CENTRES FOR EXCELLENCE IN MATHS

CAMBRIDGE REGIONAL COLLEGE

Student Engagement Coaches in Further Education for GCSE Mathematics Re-sit Students

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Summary

Research shows that approximately 21% of GCSE mathematics re-sit learners achieve a grade 4, post-16, lagging behind the secondary school achievement rates of approximately 60%. The introduction of compulsory re-sits for those sixteen to nineteen-year olds who have not yet achieved a grade 4 in mathematics, has led to disengaged, demotivated and anxious learners who struggle to overcome their barriers to learning. Thus, highlighting the need to equip these learners with the strategies to build mathematical resilience. This action research project was funded by the Centre for Excellence in Mathematics focusing on Engagement and Motivation of post-16 mathematics learners to ultimately improve attainment.

The aim of the project was to discuss whether employing Student Engagement Coaches (SEC) for mathematics, would aid motivation, engagement and reduce mathematics anxiety. The coaches would work with learners on an individual basis, in a separate environment, away from their peers, employing several strategies to re-engage learners with mathematics. Thirty-five learners from five different teachers, across numerous vocational areas, were supported by three student engagement coaches. Thematic analysis was carried out on qualitative data taken from teacher referral forms, meeting minutes, coaches reflective journals and learner post-intervention questionnaires. Quantitative data was sourced from learner attendance to mathematics lessons pre and post-intervention.

Key Findings

Addressing the psychological barriers to learning mathematics post-16 is key to raising attainment in the GCSE mathematics re-sit cohort. Barriers to learning mathematics are multi-layered and interrelated, coaching addresses these barriers and gives learners the skills to overcome them. There is a strong need for learners who are taking the mathematics re-sit over a number of years to build their resilience to enable them to re-engage with their learning.

Post-coaching interventions, almost 88% of learners identified that it helped them realise that, when they make a greater effort, they are better at some mathematics topics than they initially thought. 81% of learners went from feeling ‘stressed/worried’ pre-intervention, to ‘hopeful or excited’ post-intervention, when thinking about mathematics. 63% reported that it has given them more confidence in their ability. These results confirm the successful impact of the intervention and provide a firm foundation for future interventions.

Background

Introduction

The Centres for Excellence in Mathematics (CfEM) is an educational project created by the Department for Education and is run by the Education and Training Foundation. Its aims, over a five-year period, are to deliver sustained improvements in mathematics for sixteen to nineteen-year olds, in post-16 settings. As Ofsted discuss in their Research Review Series: mathematics (2021) the post sixteen resit program for GCSE mathematics still lags behind the secondary school achievement rates of approximately 60% and summarised as: -

In the English mathematics education system, emphases on reactive approaches are associated with a wide attainment spread and a long tail of under-achievement. Almost 180,000 students had to re-sit GCSE mathematics in 2019. Of these, only 22.3% achieved a standard pass (grade 4) or above. (Ofsted 2021)

Cambridge Regional College (CRC) is a further and higher education provider; offering vocational courses for school leavers, professional training, qualifications and community courses including English and Mathematics. As one of the Centres for Excellence in Mathematics, the college has had the opportunity to work with network partner colleges, host good quality professional development and share best practice, with a view to drive innovation and improvement not only in our environment but also those within our network. The CfEM action research projects have enabled CRC to explore ways of improving learner motivation, engagement and ultimately achievement. This was undertaken through the professional development of teachers and, as discussed in this report, addressing learners' barriers to learning.

College Goals/Our Learners

Our aim at CRC is to enable learners to adopt a positive mindset, build resilience, self-efficacy and to realise their full potential. CRC will help to identify barriers to learning by working with stakeholders, including vocational tutors and learning support staff. In order to create and sustain an improvement in the quality of teaching, a programme of mathematics teacher professional development is key. Fostering a culture of collaborative learning, teachers will be encouraged to trial new pedagogical approaches, reflect on their impact and embrace change.

