

# Community Among Adult Learners in a Maths Support Centre Setting

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***Abstract:** The UCD Access to Science, Engineering and Agriculture programme is a one-year course targeted at mature students (students aged 23 years or older on January 1<sup>st</sup> of their year of registration) with the aim of equipping them with the academic skills to successfully transition to full-time mainstream higher education. Due to recent curriculum changes to the programme and the emphasis on mathematics as an indicator of progression through higher level education, we discuss the suite of supports offered to this cohort of adults learning mathematics by the Maths Support Centre.*

## Introduction

At the Inaugural European Society for the Scholarship of Teaching and Learning (SOTL) conference in May 2015, Professor Kathy Takayama mentioned that a longitudinal study based on 10 years of student data collected at Brown University in the United States showed that the two most common reasons for dropping out of a degree course among mature students were:

1. Lack of community
2. Poor experience with an introductory course.

With this in mind the authors aimed to make the transition to university for part time Access to Science, Engineering and Agriculture students (henceforth to be described as *Access* students) as manageable as possible. In this paper we document the suite of supports put in place for this mature student cohort by the Maths Support Centre (MSC) at University College Dublin (UCD), Ireland's largest university.

## The Access Programme

The UCD Adult Education office has been offering the *Access to Science, Engineering and Agriculture* programme since 2001. Until 2013, when a new mathematics curriculum and a scientific enquiry module were introduced, the

programme remained largely unchanged. From a pool of up to 100 prospective candidates seeking a return to education, approximately 30 students are accepted on to the Access course.

The criteria for acceptance include:

- (1) No formal 3rd level education (exceptions for interrupted learning – life-changing circumstance etc.);
- (2) Evidence of some research and knowledge of the Access course;
- (3) Display self-motivation and progression plan following the courses' completion;
- (4) An interest in reading popular science books;
- (5) English language competence etc.

Evidence of learning in a formal setting in the previous 3-5 years is a strong indicator of success on the Access programme. In 2013 it was also identified by the College of Science in conjunction with the Adult Education Office, that proficiency in mathematics was also a good indicator of retention and completion of the Access course.

### **Maths Support Centre & Access Students**

Prospective students are invited to attend three pre-entry 'Hot Topics in Mathematics' workshops in the MSC, and are also asked to submit a piece of writing, based on a lecture they attend in UCD on some aspect of Science.

All candidates are obliged to take a diagnostic test in mathematics (without the use of a calculator), which assesses their knowledge of the basics of arithmetic and algebra. This first diagnostic test consisting of 16 multiple-choice questions is taken online via the MSC website. One of the answer options is *Not Sure* and we encourage students to choose this option rather than guess at an answer so that we can get the fullest picture of their prior knowledge. The diagnostic test can be viewed from the link given here [http://www.ucd.ie/t4cms/Diagnostic test1.pdf](http://www.ucd.ie/t4cms/Diagnostic%20test1.pdf).

The second diagnostic test is then completed with pen and paper on the third and final night of the Hot Topic sessions. This is then corrected and the results disseminated to the students. It should be emphasized that the final mark on the second diagnostic test is not what is being evaluated but rather the progression the student has shown from the initial diagnostic test. This second test covers the same material as the first test and it follows the Hot Topic sessions that concentrate on these fundamental areas of mathematics. Typically the two diagnostic tests and three Hot Topic sessions are completed within one week.

Students are also invited to interview where the course requirements and acceptance criteria are discussed. Acceptance on to the course is based on the student displaying evidence of how they meet the above criteria, and whilst the mathematics score is not a complete disqualifier, the student may be cautioned against taking the course and advised to take additional tuition in advance of taking a place on the programme.

## **Changes to the Curriculum**

After gaining entry on to the programme students study modules in Biology, Chemistry, Physics, Study Skills, Mathematics 1 and Mathematics 2 with both the mathematics modules being mandatory. In total, students will receive 72 hours of mathematics tuition. During the summer of 2013, following consultation with the College of Science, the School of Mathematical Sciences and the School of Electrical, Electronic and Communications Engineering at UCD, the Adult Education Centre decided to re-design the existing Access to Science and Engineering course with a particular emphasis on mathematics. In the previous 12 years *only* those students wishing to pursue entry on to an Engineering degree were obliged to do both of the mathematics modules (one in each semester) while those wishing to pursue a Science (or Agriculture) degree could choose to study mathematics in semester 1 only. From 2013/14 this condition was changed to the current one where *all* Access students must do both mathematics modules.

