# What makes a Mathematics Degree work for Mature and Part time Students?

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maths careers endless opportunities
more maths grads multiplying opportunities

## Summary

The purpose of this report is to present an evidence based model for the factors to be taken into account in the design of a mathematics degree programme which is both attractive and structurally appropriate for mature and part time students. We show that there is a need to adopt an alternative approach to that taken for traditional university entrants. A set of good practice guidelines is given for institutions of higher education to consider when designing a mathematics degree programme of this nature. A number of these recommendations will also be applicable to degree courses in other subjects.



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# Introduction

We are reporting here the results of a study conducted in the autumn of 2009 by the University of Bolton, funded by a grant from the 'More Maths Grads' project. The rationale for this project, as given in the original proposal document, was as follows:

> The mathematics degree at the University of Bolton has for over 30 years been successful in recruiting students who fall into the 'widening participation' category. The great majority of students on the course fit into one or more of the criteria of being mature, or part time, or from an ethnic minority, or female. In particular, the course has been organised with what the staff perceive as the interests of part time and mature students in mind: the course falls into Prof Nigel Steele's 'Broader Entry' group [3]; the syllabus has been chosen to ensure a broad mathematical education, partly with those who wish to teach at secondary level in mind; the attendance pattern is suitable for students who have to commute, and half of the lectures are in the evenings; transfer between full time and part time modes is simple.
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> This degree course has been successful in serving the interests of 'widening participation' students. It is clear that mathematics degree courses with similar features are rare in the UK. However, the process of designing the course has been principally 'provider led' and not evidence based, and it is not clear to what extent the various features of the course contribute to good recruitment. It is proposed to investigate the experiences and the views of the recent part time and mature graduates of the Mathematics degree at the University of Bolton in order to create an evidence based model for the correct design for degree level provision which is both attractive and organisationally appropriate for these students. In order to check the applicability of the model the investigation will be extended to a group of students who have withdrawn from the degree without graduating, and another group who have graduated in mathematics from other universities. In order to maximise the depth and reflective nature of the responses obtained, and the independence of the responses from the views of staff, the investigation will comprise informal one-to-one interviews conducted by a researcher who is one of the recent mature or part time graduates from the Mathematics degree at Bolton.
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> It is the experience of the proposers that part time and mature students are not separable into distinct groups. Mature students frequently swap between full time and part time modes as their course progresses, sometimes more than once, and the decision as to which of these modes to study in simply depends on the current balance of factors such as work and family commitments and financial issues.

The project was completed broadly in line with this rationale, subject to some minor modifications due to pressures of time and budget. In general, the results showed that although the issues which were of concern to the students were generally those which the staff already understood, the relative importance to the students of those issues was unexpected.

# Procedure

The interviews were conducted by a recent Bolton graduate with the same experiences as the interviewees. A project launch was held at a local hotel in order to introduce the project and seek the participation of recent graduates. Informal one-to-one interviews were then held in relaxed environments. The interviews were semi-structured.

The interviewer used a comprehensive list of topics which he tried to ensure were covered during the conversation. In terms of initial guidance, the interviewees were asked to reflect on the following:

- The factors that motivated them in returning to study
- The academic routes taken
- The financial issues regarding their mode of study
- What they were ideally looking for in a mathematics degree

To test how far the findings from Bolton could be generalised, a group of mature students from Sheffield Hallam University were also interviewed. The original intention had been to use a group of graduates but it has not proved practical to do this.

It only proved to be possible to interview one student who had withdrawn from the course at Bolton. The views and experiences which she reported were very similar to those of the other students. She indicated that the reason for her withdrawal from the course was related to workload and not to aspects of the structure and organisation of the course.

The sample of Bolton graduates and current students is described in detail in the appendix. To ensure consistency throughout the report, all interviewees will be referred to as students. A total of 63 Bolton students were approached with regard to the study, of which 30 agreed to participate. There were approximately equal numbers of each gender. The age distribution was satisfactorily broad, with most students being in the range 30 to 50 and a few outside this range. Both genders had similar age distributions. The majority of the sample was white British by ethnicity, with 5 of the 30 having different ethnic backgrounds. Part time students comprised approximately one third of the sample. The students had started on their degree courses in the years between 1999 and 2008.

# The evidence from the interviews

## Why return to studying?

Of those interviewed, 60% were either the first from their family to attend university or from the first generation to do so. Many took a particular pride in saying that they were the first in their family. A variety of reasons were given for returning to study, which can be grouped under the following headings:

- the opportunity to enter higher education was not taken at 18 years of age;
- a change in personal circumstances;
- self motivation;
- a family decision.

These areas are not to be taken in isolation. Virtually all of the students came into more than one of these categories, and in some cases they came into all of them.

- **opportunity not taken at 18 years**

Half of the students had completed 'A' levels at 18 years of age. Most of these had the support of their parents and teachers to enter university at the time, but did not take up the opportunity. Several had registered with UCAS and received offers on various degree courses. Some had started courses and had dropped out during the initial weeks.

