

CASE STUDY

Toward a holistic approach to mathematics support at Munster Technological University's Academic Learning Centre

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Abstract

This case study outlines plans for a revised approach to mathematics support at Munster Technological University's Academic Learning Centre. Under this proposed approach, mathematics support – delivered both on a one-to-one basis and in group settings – is to be supplemented by and integrated with learning supports offered by the Academic Learning Centre's sister programmes, Academic Success Coaching and Navigate Learning Development. This new approach will see the three programmes brought together under the Academic Learning Centre name. In implementing this approach, we have two key objectives: firstly, to determine the impact of this integrated approach on our mathematics support service and on its users – particularly those displaying traits of mathematics anxiety – and, secondly, to assess the extent to which presenting students with one integrated support option may result in increased service access and use.

Keywords: mathematics support, academic coaching, approaches to mathematics support.

1. Introduction

Mathematics support has operated as part of the Academic Learning Centre (ALC) in Munster Technological University (MTU) since 2005. In more recent years, two additional student success programmes have been established at MTU. These are Academic Success Coaching (ASC) and Navigate Learning Development (Navigate). All three are programmes of AnSEO, the university's Student Engagement Office.

Since the university's post-COVID return to on-campus activity in 2021-22, staff of these three programmes have been co-located in the ALC's hub. Due to a natural increase in collaboration between the areas, it soon became clear that our objectives and methods were complimentary, and that the synergies of approach represented a particular opportunity to address the priority areas of mathematics anxiety and mathematical resilience. Consequently, in June 2023, the three programmes were merged to form a new, rebranded Academic Learning Centre.

The rationale for this development is two-fold: first, it aims to address the real and prevalent mathematics challenges faced by our students in a holistic and developmental rather than a fragmented and episodic fashion. It also aims to streamline and simplify student- and staff-facing messaging regarding academic supports available in the institution, with a view to removing barriers to students who may know they need some academic support but may not know which of the three strands represents the best starting point for them.

In this case study paper, we first discuss the academic supports which were available to students prior to June 2023. We go on to discuss Mathematics anxiety and resilience and their possible connections to coaching in higher education, before finally outlining key reasons for implementing a change and describing our new model. To conclude, we highlight some early indications of success.

2. Background

The ALC at MTU - formerly Cork Institute of Technology (CIT) – is widely known and recognised by students and staff of the university's Cork campuses. It provides individual and group supports across a range of subjects, of which mathematics and statistics have traditionally been the largest elements with the highest student demand. The ALC's services are available to all students free of charge. While its activity is co-ordinated by one dedicated staff member, a distinguishing feature of the centre is the fact that supports are delivered by MTU lecturers who are allocated a number of hours per week. This interface with lecturers is an attractive proposition for students, and allows meaningful collaboration and cross-pollination between academic departments and the ALC. As such, the ALC is not a bolt-on but a living part of programme delivery in the university.

ALC supports operate on an opt-in basis. Students are informed about the centre and its website (<https://studentengagement.cit.ie/alc>) through in-lecture workshops facilitated by ALC staff, through all-student emails and regular social media posts on three AnSEO-administered Instagram accounts, through lecturer recommendations, and, often, through peer signposting. Any student wishing to attend can book a 30-minute one-to-one (or small-group) appointment in person or online either by visiting the ALC hub and requesting a booking or, more commonly, by using the booking calendar available through the ALC website. Drop-in support sessions which can be attended by multiple learners are also available.

In semester 1 of 2022-23, the ALC offered 16 hours of mathematics support per week across one-to-one appointments, small-group appointments and drop-in hours. An ALC attendee will typically bring a topic, question, or task by which they are challenged to their session, and they will be facilitated to address it with the lecturer. Follow-up appointments are encouraged, and return visits are common. For example, in semester 1 of 2022-23, 144 students attended for 458 mathematics support visits. Over the lifetime of the centre, mathematics lecturers have noted that many students have appeared to exhibit signs of mathematics anxiety (on which more follows). More specifically, this has been a recurring theme for students of non-technical and/or non-STEM degrees whose progression from one stage to the next depends on passing a mathematics module.

