or the student's unit.

The use of anatomy modules does not appear to save the student study time and hypothesis V must be rejected.

Table X: Reasons for Anatomy Module Use (Unit I Medical Students)

STATEMENT from QUESTIONNAIRE	BIO (+) PBL (+)	BIO (+) PBL (-)	BIO (-) PBL (+)	BIO (-) PBL (-)
A. Tutor insists on module use (Q65)	0%	8%	0%	0%
B. Tutor encourages module use (Q22)	50%	46%	57%	67%
C. Tutor sees module as essential or important (Q64)	50% 50% DNK*	46% 31% DNK*	42% 43% DNK*	67% 33% DNK*
D. Knowledge of Anatomy is essential to profession (Q37)	88%	85%	86%	100%
E. I'm not sure I've learned enough Anatomy (Q47)	90%	85%	86%	67%
F. Personal knowledge of Anatomy rated excellent or adequate by CSP** (Q25)	30% 70% DNK	23% 77% DNK	15% 85% DNK	100%
G. I think through an HCP+ better/much better than others (Q31)	50%	23%	29%	33%
H. I always have an adequate under-standing of HCP+ after tutorial (Q30)	50%	15%	14%	0%
I. If I complete the module, I can make a useful contribution to the tutorial (Q30)	70%	67%	62%	33%
J. Relative Module Satisfaction Score ++	+57	-46	-3	-99
K. Hours of Anatomy lab use/week #	1.35	1.57	1.58	1.50

STATEMENT from QUESTIONNAIRE	BIO (+) PBL (+)	BIO (+) PBL (-)	BIO (-) PBL (+)	BIO (-) PBL (-)
L. Percent of total Anatomy study time spent in the lab ##	20%	23%	22%	18%

NOTES:

1. All numbers represent the percentage of the total group who agreed with the questionnaire statement.

2. * = Do Not Know ** = Clinical Skills Preceptor
   + = Health Care Problem
   ++ = This score is described in Section 5.1
   # and ## = calculations described in Appendix C

7.2 Possible Motivations for Module Use among Unit 1 Medical Students

Analysis of the reasons why Unit 1 students might use the lab are complicated

by the 4 rather small subgroups that were created to isolate biology and PBL

experience. The five hypotheses to be tested have been described in Section 7.1. Since

many of the same conclusions can be drawn from this table as from the previous one,

only those statements were interesting differences are noted will be discussed. The

hours of Anatomy lab use per week claimed by these subgroups are so similar (ranging

from 1.35 to 1.58 hours per week) that conclusions regarding any possible influences

on lab use are not warranted.

Statements A.- C. show again that tutors at McMaster are not likely to insist on

certain kinds of learning activities, though they are slightly more likely to encourage

module use to all Unit 1 students than to Unit 4 students. The number of students who

know their tutor's opinion of the modules is similar to the rates shown in Table IX.

These Unit 1 medical students feel just as strongly about the importance of

Anatomy as their counterparts in other groups. Their responses to Statement F show a

few interesting differences, however. All of the Bio(-)PBL(-) students believed that

their personal knowledge of Anatomy was considered excellent or adequate by their

CSP while only 15 - 39% of the students in other Unit 1 subgroups believed that this

was true. It is possible that these students, conscious of the differences in their preparation for medical school, make a point of asking their CSP for direct feedback on their progress and that they work especially hard to learn the background required.

Responses shown in this table to Statements G. - I. are again quite similar to those noted in Table IX, with a few exceptions. Members of the BIO(+)PBL(+) subgroup have much greater confidence in their ability to think through Health Care Problems than their peers (50% rate themselves better or much better than others). 50% of this group also believe that they always have an adequate understanding of the HCP after the group has finished with it: comparable rates for the other groups are 15% BIO(+)PBL(-), 14% BIO(-)PBL(+) and 0% BIO(-)PBL(-).

Members of the BIO(-)PBL(-) group do not seem to believe that module use will help them make a useful contribution to the tutorial - only one third of them agreed with this statement (I.) while at least 60% of all the other students thought this was true. This finding is not surprising, however, in light of the fact that they have the lowest module satisfaction rating by far (-99, compared to a range of -3 to +57) It seems clear that these students feel much less confident with the modules and consequently don't believe that using them will help them make a contribution to the tutorial.

