Impacts on Students, Instructors and Departments of Multiple Instructors Teaching in Single Courses

Executive Summary

Francis Jones and Sara Harris, UBC Earth and Ocean Sciences, March 2010.

Teaching with multiple instructors can be rewarding (for instructors) and effective (for students) if costs are acknowledged, appropriate resources are made available, and instructors coordinate effectively. This report is based on data that were collected in order to help instructors and program directors (a) decide whether to assign two or more instructors to teach one course, and (b) plan appropriately to maximize the benefits and minimize the drawbacks for students, instructors, and departments.

Survey responses to three simple questions provided feedback from 746 students and 17 instructors involved in nine different courses taught by multiple instructors using three different teaching models. Written feedback was coded to identify commonalities and differences among students and instructors in different courses.

Principal results:

- Students and instructors independently identified similar categories of advantages & disadvantages:
  - Primary **advantages** : (i) "*variety of teaching style or perspectives*" and (ii) "*expertise*".
  - Primary **disadvantages** (i) "*adjustment to teaching styles, expectations and personality*" and (ii) "*confusion or communication problems*".
- Students from five courses either strongly or moderately endorsed multiple instructors, while students in two other courses were either neutral or against multiple instructors.
- Comparisons among courses indicated that the benefits to students of using multiple instructors can be attained when appropriate effort is taken to minimize the well-articulated drawbacks.
- True team teaching (2 teachers participating together) is highly appreciated when the learning goals are about developing thinking, collaboration, scholarly discourse and related skills and abilities.

Primary recommendations:

- Schedule multiple instructors in courses when:
  - The team of instructors is actively involved in selecting each other, not just assigned.
  - Instructors agree to work together and strive for consistency of content and learning activities.
  - Compelling justification can be made based on expertise, passion, collaboration &/or mentoring.
  - A lead instructor is clearly identified and given time & resources necessary for coordination.
- To maximize benefits and minimize drawbacks:
  - Actively and visibly reduce unnecessary variability in learning activities and materials.
  - Coordinate logistics and communication to minimize student confusion and mixed messages.
  - Plan and provide a teaching schedule.
  - Communicate with students regarding why the course involves multiple instructors.
  - Take advantage of multiple perspectives, but also ensure students can effectively resolve discussions and different points of view.
- Make sure time tabling staff are aware of multiple instructor situations as soon as possible. Logistics might make it impossible for the assignments to work in any given term.

See the full report with data, analysis, recommendations and background at http://www.eos.ubc.ca/research/cwsei/resources/mi-mar2010.pdf

IMPACTS ON STUDENTS, INSTRUCTORS AND DEPARTMENTS OF MULTIPLE INSTRUCTORS TEACHING IN SINGLE COURSES

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CONTENTS

ABSTRACT

This report aims to help instructors and program directors answer basic questions about (a) whether to assign two or more instructors to teach one course, and (b) what the impact on students, instructors, and departments will be. Data were collected using three simple questions to get feedback from 746 students and 17 instructors involved in nine different courses taught by multiple instructors using three different models. Students from five of the courses either strongly or moderately endorsed multiple instructors, while students in two other courses were either neutral or against multiple instructors. We found that students and instructors independently identify the primary advantages of multiple instructors as involving variety and expertise, and that the primary disadvantages are related to adjustment and potential confusion. There are some differences in priorities depending on how each course is run, for example instructors identify expertise as an advantage at higher rates than students. In addition, we found true team teaching (when two or more instructors work collaboratively within a classroom) to be highly appreciated by both teachers and students, for well articulated reasons that are consistent with the literature. However costs are higher in terms of time and the effort it takes to ensure the course is well coordinated and not confusing. A number of specific recommendations given in the literature, and others arising directly from this survey's results, are consistent with these data and are listed in the last section of the report.

1. INTRODUCTION: SCOPE AND INTENTIONS

The purpose of this report is to help instructors and program directors answer three questions. Bearing in mind that the first responsibility is to students because their education is the reason courses are offered, these questions are:

1. If a department wants to assign two or more instructors to teach one course, what will be the impact on the learning students can achieve?
2. Under what circumstances can the aims of the course itself suggest that two or more instructors might be a good idea?
3. What must be done to maximize the advantages of using multiple instructors in one course, at the same time as minimizing negative impacts on students, instructors and the department as a whole?

Answers to these questions should be based on solid information about impacts of multiple instructors in various settings, as well as all the other factors that make running an academic department complicated.

The undertaking of this project was timely for 3 reasons: 1) there has been a recent increase in splitting of teaching duties within the Department and the resulting effects on students needs investigating (Figure 1); 2) the curricula of several of the Department's degree programs are currently under review; and 3) as part of UBC's Carl Wieman Science Education Initiative many courses are participating in the Department's Science Education Initiative (EOS-SEI). This means there is both interest among the faculty and personnel dedicated to helping measure, recommend, and implement change in undergraduate education within the Department.

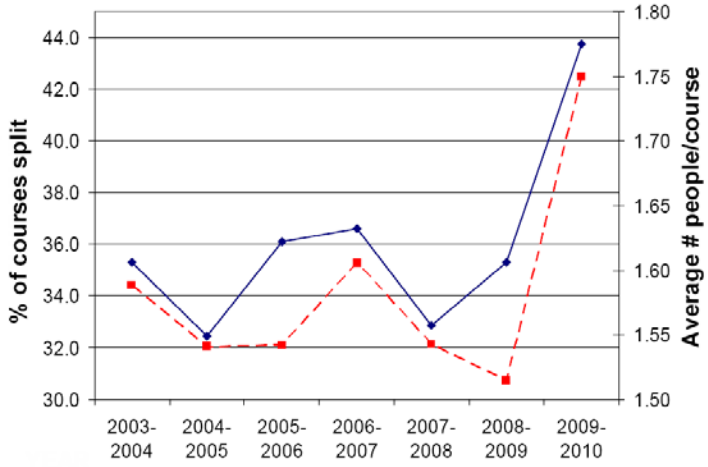

Figure 1. History of splitting undergraduate courses in the Department of Earth and Ocean Sciences (EOS). Solid curve (left axis) plots percentage of all EOS courses that use two or more instructors. Dashed curve (right axis) plots average number of instructors per course for all EOS courses.

At the end of Fall term, 2009, survey data were gathered from students in nine courses, and from instructors teaching in these and other courses. Students were asked to respond to two open questions and one ranking question. Instructors were asked to respond to the same two open questions but from three different perspectives (students, instructors and the Department). Courses investigated were being taught using multiple instructors in several different ways. Since the literature seems to have no consistent terminology for multiple instructor teaching models, those relevant in this study are defined in Table 1.

2. METHODOLOGY

Two open ended questions were used to obtain explicit perspectives from students and instructors on advantages and disadvantages of using multiple instructors in specific courses. In all, data were gathered in fall 2009 from 946 students in 9 courses, and from 17 instructors teaching in 14 courses (Table 1).