Syllabus changes to the mathematics content meant that two chapters on statistics and probability were introduced for the first time while none of the previous content was removed. Changes to the exam were also made to exclude the option of exam question choice, thus precluding a student from omitting to study certain sections of the course. The questions on the exam were also to be of a more applied nature and less theoretical. These changes are in line with developments made to the end-of-secondary school state examinations in mathematics in Ireland under a new initiative called Project Maths [3]. For more on the impact of Project Maths on the learning of a data analysis module at third level, see Cronin and Carroll (2013).

## **Maths Support Workshops**

A vital component of the suite of supports offered by the MSC to these adults learning mathematics are the (twice) weekly workshops. These are 90-minute, student-led workshops held on a Monday and Wednesday evening (to coincide with the evenings the adults are already on campus for lectures) in the MSC which is located within the main UCD campus library, the James Joyce Library.

In September 2014 there were 30 students registered to the course and 26 students completed semester one. The four students that dropped out all dropped out in the early weeks and none of them attended any of the pre-semester (or during semester) MSC Hot Topic sessions. It is noteworthy that these four students were the only students that didn't attend any MSC workshop. The remaining 26 students all completed the second semester also.

Figures 1 and 2 below show the regular engagement of the adult students with the weekly workshops. It is of interest that the attendance at workshops slowly decreased as semester one progressed and increased as semester two progressed. This may be linked to the timing of the presentation of various topics within the course.