The overall aim of the Centres for Excellence in Mathematics (CfEM) project is to raise the attainment of GCSE Mathematics resit students. Our research focuses on the key CfEM themes of Motivation and Engagement. This aligns to the findings reported in Mathematics in Further Education Colleges (MiFEC) (October 2020):

'*The prevalence of insecure foundational mathematical knowledge and underdeveloped study habits is also a challenge when teaching a one-year revision course. Without personal motivation and a change of attitude to mathematics, colleges find that enforced attendance is unlikely to lead to learning. There can also be a detrimental effect on students with emotional or attitudinal problems from the enactment of a compulsory mathematics policy, resulting in increased demands on mathematics teachers to manage challenging behaviour in classrooms.'*

And

'Previous failure in mathematics examinations is identified as a factor that reinforces low confidence and poor self-efficacy; students are even more convinced that they do not have the ability and will never succeed with the subject. Students with low levels of confidence are often afraid to make mistakes and fear being seen as stupid by their peers. They may be reluctant to try a question or quickly give up because they have no confidence that they can succeed. This lack of self-efficacy and low resilience leads to reduced effort and disengagement.'

The action research project was guided by key research studies such as MiFEC.

Research Rationale

In our first year of action research (academic year 2019/20), we identified a high proportion of disengaged, demotivated and mathematics anxious students enrolled on our GCSE Mathematics Resit course. The students' barriers to learning were found to be complex and it was felt that there was a necessity for coaching support that mathematics teachers did not have time to provide. For example, we found that a large proportion of our learners were displaying signs of mathematics anxiety; that is, "feelings of concern, tension or nervousness that are experienced in combination with mathematics" (Buckley, 2013). Although previously we had offered support of a more academic nature we felt that a more holistic approach was required to re-engage these students and to build mathematics resilience. As Johnston-Wilder et al (2016) highlight, mathematics specialists often lack awareness of the impact of the affective domain on progress in mathematics and this reinforced our view of the need for a separate team to address this.

It was agreed that we would employ engagement coaches to work with learners on an individual basis, in an environment separate to the classroom, away from their peers, employing several strategies to re-engage learners with mathematics. In that first year, we had issues around staff recruitment, and the first Covid-19 lockdown. This included the move to online learning which meant we were limited in the number of students we could help and the ways in which we supported them.

In the following academic year (2020/21), we built upon the knowledge gained from the previous year's action research. The results suggested that disengaged students did benefit from one-to-one coaching, to break down barriers to learning mathematics. Anecdotal evidence from colleagues indicated that this year, due to Covid-19, there was an even greater need for this support. The intention was that the intervention would respond and build upon both the limiting factors and opportunities revealed from the previous year's findings. For example, unlike the previous year, we had three coaches in post from the beginning of the year and all were experienced in working with further education learners in the college setting. This meant that there was no delay at the start of the year and the coaches could begin working with students from the start of their course. Furthermore, we could offer both in and out of class support and the coaches were comfortable in providing some mathematics coaching in a one to one setting to help familiarise learners with specific mathematics content so that they may feel more comfortable when they encountered the content in class.

When researching for the literature review we discovered numerous articles regarding coaching in education generally, but few specific to a Further Education setting. In some small way, we hope to bridge this gap with this action research project.

Literature Review

The introduction of compulsory re-sits for mathematics for 16 to 18-year-old students without a grade 4 – 9 (A* - C previously) has had a huge impact on Further Education Colleges. As exam entries have increased, the number of students achieving a Grade 4 or above has declined Smith, (2017). In his review of post-16 mathematics (2017), *Professor Adrian Smith* discusses how challenges are most likely to be felt in FE colleges. These challenges consider two crucial factors: FE colleges, take students with lower average grades than school sixth forms or six form colleges, and have seen the largest increase in numbers studying mathematics. According to Rodeiro (2018), this forced re-sit often leads to disengaged, demotivated and anxious learners who struggle to overcome these barriers to learning. Add to this that many learners will continue this re-sit cycle over the three consecutive years as 60% of mathematics students do not improve their grade when they re-sit the exam (Rodeiro, 2018).

Although we appear to be in a period of change, the UK still lags behind many of its developing world contemporaries in terms of mathematics achievement. According to an analysis, by the *National Foundation for Educational Research*, of the Programme for International Student Assessment (Pisa) 2018, the UK is now 18th in the world for mathematics achievement, compared to 27th in 2015 (the previous monitored cycle). While showing a clear improvement, this is still a concerning figure and does not provide the whole picture. As discussed by researchers (Cherry & Vignoles, 2020), Smith (2017), in the UK, qualification levels have risen, but the proportion of the adult workforce with very low numeracy and literacy has not reduced substantially in recent decades. In 2017, it was found that around nine million working age adults in England (more than a quarter of adults aged 16-65) had low literacy or numeracy skills or both.