Table 1: Courses involved in the study

Course	Title	Teaching model*	# in class	EOS-SEI status at time of data collection
eosc112	The Fluid Earth: Atmosphere and Ocean	SM; 2 instructors; split 50 / 50	182	At end of a 2-yr transforming project
eosc114	The Catastrophic Earth: Natural Disasters	SM; 6 instructors; split roughly evenly	515	6 mths after a 2-yr transforming project
eosc210	Earth Science for Engineers	SM; 3 instructors; split 50 / 25 / 25	216	At end of a 2-yr transforming project.
eosc212	Topics in the Earth & Planetary Sciences	CT; 2 instructors; 50% TT, 50% SM	26	At end of a 2-yr transforming project.
eosc220	Intro. Mineralogy	SM; 2 instructors; split 40 / 60	103	At end of a 2-yr transforming project
eosc331	Intro. to Mineral Deposits and Exploration Geology	SM; 2 instructors; split 50 / 50	41	Transformation project not yet started
eosc372	Intro. Oceanography: Circulation and Plankton	CT; 3 instructors; split 30 / 50 / 20	188	End of the 1st term for this new course
envr200	Environmental Science I	TT; 2 instructors present in all classes	40	Unofficial transformation
apsc160	Intro. to Computation in Engineering Design (Not EOS)	SM; 2 instructors & 2 teaching modes; 50/50	470	No transformation project

***Teaching models:**
- (SM) Sequential Model: one instructor present at a time
- (TT) Team-Teaching: all instructors present for all classes, sharing lead role
- (CT) Co-Teaching: all instructors present sometimes, one instructor present other times

Student questions: Initial efforts in spring 2009 suggested that questions needed to be carefully worded in order to avoid being interpreted as "did you like multiple instructors" rather than "what are advantages (or disadvantages) of multiple instructors". A single, multiple choice question (Q3) was also used to ascertain whether each student felt MI to be generally advantageous or not. The questions were:

1. This course has more than one instructor. What do you think are the ADVANTAGES of having multiple instructors in this course? PLEASE NOTE: This is NOT asking you to evaluate these particular instructors, but to comment on the effects of having multiple instructors.
2. What do you think are the DISADVANTAGES of having multiple instructors in this course? PLEASE NOTE: This is NOT asking you to evaluate these particular instructors, but to comment on the effects of having multiple instructors.
3. All things considered, how do you think having multiple instructors affected THIS course? It was ...
   a. a large advantage b. a small advantage c. neutral d. a small disadvantage e. a large disadvantage

For two courses (ENVR 200 and EOSC 331), students completed the survey in hardcopy at the end of a class period. For all other courses, students completed the survey on-line outside of class time. Some courses offered a small amount of extra credit for completing the survey. All student answers are anonymous, and Table 2 summarizes the number of respondents and the number of comments obtained from the two open-ended questions.

Instructor questions: Instructors were asked to respond to the same two open-ended questions, but they were asked to comment specifically on advantages and disadvantages to students, to instructors, and to the Department. Most instructors involved in the courses were surveyed, as well as other instructors known to have taught multiple-instructor courses. Seventeen instructors contributed, and data were not anonymous. Instructor's questions were:

1. Your course (EOSC XYZ) has more than one instructor. What do you think are the ADVANTAGES of having multiple instructors in THIS course? Please comment on advantages…
   a. for students b. for you c. for your department
2. What do you think are the DISADVANTAGES of having multiple instructors in THIS course? Please comment on disadvantages…
   a. for students b. for you, c. for your department

All written responses from students and instructors were coded in order to identify common trends, as well as to identify interesting specific comments. Once the dominant types of responses were identified, data were re-coded using this consistent set of codes. The coding job was shared between two people, and all responses from one course (eosc372) were coded independently by both people in order to ensure consistency in identifying codes from the written feedback data.

Table 2: Summary of data from all students and all courses. Most students answered both Q3 and the open questions, but some did not answer question Q3 and some did not answer both open ended questions. Q3 was not asked in eosc331 and envr200, while Q3 was asked with no open questions in apsc160.

	eosc 114	**eosc 372**	**eosc 112**	**eosc 220**	**eosc 210**	**eosc 331**	**envr 200**	**eosc 212**	**apsc 160**	**Totals**
Total no. students in class	515	188	182	103	216	41	40	26	470	**1781**
No. students responding to Q3	342	131	107	54	38	no data	no data	17	200	**889**
No. students answering open questions	342	131	107	54	25	32	36	17	no data	**744**
No. Advantages. codes	452	160	121	68	29	40	68	23	no data	**961**
No. Disadvantages codes	401	150	124	60	27	38	46	27	no data	**873**

3. ARE MULTIPLE INSTRUCTORS GENERALLY AN ADVANTAGE OR DISADVANTAGE?

Figure 2 summarizes students' responses to question Q3. The distributions in Figure 2 are generally broad and range from strongly skewed toward "advantage" (e.g. EOSC212), to skewed toward "disadvantage (e.g. APSC160. Some courses have distinct trends which can be highlighted by comparing the number of students choosing options "a" or "b", to the number of students choosing options "c" or "d". This is done in Table 3 which lists courses in order of strongest to weakest approval of multiple instructors. This "approval" is measured as a difference (in column four), calculated by subtracting the sum of the two "disadvantages" scores from the sum of the two "advantages" scores.

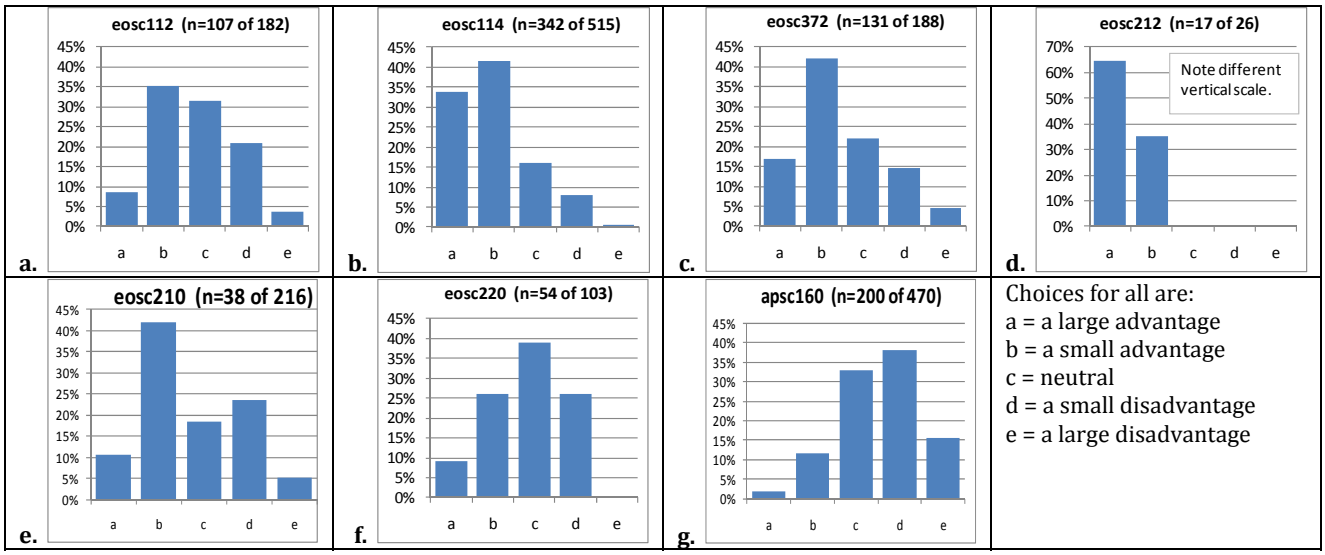

Figure 2: Responses from seven courses to question Q3, "*All things considered, how do you think having multiple instructors affected THIS course?*".

