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A University Math Help Centre as a Support Framework for Students, the Instructor, the Course, and the Department

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A University Math Help Centre as a Support Framework for Students, the Instructor, the Course, and the Department

Abstract

Among many challenges a math department at a post-secondary institution will most likely be faced with the optimization problem of how best to offer out-of-lecture learning support to several thousand first- and second-year university students enrolled in large math service courses within given spatial, scheduling, financial, technological, and manpower resource constraints, and at the same time ease the administrative work of the instructor. This article describes how math workshops, essentially math help centres, are set up in the Department of Mathematics at Simon Fraser University so that they provide the administrative and learning support structure for the students, the instructor, the course, and the department. The roles and responsibilities of the workshop coordinator, instructors, teaching assistants, and students are outlined along with a discussion of the challenges and benefits of this support framework.

Keywords

Math, mathematics, post-secondary, university, help centre, learning centre, learning support, support framework, workshop, large class, workshop coordinator, instructor, teaching assistant, student

1. Introduction

Imagine you are the Chair of a Mathematics Department at a postsecondary institution. Among the many challenges you will most likely face is the following optimisation problem:

What is the best way to provide optimal out-of-lecture learning support to several thousand first- and second-year university students enrolled in large math service courses within given spatial, scheduling, financial, technological and staffing resource constraints, and at the same time ease the administrative work of the instructor?

This article will not optimise the problem for you by analysing any particular aspects of it. Instead, it does even better: it describes how math workshops or “math help centres” are set up in the Department of Mathematics at Simon Fraser University (SFU) so that they provide the administrative and learning support framework for the students, the instructor, the course and the department for first- and second-year mathematics courses. In our view, learning support includes providing a safe and easily accessible learning space, an encouraging learning environment, various learning resources and timely and efficient academic help for a large and diverse group of students.

Traditionally, colleges and universities offer tutorials as a support framework to complement course lectures (Figure 1). In this model, students are scheduled to meet with a tutor, who reviews material covered during lectures, typically with an emphasis on examples and applications of theory. These meetings usually occur once per week for one hour in small groups. The tutor is sometimes the instructor herself, but most often this role is filled by a graduate student, referred to at SFU as a teaching assistant (TA). Figure 1 shows the linear flow of information from instructor to TA to students. However, tutorials generally have few to no resources, and become cumbersome and expensive to organise and conduct for the large first- and second-year classes¹ that are becoming the norm in university math courses across the globe, and certainly in Canada. The tutorial model is undergoing revisions at many post-secondary institutions to seek solutions to the same problems, such as the recitation tutorial at some universities (Brown 2014; Scarborough 2001).

The overall inefficiency and ineffectiveness of the tutorial model was one of the main reasons why the Department of Mathematics at SFU introduced a different model to support its large service classes in the early 1990s. While offering strong major and minor programs, the department teaches mathematics courses – typically large in size – for students in sciences, applied sciences, business and arts. Throughout this article, these courses are referred to as service courses. Tutorials were replaced by so-called math *workshops*, which were created by the department due to a need to be more efficient and effective in terms of both the teaching and learning process and cost. To the department’s knowledge, no other such model existed anywhere in North America. The idea was to divide math service courses into a few content-based clusters, to dedicate a room to each cluster, to keep the room accessible on a drop-in basis for extensive hours during the week and to provide a variety of resources such as reference textbooks, a computer station and an abundance of scrap paper. A group of TAs, under the supervision of the so-called workshop coordinator, would be assigned to provide academic help to the students taking a course in the cluster, and the necessary organisational and administrative support to the instructors.

¹ We define a large class as a class with at least 350 students (Jungić et al. 2006).