The literature review will expand on the reasons behind this challenging situation, and provide a possible means of overcoming some of the difficulties. In so doing the review will provide a rational for the research and a justification of the methodological processes. Drawing on the literature, perspectives on how affective issues impact learning is reviewed. From these foundations, the affordances and constraints of students resitting their GCSE at CRC in a time of a pandemic are considered. Following on from this, a research-based intervention consisting of one to one coaching strategy intended to alleviate the challenges and so support students, is discussed.

How Affective Issues Impact Student Achievement

In this section the relationship between mathematics learning and affect is considered. The review of these interrelationships will support how the action research intervention is designed. As the overriding aim of the research is to evaluate how we can improve student engagement and subsequent attainment, the research on attendance and engagement is discussed first. There is a plethora of research available which examines how the impact of different factors can have on improving engagement in mathematics (see below). Whilst the progress in this area is substantial, the variance of factors which have been found to be effective, highlights that one size does not fit all. What engages one learner might lack impact for another. The overlapping and interdependent affective components that align closely for many students with engagement are outlined. These include student self-efficacy, anxiety, mindset, and state of mind.

Attendance

There is undoubtedly a relationship between attendance and engagement and subsequent learning. This was confirmed in a study undertaken by Sammons e al. (2014 p.63) who found that "Learners' attendance as rated by Ofsted inspectors was a statistically significant predictor of academic attainment in Year 11". Groot, Sanders & Rogers (2017), confirm this:

"*Experimental evidence supports the hypothesis that student motivation is low in FE colleges. Chande et al. (2015) found that average attendance starts at 70% at the beginning of the year, declining sharply over the first term of enrolment.*" (Groot, Sanders, & Rogers, 2017)

Many FE learners have gaps in knowledge and understanding due to poor prior attendance, if this pattern continues, gaps never get bridged, knowledge is not cohesive and they are likely not to achieve.

Engagement

Issues and solutions surrounding the engagement of learners has been a significant focus of educational research within a variety of subject domains, including mathematics. Indeed, on a fundamental level, it is commonly understood that engagement is a prerequisite for effective learning (Finn and Zimmer, 2012). Data from Hume et al's (2018) qualitative research identified a range of barriers to engaging in GCSE Mathematics and English resits, though common themes arose. After conducting "in-depth interviews with 103 learners and 20 members of staff at 11 different colleges across England", four barriers to engagement were identified as holding particular significance:

1. *"Not viewing Mathematics and English as relevant to one's future*
2. *Having a fixed mindset (i.e. believing that their abilities are fixed and cannot be improved upon)*
3. *Being afraid of looking stupid in front of their tutor and peers*
4. *Lacking social support for one's learning" (Hume et al, 2018, p.18)*

Not only does this evidence the wide range of barriers that exist, but it also highlights how learners differ substantially in terms of their experiences of Mathematics and English. Thus, the need to be flexible regarding approaches and intervention to combat issues of engagement is imperative. However, in order to understand how to improve student engagement, it is first necessary to recognise the different types and the way in which they can be displayed through learner behaviour.

Different Types of Engagement

As part of an investigation into the relationship between mathematical self-efficacy and student engagement in the mathematics classroom, Warwick (2008) distinguishes between three different types of engagement: behavioural, cognitive and motivational. Related to the more traditional understanding of the concept, Warwick (2008) defines behavioural engagement as "the attendance, effort and persistence shown by students and their willingness to seek help" (2008, p.32). Evidence of behavioural engagement can be learners "following the rules and adhering to classroom norms", "as well as the absence of disruptive behaviours" (Fredricks et

al, 2014, p.62). Cognitive engagement, on the other hand, refers to the psychological investment students make towards learning. This is often achieved through memorisation and "the use of self-regulatory strategies to facilitate deep understanding" (Barlow et al, 2020, p.2). Warwick (2008) highlights that, whilst a student may appear to be working on a mathematics problem, this is "not necessarily indicative of the student fully engaging mental faculties in trying to complete it" (2008, p.32). The third type of engagement relates to the aforementioned concept of intrinsic motivation, whereby:

"a student may not particularly enjoy mathematics, but appreciates the usefulness of the skills being learned and that these skills will be required within their chosen profession and so is motivated to engage in learning" (Warwick, 2008, p.32).

Self-efficacy and Engagement

A factor which has been found to be closely linked with engagement is a learner's level of self-efficacy, that is their personal "judgement of their capabilities to organise and execute courses of action required to attain designated performance" (Bandura, 1997 cited in: Warwick, 2008, p.31). For example, as part of a four-month experimental program, Breso et al (2010) found that learners who participated in self-efficacy interventions displayed significant increases in their engagement and academic performance in comparison to two other control groups.