The general impression is that students without either biology or problem based learning background are struggling to keep up, at least in Unit 1. This phenomenon has been recognized from the early days of the programme: Hamilton (1976) writes "For many [students without pre-medical experience in biological science], there is essentially no problem. They recognise that they will need to work hard in the basic science areas and organise their work accordingly. Others work well, but suffer in the process and take about a year before they feel fully comfortable. The source of their discomfort is not a real difficulty, but a sense of insecurity . . . Usually this is a matter of familiarity with topic matters and with terminology rather than fundamental insights into principles."[11]

CHAPTER 8: CONCLUSIONS

This study began as a simple survey of Anatomy lab use by McMaster University medical and physiotherapy students. In the course of data analysis, it became clear that several factors including the student's programme, level (Unit or Block), and previous experience with Biology or Problem-based learning affected the rates and patterns of lab use.

Results suggest that previous experience with Biology appears to give students more confidence with the Health Care problems they analyze in tutorials and that previous exposure to Problem-based learning gives students more confidence in using the Anatomy lab and modules. Physiotherapy students, whose programme has a very heavy focus on muscloskeletal anatomy, have significantly higher use of the Anatomy lab and modules and express a much higher rate of satisfaction with this resource.

A subdivision of the Unit 1 medical class into four small subgroups by Biology and Problem-based learning experience suggested that students who had background in both were most confident, both in their approach to Health Care Problems and in their use of the Anatomy modules. Students with no experience in either Biology or Problem-based learning used the lab less and had much lower satisfaction ratings of

the modules. Students with experience in either Biology or Problem-based learning had response rates in between the two extremes mentioned above.

There is a statistically significant increase in the amount of time medical students use the lab between Units 1 and 4, though physiotherapy students show the opposite trend in lab use. Students who were tutored by research scientists rather than medical practitioners spent more time with the Anatomy modules but did not have the same confidence in their learning as their counterparts did.

Students at McMaster are not required to use the Anatomy lab or modules: their motivation to do so was a matter of considerable interest. Five hypotheses about their reasons for using modules were informally examined. Module use does not save the student time, is not required by tutors and does not arise from a strong desired to learn Anatomy for its own sake. One hypothesis regarding lab use had statistical support: students who believed that lab use helped them to contribute to tutorials spent more time in the lab than their peers. It seems reasonable to conclude that the motivation to use the Anatomy lab and modules arises from the expectation that this learning activity will be useful in tutorials, where students are constantly evaluated.

The study did provide some information about the hours of Anatomy lab use, the most common patterns of use and the most common attitudes toward the Anatomy

modules. While definitive statements about the reasons for module use and the effects of Biology and Problem-based learning on Anatomy lab use are not appropriate, the information and insights gathered here may provide a foundation for further research.

ENDNOTES

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APPENDIX A

QUESTIONNAIRES used in surveys of

1) MEDICAL STUDENTS

2) PHYSIOTHERAPY STUDENTS

McMaster School of Medicine

Division of Anatomy Student Survey

Your participation in this survey will help us evaluate our Anatomy modules and lab. We hope that the information gathered will help us improve our system so that it can be more useful to you.

DIRECTIONS

This questionnaire is anonymous. DO NOT include your name, student number or tutorial group number on your response sheets.

Please answer each question by circling the appropriate response on the survey form. If you would like to add written comments, please use the lined paper provided.