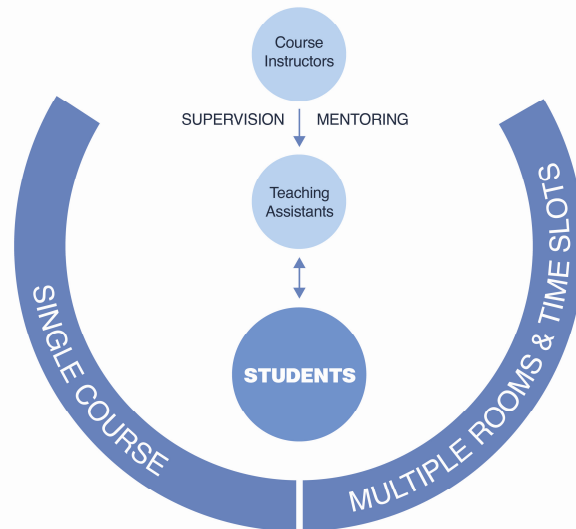


Figure 1. Tutorial Model

Drop-in math help centers have since materialised at a number of other Canadian post-secondary institutions. A few examples are the Mathematics Learning Centre (Capilano University, opened in 2013), the Mathematics and Statistics Learning Centre (Dalhousie University, in 2013) and the Math and Statistics Learning Centre (University of Toronto Scarborough, in 2004). However, these drop-in math help centres are typically not grouped by math content, and often offer general math assistance; they are more geared towards organisational and learning skills. In fact, some universities use the term “learning centre” outright to refer to a place that facilitates the transition from high school to post-secondary mathematics, such as the Mathematics Learning Centre (Memorial University, in 1988) or the Math & Stats Help offered through the University Learning Centre (University of Saskatchewan, in 2007).

The literature search for this article found very few references to operations or guidelines about such math learning centres. How should a learning centre be structured? How can it be administrated? Who should staff it? What services should be offered to students and in what format? This article offers possible answers to these and other questions, and provides a general guideline for how workshops in the Department of Mathematics at SFU operate. It is important to point out that, in general, learning centres offer a support service to help students overcome learning barriers (Gibbs 1994), which is another reason (in addition to the cost factor) why this approach was taken at SFU. In the workshop support framework the student has a voice that is responded to on a one-on-one basis.

This paper will continue to use the term “workshop” to distinguish SFU’s math-specific help centres from the general learning centres offered around the country. The following sections lay out the structural and administrative organisation of a workshop, introduce the various types of workshops in the Department of Mathematics at SFU, present the roles of the workshop coordinator, instructor and TA and discuss the students along with some survey data. Finally, the challenges and benefits associated with this model are examined.

2. Math Workshops at Simon Fraser University

Faced with the problem of supporting an increasing number of students, but with limited resources, in the early 1990s the Department of Mathematics at SFU introduced the workshop model as a way to manage large service math courses. Not only did the department seek to make its services more efficient and effective, it also saw this remodelling as an opportunity to better meet students' individual learning needs.

We define an undergraduate workshop model as a support framework that is based on dedicated space and time, various learning resources, a content-based cluster of courses and a group of TAs supervised and mentored by the workshop coordinator. As shown in Figure 2, the students are truly at the centre of learning support from the instructor, workshop coordinator and TAs; in addition, the instructor herself receives administrative support to allow her to focus on teaching.

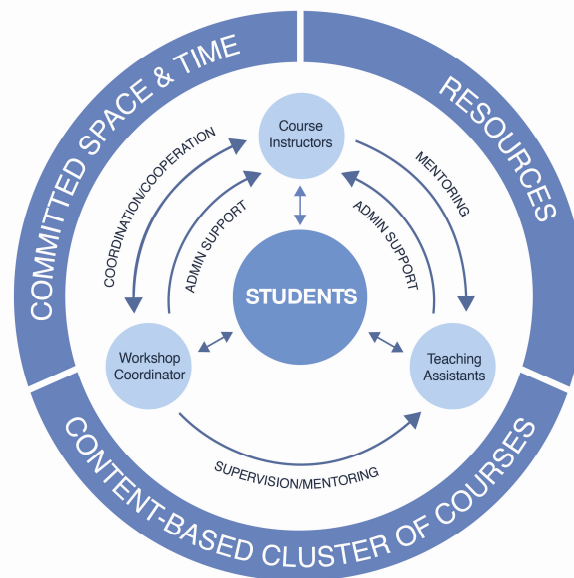


Figure 2. Workshop Model

The three main functions of a workshop are:

1. To provide academic help to students on a drop-in basis;
2. To provide all the necessary administrative support to instructors; and
3. To provide a cost-efficient student help service.

These three aims are achieved in several ways. Graduate students, mostly from within the department, are hired to fill the TA role. A workshop is open for several hours each working day, with at least two TAs present at all times. Students receive one-on-one help on a drop-in basis. The physical setting allows students to meet their classmates in the workshop and to study in groups. Students submit their homework papers and pick them up, along with marked quizzes and term papers, in the workshop. TAs mark all students' work and enter grades under the direction and supervision of the instructor and the workshop coordinator.

SFU is a trimester university with a full student body during the autumn and spring, and a reduced student body in the summer term. A term is defined as 13 weeks of instruction and a two-week examination period. Table 1 lists the current math workshops together with their course clusters provided at the main campus of SFU, the approximate size of the student population served by each workshop, and the typical number of TAs assigned to each workshop.

Based on the success of the workshop model, the department has decided to offer a fifth workshop in the spring of 2015. Unlike the four existing workshops, which support first- and second-year mathematics courses, the fifth workshop will commence in support of two third-year mathematics courses: Introduction to Ordinary Differential Equations and Numerical Analysis I.