The main reason these students gave for not having pursued higher education at 18 years of age was that they had simply had enough of education at that time. Some were rebellious teenagers who had other priorities. Generally, on reflection, they felt that not having pursued higher education at 18 years may have been a mistake. These students often required the additional stimulus of a change in their personal circumstances to motivate them to return to the academic environment.

- **change in personal circumstances**

Several students quoted changes in personal circumstances which prompted a return to study. One category was parents whose children were leaving home, the "empty nest" providing the freedom for them to pursue higher education themselves. Mothers with young children were another notable category of returners. In this case it was necessary for them to have appropriate child care arrangements in place. They organised this through support from their own families rather than seeking support from the academic institution, which would have entailed leaving their children with unknown agencies. A third category was made up of those who had recently been made redundant from their employment. In one case, the pending retirement of an employee's manager provided the impetus to enter higher education after many years of considering the issue.

- **self motivation**

A number of the students commented on their realisation that, after many years in the workplace and often with several employers, they had reached the point where they had no job satisfaction and also no prospects of a rewarding career. These views were expressed by students who had come back to education from a wide range of jobs, varying from unskilled service sector posts up to and including management level posts.

A number of students mentioned low self esteem through the lack of recognition from their peers, and through their own feelings of not having achieved their potential. One single parent's return was motivated by the desire to achieve independence.

- **family decision**

Some of the students indicated that family issues had meant that they were unable to pursue higher education at the age of 18, but that their families were supportive of their ambitions and they had delayed entering university until family circumstances made this possible. The decision to return was often taken by the family, with the benefits to the family being the most significant factor.

## Why choose mathematics?

- **enthusiasm for mathematics**

The earliest recollection of mathematics for all students was at school. There was no consensus as to whether this was specifically at primary or secondary level. Their interest in mathematics was often generated by their teachers, although one student particularly remembered his father's enthusiasm for mathematics and the times when they had studied together. Generally, however, it was teachers who encouraged their pupils and had made their lessons enjoyable. Several students recalled having the same mathematics teacher throughout their secondary school career. Some others commented that their 'O' level or GCSE teachers were very good, but that their 'A' level teachers were not. It generally seems that it was during the early school years that pupils developed a passion for mathematics. They loved the subject, put in the necessary hard work and realised in their early years that they were able to master the subject. Further encouragement was sometimes achieved through mathematics clubs.

Only a very few of those interviewed had not enjoyed mathematics at school. Some had not been allowed to pursue science based subjects at school and wished to have the opportunity to demonstrate that they could do so. One student considered his standard of mathematics a particular weakness on his CV which he was keen to rectify.

Mathematics was chosen as an academic subject and, with the exception of the teaching profession, not as a specifically vocational subject. A number chose the subject after also considering law, physics, astronomy, engineering or philosophy. In some cases it was chosen as a basis for further study in science or engineering. By contrast several students studied mathematics purely for pleasure, having enjoyed the subject since school and in some cases having applied it in various careers. One student in this category returned to study the subject after his interest had been rekindled by reading "The Code Book" by Simon Singh.

One motivation for studying mathematics was sometimes claimed to be a lack of enthusiasm for reading. Related to this was the students' ability to score high marks in mathematics relative to subjects such as English and history. Also remarked upon was the ability to apply mathematics to solving everyday problems through a logical and methodical approach.

- **objectives and expectations**

The principal objective for the majority of students was to join the teaching profession. Other objectives quoted by students included developing other career progression opportunities and personal satisfaction.

Some of the female students had worked for several years in a teaching assistant role, and were seeking career progression leading to qualified teacher status. A number of female students also indicated that the teaching profession would suit their family life in relation to childcare. Another view which was frequently expressed is that the teaching profession is one which can be entered later in life. The national advertising campaign for teachers of STEM subjects (science, technology, engineering and mathematics) and the offer of a "golden hello" had tempted some of the students into mathematics teaching.

The economic situation was also a determining factor for many students. One student had researched the employment opportunities in education and discovered that mathematics was top of the shortages list. Another student considered that few opportunities existed in general employment and chose teaching as a secure profession. Others were seeking career progression with their current employer or opportunities with other companies. A relatively small number of students intended to obtain a degree qualification and then to investigate the career paths which were open to them. Similarly, one of the graduates stated that at the start of the degree programme he had no specific objective but having completed it he was then considering alternative careers. Of the other graduates interviewed a small number had gone on to masters level courses in mathematics, statistics or operational research with the objective that this might lead to study for a Ph.D. and subsequently a post as a university lecturer.

When students who had not previously studied beyond 'A' level standard were asked if they had any particular expectations of the mathematics which they would be studying, their initial response was generally that it would build upon material covered at GCSE and 'A' level. There was no anticipation that any particular topics would be studied, and no expectation that their degree would include specific areas of work directly relevant to careers which involve the application of mathematics. A few thought that geometry and prime numbers would be studied, and one student expressed surprise at the limited use of calculators. In contrast, students with qualifications higher than 'A' level were interested in the theoretical underpinning of the mathematics which they had used or studied in other disciplines over a number of years.

