

Establishing a Mathematics Learning Centre at Donghua University

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Abstract

We analyse the current situation of mathematics teaching and learning in Donghua University. Suggestions for establishing a Mathematics Learning Centre (MLC) at Donghua University are made, and a proposal for implementing the suggestions is given. The Centre to be established at Donghua University will be modelled on the MLC at The University of Sydney.

Introduction

The history of the MLC

In 1984, The University of Sydney established the MLC to provide academic support for undergraduate students who, because of their background in mathematics, are considered 'at risk' when studying mathematics or mathematics-based courses. The MLC assists students to develop the mathematics or statistics units of study at university. The MLC is a unit of Student Services. It is the first MLC in Australia.

The purpose of MLC

There are three operational goals of the MLC.

- To provide a comprehensive range of academic support programs in mathematics and statistics and to address the development of students' learning in mathematics and statistics.
- To conduct research in mathematics and mathematics learning with research outcomes disseminated through publications and conference presentations.
- By pursuing these operational goals the MLC contributes to The University of Sydney Strategic Plan.

Target group

Students are eligible to attend the Centre's programs if they do not have the assumed knowledge in mathematics they need for their first level mathematics or statistics units of study.

The Centre targets students from the following groups:

- people who have not, at school, studied the appropriate level of mathematics which is assumed for their university studies;
- mature age students who have not studied mathematics for several years;
- students from overseas who may find gaps in their mathematical knowledge, or who are not familiar with mathematical terms in English;
- students whose studies have been interrupted by either illness or accident or some other cause;
- students from equity groups; and
- anyone who lacks confidence in their ability to learn the mathematics or statistics needed for their first level units of study.

A wide range of teaching programs have been developed to meet the needs of those undergraduate students who enter university without the mathematical knowledge, skills and confidence that is needed for studying first year level mathematics or statistics units of study at university. Students attend the Centre's programs voluntarily.

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Initial visit

When a student first visits the Centre, his or her mathematical background is assessed against the assumed knowledge for their units of study. The student is then advised about MLC programs that are suitable for his/her needs. Students, who are not considered eligible at this first visit, are referred back to the appropriate teaching staff in their unit of study.

Development and current situation

In 2003, the MLC User Advisory Committee confirmed that the primary purpose of the MLC was the support of eligible undergraduate students. During 2004, it was determined that postgraduate student groups would be eligible for assistance only with funding from the appropriate faculty. A 'grandfather' provision was included in this policy to cover a small group of postgraduate students in the School of Public Health as the Centre had supported these students for many years.

Programs and resources available to students in 2005 included:

- bridging courses in mathematics and statistics (fee paying);
- a drop-in centre where students can receive individual assistance;
- supplementary tutorials and lectures; and
- written and computer resources for self-paced study.

The MLC also provides academic support for and overseeing of the University Preparation Courses in mathematics and acts as faculty liaison in mathematics for The University of Sydney Foundation Program.

Staff profile

There are 2.5 full-time equivalent academic staff in continuing positions (2.5 Senior Lecturers) and one 0.57 administrative staff member. Eight casual teaching staff are employed.

The function of MLC

The MLC provides support for students in the form of lectures, workshops, small group teaching, self paced study and individual assistance in the drop-in centre'. Students attend the Centre on a voluntary basis and as frequently as they wish.

Some important teaching activities of the MLC

Drop-in centre

Students can attend the drop-in centre at any time during opening hours. There is one lecturer available to help students at all times and two at predictably busy periods.

In last four years, the drop-in centre has accounted for about 76% of total attendance at the MLC.

The drop-in centre is an informal environment where individual assistance is tailored as far as possible to each student's needs. The aim is to develop a learning culture-one where students are expected to understand the

mathematics they are studying and to learn to think for themselves.

The informality of the drop-in centre allows students to meet others with similar difficulties. Students are encouraged to work together, and to explain concepts to each other. Frequently, students who meet in the MLC form groups to study mathematics as well as other subjects. In the past, these study groups have continued into higher years.

Students value the ease of access, the individual assistance and being in an environment with students with similar needs. From student surveys, we know this form is deeply welcomed by students.

Small group tutorials

Students are encouraged to join one of the supplementary tutorials whenever possible, both for reasons of efficiency and because we believe group discussion and cooperative work lead to more effective learning.