Table 3:
Columns 2 and 3 compare percentages of students responding who consider multiple instructors as an advantage (a+b) or disadvantage (d+e). Column 4 is the difference between these two percentages.

	a+b	**d+e**	**(a+b) – (d+e)**
eosc212	100%	0%	100%
eosc114	76%	8%	67%
eosc372	58%	19%	39%
eosc210	53%	29%	24%
eosc112	44%	25%	19%
eosc220	35%	26%	9%
apsc160	14%	54%	-40%

Students from five of the courses in Table 3 have either strongly or moderately endorsed multiple instructors in those contexts, while students in two other courses were either neutral or against multiple instructors. As the following details about each course indicate, patterns of student responses to Q3 appear to be correlated with course structure.

EOSC212; Students strongly endorse MI. Overall learning goals for this course emphasize development of skills related to scientific discourse and thinking, rather than specific content. Two instructors act as colleagues during class time in the first two weeks, the last capstone week, and during the two weeks when students give presentations. Remaining sessions involve a single instructor leading activities and discussions about specific readings from the general scientific literature. Elements of the Team Based Learning strategy are incorporated, classes are highly active, and quizzes, in-class activities, presentation and poster projects have replaced midterm and final exams.

EOSC114; Students quite strongly endorse MI. This course, taken by several hundred students each term, is both the most extreme version of a sequential model (up to 7 instructors) and has the most convincing endorsement of MI from a large class. Several factors contribute to these results. Most importantly it was designed to incorporate a strong lead instructor who starts, finishes and manages the course. He/she (a) introduces in person each instructor as a "member of our team of experts" when they start their segment; (b) attends lectures of new instructors to provide feedback; (c) works with a paid course administrator to manage logistics and communication to students (mainly with a dedicated web-based course management system); (d) reviews all exam questions with a crew of teaching assistants to ensure questions are reasonable and consistent; (e) encourages a uniform approach to in-class and at-home activities so that students experience lectures, clicker questions, and online quizzes which are consistent for all modules.

EOSC372; Students moderately endorse MI. Three instructors, each with their own area of expertise, contribute 50, 30 and 20 percent of the course. Rather than teaching in sequence, their time in class is distributed throughout the semester, and they work together when the topic is inter-disciplinary, or is a summary lecture. Notes are shared before class so that instructors can provide each other with feedback, thus ensuring that material is consistent and complimentary. During the first semester this course was taught all instructors attended all lectures, providing support, feedback, and opportunities for students to ask interdisciplinary questions. Instructors intend to continue this practice as long as they see there is a need. Learning goals of the course were developed as a group and all assessments are reviewed by all instructors. This course was new in fall 2009, so some student feedback probably reflects the need for fine tuning. Instructors are responding with changes prior to the next offering of the course.

EOSC210; Students moderately endorse MI. This course had the lowest response rate (18% of enrolled students), and the Q3 histogram is bimodal, thus comments about this course are more speculative. Three instructors teach roughly 230 civil, mining, and geotechnical engineers, plus a handful of Forestry students. Instructors work together in class on the first day, and also during some review sessions before exams. The rest of the course is taught using a sequential model with some small variations to account for engagements and trips by the instructors. All instructors use a similar format for lecture slides, and clicker questions, activities, and discussions are designed to be similar. Students use an on-line tool called PeerWise to practice for exams by building and answering multiple choice question. These questions can also be incorporated into lectures or exams at the instructors' discretion. See http://peerwise.cs.auckland.ac.nz/ for details about this facility.

EOSC112; Students weakly endorse MI. Two instructors alternate teaching in this course, and do not typically attend each other's classes. Clickers are regularly used by both instructors, to about the same degree. Students also complete on-line quizzes and are provided with extensive practice questions. Most learning goals emerged from collaborative efforts and are agreed upon between the instructors. Both instructors contribute to exams and the exams are in a common format. Both instructors agree that either of them could teach any of the classes (i.e. there is not a compelling argument for "expertise" in this course).

EOSC220; Students are somewhat ambivalent about MI. One instructor taught the first half and prepared the midterm while a second instructor taught the second half and collated the final exam with the first instructor's help. Both instructors used in-class activities, yet end of term surveying suggests that students preferred the faster pace and more challenging material offered by the more experienced and rigorous instructor. The more experienced instructor sat in on some of the other instructor's lectures in order to provide feedback. Course-level learning goals and assessments were created jointly, but lectures and detailed learning goals were developed individually. Overall, instructors primarily dealt with their own portions of the course.

APSC160; Students object to MI. This is a high-enrolment (~900 students/year), cross-faculty course between the Faculty of Science and the Faculty of Applied Science. The Department of Earth and Ocean Sciences is not involved in this course at all, but one instructor was interested in participating in our study. The first 8 weeks of the course are taught by one instructor, using clickers and peer instruction. The latter part of the course is taught by a different instructor, using standard lecture format. This is the most extreme example of MI teaching unique material with unique pedagogy, and the low appreciation of MI indicated by Q3 results is probably a reflection of this dichotomy.

ENVR200: Students from this course answered questions 1 and 2, but were not given the Q3 question to answer. This is an unusual course in that it is run in a true team teaching mode with two full time instructors in the classroom all the time. The learning goals for this course emphasize development of basic scholarly skills, communication skills, and team working abilities. The course's learning goals do not mention specific topics at all.

EOSC331: This introductory course on mineral deposits and exploration geology is run using the sequential model with instruction split 50-50 between two experienced professors. Both professors also participate in some lectures, regularly interact simultaneously with students in the labs (augmenting the TA support), and jointly run a summarizing activity in the final lecture. Students voluntarily answered questions 1 and 2 on paper, but were not given question Q3. This is the only EOS course in our study which has not yet benefitted from support by the Department's Science Education Initiative.

In summary, the Q3 histograms can be interpreted in terms of four types of courses:

1. Students from courses using in-class instructor-instructor interaction seem to approve of MI. While there were only 17 responses from EOSC212, none were neutral or negative, indicating that students appreciated MI in this course designed to have two instructors model scientific discourse during class. The endorsement from EOSC372 was less strong, but instructor interaction is limited to contributions of expertise and perspectives, and the course is still under development.
2. Students strongly endorsed MI in EOSC114, which is the largest course with the most extreme version of a sequential teaching model (Table 1). This indicates that success can be achieved when there is explicit time, care and attention paid to consistency in pedagogy, assessment and logistics.
3. Courses with weak to moderate approval of MI are generally taught in a more typical sequential or alternating model with instructors collaborating at over-arching aspects (the course level learning goals, exams, etc), but acting somewhat independently in their own segments of the course (EOSC 210, 112, 220).
4. The course in which students were most negative about MI is the one which looks most like two "mini courses" (APSC 160). It consists of two sections, taught by different instructors, covering different subjects using different approaches to pedagogy.

4. ADVANTAGES TO STUDENTS

Responses from students to the question about advantages of multiple instructors were categorized for eight courses into nine distinct codes. Comments from many students were interpreted in terms of more than one code. For example, one student responded to the "Advantages" question by writing "*More variety in teaching styles to suit the student and instructors are experts in the specific field they teach*". This was coded with both "*t=variety of teaching styles and assessments*" and "*e=expertise*". Results for one course (131 responses from eosc372) from two independent coders were within 3% for all codes.