## Academic routes on to a mathematics degree

The students had satisfied the entry requirements for a mathematics degree by a variety of academic routes. The two principal routes taken were traditional 'A' levels gained at 18 years of age and the Institute of Mathematics and its Applications (I.M.A.) Polymaths course taken at the University of Bolton. One student had completed a number of Open University courses and used this to gain entry to the second year of his degree programme. Another student, having failed the first year of a mathematics degree at another university, was given a place to restart a mathematics degree from the beginning of the first year. Two students had completed Open College North West

levels A and B at Blackburn College. One student had transferred from an accounting degree and another had switched from a joint mathematics and psychology degree programme to single subject mathematics.

- **'A' level**

This group of students had generally enjoyed mathematics at secondary school and achieved high standards at 'O' level or GCSE. Most students commented that there was a significant step up in the level of mathematics from 'O' level or GCSE to 'A' level. Students also recalled other factors that had impacted on their studies and perhaps delayed their entry to higher education, such as a change of school or perhaps a lack of enthusiasm on the part of their 'A' level mathematics teachers.

One topic of concern repeatedly mentioned was calculus. 'A' level courses with ample calculus and Newtonian mechanics were felt to provide sound preparation for a mathematics degree. By contrast, several students who had taken 'A' level courses with an emphasis on pure mathematics and statistics had subsequently struggled with calculus.

- **Polymaths**

Although there are no formal entry requirements for the I.M.A. Polymaths course, students who have not previously passed 'O' level or GCSE mathematics, or an equivalent qualification, are generally advised to study for GCSE before starting the course. A number of the students had recently completed GCSE mathematics when they commenced the Polymaths course, and had been looking for the next step to take. Other students had come to the Polymaths course with a variety of qualifications, which may have been taken many years previously. These included 'O' level, GCSE or CSE in mathematics, HNC Business Studies, HND Mechanical Engineering, ONC Electrical Engineering, HND Computing, BSc Economics, and accounting and book keeping qualifications.

Three students with 'A' levels also took all or part of the Polymaths course as a refresher because they had been away from studying mathematics for a number of years. They also felt that taking the course was beneficial in easing them back into the pattern of attending classes and completing coursework.

One student had enrolled on Polymaths in order to help her children with their school work, and another did so with a view to studying engineering. Both of these students subsequently continued on to take a mathematics degree.

Although students were often actively seeking for an 'A' level equivalent access course, in most cases it was by chance that they stumbled across the Polymaths programme while looking for local evening courses. Numerous sources for the initial information about the course were cited, including local press advertisements, open days, the internet and also family and friends. There was a consensus that a greater promotional effort was required for the course.

The features of the Polymaths course which particularly appealed to the students were:

- availability at a local centre
- intensive course over two evenings per week for one year
- two start dates, in September or January
- high proportion of mature students
- classroom environment
- low cost.

All students required a local course as they were in full time employment or needed family and friends to provide child care. Typically students travelled from neighbouring towns within a 15 mile radius. The furthest distance travelled by any of the students was 40 miles.

The students considered that taking the Polymaths course had been critically important to their successful progression, not only with regard to the mathematics content but also in encouraging a structured approach to study. The system of weekly short tests and interim long tests had helped to generate students' confidence in their own ability. The Polymaths class size at the time when it was taken by the students was typically 10 to 15, providing for a relaxed atmosphere and the opportunity for an interactive style of teaching.

During the Polymaths course, tutorial staff were found to be supportive and to recognise each student as a mature individual. They were always encouraging and approachable. The Polymaths course has been found to be a positive experience and consequently students felt comfortable to continue with their studies on the degree programme. Indeed, Polymaths was considered to be a key factor towards further study for those who had not taken a course since leaving school.

Students did express the view that Polymaths did not provide sufficient preparation for taking examinations. It was also felt that it would have been helpful if the course had included more material on calculus, as for many students it provided their first introduction to this topic.

Students from the Polymaths course generally stayed on at the university as undergraduates rather than move elsewhere. In these cases it was found that knowledge of the environment and the lecturing staff made the transition from Polymaths to the mathematics degree a natural and comfortable progression.

A more detailed study of the I.M.A. Polymaths course may be found in [2].

- **application and entry**

As with entry onto the Polymaths course, all students commended the informal nature of the interview process carried out by staff when they applied to join the mathematics degree course at Bolton. This was conducted in a friendly and relaxed manner. Students were treated as responsible mature individuals, with appropriate consideration being given for their personal circumstances.

Some students had applied for a place on the mathematics degree course having already obtained post 'A' level qualifications in mathematics or another discipline. These included qualifications in banking, economics, engineering, business studies and computing. These students were given exemptions from various first year modules, as appropriate. Work experience in various fields was also recognised appropriately.

## Financial issues

Each student's issues concerning finances were naturally closely linked to their mode of study. Full time students had received financial support, in the form of loans or grants, while part time students had been predominately self funding.

- **full time students**

For full time mature students finances were a significant issue. All students required support with their tuition fees and living expenses. As a result of their personal circumstances some had their tuition fees paid in full. Two sources of finance were specified by students: loans or grants from the student's LEA, and the Access to Learning Fund provided by the university's Student Services department. Because the students were not progressing directly from school and hence did not have access to the support mechanisms usually provided by schools, they had found that information about these sources was not readily available and it had required persistence on their part to obtain the necessary details.