Workshop	Course Cluster	Number of Students: Autumn/Spring/Summer	Number of TAs: Autumn/Spring/Summer
Algebra	Precalculus	700/700/100	10/10/2
	Applied Linear Algebra		
	Linear Algebra		
	Discrete Mathematics II		
Applied Calculus	Calculus I for the Biological Sciences	1200/1200/200	16/16/4
	Calculus II for the Biological Sciences		
	Calculus I for the Social Sciences		
	Calculus II for the Social Sciences		
Calculus	Calculus I with Review	1000/700/600	12/10/8
	Calculus I		
	Calculus II		
	Calculus III		
Q Support	Foundations of Analytical and Quantitative Reasoning	250/200/100	4/4/2
	Principles of Mathematics for Teachers		

Table 1. Math Workshops at SFU

In the remainder of this paper we provide a detailed description of all components of a math workshop and the relationships among those components.

3. Physical and Virtual Organisation of a Workshop

A workshop is run in its own dedicated room, which is typically large enough to accommodate 30 to 40 seated students in addition to two or three TA desks. Over the course of many years, we have experimented with round tables versus rectangular tables, and have found that the rectangular tables accommodate the students and their belongings more efficiently without crowding space. There are whiteboards around the room for quick reference to answers to questions that are asked over and over again on a particular day. A computer is set up in case a TA needs to access course material to answer students' questions. There is also a bookcase with a collection of related

textbooks for students' reference. Stacks of recycled sheets of paper are available for students to use as scrap paper.

Because of the large numbers of students and multiple courses served by a workshop, the process of dropping off and picking up weekly assignments is a complex operation that we manage in the following way. Outside the workshop, assignment drop-off bins are located and labelled by course name, section number and letters of the alphabet for the students' last names. These are emptied precisely at the time each assignment is due. Of course, there are always some freshman students who drop off their assignments incorrectly. Our practice is that the consequence of such a mistake is a grade of zero on the assignment. Since only the top nine out of ten assignments count towards the course grade, the students are not really punished with one offense, but learn quickly to carefully check the course name and section number before depositing their assignments.

Assignment pick-up cases are distributed along the walls inside the workshop. It is our experience that about 80% of the students will pick up their marked assignments and remove them from the workshop. To avoid cluttering the pick-up slots, boxes are placed below these slots, where unclaimed assignments can be transferred to and recycled at the end of the course.

There is a glass-encased corkboard outside the workshop on which we post the workshop schedule and any other relevant announcements. During a busy term, a workshop is typically open from 9:30 am until 4:30 pm, Monday to Friday, with possible extended hours to accommodate students attending evening classes. Depending on enrolment numbers, there are two to three TAs per open hour staffing the workshop, ready to assist students with their assignment or course studies. Instructors also attend one to two hours per week in the workshop. It is our impression that many students find it much less intimidating to approach their instructor in the workshop than in the instructor's office.

Lastly, the workshop is also present virtually on the Canvas and the LON-CAPA course containers. Both Canvas and LON-CAPA are learning-management systems (LMSes) supported by SFU that are employed for most service math courses. The Canvas course container is the main container from which all information emanates, and the LON-CAPA course container only houses the online assignments together with a TA-monitored online discussion board. Listed below is the information pertaining to the workshop that is available electronically through each Canvas course container.

- Workshop location
- Hours of operation
- Instructions to students for how to use the workshop
- Workshop-coordinator contact information
- Etiquette for the course container and LON-CAPA discussion boards
- Assignment and exam schedule
- Assignment cover pages
- Assignment drop-off and pick-up information
- General marking guidelines for students
- Penalty information
- Remarking policy
- TA evaluation link for the end of the term.

4. People in the Workshop

4.1 The Role of the Workshop Coordinator

The Department of Mathematics at SFU consists of research and teaching faculty members. At SFU, the unwritten suggestion is that research faculty members have their workload distributed 40/40/20 over research/teaching/service, while teaching faculty members have their workload distributed 80/20 over teaching/service. On average, the trimesterly teaching duties of teaching faculty members include teaching courses and/or coordinating a workshop. If a teaching faculty member is not available to coordinate a workshop, either a sessional instructor or a graduate student is hired to fulfill this role. The requirement for sessional instructors is that they must be familiar with the operation of the workshop by previously having taught a course supported by the workshop model. The requirement for a graduate student is that they must have been trained by one of the workshop coordinators to serve as a replacement workshop coordinator. Typically, the graduate student is personally selected by the workshop coordinator, because this student was noted for his or her managerial abilities while being a teaching assistant in the workshop.