Instead of providing exhaustive coding results for all courses, student feedback is more clearly expressed after combining codes into four categories (Figure 3).

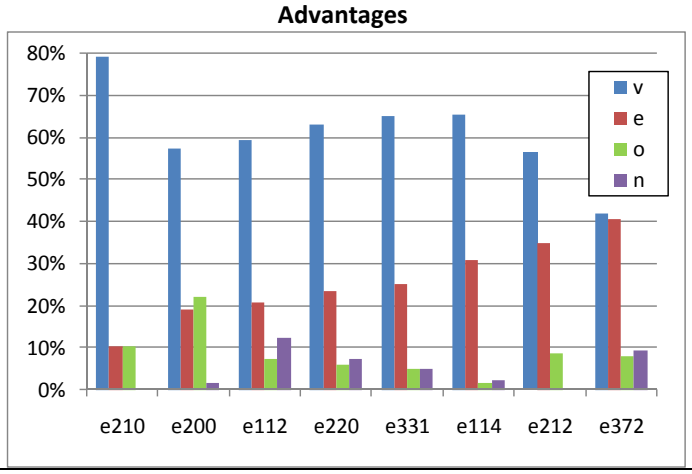

Figure 3: Distribution of responses to the question about advantages of multiple instructors, plotted as percentage relative to total number of coded answers.

v = Variety (three types; see the Discussion section)
e = Expertise
o = Other
n = No comment; or Not true; or Conditional (works if…); or Makes no difference.

Students in most courses evidently considered "*variety*" to be the biggest advantage of multiple instructors. The second most commonly identified benefit in Figure 3 was "*expertise*". This category of responses was most prominent from courses with significant breadth of coverage (eosc372, eosc212, eosc114). This seems to indicate that students recognize when a course involves a range of subjects that is broader than one individual can comfortably teach.

A few students responded in ways that did not fit the most common responses ("other" in Figure 3). These are sometimes excellent comments and a few are worth mentioning. For example "*if you don't understand one instructor, the other one will help clarify the discussion*" (from eosc212) speaks to the benefits of two instructors in class at once.

The dominance of "variety" is worth exploring more carefully. This category was coded into three types as shown in Figure 4. Proportionally fewer students seem to identify "variety of teaching style or assessment" as an advantage in courses that use instructors collaboratively (eosc372, envr200, eosc212). These same courses proportionally identify "perspectives or passion" as more important. This is likely related to teams teaching in ways that emphasize the benefits of collaboration and discussion. In contrast, proportionally more students indicate that "variety of teaching style or assessment" is an advantage when instructors act independently (eosc114, eosc112, eosc220).

The reason for the large number of "other" types of variety in eosc210 is that many responses were rather poorly developed. Examples of these kinds of responses are "*Keeps students on their toes*", "*keeps things fresh*", "*nice to have a change*", and so on.

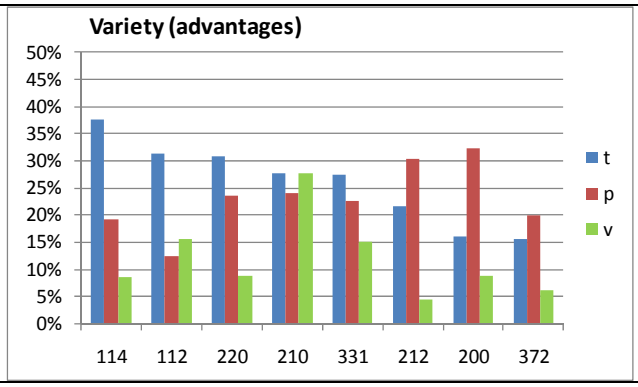

Figure 4: Percentage of all comments from each course which refer to "variety" as an advantage of multiple instructors. The three types of "variety" are:

t = teaching style, assessment or expectations
p = perspectives or passion for the subject
v = "other"

Feedback from the 17 instructors about advantages of multiple instructors to students is summarized in Figure 5. Like the students, instructors indicate they think that in general, variety and expertise are advantages (to students). When feedback on specific types of variety is compared (Figure 6), instructors are proportionally more likely to identify "variety of perspectives and passion" as important. We have yet to investigate why this should be so, but one hypothesis is that instructors recognize and value the inspirational potential of being taught by an expert who is excited and committed to their discipline. Some student comments do indicate an appreciation for this quality but evidently fewer (proportionally) than instructors.

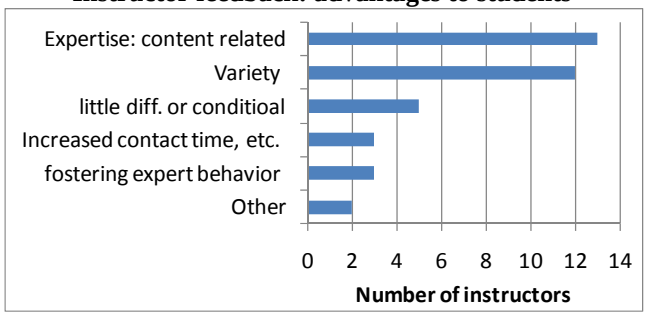

Figure 5. Coded feedback from 17 instructors about the advantages of multiple instructors to students. As with students, many instructor comments were coded into more than one category.

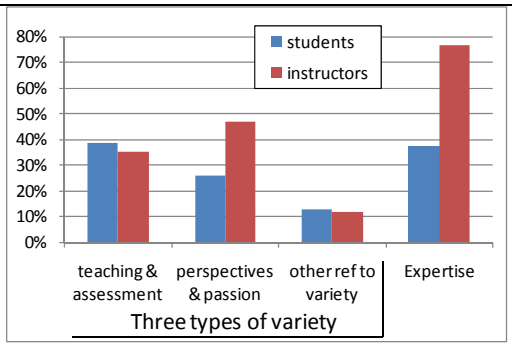

Figure 6. Percentages of individuals who identified each of three types of "variety", or expertise, as an advantage.

It is interesting that "expertise" is also identified by proportionally more instructors than students. There is likely to be an association between "perspectives & passion" and "expertise", but it is also important to recognize the distinction between these two characteristics. It is probably true that a teacher who demonstrates a personal enthusiasm for the subject with relevant examples and other motivational components, will be more beneficial to students than an instructor who may be a top expert in the subject but who does little to convey the energy, enthusiasm, and relevance of the subject to students.

Also, we have found in personal interviews a wide range of confidence among research faculty when it comes to teaching subjects that are somewhat outside their own areas of research. Whether these concerns are compatible with the actual degree of expertise necessary to teach is probably dependant on the context. In other words, instructors should feel more confident about teaching a wider range of topics in 1st and 2nd year classes compared to 3rd or 4th year courses. When "expertise" is used as the primary justification for assigning multiple instructors to courses, it is worth asking whether specific content experts are indeed needed. This aspect has not been investigated further but may be of interest in the future.

Two aspects that appear in instructor survey responses that have not yet been mentioned are the benefits of increased contact time (3 comments) and opportunities for fostering expert behavior (3 comments). Of course these can be benefits only if they are intentional (ie expressed in learning goals), and instructors have the ability to take the necessary time to focus on these aspects of mentoring young science students.