The students' experience was often that there was no communication between the various sources of finance and that considerable time and energy was required to process each application. It was suggested that a 'One Stop Shop' should exist dealing with all financial issues.

For those who had been entitled to other benefits prior to joining the course, the change in status in becoming a student had created a great deal of stress throughout the application process. The benefits entitlement for each subsequent year of study also required a further review of personal circumstances, which had the unfortunate effect of reproducing the previous stress levels. Due to a lack of communication between the various agencies involved, the payments from these sources were often incorrect, or late, or both. One case was cited where the calculation for one academic year had been incorrect and was subsequently corrected the following year leading to an unexpected shortfall in income.

In the main, however, the ordinary student loan process appeared uncomplicated with a straightforward application process. Students were aware that a minimum salary is required before repayments are collected. Some were surprised to learn, however, that interest is added to the loans from the completion of studies and so that for those not making repayments, as they are not earning above the threshold, outstanding loan values are continuously increasing. These outstanding loans accumulated by the graduates interviewed are typically around £15,000.

During their studies a number of students experienced financial hardship. Students' 'exceptional circumstances' were taken seriously by the University Student Services

department and 'one off' discretionary payments were often received from the Access to Learning Fund.

Students often supplemented their income by part time work. This was greatly aided by the structure of the academic timetable at Bolton, where the class contact has been clustered into relatively few sessions, as opposed to being made up of single one hour lectures spread throughout the week.

Few students received any financial support from their parents. One student specifically mentioned that they had received financial support from their spouse, as well as utilising a redundancy payment.

Many full time students had initially felt that the cost of their studies would be affordable, but had found that finance became a major issue as their studies progressed. Their commitment and their determination to complete their studies had generally enabled them to overcome their financial problems by a combination of additional sacrifices, an extended period of study, and robust efforts to boost their income.

- **part time students**

Part time students were predominantly self funding, and paid their fees from disposable income. Given that part time students normally take between four and five years to complete their course, and in some circumstances up to eight years, it is important to students that fees do not increase excessively. During the period over which students were on the course at Bolton the fees were found to have increased by a factor of up to three.

Three forms of payment were available, a one off lump sum, three instalments of one per term, or monthly direct debit. Each of these methods was used with varying degrees of success. The direct debit method was a repeated cause for concern.

Only one student received financial support from his employer. In presenting the case for support it had been necessary to highlight the relevance of the course material to the student's career development and also to submit a cost estimate for the full duration of the course.

## What are mature and part time students looking for on a mathematics degree?

The features of a degree programme which would encourage mature and part time students to enrol on it cover many aspects of course design and organisation. Mature students each have their own personal circumstances and individual needs to consider. This section covers the main themes about course structure which came out of the interviews. Naturally some of the issues raised were relevant to all students, but the focus in this section is on those issues where part time and mature students may be expected to have a different perspective from others.

- **motivation and environment**

For a mature student considering a return to study, the Open University is an obvious starting point. The OU is widely publicised in a variety of media sources and course information is readily available on the internet. It is acknowledged as a leading provider of degrees for mature students undertaking part time study. The courses are open to all students and are ideally suited for those in full time employment. For a student with the necessary self discipline to study on their own, all required learning materials are provided along with a limited level of academic support through various sources. Due to the popularity of the OU, it is often the case that family and friends will have prior experience of the institution.

Those who do not wish to pursue the OU route often cite isolation and the need for self discipline as barriers to enrolment. The obvious alternative would be regular attendance in a traditional classroom setting, which requires enrolling at an Institution of Higher Education. For those mature students who had not pursued their academic studies when they were school leavers this would also provide the opportunity to experience something of university life.

For students seeking solely a first degree the status of the university was found to be of little importance. Students with the intention of continuing subsequently with postgraduate studies generally sought to do so through a traditional redbrick university.

Mature students, with or without families and having an established social network, are unlikely to wish to relocate. They therefore require a local institution, typically within a radius of 20 miles. The majority use their own transport and hence adequate parking facilities are required. Public transport was found to be seldom used, despite the University of Bolton being in an area which is relatively well provided for in this respect.

It was found that mature students' general perception is that traditional universities do not welcome them. They think that the entrants to these universities will almost all be 18 year old students who have just completed their 'A' levels, and that classes will take place in large lecture theatres with upwards of 100 students sharing similar academic backgrounds. Mature students would find such a setting intimidating and not conducive to their learning style, and would instead prefer a classroom environment involving perhaps 15 - 20 students, predominantly from their own peer group. They would be hoping for a friendly and relaxed atmosphere which would enable informal dialogue between student and lecturer. They would also value a lecturer who appreciated that it may have been many years since the students had been in a classroom and so they would need to be treated in a sympathetic manner. They would also be looking for recognition that their other commitments would mean that they would be fitting classes around work or child care arrangements.