Teaching one course, regardless of its size, earns the instructor one credit point². Coordinating a workshop for the three trimesters in a year at our university earns the coordinator a total of four or five credit points, either broken down as 2-2-1 or 1.5-1.5-1 points over the autumn-spring-summer trimesters depending on the type of workshop. If a workshop coordinator is ill, either another workshop coordinator or a seasoned TA will step in.

The responsibilities of the workshop coordinator can be broken down into five functions: a) scheduling, supervising and mentoring the TAs; b) handling all grade related aspects of the courses; c) responding to queries from students; d) working together with the instructors; and e) upholding the policies set out by the Undergraduate Studies Committee (UGSC). These are in addition to the responsibility to oversee general workshop maintenance in regard to furniture, equipment, textbook copies for the workshop and other materials. We describe each function in detail below.

4.1.1 Scheduling, Supervising and Mentoring the TAs

A workshop coordinator may supervise between four and 20 TAs per term. TAs are primarily selected from graduate students in the department. If there is a need, they are also chosen among well-performing undergraduate students, typically with a major in mathematics, or among graduate students from other departments such as Math Education, Computing Science or Engineering Science. This last group accounts for at most 15% of the TAs in a given term. The TA group is usually quite diverse. It often includes graduate students who are just at the beginning of their post-graduate studies, and who themselves may struggle with various challenges ranging from adjusting to a new city (or country) to lacking any previous teaching experience. All TAs are members of the Teaching Support Staff Union (TSSU), and their work-related obligations and rights are regulated by the *Collective Agreement* (TSSU 2014) negotiated between the university and the union.

The supervision of TAs includes delegating specific tasks such as staffing the workshop, monitoring the online discussion board accompanying the online assignments, paper assignment marking, invigilating quizzes and exams, quiz and exam marking and recording grades, as well as monitoring and evaluating the performance of each TA.

² A teaching faculty member must earn six credit points per year.

The distribution of TA hours based on these tasks is managed by either allocating all TA hours and tasks before the term begins and communicating this to each TA in a Workload Letter, or allocating hours and associated tasks weekly. The advantage of the first method is that the whole term is laid out and every TA knows his/her tasks beforehand. The advantage of the second approach is that one can more readily address unforeseen events such as absence due to illnesses, a new TA's poor marking ability or a host of other issues. Furthermore, less work is required initially to ensure that TA hours are well used and balanced throughout the term.

The mentoring of TAs ensures that they are managing workshop tasks: timely and responsible communication with the workshop coordinator; one-on-one tutoring of students in the workshop; fair and consistent marking of assignments and exams; timely and error-free recording of grades; invigilation of exams; and possibly delivering a lecture in the absence of an instructor. Prior to the start of the term the workshop coordinator goes over these tasks and lays out the necessary standards and expectations in a meeting for all TAs. During the term, the workshop coordinator has to closely monitor the performance of each TA and advise those TAs who need additional direction and help.

TAs are evaluated at the end of the term by the workshop coordinator based on their performance. More details are provided in Section 4.3, which addresses the role of the TA.

4.1.2 Handling Grade-Related Aspects of the Courses

An important responsibility of the workshop coordinator is managing grade-related aspects of the course during the term, such as administration of assignments and exams, organisation of exam invigilation by TAs, supervision of TAs in the marking process and management of complaints related to marking. The workshop coordinator also prepares the grade roster for the instructor, who prepares final course averages for the department chair and assigns letter grades at the end of the term.

4.1.3 Responding to Queries from Students

It is our experience that the workshop coordinator is the primary contact for students taking the courses associated with the particular workshop. For many students it is simply too intimidating to approach their instructors in large class settings (Jungić et al. 2006; Fried 2013). This, and the fact that the workshop coordinator is present in the workshop and addresses grade-related issues, establishes the workshop coordinator as the “face” of the course. We believe that for first-year students, the workshop coordinator takes on a nurturing role, easing the transition from high school to post-secondary education. For example, emails such as “How do I get to my lecture hall?” are answered by pointing out resources available to the student to become more independent.

Most contact from students follows a missing assignment, or concerns and complaints about the grading of assignments, incorrect recording of a grade and other related issues. Here the workshop coordinator is like a detective, using information such as which TA graded which assignments and what was the grading scheme to resolve students' queries and complaints.

Lastly, the workshop coordinator also provides support to students in the form of two to five advising hours per week in the workshop, depending on the enrolment number.

4.1.4 Working with Instructors

Liaising with instructors can be the most challenging role the workshop coordinator has to take on. The challenge comes from the workshop coordinator's responsibility to be a firm guide to the instructor to ensure that the course outcomes will meet the required standards, as well as to be a supportive colleague who is there to accommodate any reasonable particulars in the instructor's teaching style or approach.

