

# **Student perception of the impact of mathematics support in higher education**

E. Ní Fhloinn<sup>1\*</sup>, O. Fitzmaurice<sup>2</sup>, C. Mac an Bhaird<sup>3</sup> and C. O'Sullivan<sup>4</sup>

<sup>1</sup>*School of Mathematical Sciences, Dublin City University, Dublin, Ireland*

<sup>2</sup>*Department of Mathematics and Statistics, University of Limerick, Limerick, Ireland*

<sup>3</sup>*Department of Mathematics and Statistics, National University of Ireland Maynooth, Maynooth, Ireland*

<sup>4</sup>*Department of Mechanical Engineering, Institute of Technology Tallaght, Dublin, Ireland*

\*eabhnat.nifhloinn@dcu.ie

***This is an Accepted Manuscript of an article published by Taylor & Francis in International Journal of Mathematical Education in Science and Technology in 2014, available online:***

**<http://www.tandfonline.com/10.1080/0020739X.2014.892161>**

## **Student perception of the impact of mathematics support in higher education**

Mathematics support in higher education has become increasingly widespread over the past two decades, particularly in the U.K., Ireland and Australia. Despite this, accurate evaluation of mathematics support continues to present challenges for those working in this area. This is because ideally, properly-structured support should function as an integral part of the overall educational experience of the student, in tandem with lectures and tutorials. When this occurs it makes it difficult to isolate the impact of mathematics support from these other entities. In this paper, the results of a large-scale nationwide survey conducted with first-year service mathematics students in nine higher education institutes in Ireland are considered, exploring students' perceptions of the impact of mathematics support upon retention, mathematical confidence, examination performance and overall ability to cope with the mathematical demands they face. Students were extremely positive about the effectiveness of mathematics support in all of these areas, in particular providing valuable insights into the higher student retention rates that can be attributed to support in mathematics.

### **1. Introduction**

Over the past two decades, mathematics support has become increasingly widespread across the U.K, Ireland and Australia, with support services of various kinds now operating in the majority of higher education institutions [1, 2, 3]. Mathematics support generally takes the form of mathematics support centres, whose main aims are *“to address issues surrounding the transition to university mathematics and to support students' learning of mathematics and statistics across the wide variety of undergraduate courses that require an understanding of mathematical concepts and techniques.”* [4, p. 3] However, evaluation of mathematics support remains a complex task, as noted by Lawson et al: *“It is very difficult to establish that the Mathematics Support Centre has been the key reason behind the retention of any particular student.”* [5, p.17] This is because the most effective support mechanisms should function within an overall model including lectures, tutorials and additional support sessions as needed,

so it is challenging to isolate the effects of support on its own.

Numerous studies have been done to-date, mostly on a small scale, which attempt to quantify the impact of mathematics support in a quantitative manner, focussing upon examination performance within particular class groups or universities, and comparing performance with incoming mathematics level and subsequent usage of mathematics support [6, 7, 8, 9]. Other studies have focused on more qualitative information, such as staff and student feedback within individual universities, generally through the form of anonymous surveys [e.g. 10, 11]. More recently, Gillard et al [12] reported on the results of an email survey to staff members involved in the provision of mathematics support in the U.K. A total of 21 higher education institutions responded in this case, giving an overview of the measures they employ to determine the effectiveness of their support; all responses were completed by staff members without student consultation. A very detailed review of the most significant work done in the area of the evaluation of mathematics support can be found in [13].

Evaluation of mathematics support is important for a number of reasons, both in terms of ensuring that the service provided improves the overall mathematical level and knowledge of students, as well as justifying the financial outlay for higher education institutes who run such a service. As noted by Green, “*(e)vidence that a centre improves retention is a powerful weapon.*” [14, p. 13]. However, a large-scale study on retention conducted in the U.K. which asked students who dropped out of college for their reasons for doing so found that “*(v)ery many of the responses... indicate that withdrawal was the result of a combination of circumstances, rather than attributable to a single cause.*” [15, p. 25], again indicating the complexity of the issue. However, in an Irish context, a recent national report on retention in higher education noted that “*mathematics is the strongest predictor of successful progression among higher*

*education students*” [16, p. 28]. The national average “non-presence” rate in higher education courses is 15%, but this rises to 20% in Engineering and 27% in Computer Science, and “*previous studies have presented evidence of particular difficulties with progression and completion in the STEM group of disciplines which have been identified as critical for sustaining the national economic development and for attracting foreign direct investment*” [16, p. 25].

The importance of students’ confidence in their own ability in mathematics is now recognised as a key feature in their overall performance:

There is growing evidence of the importance of students’ attitudes and beliefs about mathematics for their achievement in and successful applications of the subject... Typically, it is confidence in one’s own mathematical ability that is correlated with achievement rather than liking or pleasure in the subject [17, 2003].

An investigation [18] into the impact of first-year engineering students’ confidence in their ability in mathematics upon their subsequent performance in examinations found a significant difference between the marks achieved by students with different confidence levels, and concluded that “having attended to the mathematics syllabi, lecturers could seek to boost student confidence in their ability in mathematics as a further means to improve student performance at university.” [18, p. 53] The same study found that engagement with mathematics support generally improved the marks of students with lower qualifications upon entry to the course.