5. Disadvantages to Students

Responses from students about disadvantages of multiple instructors were also coded for the eight courses. As for "advantages", many student comments were categorized with more than one code. Also, coding of feedback from one course by two independent coders yielded repeatability of better than 7% for all codes.

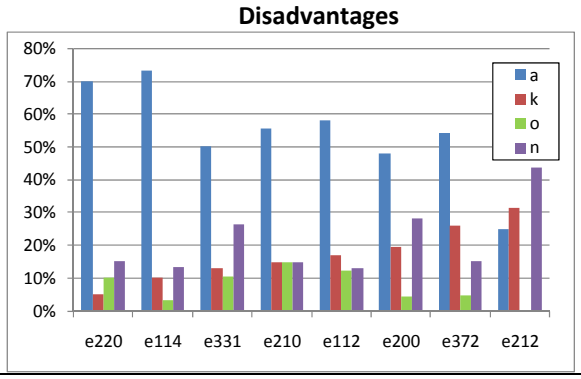

Figure 7: Distribution of responses to the question about disadvantages of multiple instructors, plotted as percentage relative to total number of coded answers. Note that courses are not in the same order as in Figure 3.

a = Adjustment (three types; see text for discussion)
k = caused some confusion; or Lack of effective communication between instructors
o = Other
n = not true, no comment, no difference, or conditional.

Students in most courses considered "*adjustment*" of various types to be the biggest problem with having multiple instructors (Figure 7). The principle exception is eosc212. Although only 17 of 26 students responded from this course, it is also the course with the strongest "*n*" response (i.e. "*multiple instructors are not a problem*"), suggesting that these instructors have managed to prevent students from having to make "adjustments". In fact, the "*n*" response was above 10% for all courses. In total, 13% of all students indicated that they did not consider it disadvantageous to have multiple instructors (5% did not answer this question).

The second most commonly identified disadvantage involved "*instructor communication"* or *"confusion*". It is noticeable that the courses most prominently expressing "confusion" as a problem of MI (eosc212, env200, eosc372) are the courses with the most team-like behavior of instructors. One student articulated this problem very clearly, saying "*if discussion over topic was brought up between the two [instructors], which is right?*". (Wenger & Hornyak 1999), point out that if students have not yet become comfortable with how scientists share, debate and compare ideas, then this kind of scholarly behavior can lead to a sense of confusion. One way to mitigate this problem in any course is for the teaching teams to concentrate on bringing a clear resolution to all instances of discussion or debate.

Although the "other" category is small, several specific remarks from students are worth repeating. For example, comments such as "*Inconsistent notes*" and "*Repetition of some material*" suggest that instructors could improve simply by working together to ensure content and learning activities are consistent and coordinated. Also comments like "*it creates a comparison between instructors*" highlight the importance of striving for consistency in order to help ensure instructor evaluations are as uniformly strong as possible.

Coding resulted in three subcategories of "adjustment" which students identified as disadvantages of multiple instructors. Figure 8 shows that for at least six of the eight courses, having to adjust to different teaching styles was identified as a disadvantage. The two courses from which students expressed relatively insignificant concerns about teaching styles are the two courses with true team teaching. All other courses are taught with a sequential model, although in one (eosc372), instructors were usually present for all classes, as explained elsewhere.

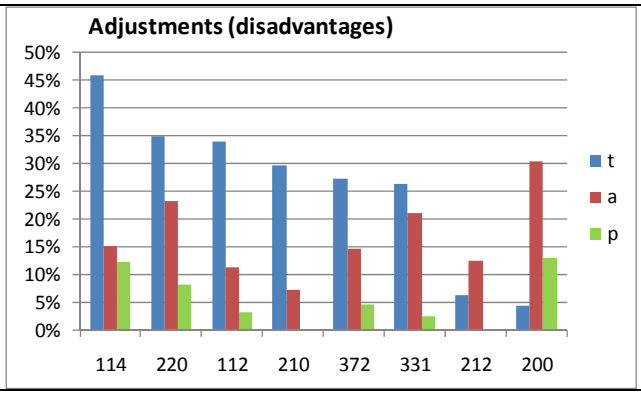

Figure 8: Percentage of all comments which refer to "adjustment" as a disadvantage of multiple instructors. The three types of "adjustments" are:

t = teaching style
a = assessment or expectations
p = personality or accessibility

The second aspect of "adjustment" that students identified refers to assessment or expectations. It is not unreasonable for students to hope for a consistent and reliable set of expectations regarding how they will be assessed. It should be possible to mitigate against this problem if teachers strive to offer well coordinated instruction, assignments and tests, and if learning goals are expressed and consistent for all portions of the course. Again, what takes is coordination and active collaboration among instructors. There are specific experiences related to this issue: the course from which students most strongly expressed " assessment or expectations" as a problem (envr200) has many written assignments and the marking is rotated among the instructors and TA. Clear, agreed-upon rubrics that are both visible to students and are regularly and explicitly utilized in the marking process may reduce the perception of this aspect as a disadvantage.

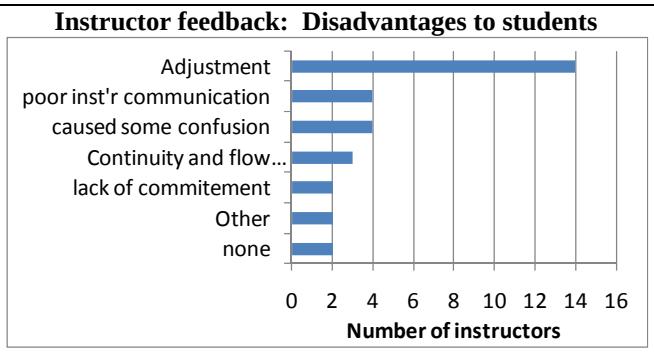

Figure 9: Coded feedback from instructors' open ended responses to being asked what are the disadvantages of multiple instructors to students.

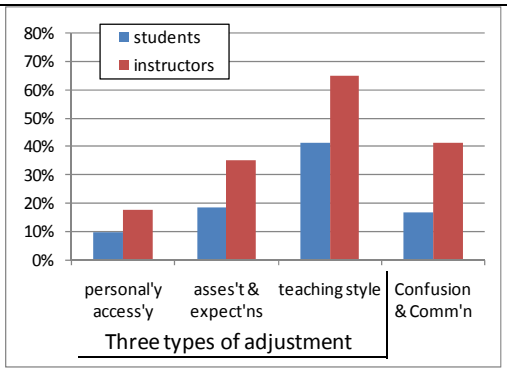

Figure 10. Percentages of people who identified any of 3 types of "adjustment", or "confusion & communication", as disadvantages.

Feedback from all instructors on disadvantages to students of multiple instructors is summarized in Figure 9. Clearly students and instructors agree on the dominant disadvantages, mainly "*adjustment*" (of several types) and both "*poor communication"* and *"confusion*". Figure 10 shows the degree of consistency in opinions about which types of adjustments students must deal with. Instructors are clearly aware of this concern, especially when the "*continuity and flow*", "*lack of commitment*" and "*other*" categories are included (Figures 9 and 10).

Comparing total numbers of students identifying similar characteristics as either advantages or disadvantages is also instructive. Figure 11 shows that students identify aspects related to teaching more often as a disadvantage, but personal aspects of instructors more often as advantages.