From the workshop coordinator's point of view there are two types of instructors: those who understand the division of tasks and take full responsibility for their role, and those who are not familiar with the division of tasks between the instructor and the workshop coordinator, and therefore either leave the workshop coordinator with more than his or her share of work or overstep the boundary of TA supervision. We have learned that the best way to avoid any possible misunderstanding between the workshop coordinator and the instructor about their roles is to begin communicating, even before the course starts, with an information letter that lists the existing practices in the workshop in terms of the roles and duties of the instructor and workshop coordinator, details the items published in the Canvas course container and provides the schedules for the lectures and all assignments, along with the midterm and final examination dates. This is followed up with a meeting in which expectations are discussed to the satisfaction of both the instructor and workshop coordinator. This initial contact usually sets the foundation to make planning for the workshop as a support structure for the instructor a lot smoother.

To support the instructor, the workshop coordinator maintains all web-based software such as mailing lists and the LMS; provides a draft of the course outline and lecture schedule to maintain the set curriculum; and sets the midterm dates and the due dates and times of assignments to ease the management burden on the TAs. The workshop coordinator also offers to proofread exam drafts, which helps to ensure that exams are set at specific levels of difficulty and the curriculum is upheld, as well as offers help with setting breakpoints for letter grades to provide consistency across different terms.

Details about the instructor's specific role are discussed in Section 4.2.

4.1.5 Upholding the Policies Set Out by UGSC

During an academic year, three or more instructors may teach parallel sessions of a particular lower-division math course at the same time. At SFU, instructors are chosen not only from among faculty members but also from among senior graduate students, post-doctoral fellows and visitors to the department. This arrangement puts the workshop coordinator in the position of securing continuity in teaching the curriculum both within a term and from one term to the next. Therefore, the workshop coordinator maintains a set syllabus, a consistent level of difficulty of assignments and exams and a grading scheme as determined by the Undergraduate Studies Committee (UGSC) in the Department of Mathematics at SFU. Lastly, should there be any dispute between a workshop coordinator and an instructor, the Chair of UGSC serves as a mediator.

4.2 The Role of the Instructor

The instructor for a workshop attached to a service course is responsible for following the course outline and lecture schedule provided by the workshop coordinator by creating all necessary course material and delivering all lectures. Specifically, it is the instructor who designs

assignments and exams and their respective grading schemes in a collaborative setting with feedback from the workshop coordinator. The instructor is the head invigilator of any exam, and participates in the marking of all exams. Decisions about any necessary disciplinary actions against a student and assignment of letter grades rest with the instructor; however, the workshop coordinator should be consulted about those decisions. On rare occasions, the workshop coordinator may have to suspend a TA and relies on the instructor's input to make this decision as well.

4.3 The Role of the TA

TAs are primarily selected from graduate students in the department. In fact, two-thirds of the funding for graduate students comes from TA earnings. Their work is concentrated mostly in the autumn and spring terms, when the bulk of service courses are taught.

Each TA assigned to a workshop performs a subset of the following duties:

- Staffing the workshop; i.e. helping the students with their assignments and the course in general
- Monitoring the online LON-CAPA discussion board accompanying the online assignments in terms of ensuring students' adherence to etiquette and answering questions pertaining to online assignments
- Marking and recording paper assignments
- Marking and recording quizzes
- Marking and recording examinations
- Invigilating quizzes and examinations
- Filling in for lectures in the absence of the instructor.

Moreover, each TA is also expected to be well prepared for their time in the workshop and to attend all planning meetings with the workshop coordinator.

As per the *Collective Agreement* (TSSU 2014), the workload unit for a TA is one base unit (BU). One BU translates into 42 hours of work per term, with the current³ value of about \$1,000 for a master's student and \$1,260 for a doctoral student. A typical workshop assignment for a TA is five BUs per term. The *Collective Agreement* (TSSU 2014) guarantees 1.17 BUs of preparation if a TA is assigned to a particular workshop for the first time. For subsequent assignments this preparation entitlement changes to 0.30 BUs per term. The number of TAs assigned to work in a workshop during a term depends on the combined student-enrolment numbers for the courses served by a particular workshop, as well as on the number of base units assigned per each TA. The *Collective Agreement* assigns one BU to every 18 students in the workshop. This translates into one full-time (five BU) TA for every 90 students (Table 1); this number depends on the size of the assignment that each TA takes on.