The students value the supplementary tutorials as an important opportunity to learn mathematics or statistic and also as a forum for meeting other students with similar difficulties.

In the practical sessions, teaching staff usually begin each session with a brief introduction to the contents. Students work on the practical materials individually or in small groups, then write the practical report and think about some questions which are handed in for marking. The teaching staff is responsible for giving students feedback on their reports and giving an explanation for some questions.

Short lecture courses

Some special courses are taught in the MLC, such as *Calculus from Scratch*. The classes were organised as a response to the large number of students enrolled in the *Mathematics for Life Sciences* units of study who had not studied calculus before. Students who attended the *Mathematics* (2 Unit) bridging course were also encouraged to attend to consolidate their knowledge and skills. The class met for 23 sessions (1 hour) at lunchtimes with an average of 18 students attending each session. Students were provided with access to lecture notes at the beginning of each week via the Internet.

Mathematics workshops

A series of workshops were developed and taught for undergraduate and postgraduate students in the Faculty of Economics and Business. These workshops were a joint initiative of the Faculty of Economics and Business and the MLC, and funded by the Faculty of Economics and Business. In Semester 1, four workshops were run and were attended by an average of 24 students. In Semester 2, three workshops were run and attended by an average of 25 students. The students rated the workshops highly with an average of 79% rating the workshops in the highest two categories on a five point scale.

Self paced study

The staff of the MLC has spent considerable time developing and writing booklets on many topics in mathematics and statistics. Students are encouraged to use these booklets for self-paced study. The number of booklets available in this series is 21. Nine booklets are published on the MLC web site.

Students have access to a range of computer based mathematical materials in the drop-in centre. These include commercial software for developing concepts in statistics and calculus and the computer algebra system, *Mathematica*. Students can also use the MLC's computers to access their unit of study materials on the Internet.

Bridging courses

The MLC organises bridging courses in mathematics and statistics in February each year. Students pay a fee for these courses bringing in a modest income for the Centre.

Mathematics

During February, the Centre, jointly with the School of Mathematics and Statistics, offered *Bridging Courses in Mathematics* at the Mathematics (2 Unit) and *Mathematics Extension 1* (3 unit) level. The courses run for 24 hours over 12 working days and a fee of \$280 is charged. The students are taught in classes of between 15 and 20 students for two hours per day and are encouraged to come to the drop-in centre for a further two hours where assistance is available.

Responses to student surveys show that students appreciate the small class format, which allows them to get to know their fellow students and tutor and believe that the bridging course will help them in their university studies. Now a *WebCT* site is maintained for the *Mathematics* (2 Unit) bridging course.

Statistics

The Centre again offered its *Bridging Course for Statistics* in February. This course is run for eighteen hours over a two-week period and a fee of \$210 is charged. The course aims to introduce students to some of the concepts they will study in statistics, to provide a mathematical base for the future study of statistics and to ameliorate the fears students may have about studying statistics.

The course was highly rated by the students. In a survey at the end of the course, over 84% of the students surveys (27 of 32) rated the courses in the two highest of five categories. About 88% of students reported that their confidence in learning mathematics had increased.

Contribution to the University

It includes individual staff contributions and collective contribution to the University.

The staff of the MLC participate in the following activities:

- course and careers day and the prospective students information days;
- SWOT (Sydney Welcome Orientation and Transition);
- Broadway orientation; and
- faculty orientation sessions;

Contribution to the profession and the community

All MLC staff provided advice to current and prospective students and members of the general community about mathematical matters. This includes advice about the assumed mathematical knowledge required for various university courses, and details of the bridging and preparation programs available in Sydney and elsewhere.

Establish MLC for Donghua University

Current situation of mathematics teaching in Donghua University

Donghua University is a comprehensive university. It includes many faculties such as the Faculty of Science, the Faculty of Computer Science and the Fashion Institute of Design. There are about 3500 undergraduate enrolments every year. Education is the basis of the university. *Mathematics* is a fundamental subject. *Calculus*, *Linear Algebra*, *Statistics* are service courses for the first year and the second year students. Through these courses, we hope that students develop computation skills, logical reasoning and problem solving abilities, and prepare students need for further courses. There is a fixed consultation time of two hours each week for each course.