Furthermore, self-efficacy is particularly significant due to it being identified as catalyst for behavioural, cognitive and motivational engagement. In the face of difficulty, such as student being presented with a mathematics task they cannot immediately do, students with high levels of self-efficacy are more likely to persevere than their counterparts (Warwick, 2008). Lower levels of self-efficacy, on the other hand, are more likely to "lead to feelings of helplessness and perhaps a premature admission of defeat" (Warwick, 2008, p.32) when presented with the same task. Lower levels of self-efficacy have also been linked with higher levels of stress, anxiety and fatigue in students (Breso et al, 2010), thus highlighting the potential positive impact self-efficacy interventions could have on the behavioural engagement and wellbeing of anxious learners. For as Breso et al (2010) highlights:

"When students experience negative thoughts and anxiety with regards their capabilities, these negative affective reactions can themselves further lower perceptions of capability and activate a stress-generating mechanism that reinforces the probability of the inadequate performance they fear" (2010, p.340)

With regards to the relationship between self-efficacy and motivational engagement, research findings have indicated that self-efficacy is "positively related to adaptive motivational beliefs, like interest, value, and utility, and to positive affective reactions" (Linnenbrink and Pintrich, 2003, p.132) – beliefs which can encourage engagement on mathematics tasks. For example, Linnenbrink and Pintrich (2003) note how some "students first like some task or topic area, and are then drawn to the activity due to their personal interest in this topic" (2003, p.132). Indeed, there are evidenced links between students' self-efficacy and motivational engagement. However, there exists debate about the causal ordering of the variables:

"In other words, do strong self-efficacy beliefs induce greater motivational engagement or is it the motivational engagement and consequent learning that generates stronger self-efficacy beliefs? In reality there is likely to be affect in both directions" (Warwick, 2008, p.32).

Engagement and Anxiety

Additionally, many mathematics students in FE are also facing challenges with anxiety and how it negatively impacts working memory. This is likely to be due to the very nature of the enforced resit, their own past experiences and confidence in their ability. Researchers Marshal and Johnston-Wilder (2017) speculated on the causes of such anxiety:

Mathematics anxiety is an acquired fear of mathematical situations or subjects which stops the brain being able to process mathematics effectively or even at all. This situation-specific anxiety occurs as a result of one or many negative experiences with mathematics and is thought to affect a large proportion of people (Marshall & Johnston-Wilder, 2017)

That a significant proportion of the UK's population suffer from mathematics anxiety was confirmed by Almehrz, et al. (2016), and is a significant contributor to mathematics underachievement. There has been much research into mathematics anxiety and the need to teach students to be resilient. Marshal and Johnston-Wilder (2017), for example, confirmed that students need guidance in overcoming anxiety:

A few participants described themselves as previously "attempting to remove ... mathematics anxiety but without a sort of strategic plan of how to do so as is now ... represented with [the] mathematics resilience structure and the growth zone model". For other participants, helplessness manifested as a 'that's life' acceptance that mathematics anxiety is a problem but not knowing what to do about it. (Marshall & Johnston-Wilder, 2017)

Engagement and Mindset

The research indicates learner mindset, can have a huge effect on student engagement and subsequent attainment (Dweck C, 2012). The researcher considers how students' mindsets generally fall into two categories, a fixed mindset or a growth mindset. Which of these two mindsets students possess has a massive impact on their learning, as well as how they respond to challenges, effort, feedback, and failure. Fixed mindset students believe that intelligence and ability is a fixed trait, and nothing can be done to change it. Learners with fixed mindsets are more likely to avoid challenges which risk failure, will set themselves lower goals, and are discouraged to continue learning due to mistakes and failure (Leung, 2018, 11). Conversely, growth mindset students believe that one's intelligence isn't fixed or set in stone, and that it can be cultivated through effort. Even though everyone has different initial abilities, aptitudes, and temperaments everyone can also change and grow through application and experience. Growth mindset students tend to seek critical feedback in order to learn from mistakes and failures, as well as display resilience and perseverance when faced with challenges or setbacks (Dweck, 2006).