TAs are evaluated at the end of each term by the supervising workshop coordinator. To facilitate some aspects of this evaluation, an anonymous web survey is set up three weeks before the term ends to gather information from the students using the workshop about any of the TAs with whom they have engaged at the workshop. The workshop coordinator uses the survey results, together with any instructor input and the coordinator's observations, to provide feedback to the TA and the department about the TA's job performance. Typically, the learning curve for a TA is quite

³ Autumn 2013.

steep, and performance deficits are overcome by the end of the first term. Improvement, of course, requires close monitoring of the TAs by the workshop coordinator.

For the period of a TA's supervision there may be issues with job performance. The Department of Mathematics created the role of the TA mediator, a neutral official who is involved in any dispute between a workshop coordinator and a TA. The graduate student's thesis supervisor will typically be involved in the resolution of the dispute as well. However, disputes are rare. Among all TAs distributed over various workshops, there is usually only one dispute per term, if that, which in most cases requires simply a clarification of the TA duties and the consequences for neglecting these duties. In the end-of-semester evaluation, the workshop coordinator can request a mid-term evaluation of a TA upon the next hiring as a TA, to ensure that the TA improves in areas that the workshop coordinator has highlighted. Furthermore, the end-of-semester evaluation includes the possibility of not recommending a TA for a particular workshop if the TA in question has failed the mid-term evaluation.

4.4 The Role of the Students

A workshop's first priority needs to be to the students it serves. It should be a space that is available to all students, and, most importantly, a space where students' different needs and expectations are respected (Duranczyk, Goff & Opitz 2006). The TAs, instructors and workshop coordinator who staff the workshop provide help with assignments, exam preparation and textbook and lecture queries. The workshop is a place where students learn to write up solutions properly and to read mathematics. We have also learned to provide a physical setting that is inviting for students to build study groups and to help each other. The benefits are twofold, as the mentoring student will manifest his or her own skills, while the mentored student will have the mathematics explained directly at the appropriate level.

Using TooFAST (Ravelli & Patz 2011), a free anonymous online survey tool, the students from MATH 157 D100, a calculus course for the social sciences that is served by the applied-calculus workshop, were surveyed on their workshop attendance (Table 2). About 50% of the enrolled students took part in the survey, and between 40% and 50% of the students surveyed regularly attended the workshop, a relatively high attendance level.

Term	Autumn 2008	Autumn 2009	Autumn 2010	Autumn 2011	Autumn 2012
Regularly attending students	43%	38%	49%	44%	50%
Total survey participants	228	199	231	215	116
Total number of students enrolled in that course	460	469	481	472	472

Table 2. Excerpts from MATH 157 Course Surveys, Autumn 2008-2012

Appendices 2 and 3 display the survey results about detailed use of the applied-calculus workshop the autumn 2011 and 2012 trimesters respectively in bar-chart format. These results are summarised together with more details about the operational flow of the workshop. Students can drop into the workshop as often as they want, and sit wherever they please. The workshops are busiest before and after the lectures and during the lunch period (middle bar charts in Appendices 2 and 3). If students want a less crowded work environment and more access to the TA, they learn quickly to visit the workshop during hours far removed from the lecture and on days when there is no lecture. Since TAs sit at dedicated desks, students line up at a TA desk to get their questions

answered, mostly one at a time. The general practice is for TAs to only answer up to two questions from each student at a time. The last bar charts displayed in Appendices 1 and 2 indicate that most students only ask one to three questions directly to a TA during their workshop visit. TAs also redirect students to their peers when they have provided the solution to a particular question already. This is done to facilitate the creation of study groups and to provide deeper learning for students by having to explain the solution process to another student. At times, TAs will gather some students around the whiteboard and review a particular question together. This process is effective and efficient, and it does not distract other students in the workshop. The middle three bar charts in Appendices 2 and 3 give more details on students' time usage of the workshop.

In the spring term 2011, three staggered surveys were held in weeks 3, 7 and 12 of another calculus course, MATH 150 D100, to analyse changes in students' views of the course as well as the workshop. These surveys were developed and analysed by Hum and Zhang (Hum et al. 2011), research assistants with expertise in survey development for educational research. Two survey items are of particular interest for this article, as they concern student satisfaction with the workshop (Table 3) and a ranking of the workshop's usefulness (Table 4). The results in Table 3 indicate that, initially, 37% of students agreed that their needs were met in the workshop ($n=60$). This was followed, in the middle of the trimester, by 59% agreement ($n=58$) and at the end of the trimester by 60% agreement ($n=60$). The total of the last three columns in Table 4 indicates that 47% to 59% of the students find the workshop useful throughout the term. Furthermore, Hum et al. deduced from the mid- and end-trimester surveys that students who found the workshops not to be useful had higher grades; in other words, these students probably had less need for the workshop. Overall, this indicates that the workshop model is indeed meeting the individual needs of a high percentage of students. Appendix 1 provides further data in the form of students' comments that are relevant to their satisfaction with and criticism of their use of the workshop.