1.   Most anatomy modules are oversimplified.

    a.   agree

    b.   disagree

2.   Your tutor is:

    a.   a physician

    b.   a research scientist

    c.   a health care professional (nurse, OT)

    d.   other

3. When you use an Anatomy module, do you usually

    a.   pick up the script and follow the text

    b.   pick up models, charts and specimens without using the script

    c.   use only the charts and models

    d.   use only the specimens

    e.   read the script only

4.   Books contain too many details.

    a.   agree

    b.   disagree

5.   I usually manipulate specimens (e.g. bones and joints) to help me understand

how they work.

    a.   agree

    b.   disagree

6. Pathological specimens (e. g. polycystic kidneys) help me understand normal tissue better.

   a. agree

   b. disagree

7. I sometimes worry about catching a disease from anatomy specimens.

   a. agree

   b. disagree

8. It is important to restrict access to the Anatomy lab to medical and health science students.

   a. agree

   b. disagree

9. Most anatomy modules contain too much information

   a. agree

   b. disagree

10. I wish that the anatomy modules would provide more detailed and complex information.

   a. agree

   b. disagree

11. I find Anatomy modules more helpful than videos.

   a. agree

   b. disagree

12. Working through the Anatomy module first generally helps me understand textbooks.

   a. agree

   b. disagree

13. I find that the Anatomy modules assume too much previous knowledge of human anatomy.

   a. agree

   b. disagree

14. Had you ever been involved in problem-based learning before you came to McMaster Medical School?

a.   for a few hours

b.   in one half course designed for self-directed learning

c.   only in senior/graduate thesis writing

d.   in more than one half course designed for self-directed learning

e.   never

15.   How much exposure to biological or health science have you had?

a.   none

b.   one course

c.   2 to 5 courses

d.   Bachelor's degree

e.   graduate degree

16.   A library book is more difficult to use than a module.

a.   agree

b.   disagree

17.   I find it difficult to do anatomy modules because I'm not sure which details are important.

a.   agree

b.   disagree

18.   What experience do you have with cadaver dissection?

    a.   none

    b.   a few hours

    c.   a half course ($\leq$ 5 hrs/wk for one semester)

    d.   one to four half courses

    e.   more than four half courses / grad work

19.   What experience do you have with animal dissection?

    a.   none

    b.   a few hours

    c.   a half course ($\leq$ 5 hrs/wk for one semester)

    d.   one to four half courses

    e.   more than four half courses / grad work

20.   Do you visit the Anatomy lab

    a.   alone

    b.   with one or two fellow students

    c.   with my entire tutorial group

    d.   do not use the lab regularly

21.   I find I learn more when doing an anatomy module with the supervision of an

anatomy preceptor.

a.   agree

b.   disagree

22.   The tutor encourages us to use anatomy modules.

a.   agree

b.   disagree

23.   How often does your tutorial group have resource sessions in the Anatomy lab?

a.   always

b.   frequently

c.   sometimes

d.   never

24.   What does your Clinical Skills Preceptor think of your group's grasp of

anatomy?

a.   excellent

b.   adequate

c.   inadequate

d.   do not know

25.　What does your Clinical Skills Preceptor think of your own grasp of anatomy?

    a.　excellent

    b.　adequate

    c.　inadequate

    d.　do not know

26.　Some module guides do not explain specimens in that module very well.

    a.　agree

    b.　disagree

27.　How many HCPs do you expect your tutorial group to complete this semester?

    a.　less than 5

    b.　5 - 8

    c.　9 - 11

    d.　more than 11

28. How does your group regard your own understanding of behavioural concepts involved in HCPs?

   a.   excellent

   b.   good

   c.   average

   d.   fair

   e.   do not know

29. How does your group regard your own understanding of biological concepts involved in HCPs?

   a.   excellent

   b.   good

   c.   average

   d.   fair

   e.   do not know

30.   Do you feel that you have an adequate understanding of the HCP (for a student in your unit) after your group has finished dealing with it?

a.   always

b.   most of the time

c.   some of the time

d.   rarely

31.   How would you rate your ability to think through medical problems as compared to others in your tutorial?

a.   much better than others

b.   better than others

c.   about the same as others

d.   not as good as others

e.   much poorer than others

32.   I often find anatomy modules boring.

a.   agree

b.   disagree

33. Anatomy modules would be improved by the addition of more clinical information.

   a. agree

   b. disagree

34. I would learn more anatomy if I dissected cadavers myself.

   a. agree

   b. disagree

35. How many students in your tutorial group have some university training in behavioural science?

   a. none

   b. one

   c. two or more

   d. all

   e. do not know

36. How many students in your tutorial group have some university training in biology or health science?

   a.   none

   b.   one

   c.   two or more

   d.   all

   e.   do not know

37. I believe that detailed knowledge of anatomy is vital to being a good clinician.

   a.   agree

   b.   disagree

38. I am the type of person that likes to know exactly what is expected of me.

   a.   agree

   b.   disagree

39. Working in the Anatomy lab reminds me that I am training to be a professional.

   a.   agree

   b.   disagree

40. In what medical school unit are you registered?

a. Unit 1

b. Unit 2

c. Unit 3

d. Unit 4

e. Other

41. I can usually finish an Anatomy module in the time that I had planned to spend

on it.