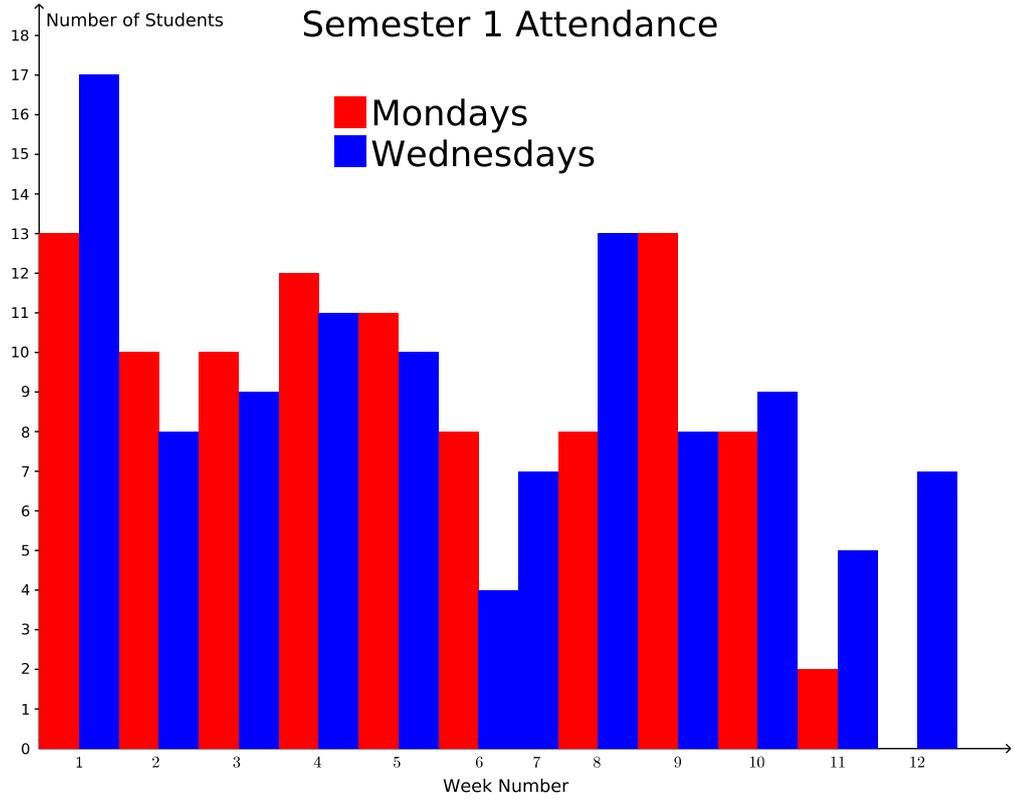


Figure 1: Semester one attendance at weekly MSC workshops

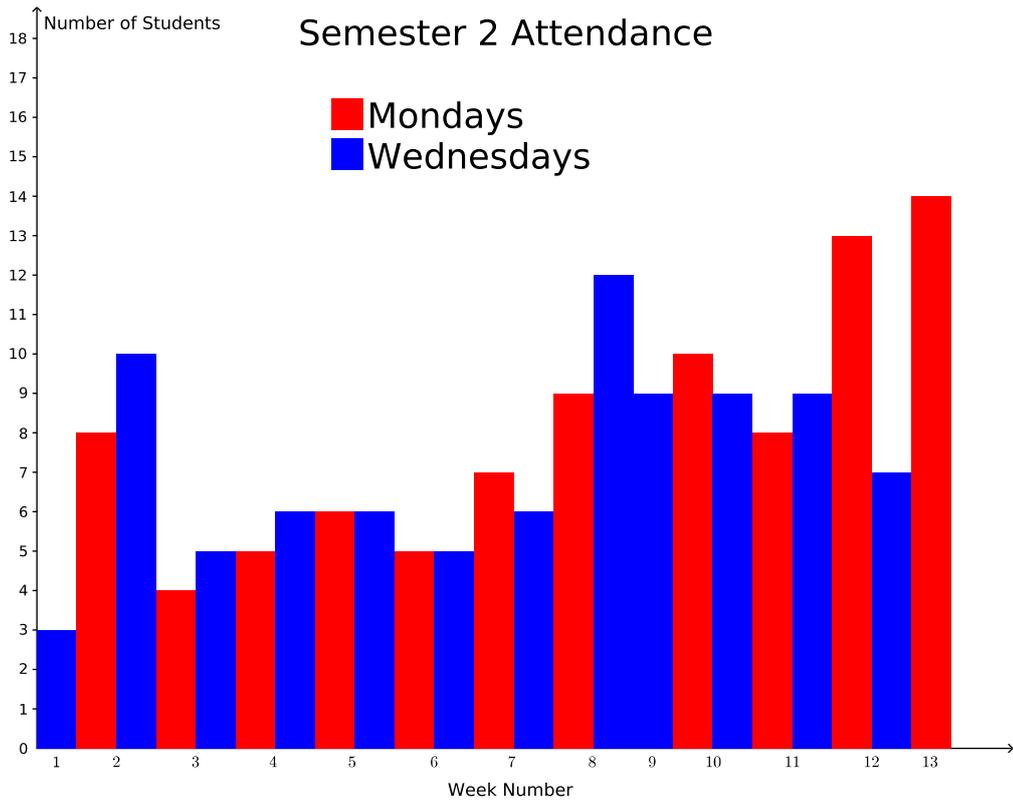


Figure 2: Semester two attendance at weekly MSC workshops

The Access students' attendance at the MSC sessions can be broken into three cohorts (see Figure 3 below). Cohort A are those that attended three or less sessions, Cohort B attended between four and ten sessions (inclusive) and Cohort C attended more than ten sessions. The following tables show the average final percentages of each of the three Cohorts and the number of students in each.

**Semester 1:**

Cohort	Number of Students	Average Mark
A	7	84.58%
B	10	90.69%
C	9	78.51%

**Semester 2:**

Cohort	Number of Students	Average Mark
A	8	89.38%
B	12	79.98%
C	6	84.50%

Figure 3: The final marks by MSC session cohorts

Note that cohort X for semester one does not contain the same students as cohort X for semester two as the attendance patterns were not constant from term to term.

**Survey of Access Students**

A survey of the 26 students was taken in June 2015 to gather the students' opinions on various aspects of the MSC service in relation to both their mathematics modules. There was an impressive 65% response rate to this survey (17 of 26 students). One such question asked the students to rate, what they felt, were the most difficult topics in the each of the two mathematics courses. For semester one (Mathematics I) an overwhelming 76% of students ranked *Integral Calculus* as the most difficult topic, with *Differential Calculus* (71%) coming a close second. *Functions* (41%) and *Statistics* (24%) were the next two most difficult topics for respondents. Interestingly 71% of students stated that *Arithmetic and Algebra* was one of the easier topics. These topics were the focus of the three pre-semester MSC Hot Topics.

The fact that so many students found Integral and Differential Calculus so difficult may explain the spike in the MSC workshop attendance in weeks 8 to 10 of semester one. However upon deeper analysis of the feedback provided by the MSC tutor of the workshops we see that *Functions* and *Trigonometry* (see the table below) were the central focus of the workshops around this three-week period. Perhaps those students who found Integral and Differential Calculus so hard were among those students in Cohort A but unfortunately the survey was anonymous and so we cannot tell which of the survey respondents were also regular/non-regular MSC workshop attendees.