The current teaching approach is teacher-centred. Teachers present lectures by introducing definitions, proving properties and theorems and giving some examples for computations and applications. On most occasions, we give the background of a concept before we write down its definition on the blackboard. Teaching is carried out in large classes that may generally have 120 to 150 students, teachers deliver formal lectures to transmit knowledge, and students watch, listen, take notes and receive the information passively.

Students are asked to hand in their homework once a week. Teachers correct one half of it and make some comments during the tutorial hours.

Good students have time to read some reference books and do more difficult problems. Many students are so busy struggling with their homework that they only look up related content in the textbook when they encounter difficulties with their homework. Quite a number of students are learning at a surface level. They are ready to accept passively rather than enquire actively. They do not gain a deep understanding of key concepts and theories and some of them forget what they have learned soon after the final examination. *Mathematics* is a hierarchical discipline in structure – you need to know the basics before you can progress to higher level mathematics. Some students feel mathematics course is too abstract and difficult to learn, and quickly lose interest.

In our university, the question and answer aspect of learning does not work well. Students seldom come to teachers' offices for help. The reasons may be that students are shy, or that they consider they have already learnt well, or that weak students have too many difficulties so that they

do not know how to ask for help, and so on. In large classes, only a few students can get help from the question and answer sessions.

At the end of each semester, students take a closed-book examination, and then students gain their final marks from the examination and their homework throughout the semester. The total mark is 100, and its distribution is 80 for the examination and 20 for homework. If a student's final mark is less than 60, he or she fails the mathematics course. Each semester 15%–25% of the students fail. Students have to redo the subject to gain credit.

In my experience of teaching mathematics, I have identified some issues with teaching students mathematics. We really meet a lot of problems in mathematics teaching and we must face these issues, how to:

- stimulate students' interest;
- increase the motivation for learning;
- improve confidence in learning;
- understand the concepts, theorems of what they have learned;
- involve students in mathematics learning; and
- apply the knowledge to solve problems in real life.

My opinion of MLC

As far as we know the MLC at The University of Sydney has been successful. From the students' survey, we know that students are satisfied with the MLC. The MLC helps students become more confident, autonomous, and proficient learners of mathematics. Using teaching activities, the MLC provides a supportive environment for mathematics students with diverse backgrounds and abilities to work and learn.

Differences

Compared to the MLC at The University of Sydney, I think our MLC should have some differences, including purpose, target groups, initial visit and teaching activities.

Purpose

- To help students who may have gaps in their mathematical knowledge.
- To help the transition from first year education to second year.
- To help students develop as independent autonomous learners.
- To maintain the quality of mathematics education in Donghua University.
- To develop the mathematical knowledge, skills and confidence that are needed in undergraduate students.

Target group

People who:

- have not taken sufficient mathematics units at high school;
- have forgotten concepts previously learned;
- had unpleasant association with the learning of mathematics;
- lack confidence in mathematics;
- feel left behind in mathematics lectures; or
- whose studies have been interrupted by illness.

Initial visit

We will use diagnostic tests to find out whether a student has gaps in their knowledge. Two ways are available to carry out the diagnostic tests, paper-based and computerised. Both tests use multiple choice questions. In either case, the University will not use the results in any way that might affect the students' assessment. The tests are provided solely for the student's benefit.

Teaching activities

Drop-in

When students come to the MLC; they can receive extra one-to-one mathematics tuition. They can also come along to work on their mathematics by themselves as they will have a tutor on hand if they have any questions. We can recommend relevant books or other material if necessary. No appointments will be necessary and use of the Centre will be free.

Small group workshops

Small group workshops provide an opportunity for motivated students in fundamental mathematics courses to work together cooperatively on problems related current course material. These students can generally be expected to do better (often much better) on their examinations.

'Students helping students to learn mathematics' will be our focus. We learn best when we teach. In small group workshops, students learn as they teach and help one another: asking questions, explaining concepts, discussing strategies, sharing frustrations; and celebrating successes.

Workshop leaders and student assistants guide, coach, and provide clues but do not generally tell students how to solve problems. Students must take responsibility for their own learning and the learning of their peers.

Small group workshops require that all students be prompt and faithful in their attendance at two workshops each week. This can result in students earning additional credit on a pass/no pass basis.

Small group workshops require that students work together cooperatively in small groups. In every workshop session they are expected to actively discuss, share ideas and insights, and support each other's efforts as they solve problems.