a. agree

b. disagree

42. Most anatomy modules are about the right length.

a. agree

b. disagree

43. I always use Anatomy modules to review textbook reading that I have done.

a. agree

b. disagree

44.   I find videos more helpful than the Anatomy modules.

    a.   agree

    b.   disagree

45.   What resource do you find is most important as you work with HCPs?

    a.   texts and library books

    b.   anatomy modules

    c.   faculty

    d.   organized large group sessions

    e.   audio-visual materials (e.g. videos and tapes)

46.   Modules offer only the most important information on a given topic.

    a.   agree

    b.   disagree

47.   Most of the time, I'm not sure that I've learned enough anatomy.

    a.   agree

    b.   disagree

48. I learn more anatomy when I observe the live patient (e.g. in the OR) than I do when I work with preserved specimens.

   a. agree

   b. disagree

49. I feel I have a better grasp of anatomy when I can relate form to function.

   a. agree

   b. disagree

50. Approximately how much time per week do you spend learning Anatomy from textbooks?

   a. less than one hour

   b. less than ten hours

   c. ten to twenty hours

   d. twenty to forty hours

   e. more than forty hours

51. How does your group regard your own understanding of the population

perspectives involved in HCPs?

    a.   excellent

    b.   good

    c.   average

    d.   fair

    e.   do not know

52. Which type of specimens do you use most often?

    a.   cadavers

    b.   wet specimens

    c.   plastinated specimens (e.g. flexible knee joint)

    d.   all of these are used

    e.   none of these are used regularly

53.   About how long does it take your tutorial group to complete a typical health

care problem?

a.   less than one week

b.   about a week

c.   about two weeks

d.   more than two weeks

e.   varies with the problem

54.   I find materials on clinically-oriented anatomy more helpful than materials with

no mention of clinical relevance.

a.   agree

b.   disagree

55.   How often do you expect to use the Anatomy Lab in this Unit?

a.   less than twice

b.   2 - 4 times

c.   5 - 10 times

d.   10 - 15 times

e.   more than 15 times

56. Approximately how much time in the average week do you spend in the Anatomy lab using the modules?

    a.   never visit

    b.   less than one hour

    c.   one to three hours

    d.   three to five hours

    e.   more than five hours

57. Modules make it easier to visualize the organs as part of a system

    a.   agree

    b.   disagree

58. How would you rate the spirit of your tutorial group?

    a.   very co-operative

    b.   usually helpful

    c.   occasionally helpful

    d.   not helpful

    e.   antagonistic /competitive

59. How do you feel about the human material used in Anatomy modules?

 a. I have little emotional reaction to human material

 b. I used to find some of the material emotionally disturbing but am accustomed to them now.

 c. I find some of the material emotionally disturbing.

 d. I never use cadavers because they are disturbing

 e. I find the material so disturbing that I only go into the lab when I am with others

60. There is not enough room at the module desks for my writing materials and the various models, scripts and charts.

 a. agree

 b. disagree

61. If I have completed the relevant Anatomy modules, I feel confident that I will make useful contributions to the tutorial.

 a. agree

 b. disagree

62. I use anatomy modules to review material covered in a tutorial.

   a. agree

   b. disagree

63. On admission to McMaster Medical School my undergraduate average was

   a. A +

   b. A

   c. A -

   d. B +

   e. B or lower

64. What do you think is your tutor's opinion of the value of the anatomy

   modules?