As a result, there are four main research questions which we seek to address in this paper:

- (1) Do students report that mathematics support has an impact upon student retention?

- (2) Do students perceive an improvement in their mathematical confidence as a result of mathematics support?
- (3) Do students feel that mathematics support impacts upon their examination performance?
- (4) As a result of mathematics support, do students feel that they are better able to cope with the overall mathematical demands of their course?

## **2. Methodology**

The Irish Mathematics Learning Support Network (IMLSN) was established in 2009 to act as an informal focus point for those interested in the provision of mathematics and statistics support in higher education in Ireland [19]. Committee members are drawn from a range of higher education institutions from around the country. In order to ascertain student usage, experience and perceptions of mathematics support, the committee decided to conduct a nationwide survey of first-year students on this issue. Surveys which had been in use within institutions to assess the success of mathematics support were collected from all IMLSN members, and questions from these were collated and adapted to form the basis of the nationwide survey. It was designed to be anonymous and paper-based, with a variety of multiple-choice and open-ended questions. There were 17 questions in total (see Appendix A). A pilot was conducted with approximately 100 students from four different institutes, and the survey was duly modified as a result of findings from the pilot.

In February 2011, the survey was emailed by IMLSN committee members to a representative within each higher education institution in Ireland. They were invited to print out the survey, arrange for it to be given to any first-year students who were studying at least one service-mathematics module, and return the completed surveys for analysis. As a result, the survey was carried out in nine higher education institutions,

with five universities and four institutes of technology taking part, from a possible total of seven universities and fourteen institutes of technology in Ireland<sup>1</sup> [20]. The universities involved were Dublin City University (DCU), National University of Ireland Galway (NUIG), National University of Ireland Maynooth (NUIM), University College Dublin (UCD) and University of Limerick (UL). The institutes of technology involved were Institute of Technology Blanchardstown (ITB), Institute of Technology Carlow (ITC), Institute of Technology Tallaght (ITT) and Institute of Technology Tralee (ITTRA). The survey was completed by 1633 first-year students. The breakdown of responses from each institute can be seen in Table 1 [Table 1 near here]. It should be observed that the number of first-year service mathematics students in each institute varies considerably, and not all institutes target all first-year service mathematics students in their provision of mathematics support. However, based on the number of first-year students registered in relevant discipline areas for that year [21], a minimum overall response rate of 25% for universities and 28% for institutes of technology can be calculated for the survey.

The responses from the survey were collated in SPSS and the open questions analysed using General Inductive Analysis (GIA) [22], an approach to Grounded Theory data analysis. As a result, the main themes within comments made for each question were identified. A small number of comments did not fall under any of the main themes identified and were not considered further. This analysis was conducted independently by each of the four authors and the results compared to ensure reliability.

---

<sup>1</sup> At undergraduate level universities focus on Level 8 (Honours Degree programmes). Institutes of technology emphasise career-focused higher education offering level 8 programmes but also programmes Level 7 (Ordinary Degrees) and Level 6 (Higher Certificates).

[<http://www.heai.ie/content/2001>]

### **3. Analysis of results**

For the scope of this paper, five questions from the survey were analysed in detail.

These aimed to address our four research questions, relating to the impact of mathematics support upon student retention, confidence in mathematics, performance in mathematics, and the ability of the student to cope with mathematical demands of their course. It should, of course, be noted that this is self-reported data based on students' perception of this impact. In addition, these questions were applicable only to students who had used the mathematics support services in their higher education institute, a total of 586 from the 1633 respondents. While there was a variation in the number of students attending mathematics support in each institute (based largely upon the size of the institute in question), the pattern of responses to each question was similar within each institute, so the results that follow may be taken to be representative of all.

#### ***3.1 Dropping out of chosen course due to issues with Mathematics***

Students were asked:

*“Did you ever consider dropping out of your course/college because of mathematical difficulties?”*

This question relates to our first research objective, namely to explore if students perceive that mathematics support has an impact upon retention. This question was deliberately only asked of students who had used mathematics support, as the aim was to link it to the subsequent question about the potential impact of mathematics support, rather than to investigate retention issues in a wider sense. There were 573 responses to this question, of whom 125 (21.8%) said that they had considered dropping out due to mathematical difficulties. Of these, 51.2% were male and 48.8% were female, while 20% were mature students (defined as a student who is 23 years of age or older upon

entry to college). 8.8% had done Higher Level Leaving Certificate Mathematics<sup>2</sup> while 81.6% had done Ordinary Level. There is an association between Leaving Certificate level and considering dropping out with a  $p$ -value  $< 0.001$ . A total of 468 of the respondents were attending a university, with the remainder attending institutes of technology.

There were 135 additional comments made by students in relation to this question, and the most common themes are shown in Table 2. [Table 2 near here]

### *Difficulty of Mathematics*

This was the most common theme running through the students' comments, both for those who considered dropping out and those who did not. 56% of comments under this theme were made by students who considered dropping out due to mathematical difficulties, with statements such as "*I am finding maths exceedingly difficult in comparison to my other subjects*" and "*It is very time consuming – I didn't realise how difficult it was going to be.*" All but two of the students who commented thus had taken Ordinary Level mathematics. However, even for students who did not consider dropping out, the difficulty of their mathematics module was frequently mentioned, with comments such as "*Didn't consider dropping out but I do find 3rd level maths very hard!*" and "*But still didn't realise it would be so difficult.*"

### *Overcame difficulties due to mathematics support*

This theme was far more prevalent among students who had not considered dropping

---

<sup>2</sup> The Leaving Certificate is the terminal examination taken by students at the end of secondary school in Ireland. Mathematics must be taken by all students and is offered at three levels, Higher, Ordinary and Foundation.