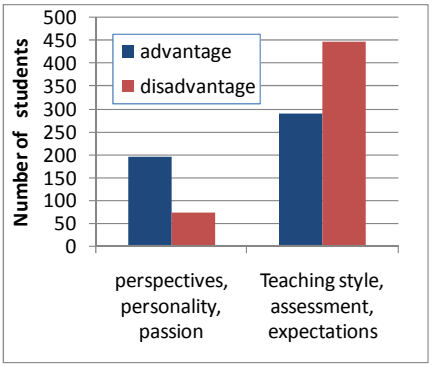

Figure 11. Total numbers of students identifying personal aspects and teaching aspects as advantages or disadvantages of multiple instructors.

Several opportunities for optimizing student learning in all courses with multiple instructors are suggested by data such as we have presented here. First, students evidently recognize that it takes time to become familiar with an instructor's habits, expectations, assessment practices and perspectives. The effort to "acclimatize" more than once will take up time and mental effort that would otherwise be spent focusing on learning concepts or practicing skills. Therefore every effort should be made by the teaching team to (a) strive for consistency, (b) clarify the similarities and differences clearly and frequently, and (c) articulate learning goals that are consistent with the reasons multiple instructors are being used in the course. Second, instructors and administrators need to be aware of the opinions and priorities expressed by students and instructors so that they and their departments can justify the time needed to implement appropriate practices. This means noting results from surveys such as this one, and carrying out (and reacting to) midterm or end-of-term surveys that assess effectiveness of teaching strategies.

6. CORRELATING COMMENTS WITH OVERALL PREFERENCES

Do students' open ended comments correlate with their opinions about whether MI is generally an advantage or disadvantage in their course (question Q3)? Generally speaking, students identify advantages and disadvantages regardless of their answer to Q3, however there are cases where the rates differ. Figures 12a, 12b and 12c display this correlated information about comments regarding disadvantages for three courses, chosen because they have enough students to generate meaningful numbers of students in each grouping.

1. For all three courses, but particularly in eosc112, "*adjustment*" was identified most frequently by students who said MI was a disadvantage. This means that students who do *not* appreciate multiple instructors are telling us that "*adjustment*" is the most important difficulty.
2. Figure 12b helps us recognize a result mentioned above, namely that students in eosc372 identify "*confusion & communication problems*" as a problem proportionally more often than students in the other two courses. However, for all three courses, these comments do not seem to be related to general impressions of MI.
3. Figure 12a reminds us that students in eosc114 seem more consistent about identifying "*adjustment*" as the principle disadvantage compared to students in the other two courses, but again, these comments are not related to general impressions of MI.

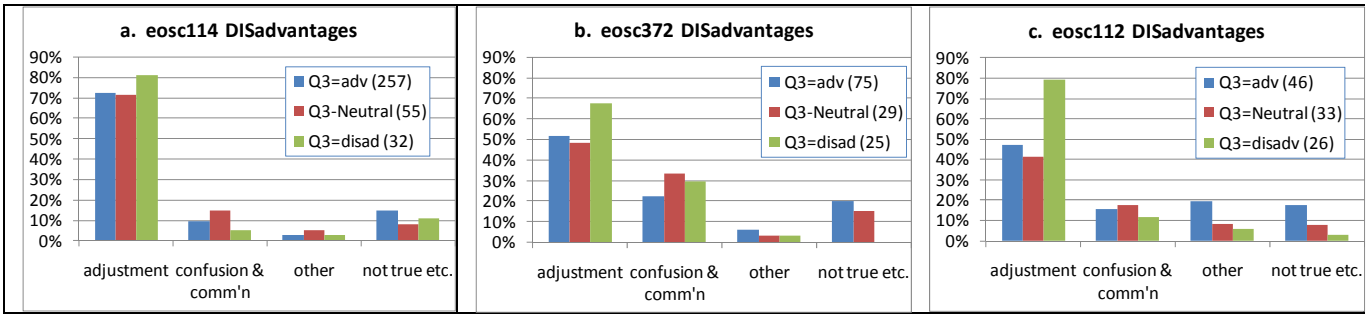

Figure 12: Percentage of total comments about "*disadvantages*", grouped according to Q3 responses. Bracketed numbers within legends indicate the number of students in each grouping.

Using Figure 13 to carry out similar comparisons as "*advantages*" yields the following observations:

1. Students in the two first year courses (eosc112, eosc114) who *do* appreciate MI are saying that "*expertise*" is the advantage more often than those who do *not* appreciate MI.
2. In eosc372, more students who appreciate MI identify "*variety*" as the advantage than students who do not appreciate MI.
3. Also, eosc372 is apparently unusually in that students identified "*expertise*" just as often as "*variety*".
4. Figure 13b also shows that 30% of students who were "*neutral*" about MI in 372 gave feedback in the "*not true etc.*" category. This is one example of an unexplained pattern that could be pursued with interviews or other follow up methods.

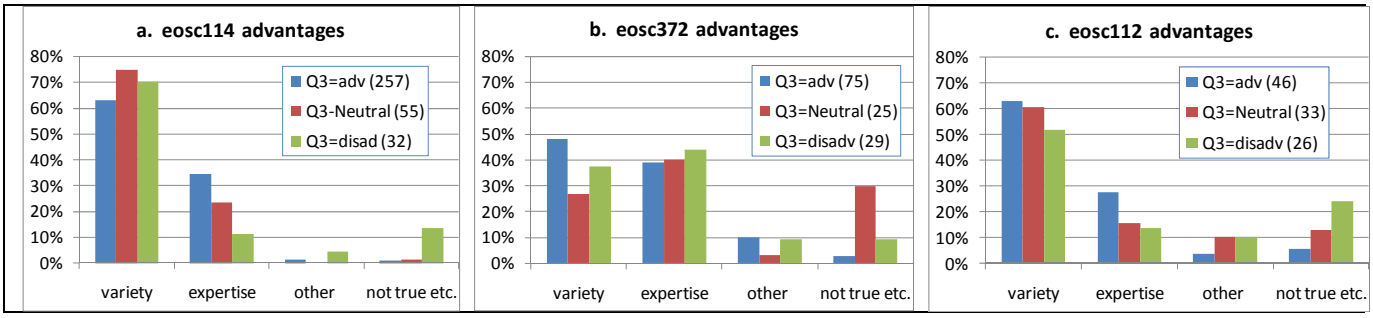

Figure 13: Percentage of total comments about "*disadvantages*", grouped according to Q3 responses. Bracketed numbers within legends indicate the number of students in each grouping.

7. IMPACTS ON INSTRUCTORS AND THE DEPARTMENT

Instructors were also asked about advantages and disadvantages of MI to themselves, and to the Department. In this section feedback about advantages and disadvantages are compared together. Values in brackets are numbers of instructors making the comment out of the seventeen who answered these questions.

Advantages and disadvantages to *instructors* (instructor feedback):

- *Flexibility with time* (9) and *reduced workload* (1) were both recognized as advantages. However, *extra time needed* (9), and *complexity* (5) were identified as disadvantages.
- *Collaboration & mentoring* (9) was often identified as an advantage, yet *incompatibility*, *poor communication* and *need to adjust personal style* (7) were all mentioned as disadvantages.
- Aspects of *expertise* (8) were identified as advantages to instructors, but *less freedom* and *frustration* (5) were both noted to be disadvantages.
- Other particularly interesting individual comments included *lack of commitment* and *poorer connection with students* as disadvantages of multiple instructors.