   a. essential

   b. important

   c. somewhat useful

   d. not useful

   e. don't know

65. The tutor insists that we use anatomy modules to prepare for every HCP.

    a. agree

    b. disagree

66. How many hours a week do you use video and audio tapes to study Anatomy?

    a. less than one

    b. one to three

    c. three to five

    d. five to ten

    e. more than ten

67. How well prepared do you usually feel in comparison to the other members of your tutorial group?

    a. much better prepared

    b. as well prepared

    c. less well prepared

    d. much less well prepared

68.   What resource do you think your tutor considers most important for

understanding HCPs?

a.   texts and library books

b.   anatomy modules

c.   faculty / large group sessions

d.   clinical exposure

e.   audio - visual materials (e.g. videos and tapes)

69.   **UNIT 4 ONLY:** Compared to when you were in Unit 1, has the amount of

time you spend using Anatomy modules per week:

a.   increased significantly

b.   increased somewhat

c.   stayed about the same

d.   decreased somewhat

e.   decreased significantly

McMaster Physiotherapy Programme

Division of Anatomy Student Survey

Respond as you would have during the Academic part of Block I and II. Your participation in this survey will help us evaluate our Anatomy modules and lab. We hope that the information gathered will help us improve our system so that it can be more useful to you.

DIRECTIONS

This questionnaire is anonymous. DO NOT include your name, student number or tutorial group number on your response sheets.

Please answer each question by circling the appropriate response on the survey form. If you would like to add written comments, please use the lined paper provided.

---

1. Most anatomy modules are oversimplified.

    a. agree

    b. disagree

2.   Your tutor is:

     a.   a physiotherapist

     b.   a research scientist

     c.   a health care professional (nurse, physician, OT)

     d.   other

3. When you use an Anatomy module, do you usually

     a.   pick up the script and follow the text

     b.   pick up models, charts and specimens without using the script

     c.   use only the charts and models

     d.   use only the specimens

     e.   read the script only

4.   Books contain too many details.

     a.   agree

     b.   disagree

5.   I usually manipulate specimens (e.g. bones and joints) to help me understand

how they work.

     a.   agree

     b.   disagree

6.   Pathological specimens (e.g. osteoporotic spine) help me understand normal tissue better.

      a.   agree

      b.   disagree

7.   I use the anatomy lab most often on

      a.   weekdays 0900-1700

      b.   weeknights 1700-0900

      c.   weekend days 0900-1700

      d.   weekend nights 1700-0900

      e.   a combination of the times above

      Specify _____

8.   It is important to restrict access to the Anatomy lab to health science students.

      a.   agree

      b.   disagree

9.   Most anatomy modules contain too much information

      a.   agree

      b.   disagree

10. I wish that the anatomy modules would provide more detailed and complex information.

a. agree

b. disagree

11. I find Anatomy modules more helpful than videos.

a. agree

b. disagree

12. Working through the Anatomy module first generally helps me understand textbooks.

a. agree

b. disagree

13. I find that the Anatomy modules assume too much previous knowledge of human anatomy.

a. agree

b. disagree

14. Had you ever been involved in problem-based learning before you came to

 McMaster Medical School?

   a. for a few hours

   b. in one half course

   c. only in senior/graduate thesis writing

   d. in more than one half course

   e. never

15. How much exposure to biological or health science have you had?

   a. none

   b. one course

   c. 2 to 5 courses

   d. Bachelor's degree

   e. graduate degree

16. A library book is more difficult to use than a module.

   a. agree

   b. disagree

17. I find it difficult to do anatomy modules because I'm not sure which details are

 important.

a. agree

b. disagree

18. What experience do you have with cadaver dissection?

   a. none

   b. a few hours

   c. a half course ($\leq$ 5 hrs/wk for one semester)

   d. one to four half courses

   e. more than four half courses / grad work

19. What experience do you have with animal dissection?

   a. none

   b. a few hours

   c. a half course ($\leq$ 5 hrs/wk for one semester)

   d. one to four half courses

   e. more than four half courses / grad work

20. Are most of your visits the Anatomy lab

    a.   alone

    b.   with one or two fellow students

    c.   with my entire tutorial group

    d.   with more than 2 students (from any tutorial group)

    e.   do not use the lab regularly

21. I find I learn more when doing an anatomy module with the supervision of an

    anatomy instructor.