[<http://www.examinations.ie/index.php?l=en&mc=ca&sc=sb>]



out with such students making 76% of the comments under this theme. These students tended to admit to mathematical difficulties but felt that they had received sufficient mathematics support so that they felt they could cope: *“Because I got good help I didn’t need to worry about dropping out.”* Others felt they had ongoing mathematical difficulties, but these were being adequately managed through mathematics support: *“I had difficulties with maths and still do but the MSC (Maths Support Centre) helped me a lot and made me think to do maths next year.”* Others mentioned that, without mathematics support, they would have been more likely to consider dropping out: *“I hadn’t considered it but I know if the MSC wasn’t there I probably would have considered it.”* Students who considered dropping out were quite explicit in their credit for the impact that mathematics support has had for them: *“I thought I would really struggle but the extra support is just excellent!!”* and *“The MSC helped me get over this”*.

#### *Fear of failure/Worried*

A theme which was almost equally prevalent among the two groups was that of a fear of failing their mathematics examinations, or general expressions of anxiety and nervousness regarding mathematics. Some students stated that *“I’ve considered dropping out because I’m worried about failing my maths exam in May”* or *“I’m finding the maths aspect of the course very difficult and fear that I may fail in the summer exams.”* Another student observed: *“Was always scared of maths.”* Some credited mathematics support with removing these worries: *“But did worry about failing maths before using these facilities”* While others felt failure was an ongoing concern *“However, I do fear failing this module in the summer and the repeats also.”*

### *Falling behind*

Under this theme, 80% of the comments came from students who had considered dropping out due to mathematical difficulties. One student quite simply stated:

*“Sometimes I feel I am falling behind.”* Others identified specific reasons such as:

*“When you miss a class it’s difficult to catch up”* and *“Unless you walk straight out of school into college it can be extremely frustrating to catch up.”* Another student, who had considered dropping out, had also considered *“repeating the year because I couldn’t catch up.”*

### *Problems with lectures/lecturers*

There were surprisingly few comments that fell under this theme, with only 4.4% of comments making any direct reference to lectures or lecturers. A couple of students mentioned how quickly material was covered: *“Lectures covered fast at times and a lot of other work needed to be put in”*. A couple of students also criticized their lecturers:

*“The maths is very hard and not explained very well”* and *“Some of the teachers weren’t the best at their jobs.”*

### *Gap between secondary and higher education*

Only 4.4% of comments fell under this theme, with this small number of students all drawing attention to the gap between the Ordinary Level Leaving Certificate material and that which they covered in college: *“The maths level from ordinary leaving [Leaving Certificate] to the maths I’m doing now is a big step up.”* One student mentioned the difficulty adjusting to this level: *“Find it hard to adjust from ordinary level [Leaving Certificate] maths to college maths”* while another linked feelings of fear of failure and anxiety to not having completed the Higher Level (“honours”) course at Leaving Certificate level: *“I feel intimidated as I didn’t do honours and have the*

*mind set that I'm going to fail my maths module".*

### **3.2 Impact of mathematics support on not dropping out of chosen course**

Students who answered that they had considered dropping out due to mathematical difficulties were then asked:

*"If yes, has mathematics support influenced your decision not to drop out?"*

Again, this relates to our first research objective. 125 students were eligible to answer this question, based on their previous answer, and 110 of these did so. 69 students (62.7%) felt that mathematics support had influenced their decision to not drop out. Of these, 46.3% were male and 53.6% were female, while 24.6% were mature students. 7.2% had done Higher Level Leaving Certificate mathematics while 82.6% had done Ordinary Level, but there was no significant association between Leaving Certificate Level and the influence of mathematics support on not dropping out, with a  $p$ -value = 0.452. There were 91 respondents from universities, with the remainder from institutes of technology.

There were 41 additional comments made by these students. The most common themes that emerged in these students' comments related to the encouragement students received in mathematics support: *"Encouraged me to trust that my worries were normal and that practice would improve me"*; the increase in their understanding of mathematics as a result of mathematics support: *"Greatly! It's the reason I'm still here. It has helped me to understand"*; the importance of the individualised support: *"It seems more doable when explained one-to-one"*; the positive impact mathematics support had on their confidence: *"Gave me more confidence because I knew I had help"*; and their changed attitude towards mathematics: *"Maths isn't scary anymore."*

### ***3.3 Confidence in mathematics***

Students were also asked to rank how mathematics support had helped their confidence in mathematics, with a five-point scale from “Not at all helpful” to “Extremely helpful”. This question aimed to address our second research objective, exploring how students view any possible impact from mathematics support upon their mathematical confidence. There were 541 responses to this question, and the results are shown in Figure 1 below. [Figure 1 near here]. 56.01% of respondents felt that mathematics support had been “helpful” or “extremely helpful” to their confidence in mathematics.