When I needed it, I found that the individual present in the math workshops addressed my needs.						
	Do Not Know	Disagree	Somewhat Disagree	Somewhat	Somewhat Agree	Agree
Week 3	37%	5%	3%	18%	8%	29%
Week 7	21%	2%	9%	10%	16%	43%
Week 12	18%	2%	7%	13%	28%	33%

Table 3. Question 17 from MATH 150 Course Surveys, Spring 2011

Rank the Calculus Workshop from 1-7 where 1= least useful and 7= most useful in supporting your learning.							
	1=least useful	2	3	4	5	6	7=most useful
Week 3	8%	5%	13%	23%	10%	23%	19%
Week 7	7%	7%	14%	15%	14%	20%	24%
Week 12	8%	7%	8%	27%	15%	20%	12%

Table 4. Question 18 from MATH 150 Course Surveys, Spring 2011

5. Challenges for Using the Workshop Model

Despite its success, the workshop model faces numerous challenges. Possibly the most significant challenge is that the model requires students to take full responsibility for managing their studying time. For many first-year students this comes as a major obstacle in their transition from high school to university. As Table 2 illustrates, there are situations in which fewer than 50% of students attend workshops on a regular basis. What happens with those students who do not use the support offered by the workshop model? In our experience, this group contains the two tails of the student population: stronger students who do not need any significant help with the course material, and those students who, for any number of reasons, are in the poorly performing group of students who often end up failing the course.

Another challenge that comes with the workshop model is that the approach heavily depends on TAs and the quality of their work. We agree with McLoughlin that a math help centre “places the responsibility on the tutor to root out the question that the student may really want to ask”; however, not every math graduate student has the necessary interpersonal skills (McLoughlin 1999). For example, young people who have been successful in mathematics sometimes cannot understand or accept that there are others who struggle with “basic” math concepts. For some of our TAs, it is difficult to draw a line between saying “too much” or “too little” when they advise students. One uncertain marker could spoil hours of work by a dozen people. Since there is a large population of international undergraduate and graduate students involved with our workshops, linguistic and cultural differences can be an issue when a TA and a student communicate one-on-one. The main priority for graduate students is their own studying, so their workshop duties often come as a (distant) second priority. An unprepared or unfocused TA could further confuse dozens of students and cause a major headache to the workshop coordinator.

The workshop is based on a teamwork model. For some instructors it can be a new experience to be asked to follow certain procedures or to adjust their teaching style to established standards. An instructor who is too involved or too indifferent regarding their workshop responsibilities could disturb the fine balance among all parties that is necessary to successfully run a workshop.

Finally, the major difference between models is the level of responsibility and the level of authority of the workshop coordinator. On the one hand, from the perspective of the department, the workshop coordinator is responsible for all issues related to the workshop, from a leaking roof in the workshop room to the problems with final grade distribution. On the other hand, the workshop coordinator has little, if any, input in choosing the instructors or TAs that he or she will work with. The workshop coordinator is expected to guide instructors, mentor and supervise a group of graduate students and be the main contact for hundreds of students. At the same time, instructors report to the chair of the department, graduate students report to their thesis supervisors and students are assigned grades by their instructors.

6. Concluding Remarks

In closing, our experience is that the workshop model works very well as a way of supporting undergraduate students taking courses and instructors teaching large service math classes. It provides an encouraging learning environment where students can study in groups and receive timely academic advice from their instructor, the workshop coordinator and TAs. Since workshops are open for long hours, students can easily fit studying in the workshop into their schedules. TAs receive invaluable experience in communicating challenging material to undergraduate students and learning how to mark papers under the instruction and supervision of their peers and colleagues. Thanks to the existing support structure, instructors focus only on the creation of the relevant teaching resources and delivering their lectures. The department has a relatively low-cost mechanism in place that manages a smooth flow of thousands of students through its service courses.

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Appendix 1 – Student Survey Autumn 2008 Selected Comments about the Workshop

Positive Comments:

It is pretty good and the TAs are very helpful.

THE WORKSHOP IS VERY HELPFUL!

The workshop is great!

can work together and conveniently to ask Q.

The workshops are very helpful. It would be nice if they were run like classes and they went through everything.

When I have questions about a concept or particular question, there is always a TA or other students who can provide help. While I have not spent too much time in the workshop, when I have it has been very useful, especially the week of the midterm.

I find the workshop to be very helpful. It provides us with the basic skills that we need to do well in this course. The examples covered in workshop are good and the extra homework helps me understand the material more clearly. I like how the times are flexible. The workshop allows us to ask questions which I also like.