    a.   agree

    b.   disagree

22. The tutor encourages us to use anatomy modules.

    a.   agree

    b.   disagree

23. How often does your tutorial group have an extra resource session in the Anatomy lab?

    a.   every week

    b.   2-10 times a unit

    c.   1-2 times a unit

    d.   never

24. What does your Clinical Skills Instructor think of your group's grasp of anatomy?

    a.   excellent

    b.   adequate

    c.   inadequate

    d.   do not know

25. What does your Clinical Skills Instructor think of your own grasp of anatomy?

    a.   excellent

    b.   adequate

    c.   inadequate

    d.   do not know

26.   Some module guides do not explain specimens in that module very well.

   a.   agree

   b.   disagree

27.   How does your group regard your own understanding of behavioural concepts

   involved in HCPs?

   a.   excellent

   b.   good

   c.   average

   d.   fair

   e.   do not know

28.   How does your group regard your own understanding of biological concepts

   involved in HCPs?

   a.   excellent

   b.   good

   c.   average

   d.   fair

   e.   do not know

29. Do you feel that you have an adequate understanding of the HCP (for a student in your unit) after your group has finished dealing with it?

   a. always

   b. most of the time

   c. some of the time

   d. rarely

30. How would you rate your ability to think through health care problems as compared to others in your tutorial?

   a. much better than others

   b. better than others

   c. about the same as others

   d. not as good as others

   e. much poorer than others

31. I often find anatomy modules boring.

   a. agree

   b. disagree

32. Anatomy modules would be improved by the addition of more clinical information.

   a.   agree

   b.   disagree

33. I would learn more anatomy if I dissected cadavers myself.

   a.   agree

   b.   disagree

34. How many students in your tutorial group have some university training in behavioural science?

   a.   none

   b.   one

   c.   two or more

   d.   all

   e.   do not know

35. How many students in your tutorial group have some university training in biology or health science?

a. none

b. one

c. two or more

d. all

e. do not know

36. I believe that detailed knowledge of anatomy is vital to being a good physiotherapist.

a. agree

b. disagree

37. I find the behaviour of other Anatomy Lab users inappropriate (ie. noisy, disrespectful of specimens, careless with materials).

a. always

b. frequently

c. rarely

d. never

38. Working in the Anatomy lab reminds me that I am training to be a professional.

   a. agree

   b. disagree

39. In what Block are you registered?

   a. Block I

   b. Block II

   c. Block III

   d. Block IV

   e. Block V

40. I can usually finish an Anatomy module in the time that I had planned to spend on it.

   a. agree

   b. disagree

41. Most anatomy modules are about the right length.

   a. agree

   b. disagree

42. I always use Anatomy modules to review textbook reading that I have done.

   a. agree

   b. disagree

43. I find videos more helpful than the Anatomy modules.

   a. agree

   b. disagree

44. What resource do you find is most important as you work with HCPs?

   a. texts and library books

   b. anatomy modules

   c. faculty

   d. organized large group sessions

   e. audio-visual materials (e.g. videos and tapes)

45. Modules offer only the most important information on a given topic.

   a. agree

   b. disagree

46. Most of the time, I'm not sure that I've learned enough anatomy.

    a. agree

    b. disagree

47. I learn more anatomy when I observe the live patient (e.g. in a clinical setting) than I do when I work with preserved specimens.

    a. agree

    b. disagree

48. Approximately how much time per week do you spend learning Anatomy from textbooks?

    a. less than one hour

    b. less than ten hours

    c. ten to twenty hours

    d. twenty to forty hours

    e. more than forty hours

49. How does your group regard your own understanding of the population perspectives involved in HCPs?

    a.   excellent

    b.   good

    c.   average

    d.   fair

    e.   do not know

50. Which type of specimens do you use most often?

    a.   cadavers

    b.   wet specimens

    c.   plastinated specimens (e.g. flexible knee joint)