106 respondents made additional comments, which fell broadly into the categories outlined in Table 3 below. [Table 3 near here]

#### *Very helpful /good to know it's there*

The most prominent theme in these comments (with 32% of comments falling into this category) was that of students mentioning how helpful they found mathematics support and how *“I know that if I don't understand something in class that I can always go there.”* Most of these found mathematics support to have been helpful or extremely helpful to their confidence, although some were neutral, with comments such as *“Very helpful – just have a slow understanding of maths.”*

#### *Made maths/exams/assignments doable*

Students identified mathematics support as having made mathematics in general more doable: *“Made me see that it is not impossible to grasp a particular mathematical task but that it takes practice and time”* with some commenting specifically on the approach used to achieve this: *“Instead of just giving you the answer the MSC helps you and makes you get the answer yourself - when you see this is possible it increases confidence.”* Others linked their increased confidence specifically to examinations or

assignments: *“I feel confident with the material as far as how and when to apply it in exams and homework.”*

#### *Understanding improved*

Students in this category (all of whom felt that mathematics support had been helpful or extremely helpful to their confidence) specifically mentioned an improvement in their understanding of mathematics. Some students restricted their comments to the specific topic in which they received support: *“They answered all my questions very clearly and my understanding of that topic of maths increased”* while other students felt the impact across a range of mathematical topics: *“Tutors help me understand concepts that I can then apply to other maths problems”* or in their ability to comprehend what was being asked: *“It helped me to understand questions and not to be afraid of attempting them.”*

#### *Weak at maths/not confident*

Respondents in this theme displayed low confidence in their mathematical ability in their comments: *“I’m just not the best at maths”* and *“Still would never say I’m confident whilst doing maths.”* A couple of these students found mathematics support *“no help”*, while others felt that *“I’m still not very confident doing it on my own but it has helped.”*

#### *Didn’t go enough*

These students all felt that mathematics support had been *“not at all helpful”* or *“not helpful”* to their confidence in mathematics, but identified the reason for this being that they had not used the services enough: *“Only availed of the service twice this year so it hasn’t really influenced me greatly”* and *“Have only gone twice and only helped with specific question – not maths in general.”*

### *Confidence not an issue*

While looking at the perceived impact upon students' confidence in mathematics, it must of course be borne in mind that some students who chose the "Not at all helpful" option may have done so because "*I was already confident*". Six of the comments fell into this category, with one suggesting nonetheless that "*I was always confident in maths but now it's easier to look and ask for help.*"

### **3.4 Performance in mathematics**

In the next question, students were asked to rate how mathematics support has impacted upon their mathematics performance in tests or examinations to date, with a five-point scale from "No impact at all" to "Has had a large impact". Here, our third research objective was explored, aiming to ascertain students' opinions of the effects of mathematics support upon their assessment performance. There were 528 responses to this question, and the results are shown in Figure 2 below. [Figure 2 near here]. 56.25% of respondents felt that mathematics support has had some or a large impact on their mathematics performance.

There were 103 additional comments made by students in relation to this question, and the most common themes to emerge are summarised in Table 4 below.

[Table 4 near here]

### *Grades improved*

Due to the phrasing of the question, a large number of students made direct reference to the improvement in their grades as a result of mathematics support. Some simply gave the percentage improvement: "*Went up 20% - Whoo!!*" while others expounded on the reasons for this improvement: "*Has helped me get better grades by helping me with things I was having trouble with.*" Several students expressly stated that they would

have failed their mathematics modules without mathematics support: *“I would have failed if the extra help had not been there.”*

#### *Very helpful*

As before, the majority of respondents making comments under this theme felt that mathematics support had had some or a large impact on their performance, and the comments were largely uniform: *“It has helped no end and the only problem is I’d like to be able to make more use of it”* and *“Great for the questions I was stuck in”*. A small number of students mentioned that, although mathematics support had improved their performance overall, they failed overall: *“Helped me with one exam but I still failed”*.

#### *Useful for assignments*

Although this theme overlaps with several of the other themes, it is worthy of some separate reporting due to the number of students who expressly mentioned the ongoing support they received with assignments and the overall impact this had. Some of these students mentioned not being able to attempt or complete assignments without mathematics support: *“Helped a lot with assignments that I may not have been able to do by myself.”* Others mentioned help with assignments in relation to their overall grade: *“Has helped me get through my assignments throughout the year which adds to continuous assessment.”*

#### *Understanding improved*

Again, students mentioned an improvement in understanding and confidence here, this time relating this to an improved overall performance in assessments: *“They have given me more confidence which came through in the exam”* and *“It has helped me to understand methods quicker than I otherwise would be”*.

### *Didn't go enough*

As in the previous question, some students felt there had been little impact due to the fact that they did not attend very much. Some indicated that they should have attended more than they did: *“Need to attend MLC more”* while others stated that they did not need the additional support frequently: *“I rarely use it. Usually do maths by myself.”*

### *Results unknown*

A number of students responded that they had not had any assessment in mathematics thus far (*“No exams undertaken to date”*), or else were unaware of the results (*“Don't know – still have no results!”*) and thus, were unable to answer this question accurately.