- c**urriculum content**

It was stated earlier that students generally have little expectation as to the likely content of their degree before they start it, and do not usually choose a particular course because of its content. However, that is not to say that the content is unimportant to them whilst they are progressing through the degree or when they are in employment afterwards. As may be expected, given the wide interests and backgrounds of the

students, a good mix of modules is required from each of the areas of pure mathematics, applied mathematics, statistics and computing in order to satisfy their preferences. Many students would rather concentrate on one particular area of mathematics, so that ideally an appropriate number of modules from each area would be required in order to provide a choice throughout their programme. It was accepted, however, that the number and variety of modules on offer from each topic had to depend on staff resources.

While the ability to offer a joint programme was of interest to some, the students interviewed had almost all chosen a single honours programme.

Calculus has been found to be a particular weakness of many students from all backgrounds, and the students would have appreciated additional tutorial support in this area.

Students enrol on a mathematics degree programme with the intention of obtaining an honours degree but, particularly for part time students whose course will take a minimum of four to five years, there is the prospect that their personal circumstances may change over the period of their course. In these circumstances the offer of an intermediate qualification may be of benefit. Two options were suggested, one for those who complete half of their level two and three modules and another for completing all modules except the level three dissertation.

The graduates from Bolton had found that a degree of flexibility in the order in which modules had to be taken was a great advantage to them, as it assisted them in fitting their academic programme around the other constraints on their time. Clearly it is necessary that prerequisite modules must be taken before any specific topic is studied, but in general it is better for mature and part time students if the rigidity built into the programme is kept to a minimum. Similarly, the option for a student to change a choice of module during the very early weeks of the tuition for that module is helpful.

- **course calendar and the semester system**

At Bolton the academic year is divided into two semesters, one starting in October and the other in January. Full time students take three modules per semester while part time students take a maximum of two modules per semester. The students felt that this relatively short semester period was less stressful than the alternative of taking six modules throughout the academic year and consequently having the full examination load at the end of year, and that it was easier to accommodate this pattern of study within their other commitments.

The first semester spans the Christmas vacation and the second semester spans the Easter vacation. It was found that the first semester works well, with the majority of the course material covered, and the final assignment issued, before the Christmas vacation. This vacation provides time to complete the assignments and start revision for the examinations. It is preferable if, after the vacation period, two weeks are available before the examinations, to receive assignment feedback, allow consultation with staff, and then to complete examination revision.

It was generally found that the structure of the second semester was less convenient for mature and part time students, because of the variable date for Easter. It was felt that a useful alternative would be along the lines of the model used at, for example, Cambridge and Sandhurst, where the academic calendar ignores the variability of Easter and has exactly the same structure in every year. It would be impractical to have lectures or examinations on Good Friday or Easter Monday, but subject to taking these two days off a two or three week spring break could be positioned a couple of weeks before the start of the examinations, as in the first semester. It was felt that this fixed calendar may in fact be of significant benefit to all students. Although in theory a student can prepare for the likely impact of the timing of Easter in future years on their study pattern, in practice it would be much easier for them if the spacing of the various events in the academic calendar were always the same.

The view was expressed that it is very helpful if the module timetable can be published well in advance, ideally giving students at least a three year horizon. This enables students, both full and part time, to fit their other commitments around their academic work and also to exploit any flexibility available in the academic programme to the best advantage. The model used at Bolton, where all of the modules which are timetabled during the day in one year are then timetabled in the evening in the following year, and vice versa, was found to be particularly helpful. It clearly ensures the availability of modules for part time students who can only attend evening sessions. Surprisingly, it was also found to be of benefit to many full time mature students, who would often take evening classes to work around family life. It was often the case, for example, that a student's partner would be available to provide child care in the evenings but not during the day. It was found to be best if evening lectures did not start before 6pm so that those in employment had sufficient time to travel to the university. Similarly, morning lectures are best starting at 10 am, to enable students who have to drop children off at school to attend.

- **teaching materials**

It is recognised that in making the choice to attend a university with traditional lecture room teaching, students cannot also expect distance learning materials of the quality and quantity they would have received if they had chosen to study with the Open University. However, high quality course materials are of particular benefit to mature and part time students, as they may have limited time in which they can attend the university to work in the library. Good course materials can also enable them to do preparatory work if they have time available during the vacations. A set of notes for each module, containing exercises for each chapter and detailed solutions, is very helpful. It is more beneficial if the full set can be made available at or before the start of each module, preferably electronically.

- **examinations**

The examination timetable should be publicised as early as possible. Students who are working, either full time or part time, will have made arrangements to fit the normal schedule of lectures in with their work commitments. Examinations, however, may require them to book holiday time with their employer, and in some jobs where the employer requires continuous staff cover this may have to be done well in advance.

Training in examination techniques is very beneficial to students with limited experience of examinations. Students who are fresh out of school will have been taking examinations once or twice each year for some years, but some mature students may not have taken an examination for a long time. It is likely that their examination performance will be weaker than that of younger students because of poor examination technique and, in a lot of cases, fear of examinations.

- **dissertation**

The purpose of a dissertation is to develop students' all round ability in producing a mathematical piece of work, and it is undertaken as an individual project requiring self guided study. As with examinations, most school leavers will have been writing essays, reports and projects over the years immediately preceding their degree course. Some mature and part time students will have been working in professions which require them to construct reports on a regular basis. Others however, particularly those employed in manual or semi-skilled roles, may have very little recent experience of producing an extensive piece of written work. For many students there is another cause for concern, as they have deliberately chosen a conventional degree course rather than studying with the Open University because they preferred the structure of weekly lectures to a model based on self guided study. The dissertation is the one element of the course which has no regular class contact.