    d.   all of these are used

    e.   none of these are used regularly

51. I find materials on clinically-oriented anatomy more helpful than materials with no mention of clinical relevance.

    a.   agree

    b.   disagree

52. How often on average did you use the Anatomy Lab in Block I or II?

    a.   less than twice

    b.   2 - 4 times

    c.   5 - 10 times

    d.   10 - 15 times

    e.   more than 15 times

53. Approximately how much time in the average week do you spend in the Anatomy lab?

    a.   never visit

    b.   less than one hour

    c.   one to three hours

    d.   three to five hours

    e.   more than five hours

54. Modules make it easier to understand the organization and function of structures in a region.

    a.   agree

    b.   disagree

55. How would you rate the spirit of your tutorial group?

    a. very co-operative

    b. usually helpful

    c. occasionally helpful

    d. not helpful

    e. antagonistic /competitive

56. How do you feel about the human material used in Anatomy modules?

    a. I have little emotional reaction to human material

    b. I used to find some of the material emotionally disturbing but am accustomed to them now.

    c. I find some of the material emotionally disturbing.

    d. I never use cadavers because they are disturbing

    e. I find the material so disturbing that I only go into the lab when I am with others

57. There is not enough room at the module desks for my writing materials and the various models, scripts and charts.

    a. agree

    b. disagree

58.   If I have completed the relevant Anatomy modules, I feel confident that I will

make useful contributions to the tutorial.

a.   agree

b.   disagree

59.   I use anatomy modules to review material covered in a tutorial.

a.   agree

b.   disagree

60.   On admission to McMaster my average was

a.   A +

b.   A

c.   A -

d.   B +

e.   B or lower

61. What do you think is your tutor's opinion of the value of the anatomy modules?

    a. essential

    b. important

    c. somewhat useful

    d. not useful

    e. don't know

62. The tutor insists that we use anatomy modules to prepare for every HCP.

    a. agree

    b. disagree

63. How many hours a week do you use video and audio tapes to study Anatomy?

    a. less than one

    b. one to three

    c. three to five

    d. five to ten

    e. more than ten

64. How well prepared do you usually feel in comparison to the other members of your tutorial group?

a. much better prepared

b. as well prepared

c. less well prepared

d. much less well prepared

65. What resource do you think your tutor considers most important for understanding HCPs?

a. texts and library books

b. anatomy modules

c. faculty / large group sessions

d. clinical exposure

e. audio - visual materials (e.g. videos and tapes)

66. **BLOCK 2 ONLY:** Compared to when you were in Block 1, has the amount of time you spend using Anatomy modules per week:

a. increased significantly

b. increased somewhat

c. stayed about the same

d. decreased somewhat

e. decreased significantly

APPENDIX B

COMMENTS ADDED TO SURVEY BY MEDICAL STUDENTS

UNIT 4

67.   Wow Dr Rick your neurology tapes were SO very amazing. Please make more.

Sometimes the content in the modules is too demanding and yet also leaves out

the very basic concepts. It's frustrating. Could be more systematically

approached (like you do in your tapes. Don't assume anything.) Thanks for

asking.

68.   I found it difficult to answer a lot of the questions that asked for agree/disagree

answers. They did not allow for no opinion / can't answer. Also they often

were comparing two opposite views and if I thought that the two options were

equivalent,I could not state this.

69.   I was particularly disappointed with the neuro modules this unit. I, as well as

other members of my group, thought that they were very oversimplified and

because they left out quite a lot of relevant details they were not useful. After

finding many of the other modules (cardio, resp, etc) very useful I was very disappointed.

70.   I'd be interested to see the results concerning this survey. Some questions, in my opinion, do not really relate to anatomy interests but I am curious to see conclusions to be derived. note: could a copy be put up in home base? (no matter when it gets done)

71.   I think the anatomy lab is very important and potentially an invaluable learning tool. Unfortunately modules are often incomplete, disorganized, scripts confusing or cumbersome.

I would love to see the school put the money into hiring an education specialist or technician to staff the lab full time, to improve modules and to be available to guide students. The wet specimens are invaluable but intimidating. Often a resource session is not required but having someone available to help select specimens to initiate study would be very helpful.