### **3.5 Mathematical Demands of Course**

Finally, students were asked how they felt that mathematics support had helped them to cope with the mathematical demands of their course, with a five-point scale from “No help at all” to “Has been a huge help”, in an attempt to address our final research objective. 532 students responded to this question and the results are given in Figure 3 below. [Figure 3 near here]. 64.85% of respondents felt that mathematics support has been some or a huge help to them with this.

There were 55 additional comments made by students in relation to this question. The theme most commonly featured in these comments was how helpful they found mathematics support, with 30 students directly mentioning this in their comments. Some focused particularly on assignments or specific topics with which they had received help: *“Huge help in completing assignments and my understanding of maths”* and *“It taught me how to draw graphs which come up in all questions”* while others just mentioned its helpfulness in an overall sense: *“The maths in science appears to be quite difficult, so the centre helps me a lot”*. Several students mentioned their fear



that without mathematics support, they would fail their module: *“I probably would be failing really badly without it”*. A small number alluded to the fact that, although they had received help from mathematics support, they still found mathematics challenging: *“It helped a lot, but maths is still so difficult”*.

#### **4. Discussion and conclusions**

In this paper, we have considered students’ perceptions of the impact of mathematics support upon retention, confidence, performance and ability to cope with mathematics, as reported in a nationwide survey in Ireland. It should be noted that the focus here has solely been on responses by students who voluntarily chose to engage with mathematics support. As observed by Green:

When investigating the impact of a service to students, such as mathematics and statistics support, there is the danger of confusing *impact* with *student satisfaction*...Finding out what perceived benefits visiting a centre brings is clearly important – getting much closer to “impact” than just asking why the student came or what resources were used. [14]

By asking specifically about these “perceived benefits” and subsequently applying General Inductive Analysis to the many open-ended responses given to the questions, key themes that emerged in each area were identified. Overall, the results are extremely positive regarding the impact of mathematics support and provide us with large-scale, first-hand evidence of student experience of these services.

In terms of our first research question, exploring whether mathematics support impacts upon student retention, the responses reported in sections 3.1 and 3.2 provide us with valuable insights into the student mindset after one semester of first-year service mathematics. Green observes that *“(p)roving irrefutably that support has prevented drop-out (usually through averting failure) is very difficult to achieve”* [14, p. 13];

however, by asking students mid-way through their first year, we found that more than a fifth of respondents had considered dropping out of their course due to mathematical difficulties at this point, with many citing the overall difficulty of the subject as well as its time-consuming nature for this. Fear of failure also came through as a strong concern for these students. This aligns with the results from Yorke's major study on retention in the U.K. [15] in which "*concern about their study skills*", "*feelings of not making adequate academic progress*" and "*failure of assessments*" were all cited as significant issues for students who dropped out in the period after Christmas of first year.

It is striking that twelve students volunteered the information that, as a direct result of the effectiveness of mathematics support for them, they did not consider dropping out, suggesting that without support, the overall figure thinking of dropping out would be notably higher. These are students who may not otherwise have featured in our retention study and illustrate the value of posing this question to a large cohort of students. It is also positive to observe that over 60% of respondents who had considered dropping out felt that mathematics support had influenced their decision to stay in their course. Despite the difficulty of evaluating the many factors that impact upon student retention, this is clear evidence that these students themselves identify mathematics support as an important lifeline during the vulnerable initial months of their university careers.

Several themes overlapped significantly in students' comments in relation to our three other research questions, relating to the impact of mathematics support upon students' mathematical confidence, performance and ability to cope, notably the helpfulness of mathematics support (common to responses in all three questions); the fact that students felt their understanding improved; that it was useful for examinations and assignments; and the fact that some students felt they had not used the service

enough (all common to the first two questions). This overlap in themes is not unexpected, given the prior work done by Parsons [17] showing a link between increased confidence and improved performance; students frequently made comments under similar themes for more than one question. In addition, it is worth noting that over 75% of students who answered positively for one of these three questions also answered positively for the other two. Similarly, approximately 60% of those who answered negatively in one area answered negatively in the other two.

Most students did not directly address the issue of the overall mathematical demands of their course in their comments, focusing instead on their particular mathematics module, but this was possibly due to students' inability at this early stage of their college career to identify mathematical elements within other modules, or to the fact that the mathematics being covered at this point will not be used in other modules until later years.

Strongly present in comments across all five questions from the survey which were analysed for this paper was the students' fear of failure in mathematics, with responses ranging from those who were considering dropping out as a result to those who credited mathematics support with the reason they no longer considered themselves to be at risk of failing. It should be stated at this point that there are, of course, limits to what mathematics support can achieve, and the problem of engaging at-risk students with support at an early enough stage in the academic year (or indeed, at any point) is an ever-present one [23]. However, the results of this survey strongly indicate that students identify mathematics support as having a positive impact on their mathematical experience.

## **Appendix A: Mathematics Support Survey**

We are looking for your feedback on the Mathematics Support Centre (MSC) and its

services. This evaluation is designed to help us to improve the MSC for you and other students. Even if you have not used the MSC's services, your feedback is important.