It is important that course design allows for the development of the skills necessary to undertake a dissertation, in order that the mature and part time students can compete on equal terms with younger students. The following list gives some of the useful ideas which were mentioned. Many of these points are good dissertation practice in any case, but they are often particularly helpful to mature and part time students.

  - Some of the earlier modules should prepare students for report writing.
  - A library of dissertations completed by earlier students should be available for consultation.
  - Students should be encouraged to make an early start.
  - Care should be taken that students have a topic that interests them.
  - Lecturers in preceding modules could highlight possible dissertation topics.
  - A detailed dissertation guide should be provided.
  - Regular contact between supervisor and student of around 15 to 20 minutes a fortnight should be maintained.

- **the lecture room environment**

It is recognised that lectures cannot be organised exclusively for the comfort and convenience of mature and part time students, and that compromises have to be made with regard to the available facilities. However, in the context of this report it is worth giving a description of the 'ideal' lectures which would match the consensus of the views of the students.

Lectures should take place in a traditional classroom style setting. Ideally there should be around 15 to 20 students in a relaxed and friendly atmosphere, which encourages interactive teaching. Large lecture theatres are not felt to be appropriate.

While mature students are not seeking a class exclusively made up of their peer group, they would feel socially isolated, and intimidated about asking questions, in a group made up principally of younger students.

A 'classroom' environment, and the use of blackboards, provides comfortable and familiar surroundings. The use of IT and smart board technology is generally less reassuring to mature students, and in any case these are felt to be less suitable tools for teaching mathematics. The most important accessory in the classroom is a minimum of two blackboards, enabling the lecturer to demonstrate the mathematical arguments and to respond to questions by developing ancillary work.

- **library and computing facilities**

Mature and part time students generally require the same support from library and computing facilities as other students, but the emphasis on which aspects of the facilities are most important will naturally be different. The following topics were often mentioned by students:

Part time and mature students will not usually have accommodation on campus where they can work between lectures or work with other students. It is therefore vital that there should be quiet areas for individual study, and provision should be made for small rooms for informal group work. The provision of a social learning zone, an open space allowing work discussion and social interaction, is a useful facility.

A good selection of text books is required with various loan periods and multiple copies available. Library staff should be as aware of the needs of part time and mature students as the lecturing staff, particularly in the case of part time students who have limited time on site. Open internet access to the library catalogue and the enabling of online reservation and renewal is very helpful.

One particular reference text that is useful to mature students is a Mathematics Dictionary!

- **support group**

Some students suggested that it would be useful to have a forum in which final year students could discuss their experiences with first year students in an informal way. There may be a variety of topics where the advice of graduates could supplement the guidance given by staff. For example, graduates often stated that taking their modules in a slightly different order would have provided a more enjoyable and rewarding programme and this experience could be usefully passed on to new students.

- **graduation ceremony**

It is likely that mature students will have a different attitude to the graduation ceremony from that of most of the younger students. For many it will be an event of particular significance. The view was expressed that the graduation ceremony should be an opportunity to publicly acknowledge the sacrifices made by students and families as well as the achievement of a qualification after a number of years of study. The ceremony should be formal in nature and professionally conducted. It was also felt to be important that it should be clearly indicated within the ceremony that the student had been awarded a degree in mathematics.

## Students from another institution

In order to test how far the findings from interviews with University of Bolton students could be generalised, a group of 8 mature students from Sheffield Hallam University were interviewed in a similar manner. The Sheffield Hallam students expressed very similar views to those from Bolton, particularly in relation to their reasons for returning to study, their choice of mathematics and their personal objectives.

There were several key differences in the experience of the Sheffield Hallam students which may have influenced their responses:

Students had gained places on the degree course after taking a Foundation Year (Year 0) course at Sheffield Hallam. Unlike the Polymaths programme, the Sheffield Hallam Foundation Year is not wholly mathematical, but included a reasonable proportion (approx 30%) of mathematics. It was commented by the students that a purely mathematical course would have been ideal.

All of the students interviewed were full time and appeared to be fully integrated into university life. They attended throughout the week for lectures and tutorials. One student had relocated to Sheffield Hallam and another had found accommodation in halls of residence.

At Sheffield Hallam, the mathematics degree programme is located within the Department of Engineering and Mathematics. The content at Sheffield Hallam is more biased towards computing and applications than the Bolton course, with modules including mathematical modelling, business mathematics, optimisation methods and digital signal processing.

As noted above, the views of the Sheffield Hallam students were very similar to those of the Bolton students. Some areas in which there were differences of emphasis were:

Although finances were again a major issue, some of the organisations and processes which the students had to deal with were different. The various agencies and application procedures were irksome to all students. The lack of communication and the grey areas between the boundaries of these agencies were frequently highlighted.

It was noted that a particular item of good practice is that a number of the modules are project based, and this was seen as providing greater experience and confidence for the final year dissertation than had been the case with the Bolton students. The dissertation has an assessment weighting of 1.5 times that of a standard module.