ASC has traditionally provided bookable one-to-one coaching sessions or in-lecture group coaching workshops. Similar to ALC supports, students can opt in to an online or an in-person one-to-one coaching session by visiting the ALC office and requesting an appointment or by booking through the booking calendar accessed through the coaching website (<https://studentengagement.cit.ie/asc>). The programme is overseen and delivered by two full-time coaches. ASC workshops are usually requested by lecturing staff to address a theme or area of particular relevance to a student group. Both one-to-one sessions and group interventions typically target themes like motivation, goal-identification and goal-setting, and identification and exploitation of personal strengths. Student coachees generally work with their coach to identify actions which will enable them to achieve a goal or goals which they have identified as important to them.

Navigate focuses on generic skills for university studies. It, too, interacts both with individual students and with whole-class groups. The programme was developed in response to requests from both lecturing staff and students for additional supports in areas such as writing and presentation, but also in disciplinary competences. In the latter area, workshops covering, for example, technical and scientific writing skills have been piloted. In 2022-23, through a combination of group and one-to-one interventions, Navigate interacted with students more than 1,450 times.

The separate branding and messaging of the programmes challenged students and staff. Furthermore, it was difficult clearly to delineate the remit of each for a growing student body with limited time to interact with additional supports. As such, our objectives for the programme merger are two-fold: they

are, firstly, to determine the impact on our mathematics support service and its users of this integrated approach (with specific reference to working with mathematics anxiety) and, secondly, to assess the extent to which service access and use increases as a result of streamlined messaging. It is anticipated that communicating the availability of comprehensive support for any academic issue students may be confronting will enable learners to find our services more readily.

3. Mathematics anxiety, mathematical resilience and coaching: an overview

The emerging discourse around mathematics anxiety and mathematical resilience is at the forefront of our thinking. Mathematics anxiety has been recognised as a phenomenon impacting students' mathematical performance for some decades. As early as the 1980s, the impact of early negative experiences with mathematics on adults' mathematical self-concept and avoidance of numerical challenges was discussed in the literature of second-level teaching (Morris, 1981). However, more recent scholarship has pointed to the fundamental importance of awareness of mathematics anxiety and approaches to working successfully with mathematics-anxious learners on effective mathematics learning and teaching (and support) in higher education (Núñez-Peña, Suárez-Pellicioni and Bono, 2013; Núñez-Peña, Bono and Suárez-Pellicioni, 2015; Bhowmick et al., 2017). As such, we are curious to determine how an intentional integration of mathematics support, ASC and Navigate could impact the effectiveness of the ALC in facilitating students to confront mathematics anxiety.

Below, we provide an overview of the salient features of both coaching and of mathematical resilience within higher education. We seek to identify the areas in which coaching can support mathematical resilience, thus potentially addressing emerging priorities in higher education mathematics support.

3.1 Mathematics anxiety and mathematical resilience

Much scholarship has been devoted to the incidence of and learning challenges posed by mathematics anxiety, especially among students of disciplines not specifically connected with numeracy and among students belonging to 'non-traditional' demographic groups. The literature suggests that more mature undergraduates may experience lower mathematical self-efficacy than their younger counterparts (Jameson and Fusco, 2014; Marshall et al., 2017). Bull (2009) investigated the prevalence of mathematics anxiety among nursing students, and Chapman (2010) reported on the impact of a foundation mathematics course using an applied approach for students of geography. The impact of mathematics anxiety on business undergraduates, too, has received comment (Joyce et al., 2006), and it has been argued that a holistic approach is required to address the mathematical self-concept and self-efficacy issues that can arise for students of marketing in higher education (Bhowmick et al., 2017). Núñez-Peña and Bono (2021) have elucidated the negative impact on mathematical performance in multiple choice tests where a student exhibits both high mathematics anxiety and high levels of perfectionism. Coaching has been cited as a constructive approach to the cultivation of the self-efficacy that mathematics-anxious learners may need to develop (Lee and Johnson-Wilder, 2017).