### Section A

1. Degree Programme:
2. Year: **Certificate**    **1<sup>st</sup> year**    **2<sup>nd</sup> year**    **3<sup>rd</sup> year**    **4<sup>th</sup> year**    **Postgrad**  
 Student Category:    **Full-time**                      **Part-time**
3. Gender:                      **Male**                      **Female**
4. Leaving Certificate Mathematics Level (if applicable):  
**Higher**                      **Ordinary**                      **Foundation**                      **Other**
5. Leaving Certificate Mathematics Grade (if applicable):  
**Leaving Cert 1991 or before:**                      A    B    C    D    E    Other  
**1992 or after:** A1    A2    B1    B2    B3    C1    C2    C3    D1    D2    D3    Other
6. If you started off doing Leaving Certificate Higher Level Mathematics, but changed to Ordinary Level, roughly when did that happen? (Please circle)  
**Before Christmas in 5<sup>th</sup> year**                      **Before the end of 5<sup>th</sup> year**  
**Before Christmas in 6<sup>th</sup> year**                      **After the Mocks in 6<sup>th</sup> year**    N/A
7. Are you registered as a mature student?                      **Yes**                      **No**
8. Have you used any of the Maths Support Centre's services (drop-in centre, support workshops, online courses)?                      **Yes**                      **No**

If **YES**, please proceed to **Section B**. If **NO**, please proceed to **Section C**

### Section B (Students who used the MSC)

9. Why did you first decide to use the MSC or its services?
10. Being as honest as you can, rate the following services that you have used below on a scale of 1 to 5 where 1 = Not at all Worthwhile and 5 = Extremely Worthwhile  
**Drop-In Centre**                      Comments/Suggestions:  
**Online Courses**                      Comments/Suggestions:  
**Workshops**                      Comments/Suggestions:
11. Did you ever consider dropping out of your course/college because of mathematical difficulties?    Yes                      No    Comments:
12. If yes, has the MSC influenced your decision not to drop out?    Yes                      No

Comments:

13. Rate how the MSC has helped your confidence in maths on a scale of 1 to 5 where **1 = Not at all Helpful** and **5 = Extremely Helpful**. Comments:
14. Rate how the MSC has impacted on your maths performance (in exams/tests) so far on a scale of 1 to 5 where **1 = No impact at all** and **5 = Has had a large impact**.  
Comments:
15. Having used some of the MSC's services, rate on a scale of 1 to 5 how you feel the MSC has helped you cope with the mathematical demands of your course where **1 = No help at all** and **5 = Has been a huge help**.  
Comments:

### Section C (Students who did not use the MSC)

16. If you did not use the MSC, why not? Tick as many reasons as apply:
- I do not need help with Maths
  - I never heard of the Mathematics Support Centre
  - I did not know where it was
  - The times do not suit me
  - I was afraid or embarrassed to go
  - I hate Maths
  - Other (please specify)
- Comments:
17. What would encourage you to use the MSC and its services if you needed to?

### References

- [1] Perkin, G., Lawson, D. and Croft, T. (2012) Mathematics learning support in Higher Education: the extent of current provision in 2012. Available from <http://www.mathcentre.ac.uk/resources/uploaded/52789-mls-in-uk.pdf> [Accessed 22 February 2013].
- [2] Gill O., O'Donoghue, J. and Johnson, P. (2008) An audit of mathematical support provisions in Irish third level institutes, CEMTL, University of Limerick, Available from <http://www3.ul.ie/cemtl/pdf%20files/FullAudit.pdf> [Accessed 22 February 2013].
- [3] MacGillivray, H. (2008) Learning support in mathematics and statistics in Australian universities – a guide for the university sector. Australian Learning and Teaching Council. Available from <http://www.olt.gov.au/resource-learning-support-mathematics-guide-qut-2008> [Accessed 22 February 2013].
- [4] Matthews, J., Croft, T., Lawson, D. and Waller, D. (2012) Evaluation of mathematics support centres: a review of the literature. Loughborough: sigma

- Centre for Excellence in Mathematics and Statistics Support. Available from <http://www.mathcentre.ac.uk/resources/uploaded/52487-evaluation-of-msc-7.pdf> [Accessed 4 March 2013].
- [5] Lawson, D., Croft, T. and Halpin, M. (2003). *Good practice in the provision of mathematics support centres*. [Online]. Available from <http://www.sigmacetl.ac.uk/index.php?section=22> [Accessed 22 February 2013].
- [6] Cuthbert, R. and MacGillivray, H. (2007) Investigation of completion rates of engineering students. *Proceedings of the Sixth Southern Hemisphere Conference (DELTA 07)*, El Calafate, Argentina, pp 35-41.
- [7] Lee, S., Harrison, M., Pell, G. and Robinson, C. (2008) Predicting performance of first year engineering students and the importance of assessment tools therein. *Engineering Education*, 3(1):44-51.
- [8] Mac an Bhaird, C., Morgan, T., and O'Shea, A. (2009) The impact of the mathematics support centre on the grades of first year students at the National University of Ireland Maynooth, *Teaching Mathematics and its Applications: An International Journal of the IMA*, 28(3):117-122
- [9] Dowling, D. and Nolan, B. (2006) Measuring the effectiveness of a maths learning support centre - The Dublin City University experience, *Proceedings of the CETL-MSOR Conference 2006*, 51-54
- [10] Ní Fhloinn, E. (2009) The role of student feedback in evaluating mathematics support centres, *Proc. Centre for Excellence in Teaching and Learning Maths, Stats and OR Network (CETL-MSOR) Conference 2009: Continuing Excellence in Teaching and Learning*, pp. 94 - 98.
- [11] Perkin, G., Pell, G. and Croft, A.C. (2007) The Mathematics Learning Support Centre at Loughborough University – staff and student perceptions of mathematical difficulties, *Journal of the Higher Education Academy Engineering Subject Centre*, 2(1):47-58.
- [12] Gillard, J., Robathan, K. and Wilson, R. (2011). Measuring the effectiveness of a mathematics support service: an email survey. *Teaching Mathematics and its Applications: An International Journal of the IMA*, 30(1): 43-52.
- [13] MacGillivray, H.L. and Croft, A.C. (2011) Understanding Evaluation of Learning Support in Mathematics and Statistics. *International Journal of Mathematical Education in Science and Technology*, 42 (2):189-212
- [14] Green, D. (2012) Gathering student feedback on mathematics and statistics support and provision: A guide for those running mathematics support centres. Loughborough: sigma Centre for Excellence in Mathematics and Statistics Support. Available from <http://www.mathcentre.ac.uk/resources/uploaded/sigma-brochure-for-accf5-finalv1opt.pdf> [Accessed 4 March 2013]