It was clearly evident to the interviewer that the findings from Bolton had been reinforced by the students at Sheffield Hallam. The students felt that they were treated by staff as mature individuals each with different personal circumstances and varying previous experience.

# Conclusions and recommendations

A number of desirable features for a mathematics degree programme for mature and part time students emerged in the course of the interviewing process and these were described above. While some of these might have been anticipated in advance of the process, others were not so predictable.

What is clear is that although a "standard" mathematics degree programme aimed predominantly at a cohort of 18 year old school leavers might be able to accommodate a number of full time mature students, it is unlikely to be suitable for part time mature students. Ideally a course for mature and part time students should exist as an independent entity, although it is appreciated that resource constraints are likely to make this approach untenable. Although the views of younger students were not gathered in this research, there does not appear to be any reason why a degree course designed around the needs of mature and part time students should not also include a substantial cohort of 18 year old school leavers. Indeed, it may be the case that for those of this cohort who are living at home and commuting to university, or for others who may for some reason find the environment of a traditional mathematics department uncomfortable, joining a course of predominately older students may be more acceptable.

It must be recognised is that in order to succeed with mature and part time students, a greater level of support may be required than that provided for traditional students.

The following are given as good practice guidelines for institutions of higher education wishing to offer degree provision in mathematics to mature and part time students. These seek to focus only on those issues which are specific to these categories of students. Naturally, there are some issues which would apply equally well to students of any academic discipline. Only the most significant areas have been highlighted here. Further recommendations can be found in the discussion given above.

- The availability of a flexible access programme is a major factor in attracting adult returners. Additional support in the specific curriculum area of calculus is also an important requirement.
- The course structure should be sufficiently flexible to enable students to switch between full time and part time modes of study as their circumstances dictate.
- An essential programme design feature is that the timetable should be structured to facilitate attendance by mature and part time students. It should be possible for part time students to take the course entirely in the evenings, and it is helpful if full time students have the option to do some evening classes. Lectures and tutorials should be grouped so that students are **not** required to attend a large number of short sessions spread throughout the week. The course calendar should be published up to three years in advance.
- As much flexibility as possible should be built into the structure of the course with regard to the order in which the modules or lecture courses are taken, in order to help students to fit the course in with their other commitments.

- Particularly for part time students, there should be the availability of intermediate qualifications when circumstances dictate that the full honours degree course cannot be completed.
- Mature and part time students appreciate a relatively informal environment with classes of modest size, in which the majority of students are mature.
- In recognition of the attendance difficulties likely to be faced by mature and part time students, it is important that comprehensive notes, exercises and solutions are provided, ideally in advance.
- It is accepted that financial issues faced by all students are extremely complex and involve many different agencies. Given, however, that this is certainly the most important non-academic issue that students have to face, and that mature students do not have access to the support and information provided by schools to 18 year olds, it is essential that institutions provide a dedicated financial advice service which can provide a “one stop shop” approach.

# References

[1] Robinson, M, Challis, N and Thomlinson, M, “Accessibility of Mathematics Degrees to Adult Returners”, Sheffield Hallam University, 2009

[2] Robinson, M, Challis, N and Thomlinson, M, “The future of Polymaths”, Mathematics Today, **45**, June 2009

[3] Steele, N, “Keeping HE Maths where it counts”, The Council for the Mathematical Sciences, June 2007

# Appendix – Demographics of the sample of Bolton students

**Number of graduates and current students**

| | | sex | |
|---|---|---|---|
| | | male | female |
| status | graduate | 15 | 8 |
| | student | 1 | 7 |
| | withdrawn from degree | | 1 |

**Ethnic origin**

| | ethnic origin |
|---|---|
| | Count |
| White British | 25 |
| Indian or Pakistani | 4 |
| Other Asian | 2 |
| Black Caribbean | 1 |

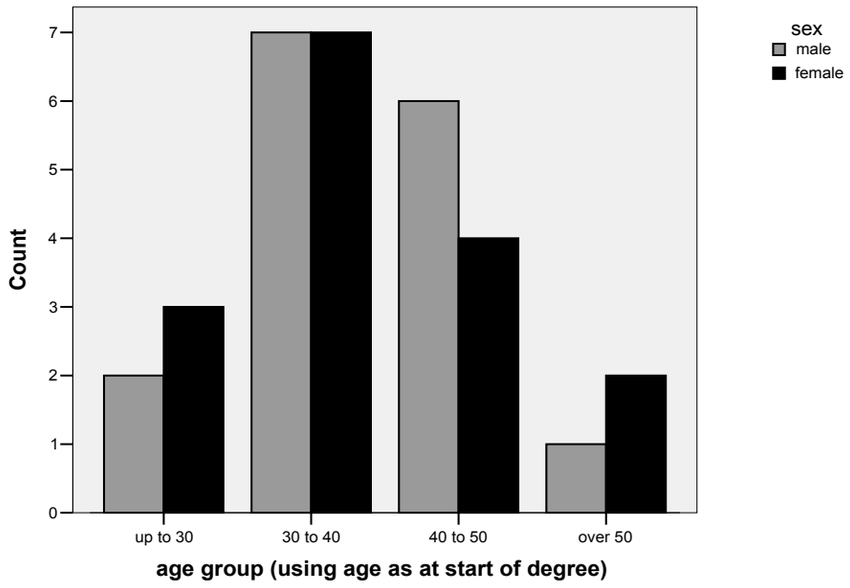
**Mode of attendance**

| | | sex | |
|---|---|---|---|
| | | male | female |
| full time or part time | full time | 10 | 13 |
| | part time | 6 | 3 |

