

The Mathematics-Physics Learning Centre: a supportive service for engineering technology education

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ABSTRACT: It is evident that there is a need for academic support in the fields of mathematics and physics in order to increase the collegiate success of engineering technology majors. A by-product of academic success in mathematics and physics is increased student retention in these technical programmes. The Mathematics-Physics Learning Centre is a tutoring and academic support centre available at no financial charge to all students. The College of Applied Science at the University of Cincinnati provides funding for the Mathematics-Physics Learning Centre. The programmes, physical set-up, personnel staffing, *soft* support and student usage are factors that contribute to the success of the Mathematics-Physics Learning Centre.

INTRODUCTION

The academic success of students is the primary goal of any institution of higher learning. The methods employed to achieve that goal are varied. A comprehensive package developed by the University of Arizona, USA, recommends providing tutoring for students in a friendly environment for an extended day as a means of academic support [1]. The Mathematics-Physics Learning Centre (Learning Centre) offers academic support to all students in all engineering technology disciplines offered at the College of Applied Science, the University of Cincinnati, Cincinnati, USA. The Learning Centre is strategically located in the hallway of the Mathematics Faculty offices to allow easy access to all students, tutors and faculty. A few of the academic support services offered by the Learning Centre to encourage student achievement include individual tutoring and review sessions for specific courses.

The Learning Centre was opened in September 1993 to help increase student retention by offering tutoring in mathematics. In the beginning, the Learning Centre was opened a few hours each day with only faculty as tutors. Presently, the Learning Centre is opened 12 hours per day during the academic quarter.

Physics tutoring is now a major component of the individual tutoring programme. Upperclassmen, as well as faculty, serve as tutors. In addition to individual tutoring, a student may work quietly on an individual assignment, attend a review session for an upcoming examination, or participate in a workshop that has been developed to meet the specific needs of a group of students.

SUPPORT SERVICES

A number of programmes are offered by the Learning Centre. Many of these programmes involve a collaborative effort with

the technical departments of the College. A review and tutoring programme was designed to ensure mechanical engineering technology students understood the prerequisite mathematics for that department's core courses. A pre-test, developed jointly by the instructor and the Learning Centre, was given to all freshmen in that department to determine areas of weakness. A series of review packets was developed and given to the students with instructions to use the Learning Centre for individual tutoring in the area of their particular weakness.

All freshmen chemical technology students follow the same sequence of mathematics courses. Special weekly review sessions were developed for these students to increase student success on examinations, resulting in increased student retention in that programme. Specialised topics, such as unit conversions and graphing techniques, were also included in these weekly sessions.

The Learning Centre offers special programmes to meet the general needs of all students enrolled in the College of Applied Science. Workshops are routinely held to demonstrate the special features of computer algebra system calculators, which are required of all students enrolled at the College. Mathematics Department faculty conduct these workshops based on their area of expertise.

Review sessions are always offered prior to the administration of mid-term and final examinations in mathematics and physics courses. In addition, workshops designed to address individual topics of instruction are held as the need arises and as indicated by student or faculty requests.

The majority of the students visiting the Learning Centre use it as a quiet place to do homework and to study. If a question arises with a homework problem, a student tutor or a professor is available for individual tutoring.

Professionally produced software is also available to students in the form of instructional videos, interactive CD-ROMs and Web links to support services offered by the textbook publishers. The Learning Centre's staff have produced practice packets for student usage covering specific topics suggested by the faculty of the College. Review packets are also available for individuals wanting additional study prior to examinations. Approximately 64% of students visiting the Learning Centre utilise the supplemental materials provided by the Centre.

ACADEMIC ENVIRONMENT

Students who have a close interaction with faculty have proven to be successful and tend to be retained by a learning institution [2]. The Learning Centre is an excellent setting for students to receive the support, interest and interaction with faculty. With many of the mathematics and physics professors volunteering time to tutor in the Learning Centre, students are aware daily of the concern of the faculty for academic success. This type of informal interaction leads to the integration of the student into the qualitative atmosphere of the College [3].

The Fennema-Sherman Mathematics Attitude Scale, developed in the 1970s to give information about a student's attitude towards mathematics, was given to students who use the Learning Centre [4]. Seventy-five percent of the respondents indicated that faculty interest in their progress was important to them.