- [15] Yorke, M. and Longden, B. (2008). *The first year experience of higher education in the U.K.* York: The Higher Education Academy. Available from <http://www.heacademy.ac.uk/assets/documents/resources/FYEFinalReport.pdf> [Accessed 5 March 2013].
- [16] Higher Education Authority (2010). *A study of progression in Irish higher education*. [Online] Available from [http://www.heai.ie/sites/default/files/study\\_of\\_progression\\_in\\_irish\\_higher\\_education\\_2010.pdf](http://www.heai.ie/sites/default/files/study_of_progression_in_irish_higher_education_2010.pdf) [Accessed 1 July 2013].
- [17] Ernest, P. (2003) The mathematical attitudes, beliefs and ability of students. *Maths for Engineering and Science* [Online]. Birmingham: LTSN MathsTEAM, Available from <http://www.mathcentre.ac.uk/resources/mathsteam/ernest.pdf> [Accessed 22 February 2013].
- [18] Parsons, S., Croft, A.C. and Harrison, M. (2009) Does students' confidence in their ability in mathematics matter? *Teaching Mathematics and its Applications: An International Journal of the IMA*, 28(2):53-68
- [19] Higher Education Authority (2011). *New entrant reports by institution 10/11*. [Online] Available from <http://www.heai.ie/content/new-entrant-reports-institution-1011> [Accessed 1 July 2013].
- [20] Reference removed to preserve anonymity
- [21] Higher Education Authority (2013). *About HEA* [Online] Available from <http://www.heai.ie/en/node/981> [Accessed 25 February 2013].
- [22] Thomas, D. (2006) A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation*, 27(2), 237 – 246.
- [23] Symonds, R., Lawson, D. and Robinson, C. (2008) Promoting student engagement with mathematics support. *Teaching Mathematics and its Applications*, 27(3):140-149.

| University | # Respondents | Institute of Technology | # Respondents |
|------------|---------------|-------------------------|---------------|
| DCU        | 208           | ITB                     | 34            |
| NUIG       | 90            | ITC                     | 83            |
| NUIM       | 345           | ITT                     | 255           |
| UCD        | 295           | ITTRA                   | 59            |
| UL         | 263           | <b>Total</b>            | <b>1633</b>   |

Table 1: Breakdown of student respondents per higher education institute in the survey.

| Theme   | Comments<br>(Considered<br>dropping out) | Comments<br>(Did not<br>consider<br>dropping out) | Total<br>Comments |
|---|--|---|-------------------|
| Difficulty of Mathematics                           | 23                                       | 18  | 41                |
| Overcame difficulties due to<br>mathematics support | 6  | 19  | 25                |
| Fear of failure/ Worried                            | 11                                       | 10  | 21                |
| Falling behind                                      | 8  | 2   | 10                |
| Problems with lectures/lecturers                    | 6  | 0   | 6                 |
| Gap between secondary and higher<br>education       | 5  | 1   | 6                 |

Table 2: Most common themes in additional comments made by students in response to the question: “*Did you ever consider dropping out of your course/college because of mathematical difficulties?*” ( $n = 135$ )



| Theme                                | Number of Comments |
|--------------------------------------|--------------------|
| Very helpful/good to know it's there | 34                 |
| Made maths/exams/assignments doable  | 21                 |
| Understanding improved               | 16                 |
| Weak at maths/not confident          | 13                 |
| Didn't go enough                     | 12                 |
| Confidence not an issue              | 6                  |

Table 3: Themes identified in student comments in response to the question “Rate how mathematics support has helped your confidence in maths on a scale of 1 to 5 where 1 = Not at all helpful and 5 = Extremely helpful.” (n = 106)

| Theme                  | Number of Comments |
|------------------------|--------------------|
| Grades improved        | 29                 |
| Very helpful           | 28                 |
| Useful for assignments | 18                 |
| Understanding improved | 10                 |
| Didn't go enough       | 7                  |
| Results unknown        | 6                  |

Table 4: Themes identified in student comments in response to the question “Rate how mathematics support has impacted on your maths performance (in exams/ tests) so far on a scale of 1 to 5 where 1 = No impact at all and 5 = Has had a large impact.” (n = 528)