Cousins et al. (2019) have suggested that resilience comprises two facets: first, the experience of being overstretched by challenge and second, the ability to manage the emotion which accompanies it. Drawing on Dweck's (2000) concept of the growth mindset, Lee and Johnston-Wilder (2017) have proposed the "*growth zone*" approach to tackling mathematics anxiety through a specifically "*mathematical resilience*" (emphasis ours) which recognises the impact of the emotional experience arising from mathematical challenge. They theorise that this mathematical resilience comprises four facets: the growth mindset, the value placed by the learner on mathematics, an understanding of the process of and perseverance needed to learn mathematics and an understanding of how to seek support and collaborate on mathematics tasks (Lee and Johnston-Wilder, 2017). Developing mathematical resilience, they argue, enables the student to persevere in the "*growth zone*" which

represents the middle ground between working without challenge on familiar tasks and becoming overwhelmed by emotional responses to mathematical challenge in a “*danger zone*” (Lee and Johnston-Wilder, 2017).

3.2 Coaching in Higher Education

The International Coaching Federation (ICF) defines coaching as “*partnering with clients in a thought-provoking and creative process that inspires them to maximize their personal and professional potential*” (ICF, 2023). Although nebulous, the definition points to the centring of the coaching client in the process and to the accent on growth and development. Per Whitmore (2009), coaching is focussed on developing people’s capacity to learn rather than on teaching.

In her monograph on coaching in higher education, Andreanoff (2016) indicates that the facilitative and non-directional nature of coaching is suited to building self-efficacy. She argues that using coaching techniques minimises the need for advice to be offered to help-seeking learners, thus scaffolding them to identify their own path to academic success. Therefore, the potential for a collaboration between mathematics lecturers and coaches to develop mathematical self-efficacy is clear. Spencer (2021) notes that with such measures in place, coaches working with “*non-traditional*” students in higher education will need to be attentive to finding a suitable equilibrium between support and challenge, mirroring the “*growth zone*” approach.

Coaching is explicitly concerned with the development of resilience. Of the positive psychology approach to coaching, Boniwell and Kauffman (2018) write that its roots are in the adult learning field, and it is inflected with a variety of psychological traditions focussing on the trajectory from self-efficacy to goal-achievement. Like Lee and Johnston-Wilder (2017), Boniwell and Kauffman (2017) highlight the role of positive emotion in enhancing performance and achieving measurable outcomes. They also emphasise the power of improving outcomes further to bolster positive affect.

While recognising its potential, we do not seek to endorse the “*coaching approach*” unproblematically. Some of the concepts which have informed the discipline – notably the “*growth mindset*” itself – have come under scrutiny and remain the subject of debate. The possible misapplications of the growth mindset in adult mathematics education have been signalled by Barger, Xiong and Ferster (2022). Yan and Schuetze (2023) have highlighted the ambiguity of the concept and of its measurement and indicate that assessing its utility conclusively is challenging. Indeed, Dweck herself returned to the concept, acknowledging and responding to the controversies surrounding it in a 2020 article co-authored with David S. Yaeger (Yaeger and Dweck, 2020).

Notwithstanding valid critiques of the approach, in the context of the new ALC, the coaching approach, with its focus on resilience and self-efficacy, merits piloting as a potentially relevant means of working constructively with students on issues surrounding mathematical self-efficacy.

4. Impetus for change at the ALC

During the initial post-COVID transitional period, it quickly became apparent that a significant number of students seeking academic support at MTU had multifaceted requirements. Co-location of our support programmes made the process of cross-referral and collaboration on student cases more seamless and brought our attention to the possibilities of an integrated model. Closer collaboration between the university’s core student-facing academic support programmes thus emerged as a critical priority. Their integration will, we argue, create a ‘safety net’ for students facing academic challenges. Furthermore, students interacting with each programme throughout the transition back to on-campus learning post-COVID tended to report broadly similar challenges in re-engaging with traditional university life which called for a complex support plan drawing on the expertise of staff from all three

areas. The combination of these factors amounted to a compelling rationale for full integration of the programmes under the best recognised of the three programme titles, the ALC.