The support of the faculty and student tutors fosters a non-threatening learning environment for all users of the Learning Centre. Tutors for the Learning Centre include mathematics and physics faculty who volunteer time to the Centre, as well as students, who have successfully completed upper-level mathematics and physics courses. The academic majors of the student tutors represent all technical disciplines offered at the College. This lends a feeling of support to the students as they struggle with freshmen core courses.

In a survey of students who use the Learning Centre conducted in spring 2002, results showed that 91% of respondents rated the knowledge of the student tutors as excellent and that 82% rated the helpfulness of the staff as excellent. A full-time faculty member is always available for academic reference for both the tutors and students using the Learning Centre. One student's response to a survey question is indicative of the goal of the Learning Centre was that *The math centre is an excellent (exceptional) place to be!*

The Director of the Learning Centre is a member of the mathematics faculty. As such, she is aware of the requirements for each of the mathematics and physics courses offered. The office of the Director is located within the Learning Centre allowing for a consistent reassuring faculty presence. This location allows the Director to become very familiar with students. She knows their names, their successes and their academic needs. She is available to listen to student recommendations for ways to improve services and by acting on those recommendations helps to foster a cooperative atmosphere.

STUDENT USAGE

The College of Applied Science has a full-time enrolment of approximately 1,400 students. Underclassmen constitute

approximately one-half of the student body. The majority of the students are commuters, male (83%) and 18-25 years old. Seventy-five percent of the users of the Learning Centre are freshmen in the Construction Science and Mechanical Engineering Technology departments. This represents the clientele of the Learning Centre.

The average user of the Learning Centre visits one to three times per week with an average visit lasting 30 to 90 minutes. The most frequent activities in which these students are engaged are quiet study, completion of homework and receipt of individual tutoring. The academic calendar of the University of Cincinnati is based on the quarter system. Each quarter is ten weeks in duration with an additional week for final examinations. The number of mathematics and physics course offerings is highest in the autumn quarter and decreases each quarter until the summer quarter, when the offerings are approximately one-third that of the autumn quarter.

Table 1 presents a breakdown of the number of visits by academic quarter and the total number of visits. A visit is defined as one hour of time spent by a student in the Learning Centre. Data tabulation began in the autumn quarter of 2001.

Table 1: Number of visits by academic quarter.

	Autumn Visits	Winter Visits	Spring Visits	Summer Visits	Total
01-02	1,230	1,181	1,072	612	4,095
02-03	1,250	1,256			

Data tabulation is accomplished by having each student sign in when entering the Learning Centre and signing out when exiting. When signing into the Learning Centre, each student is asked to supply the following information:

- Name: used for tracking multiple usages by a student.
- Class rank: freshman, sophomore, junior, senior.
- Course name: algebra, calculus, statistics, etc.
- Instructor: each professor is notified when one of their students visits the Learning Centre and the area in which the student needed help.
- Area needing help: homework, examination review, further explanation of classroom lesson, etc.
- Topic: matrices, limits, probability, etc.
- Time in and out: used to keep track of the length of time a student utilises the lab.

Usage has been increased by an expanded advertising campaign that includes the use of flyers, bookmarks and e-mails to faculty.

CONCLUSION

The Mathematics-Physics Learning Centre offers academic support for collegiate success. Those students who use the Learning Centre have the motivation for achievement – if they believe in themselves, have the drive to succeed and a strategy to succeed [5]. Students using the Learning Centre are not embarrassed about seeking help, but realise a sense of accomplishment and success. Interaction with faculty tutors helps to reinforce the belief in the academic abilities of the students. The high usage data indicates the drive on the part of these students to be successful academically and should set the stage for success in future endeavours.

A compelling reason for the success of the Learning Centre is the sense of *ownership* felt by student tutors and clients of the Centre. Both the tutors and clients of the Learning Centre want it to be the best source of academic assistance for the student body of the College. Tutors contribute ideas to improve the Learning Centre and are willing to work to help implement those ideas. Student clients, through word of mouth, tell other students of the benefits of coming to the Learning Centre. Using available resources is a sound academic strategy employed by student users of the Centre.

The Mathematics-Physics Learning Centre is a positive influence in technology education. The programmes offered and the dedication of the Learning Centre staff are factors that have created an academic support system in mathematics and physics that contributes greatly to the success of students in engineering technology at the University of Cincinnati's College of Applied Science.

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**Conference Proceedings of the
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