I would like to see lab work available (e.g.: urine microscopic exam) on a drop-in basis vs. setting up a resource session in Labr. Med.

UNIT I (or not identified as Unit 4)

1.   What do Q 28-31, 51, 63, 67 have to do with this Anatomy Questionnaire? I

am really interested to know how these above Q relate to or are useful info for

you? The purpose of survey is to see how medical students use the self-directed

modules in Anatomy right?

I do think that you should rewrite Q#38 unless you put the Q in to identify the

following about the personality of the individual answer:

    (i) He/she does want to know what's expected of them!

    (ii) He/she " not "   "   "   "   "

    (iii) He/she is like me and will give you a reactionary answer to such a

    loaded Q. My answer is reactionary b/c no one should have been

    accepted into the McMaster MD program if they are always "wanting to

    know what's expected of them!"

2.   These questions are not realistic to answer. Many times more than one answer

is applicable. eg Q#3 Depends on the module. Usually A but have done b, c, d,

e as well

#20 sometimes a, sometimes b, sometimes c.

3.	re #10 I would like more detailed and complex info, but not at the expense of the simpler info, I.e. if there was more detailed info, it should be provided but <u>labelled</u> as such so the student could choose.

	#34. I would probably learn more but I would not necessarily want to do it, anyway!

	#37 Detailed knowledge, no. Solid knowledge, yes!

4.	I completed the B.Sc.N. programme at McMaster (self-directed learning is also emphasized) before entering medical school, I am using the Anatomy lab much more now than I did in nursing.

5.	When I tried doing modules on my own I found that I had to know most of the anatomy I was after before beginning the module in order to get anything out of it. Now, our group has begun weekly sessions with an anatomist and we wish we had started sooner because the increase in understanding is enormous. (When doing a module alone, it's hard because you can't really ask questions unless you write them all down and seek out an anatomist later; also, you can be deceived into thinking you understand something when you really don't because no one in the group may be sure either.)

6.	Well equipped lab. Cadaver specimens very helpful.

7.   Some questions are too direct, e.g. #45 it depends on the problem, where my

weaknesses are and what is available to me.

The questions that say "always" I do not like because each problem or situation

is different, thus my method of choosing AV over books or anatomy lab may

differ.

Question 68 I did not answer because our tutor did not push one resource for

understanding, instead we were encouraged to explore many resources including

all of those listed. As emphasized in the McMaster programme all these

learning resources are essential for students to become well rounded health care

professionals.

8.   I find the Anatomy modules useful to review important Morphology and to

help understand difficult concepts.

I usually use the lab to consolidate learning or clarify certain aspects on a semi

regular schedule!

APPENDIX C

CALCULATIONS

Calculations Described

1. The estimated hours of Anatomy lab use time was calculated using a weighted average. Answers (a.- e.) to Question 56 were assigned estimated numerical values as follows:

       answer a. - assigned a value of 0 hours/week

       answer b. - assigned a value of 1/2 hour/week

       answer c. - assigned a value of 2 hours/week

       answer d. - assigned a value of 4 hours/week

       answer e. - assigned a value of 6 hours/week

These assigned values were multiplied by a decimal number equivalent to the percentage of the class that chose that answer. The sum of the five numerical equivalents was totalled to create a weighted average.

2. The estimated hours of Anatomy study time using textbooks was also calculated using a weighted average. Answers (a. - d.) to Question 50 were assigned the following numerical values:

       answer a. - assigned a value of 1/2 hour/week

answer b. - assigned a value of 5 hours/week

answer c. - assigned a value of 15 hours/week

answer d. - assigned a value of 30 hours/week

These assigned values were multiplied by a decimal number equivalent to the
percentage of the class that chose that answer. The sum of the five numerical
equivalents was totalled to create a weighted average.

3. The percent of total Anatomy study time spent in the Anatomy lab was calculated
as follows:

Total anatomy study time = weighted average of lab time (estimated in 1.
above) + the weighted average of textbook time

The lab time average (from 1. above) was divided by the total Anatomy study time
(3.) and multiplied by 100. This number represents the percentage of a student's total
Anatomy study time that he or she spends in the Anatomy lab.