It is a helpful resource when I can't figure out problems even after I have asked a friend. When we can't work it out, it's nice that TAs are accessible so we can ask about how to interpret a question.

pretty good to work on homework there since we can ask as soon as we have problems

Never been to one, never had the time. It seems very good though, I always see students in them-- a sign of success?

workshop should continue

They are really helpful, because they are open a lot of the times so I can just drop in whenever for any questions. Not only do the TA's help but also the people in the workshop are also really helpful.

I think it is a very good tool that we students can use. The atmosphere is quite positive, which is helpful.

After finishing the 1st midterm exam, I think that I should attend to the workshop for extra help because I need to understand what I need to do for the questions but not to memorize what I should do. Workshop is good to ask questions and seek support.

workshop is very reliable to get help!

I often attend to the workshop, almost every day. I feel join the workshop is really useful for me to learn well.

The workshop is helpful for students. Thank you.

The workshop is helpful, it explains the questions that i need answered whenever i attend.

I only use the workshop sometimes, but I always get any questions that I have answered.

Critical Comments:

At times it's hard to find help cause of limited TAs in the workshop.

More TA's available to help students with their questions in the week of midterms would help.

The TA's in the workshop are quite knowledgeable, however it is hard to receive help in the time slot given, with the number of people in the workshop. Increasing the number of TA's in the workshop during exam time and when assignments are due would really help students prepare.

People should only be allowed to ask at most 2 questions at a time so you don't have to stand and wait in line so long.

it is very useful when you are stuck with LON-CAPA and homework questions, however, sometimes the workshop gets very crowded and there are lengthy line ups for TA's assistance

some of the TA's need more patience

It can be helpful, but I have had conflicting answers/aid coming from the TA's which is slightly frustrating.

The workshop is too far from the math lecture room, its easy to get lazy and not go.

Good, except sometimes if you go to a different TA they have their own style so it can be confusing.

never fits in with my schedule...

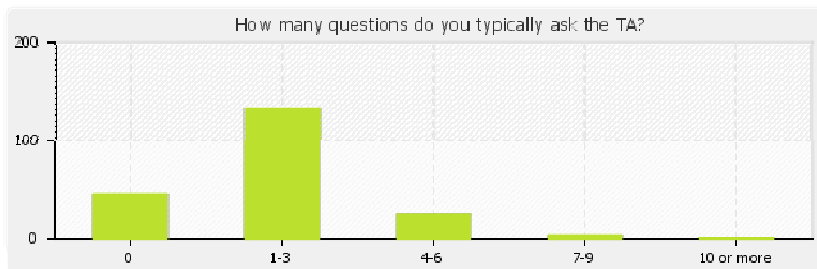
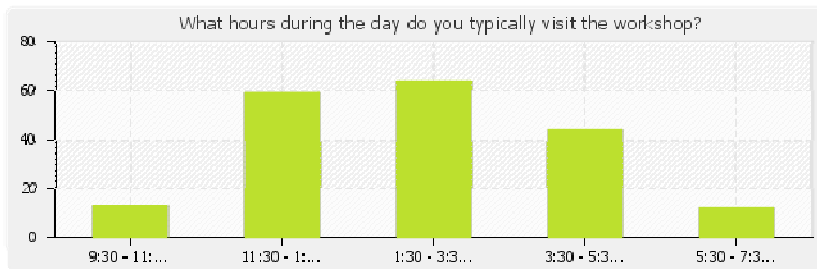
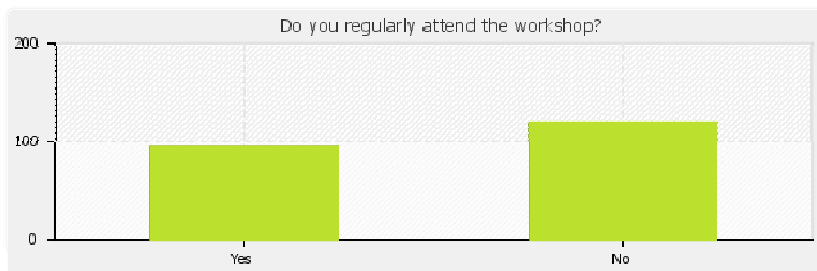
the TAs should explain more thoroughly. sometimes when i ask, they just give me the answer, expecting me to understand right away. that isn't very helpful.

Workshop is completely useless...

Useful, but hard to get help because TA's are always busy. I often find myself getting more peer-to-peer help than from the TA.

I would like it if the TA's actually solved the question for you when you ask it, instead of just telling you how to solve it.

Appendix 2 – Student Survey Autumn 2011 on Use of Workshop



Appendix 3 – Student Survey Autumn 2012 on Use of Workshop