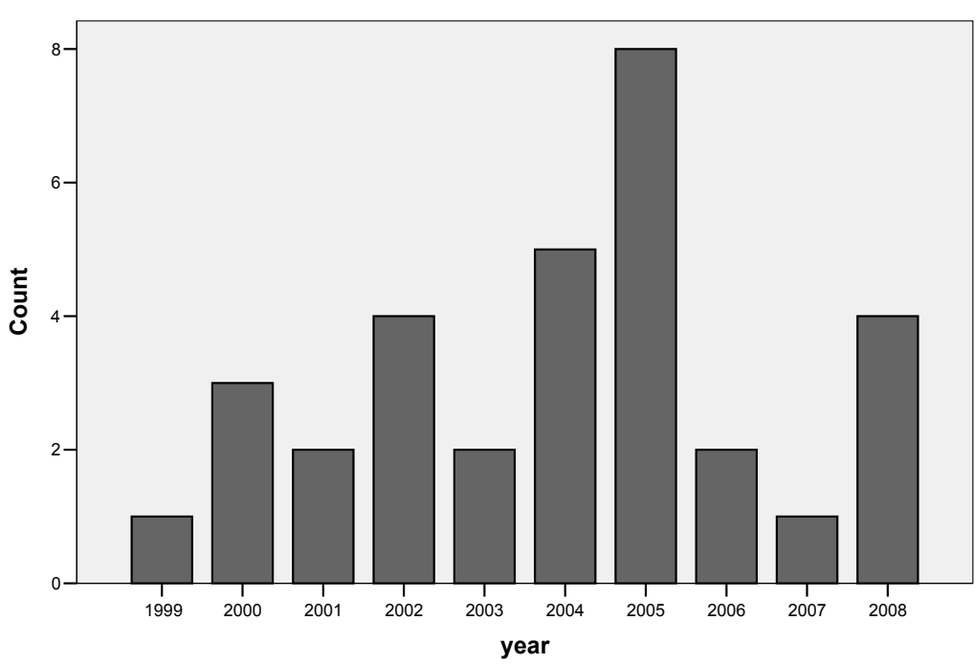
**First destination after graduating**

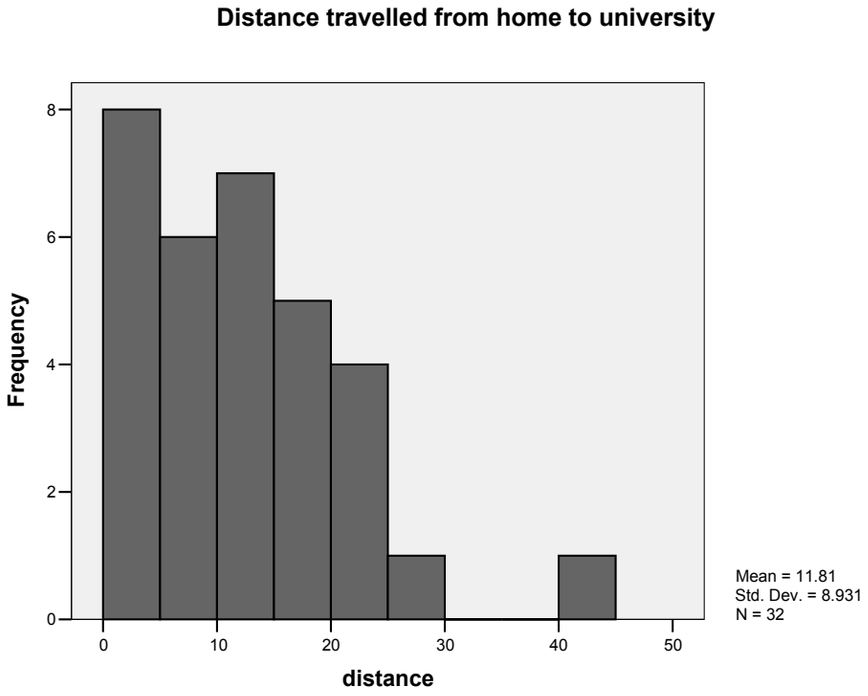
| | | sex | |
|---|---|---|---|
| | | male | female |
| first destination | PGCE or PGDE | 8 | 7 |
| | Other postgraduate course | 3 | |
| | Continuing current employment | 3 | |
| | Other employment | 2 | 1 |
| | Retired | | 1 |

**Distribution by age and gender**




**Year of entry on to the degree**




Distance travelled from home to university
Frequency
8
6
4
2
0
0
10
20
30
40
50
distance
Mean = 11.81
Std. Dev. = 8.931
N = 32