Advantages and disadvantages to the *Department* (instructor feedback):

- *Flexibility with time* (5) was referenced in comments as an advantage to the Department. In contrast, *extra time* and *fairness* (5) were referenced as disadvantages.
- *Expertise* and *breadth of coverage* (6) were noted to be advantages, while *complexity of management* and *frustration* (4) was recognized as a disadvantage.
- *Economic benefits* (3) and *enhanced reputation for the Department* (3) were referenced as advantages, but *increased costs* (2) and *reduced reputation* (2) were also mentioned.
- Three instructors noted that *enhanced collegiality and mentoring* are advantages.
- Finally, 3 instructors said "*none*" or "*not sure*" regarding disadvantages to the department.

These data help identify important considerations when deciding whether to run a course with more than one instructor. For example, there were consistent comments about flexibility and reduced (or at least spread out) workloads, as well as recognition that teaching and managing these more complex scenarios takes extra time for everyone involved. Individual workloads may also end up concentrated at one time in the term, rather than spread out. These are messages that individuals and departments need to incorporate when planning and delivering their courses and programs.

Another important dichotomy is that benefits of collaboration and mentoring were identified, yet difficulties were noted which relate to incompatibility within the team, poor communication and reduced freedom to teach whatever and however one pleases. The lessons here are that instructors themselves should be choosing whether to teach as part of a team, and that regular (although not necessarily frequent) planning and collaboration meetings should be considered a high priority and an expected component of teaching with MI. Some instructors also noted that these benefits can accrue to the department as well, in the form of improved collegiality. This is especially important in a large department with a wide range of research faculty who do not always have good opportunities to collaborate intellectually.

Survey data from instructors also identified the challenge of striking a balance between having experts in the classroom while maintaining teaching quality, enthusiasm and freedom. For instructors with just a small part in a course, lack of commitment and poorer connection with students were also noted. These findings are supported by interviews in which we have heard several instances of instructors acknowledging the benefits of teaching a short segment on their own specialty, yet feeling they had to treat this task as a low priority because their contribution to the course was small. Perhaps in these examples the reduced quality (which affects students) and increased complexity (affecting instructors and students) resulting from instructors' lack of effort and enthusiasm may outweigh the benefits of having a few lectures given by an expert.

From the department's point of view, our data show that instructors thought there could be both economic benefits and increased costs due to MI. We have not asked for clarification on these points, but if "costs" are equated to "time" then this dichotomy is similar to one associated with effects on instructor workload, time and fairness. Again, the message is that, in order to make multiple instructors work for student learning, more total faculty time is needed than if a single instructor is assigned to a single course.

There was also a similar dichotomy in comments about effects on the reputation of the department. The message here is that MI may or may not benefit the department's reputation. Clearly this depends on whether the course with MI is seen as a success from students' perspective, in terms of learning outcomes, and in terms of instructor satisfaction. These data suggest that instructors recognize the importance of "doing it right", and the implication is that departments and instructors need to actively mitigate the challenges and while enhancing the benefits.

One aspect not derived from our data, but recognized from experience, is that managing the time tabling of a department's courses is much more challenging when schedules of several instructors must be fitted into course timetables. In some cases, when courses cannot be moved because they are part of standard time tables, scheduling may end up making it impossible for particular instructors to work together.

In conclusion, many of these pairs of pros and cons identified by instructors demonstrate how instructors recognize that the actions which promote the benefits will also likely reduce many of the problems. Specific recommendations are summarized in the next section.

8. RECOMMENDATIONS

There are five principle conclusions or recommendations suggested by data obtained from the 746 students and 17 instructors who participated in this survey.

1. Multiple instructors teaching specific components of a single course (the sequential model) can work well if instructors bring some aspect of passion or expertise that is unique and relevant to the learning, and if the course is well-coordinated.
2. There must be active and visible (to students) efforts made to reduce un-necessary variability in the learning activities and experiences, and to avoid confusion.
3. Teaching this way can be rewarding for instructors and departments so long as the costs are acknowledged and corresponding resources are made available. This means incorporating additional time for the team to meet and collaborate, identifying one individual as "instructor in charge" (even if only two instructors are involved), and expecting that the instructor in charge will spend additional time coordinating.
4. True team teaching (two teachers participating together in classes) is highly appreciated in settings where the principle learning goals focus on developing thinking, collaboration, scholarly discourse and related skills and abilities. It is also important to ensure that students can resolve these discussions effectively.
5. Finding a balance between the benefits of expertise and the drawbacks of complexity, confusion to students, and lack of instructor commitment, involves considering how to balance breadth versus depth of learning. The lead instructors in courses with MI need to scrutinize the course's learning goals and ask whether the experts truly are contributing in ways that another instructor could not.

In addition to these principle recommendations, it is worth quoting the "Dos and Don'ts" identified in the University of Toronto faculty survey (Neumann et al. 2006). All their suggestions (Table 4) are compatible with our data, and we recommend that they be carefully considered by all instructors and departments who currently (or plan to) make use of MI in single courses.

Table 4: Summary of outcomes from Neumann et al. 2006

Sixty faculty in fifteen departments were interviewed to investigate team-teaching methods within the Faculty of Arts and Science at the St. George Campus of the University of Toronto. Some key findings included:

A. Many courses are team-taught using the "sequential" method;
B. Faculty placed a high value on the mentorship and collaboration aspects of team teaching;
C. Depending on the circumstances, team teaching led to either an increase or decrease in instructor workloads;
D. Many faculty felt the sequential team-teaching method was **not** advantageous to first-year students in large classes;

E. Students need to be surveyed in all years to see how team teaching affects the student experience.

Suggestions offered by instructors who had been part of a team include:

Do:

1. Work with people you know, respect and like.
2. Strive for consistency in course content, academic aims and vision, and level of work expected from students.
3. Teach similarly: presentation style and format, reliance on readings, level of responsiveness, email replies, etc.
4. Share content to reduce duplication and smooth transitions.
5. New team members must anticipate some trial and error while learning to coordinate with others.
6. Coordinate to prevent important aspects from falling through the cracks.
7. Select a strong team leader, with a clear view of the role of the course.
8. Clearly identify the particular people to contact with questions and problems (content, personal, logistics, etc.).
9. Be ready to make compromises.
10. Meet regularly if not frequently.
11. Attend each others' lectures, especially if the team is new or you're new to it.
12. Respect each others' research and opinions.

If you're an administrator …

13. Reward team teaching appropriately.
14. For courses of more than 100 students, give credit for course coordination.

Do Not:

1. Repeat topics – but if you have a different take on a topic, do cover that.
2. Make compromises that interfere with your ability to teach at your best.
3. Assume that effective team teaching techniques are the same for students in all years.
4. View team teaching as a division of labour; it's an approach to teaching.
5. Work with too large a team. Seeing more than two or three instructors per semester is difficult for students.
6. Become lax with course policies or expectations.
7. Use team teaching to reduce teaching loads.

All 26 of these items are compatible with comments we recorded from students and instructors at EOS, except perhaps for key finding D. Some may be more practical than others, but a great many could probably be implemented without significant cost in time, or other risk, to instructors.