### Table of MSC workshop feedback during weeks 8-11 of semester one

<p><b>5 November 2014</b> - Access workshop mainly on functions. Does a definition give a function? Is a function injective, surjective or bijective? Finding inverse functions. I think that the students are doing well but the students are commenting that they think this is the hardest chapter so far.</p>
<p><b>10 November 2014</b> - Access workshop on trigonometric formulae and the sine and cosine rules. The students seem to be finding this chapter much easier than the abstract work on functions. There are still some students struggling with domains and codomains. One interesting problem was one student who thought that the rule should be applied to the codomain rather than the domain to get the image. Working on problems related to domain and range of functions and whether definitions of certain functions were valid given the range and co-domain definitions.</p>
<p><b>12 November 2014</b> - Access workshop on trigonometric formulae, sine and cosine rules. The students are working well on this section with no real problems.</p>
<p><b>17 November 2014</b> - Access workshop. This was originally going to be on differentiation but most students seemed to do well with this, so some were working on trigonometry and others were starting to revise the whole course. There were no real problems.</p>
<p><b>19 November 2014</b> - Access workshop. Most of the students were comfortable with differentiation so started revision - mainly on rules of indices. There were no real problems.</p>
<p><b>24 November 2014</b> - Access workshop - students working on integration, no real problems.</p>

For semester two, 76% of respondents again ranked *Integral Calculus* as the most difficult topic while there was a drop to 41% who felt that *Differential Calculus* was the most difficult. 47% felt that *Probability* was one of the more difficult topics while *Matrices & Vectors* (35%) and *Complex Numbers* (12%) were deemed easier sections of the semester two course. For how these topics are assessed the interested reader may want to consult the final exam papers from both semesters of the 2014/15 academic year via the following two links:

<http://www.ucd.ie/t4cms/ADEDEX424%20Exam%20Semester%201%202014-2015%20.pdf>

<http://www.ucd.ie/t4cms/ADEDEX428%20Exam%20Semester%202%202014-2015%20.pdf>

When asked “If you didn't attend the Maths Support Centre sessions during (and after) term time can you state the reasons why?” 64% said they could not attend due to work commitments and 18% cited family commitments as the reason they did not attend. Interestingly 27% of respondents said they “did not need to attend them”.

When asked “How can the MSC sessions be improved?” it is interesting to note that there were no responses relating to the content or style of the sessions but 53% said they'd like “More MSC sessions on different nights but later times” and 41% said they'd like “More online support via forum” and finally 24% said they'd like “More online support via a virtual drop-in centre”. For more on a virtual mathematics learning centre see Golding (2015).

In relation to the issue of the two most common reasons among adult students for dropping out of a degree course, we asked the following question:

*If you found the MSC sessions useful can you state the reasons why?*

41% said they “helped me to meet fellow classmates”, while 29% said they “helped my sense of belonging to the university” and “helped me to learn how to work with others”. Not surprisingly the majority of respondents (65%) said they “helped me solve (mathematical) problems” with a further 59% stating that they “helped me digest material from the course”. Also 47% and 41% respectively, said they “helped me to prepare for the assignments” and they “helped me to prepare for the final exam”. These responses bode well for the initial objective of offering a sense of community and confidence for adult learners within a Maths Support Centre setting. One student summarised the general positive reaction the adult students had towards the MSC sessions by stating:

*“honestly, I couldn't have asked for more from the support centre”*

### **Conclusions and Future Work**

In future work the authors will perform further analysis of the attendance, exam results, exam topics and survey feedback to see if we can identify the students that would have benefited from the MSC sessions but did not attend them and attempt to determine the reasons for this. Is it that they thought they did not need them, or did they know that they needed the sessions, but there was some reason they did not attend them, for example, work or family commitments? Additionally, we will examine if there is any way we can overcome this, for example by scheduling an MSC session for a later time or on a different evening (when the students are not already on campus for lecturers) or through online support etc.

### **References**

Cronin, A., Carroll, P. (2013). Building analytic skills in undergraduate business students: The impact of Project Maths. *Proceedings of the Fifth Conference on Research in Mathematics Education MEI 5*, St. Patrick's College, Drumcondra, Dublin, Ireland.

Golding, G. (2015). Virtual Mathematics Learning Support at the Open University. *9<sup>th</sup> Annual IMLSN Conference, UCD, Dublin, Ireland.*

Video: <https://www.youtube.com/watch?v=KJxWbItOe6c>

Slides: <http://supportcentre.maths.nuim.ie/mathsnetwork/imlsn9abstracts>