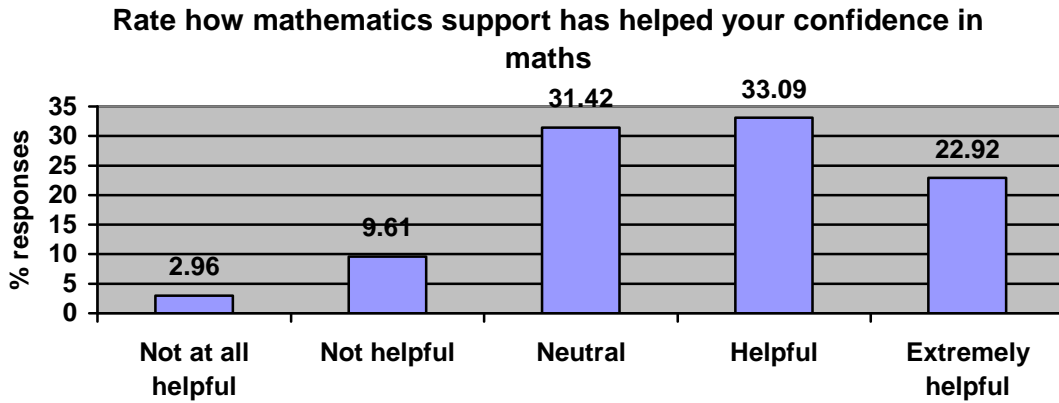


Figure 1: Student responses to the question “Rate how mathematics support has helped your confidence in maths on a scale of 1 to 5 where 1 = Not at all helpful and 5 = Extremely helpful.” (n = 541)

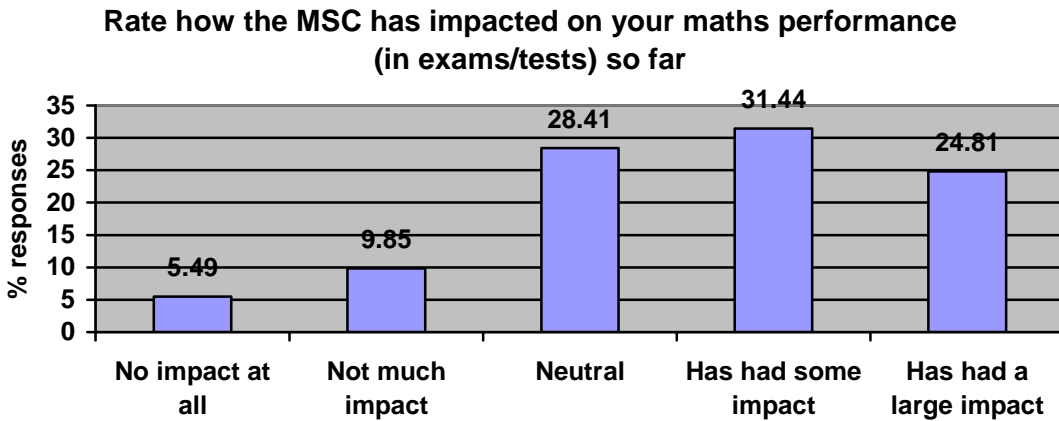


Figure 2: Student responses to the question “Rate how mathematics support has impacted on your maths performance (in exams/ tests) so far on a scale of 1 to 5 where 1 = No impact at all and 5 = Has had a large impact.” (n = 528)

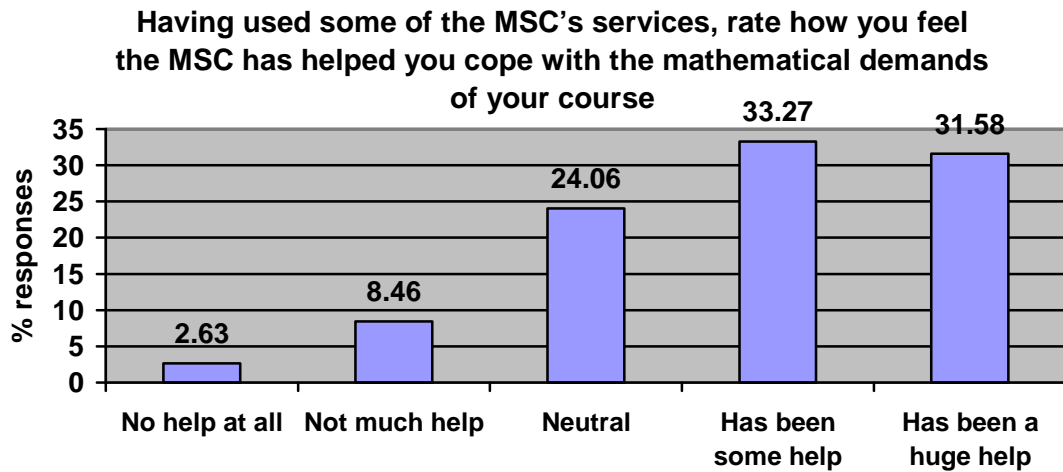


Figure 3: Student responses to the question “*Having used some of the MSC’s services, rate on a scale of 1 to 5 how you feel the MSC has helped you cope with the mathematical demands of your course where 1 = No help at all and 5 = Has been a huge help.*” ( $n = 532$ )