In addition to those of Table 4, other detailed recommendations that arise directly from our survey include:

1. Team teachers should not be assigned, they should be active in selecting each other. (Also recommended by (R. Anderson & Speck 1998).)
2. Instructors must work together to ensure that content and learning activities are consistent and coordinated.
3. Announce the teaching schedule. This is an example of how the little details can have a big impact.
4. Minimize cosmetic differences. For example use a common powerpoint template for lectures. This is not to say two instructors should appear as similar as possible in all aspects, but cosmetic differences are distracting and interfere with focusing on concepts.

5. If a reason for using MI in a course is to "show students the breadth of the discipline", then include learning goals related to breadth, and address this goal explicitly.
6. When teaching teams discuss or cover material either separately or together, it is important to resolve this coverage or discussion. "Resolve" means clarify conclusions, relate outcomes to principle goals, and so on. The importance of "resolution" derives from student comments complaining about not being sure "who was right" or "how to take everyone's perspective into account". The importance of resolution is also noted by (Wenger & Hornyak 1999), and is a fundamental component of working with teams in any setting (Stanfield 2000).
7. Other recommendations related to true team teaching can be made, both from our data and the literature. This is beyond the scope of this report, but should perhaps be the subject of another set of recommendations specifically targeting those courses that involve true teaching teams.
8. Make sure time tabling staff are aware of multiple instructor situations as soon as possible. Logistics might make it impossible for the assignments to work in any given term.

9. CONCLUSIONS

Seven hundred and forty six students and seventeen instructors involved in courses using multiple instructors (MI) were surveyed using a single multiple choice question and two open-ended questions to learn about advantages and disadvantages of using MI in nine different courses that use three different multiple instructor teaching models. Written feedback was coded in order to look for commonalities and differences among students and instructors in different courses. The results provided insight into those characteristics of courses that affect students in positive ways, and those that appear to get in the way of effective learning. The insights and recommendations discussed are expected to help departments and instructors make adjustments that will emphasize the benefits of using MI to teach individual courses while minimizing the drawbacks.

APPENDIX 1: BRIEF LITERATURE REVIEW

Several models for teaching with multiple instructors are described in the literature(Carpenter et al. 2007) but they all fall into one of two basic types. Either there are two or more instructors in the classroom at once, or there is one instructor in the class at a time. In this report we call the first scenario "team teaching" and the second scenario "sequential teaching".

A1.1 TEAM TEACHING

Team teaching literature seems to focus on models involving two or more instructors sharing all or most classes; e.g (Lester & Evans 2009). In a particularly useful review of the literature prior to 2007 (Carpenter et al. 2007) notes that most reporting has been descriptive and qualitative. In particular, they identify many ways in which a class with two interacting instructors differ from one with a single instructor. These differences are also highlighted in (Wenger & Hornyak 1999) who emphasize that true teaching teams can model how experts think, learn and interact in ways that are difficult for a single instructor.

Although evidence that team teaching improves student performance is slight, this is very likely a problem of what is assessed. Traditional courses tend to involve assessments that emphasize content, often in the lower half of Bloom's taxonomy of learning (L. W. Anderson et al. 2000). Learning goals (and corresponding assessments) are more difficult to define at higher Bloom's levels, especially when targeting the psychomotor and affective learning domains. Yet the benefits of true team teaching are often described by instructors and students in terms of learning outcomes that reflect higher level cognitive activity, or attitudes, believes and habits associated with the relevant discipline. Wenger and Hornyak note that "*At some point we expect students to piece together their own view of situations, articulate those views, and evaluate their own actions and decisions*", and Anderson and Speck identify two essential elements as collaboration and multiple perspectives, stating that "*both are modeled when instructor teams interact appropriately*".

Ideally, demonstrating improved student achievement should involve assessing all learning goals in different settings, but when goals are different in the various settings, comparison is difficult. Therefore, descriptive and qualitative evidence of success at these more challenging types of learning goals should be considered rather than comparisons between results on traditional exams or other assessments. Wenger and Hornyak quote from open-ended student evaluations of their team teaching initiatives, noting that students said "*you taught concepts well, but then you tested definitions and terms*". In our Department, several instructors have begun to replace final exams with assignments, projects and other activities that provide feedback and assess discussion, communication and peer evaluations, precisely because they find it difficult to assess achievement at higher level learning goals with traditional exams (examples are in envr200, envr300, eosc212, and eosc355).

One aspect of true team teaching which all authors agree on is that it does take more time for instructors to plan the course and coordinate their lessons. This is not surprising as collaborative efforts of any type require time and energy to ensure that project outcomes are successful.

A1.2 SEQUENTIAL TEACHING

There do not seem to be many studies that consider the benefits and challenges of instructing single courses with a sequence of individual instructors. However, two reports leaning in this direction are (Neumann et al. 2007) and (Dugan & Letterman 2008).

Neumann's investigation into the effects of "serial team teaching" (Neumann et al. 2006) involved interviewing over 60 faculty members at the University of Toronto (U. of T.). Resulting recommendations in the form of do's and don'ts are highly compatible with our findings. They mainly referred to the importance of collaborative behavior, consistency of pedagogy and assessment, and the need for active leadership and coordination. Things to avoid included use of team teaching simply for division of labor or to reduce teaching loads, and teaching without attention

to the differences between solo and collaborative work. Findings and recommendations from this reference are summarized elsewhere in this report.

This study at U. of T. was followed up with a survey of students (Neumann et al. 2007). A simple questionnaire, posted on a website referred to as "The meeting place for life science students at U of T" (http://biome.utoronto.ca/) yielded 163 responses. This was a disappointingly small number spread roughly equally among 1st, 2nd, 3rd, and 4th year students, and the Likert scale questions left few opportunities to elucidate or qualify responses. Student opinions ranged from slightly opposed to slightly in favor of team teaching overall. Also, students who liked team teaching tended to like all aspects of it, but little information was obtained about what they did not like. This is perhaps because students had to decide on answers based on their whole university experience rather than being able to focus on experiences in individual courses.

Another study (Dugan & Letterman 2008) investigated student perceptions of three multiple instructor settings using survey questions from the "Individual Development and Educational Assessment Center". Based on 211 responses from eleven courses in three institutions, they found that student perceptions of three models were similar. (The three models are two teachers teaching simultaneously, two teachers splitting the term into halves, and three or more teachers acting as a panel.) They also found that exam scores they obtained for team-taught classes were similar to exam scores for single instructor courses contained within in the IDEA database (IDEA 2010).

However, rather than investigating specific benefits or challenges of team teaching, Dugan and Letterman asked questions about overall course excellence, feelings and attitudes towards the course, and effort that was put into the course. Our study in EOS aims to learn more about what does and does not work rather than simply asking students what they "felt" about the course. One result from Dugan and Letterman which is consistent with our own findings is that most criticism tended to focus on problems in communication and organization, especially with regard to figuring out professors' expectations and how to earn good grades.

Finally, one common justification for sequential teaching is that exposure to multiple experts is presumed to be a "good thing". However (Wenger & Hornyak 1999) suggest that this model inherently focuses learning towards the bottom third of Bloom's taxonomy. It may allow greater breadth (exposure to expertise), but it likely will be more difficult to explore the subject in greater depth. The sequential model also emphasizes the centrality of authority, not necessarily a recommended outcome if a course includes learning goals related to appreciation of how science works or how scientific information can best be used.

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