Lunchtime short courses

The MLC will be running a programme of lunchtime short courses to give any undergraduate the opportunity to revise, practice and develop basic mathematical and statistical skills, which will be useful in their mainstream studies. They are primarily confidence building sessions and there will be the opportunity to ask for help.

Student workbooks and related resources

Students at Donghua University may be asked to collect workbooks from the MLC to help with their studies. These workbooks are available to view and download from the MLC web site.

Online support

The MLC Online Support is a resource that students may use in any combination with other MLC services. It is intended for students who like to work with technology. Students can access the most useful mathematical applications and web sites for their study. They can view material relating to their module of study by clicking on the appropriate tab. Also they can ask the questions on the MLC bulletin boards. The staff will answer the question by email or, if it is necessary, the staff can make an appointment with the student to solve the problem one-to-one.

Problems to overcome

Now we still have a lot of problems to overcome, when we want to establish a MLC for Donghua University.

Lack of funds

Without funding, we cannot establish the MLC. We will make a proposal and implementation plan in detail, such as the payment of staff and casual teaching staff; the furniture and equipment of MLC; computer equipment and software. We apply for funding from the university. If no funding is available, we can only make a small start. A few volunteers can provide drop-in services.

Lack of related resources and workbooks

To solve this problem we can organise some experienced teachers to compile the workbooks, which will be aimed at students whose mathematics background is 'poor' or who have not taken sufficient mathematics units at high school. Then we will improve it step-by-step to make it perfect and to meet students' need. The workbooks should be efficient and provide great assistance to the students.

Lack of staff

As the members of staff in the mathematics department have heavy workloads, we lack the staff to work in MLC. The reasonable way to solve this problem is to engage some experienced and retired teachers to be the mentors of MLC and employ some casual teaching staff such as science PhD candidates. Appoint several mathematics teachers to be the staff of MLC. We also need secretary assistant whose duties including typing, bookkeeping, maintenance of student records, and issuing of materials to students.

Divided campus

Donghua University has two campuses; one is in the central area of the city, the other in the suburb Songjiang. It takes 90 minutes to go from one campus to the other. The majority of the first year students are at Songjiang campus. Therefore, we should first establish one MLC on Songjiang campus. If the MLC proves to be successful, we can establish another MLC at Changning campus.

Lack of accommodation

To establish the MLC, we need a suitable place. The accommodation allocated to the MLC needs to be centrally located, close to areas where most first year teaching takes place in subjects from which students are likely to be drawn, notably science subjects. The space should comprise: 1) a main study room with seating for 25 students at tables or study carrels; 2) a separate room for small group

teaching or informal discussions, with seating for about 8 students around a table; and 3) a private office for study in the main room.

Time schedule

For the convenience of the students, we arrange the schedule according to students' need. We have lunchtime short courses, so students can attend the courses without confliction to their daily courses. We will extend the drop-in time during busy periods. During winter and summer holiday, we will give some tutorials to students who need them for their future studies.

How to start

1. We will carry out some surveys of the students to investigate their opinions. From the data, we can analyse what help students want to get and what we can do for them. We can get the valid information and know what they really need. Let us consider the target group of the MLC and adjust the strategy of MLC. It can arouse the attention from upper level of the university.
2. After the survey, we should let colleagues realise the current situation and what students want. Let them be aware of the establishment of the MLC. It is not only good for students but also good for teachers. Students get help to learn techniques in solving difficult problems thus to build up their confidence. The most important thing is that students learn the methods to master mathematics, thus to develop the ability to learn mathematics. Teachers get feedback on issues which require improvements in teaching. For example, students may find certain material too difficult to grasp, thus teachers need to find ways to make the material more understandable. We will also need to get the support from colleagues.
3. After this consideration, we will make a proposal to Vice-Chancellor. In the proposal, it should include:
 - the reason of establishing the MLC;
 - the necessity of establishing MLC;
 - the possibility of establishing MLC;
 - teaching activities;
 - collection of available material; and
 - tentative suggestions on resources require such as accommodation, staffing, furniture and equipment, conference expenses, projected future needs, etc.

Summary

According to the current situation of mathematics learning at Donghua University and using the reference of The University of Sydney's MLC, we can and should establish a MLC for Donghua University. Let students be happy when they learn mathematics.

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References

- Mathematics Learning Centre Annual Report 2005. The University of Sydney.
- King, M. (2006) Courses notes: Teaching Science in English. The University of Sydney.