The streamlining of both service and message is also likely positively to impact the delivery of ALC supports. By addressing the previous fragmentation of academic supports, we expect to:

- reduce time spent by students differentiating between programmes and by us explaining the discrete remit of each to both staff and students;
- increase the value and effectiveness of time spent in classroom visits, allowing more time for content delivery or task facilitation;
- eliminate confusion caused for staff and students by our communication of three separate messages and, as a result, removing a significant barrier to students' engagement with us;
- eliminate 'cracks' through which a student might fall when, for example, being referred to mathematics support by a coach without a mechanism for accountability or follow-through; and
- design and implement a holistic, coaching approach to mathematics supports to provide a meaningful response to the incidence of mathematics anxiety discussed above.

5. A new model

Under the integrated model, launched in September 2023, a student presenting to the ALC will no longer need to determine whether their academic performance limitations stem from the challenges posed by an individual module or topic, from broader, underlying study skills or study management needs, or from past negative experiences of the subject. In the case of a student facing difficulties in a mathematics module, for instance, an initial approach to the ALC could result in a one-to-one mathematics support appointment being booked, but where the mathematics tutor determines that there are underlying challenges with key skills such as note-taking or with clarity around learning goals, the onward referral to Navigate or ASC can be immediate and concrete rather than a suggestion.

Collaborative work between tutors, coaches and learning developers opens the way for new possibilities in the provision of one-to-one mathematics support and, especially, in the cultivation of mathematical resilience. It will represent a move away from working episodically with students on specific concepts or problems and toward working holistically with students to get to the bottom of their mathematical challenges.

The current pilot will allow us to determine:

- whether or not the new approach increases student uptake of mathematics support;
- the extent to which students find an integrated approach to mathematics support (more) effective;
- whether by amalgamating and integrating services and streamlining messaging, students find and engage with the ALC more readily;
- the extent to which students report meaningful decreases in mathematics anxiety and increase in mathematical resilience; and
- where further scope for meaningful cross-discipline offerings may exist.

To support embedding of the pilot model, a new mode of interaction between student and ALC is currently being trialled. Through discussion of the best mechanisms through which to deliver the integrated model, it was agreed that offering a bookable, 20-minute, one-to-one initial consultation for any student wishing to avail of academic would practically support our holistic approach. This has been entitled 'Academic Mentoring', is open for bookings via the ALC's online booking system, and has attracted significant engagement from students since its introduction in September 2023 (100 students

during the first three months). That this option has proven popular justifies the choice to remove the decision barrier students previously faced.

6. Discussion

By creating opportunities for staff to work together on the same students' cases, we aim to generate nuanced perspectives on the challenges and mathematical anxieties learners are reporting upon initial contact with the ALC. This will drive ongoing development by highlighting areas in which additional interventions or new intervention types are needed. We also anticipate that by looking at individual student cases and at the broader picture regarding student need and priorities, we will more quickly and more effectively identify gaps in our provision.

This process of gap identification and intervention design would be aided by a higher influx of students, which should arise from simplified messaging. Initial indications regarding student uptake are positive, with an increase of 12% on the numbers of students accessing mathematics support in semester 1 2023-24 when compared to the same period in 2022-23. Once embedded, the new model, with its single logo and single message should position the ALC as the single, easily identifiable hub for academic and mathematical support of any kind at MTU. This should position the ALC as the first port of call for any academic issue and should highlight to staff the simplicity of referring a student whom they perceive to be in need of additional support.

7. Conclusion

Ethical approval will be sought to run interviews and focus groups with learners who have interacted with the ALC throughout the pilot year. The participant sample will comprise students who have engaged with the ALC, ASC and/or Navigate pre-amalgamation, learners who have engaged only post-amalgamation, and those who have experienced both models. Sampling will reflect the demographic profile of the university's student body as closely as possible.

When evaluating impact, we will be focussed on the effects of increased mathematical resilience training, on the student experience of receiving support from more than one discipline and on the influence of the holistic approach on the student's decision to return or not to return to the ALC. We will further investigate any impact students report in relation to their attitudes to mathematics challenges and their mathematical resilience. Analysis of engagement and re-engagement trends will be used to determine the real impact of integration of support disciplines on students' academic success and outcomes.

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