Engagement and States of Mind

In addition to mindset, students different 'states' of mind (Gold, 2018) can impact achievement. This area of research is pertinent to CRC students as they transition from child to adult state. Transactional analysis tells us that there are three eco states, Parent, Child and Adult states. To enable learning to take place, students need to move from child to adult state. In child state, a student may behave, feel and think similarly to how they did as a child. The Child is the expression of feelings, thoughts and emotions that are replayed from childhood. In terms of the FE environment, students may regress to how they felt as a child, in mathematics classes

in school and respond negatively, for example by getting angry or displaying negative behaviour. This conjecture was confirmed by researcher Dalby (2015):

"…students entered college with existing attitudes that influenced their approach to learning mathematics in college, affected their social behaviour in the classroom and impacted on their learning process (Dalby, 2015)

Adult State describes our ability to think and determine action for ourselves based upon the 'here and now'. It draws on our understanding and analysis of our external and internal environment. Students are often in adult state in their vocational environment, where they have no prior emotional response to this situation and view it as a new experience. Motivation and resilience are a key factor in switching to and maintaining an adult state and for improving engagement.

"*In Self-Determination Theory (Deci & Ryan, 1985) we distinguish between different types of motivation based on the different reasons or goals that give rise to an action. The most basic distinction is between intrinsic motivation, which refers to doing something because it is inherently interesting or enjoyable, and extrinsic motivation, which refers to doing something that leads to a separable outcome……. Students can perform extrinsically motivated actions with resentment, resistance, and disinterest or, alternatively, with an attitude of willingness that reflects an inner acceptance of the value or utility of a task*" (Deci & Ryan, 2000)

There is no doubt that students' prior experiences of learning mathematics taint their motivation in resitting mathematics in FE colleges, as well as the examination outcome and career aspirations. Archer, et al. (2017) discuss how those students that have not yet managed to achieve the accepted standard of a Grade 4 feel that they have failed, leading to various levels of motivation to re-engage with the subject. A few students although disappointed with their grade can still find the motivation to improve, most though will continue to become more and more demotivated in ever increasing cycles of continuing 'failure' driven by their own lack of confidence or how they have been labelled previously. Once at this point, it is almost impossible for students to find the resilience and motivation to try again on their own.

Affect Issues Specific to 2020

There are a number of issues facing CRC this year that have a direct impact on engagement and subsequent attainment. These are outlined below.

Covid 19: Disengagement

This academic year, with the Covid-19 pandemic still being a major feature, we are seeing many more students needing support with disengagement, demotivation and mathematics anxiety. For example, as reported earlier in this review, many students had no formal teaching from the first lockdown in March and this has increased anxiety in their own ability. There is an emerging picture, nationwide, of many learners' achievement not matching their teacher awarded grades after the cancellation of the summer's exams. This, alongside socially distanced classrooms, the lack of resources being Covid-19 safe, and a cohort that have not been in classrooms for a number of months, has led to many disengaged students. Add to this the likelihood that student access to online sessions (March-August 2020) was limited, makes for classes of very demotivated and anxious students:

"…….*at home, they suffer with limited social connection, crucial for identity and well-being at young ages, reduced physical activity, loneliness and boredom (Fegert et al., 2020; Jiao et al., 2020; Loades et al., 2020), which may result in long-term effects. Indeed, the mental and physical health, as well as productivity in adult life, is deeply rooted in the childhood years (Loades et al., 2020; Wang G. et al., 2020). Data from previous epidemics demonstrate that children who experienced isolation measures were five times more prone to demand mental health services and more inclined to experience PTSD (Loades et al., 2020)"* (Bitencourt, et al., 2020).

Students are more disengaged with learning in general, the longer the pandemic goes on. They are becoming more fatigued with the situation, and there are an increasing number of students with mental health issues such as depression. This is discussed by Labrague (2020), in his yet to be peer reviewed work, on how young people such as college students are particularly vulnerable to the adverse mental and psychological health consequences of the stay-at-home orders or lockdown measures, as they pose a potential threat to their physical, mental and emotional health as well as their educational and developmental progress (Singh et al., 2020). This lack of developmental progress is being reported by education professionals across the UK. School leavers have missed out on a key part of their development, the time when teachers would get them ready for moving on. The students were in lockdown during the time when they would learn the organisational and independence skills for preparing for the exam season and take on the responsibility for being at the top of the school hierarchy. Teachers in FE colleges are noticing that learners, in the main, do not have the same level of emotional maturity as in previous years.

Teachers are reporting that group development sequencing as defined by Tuckman's hypothesis (1965) that groups go through the stages of "forming," "storming," "norming," and "performing" before they can effectively work together, is much slower this academic year, possibly due to the restrictions imposed. This year more than any other there is a need for tailored support, as discussed by Labrague, (2020):

Measures should be implemented to better support young people during the pandemic in order to reduce the ill effects of the lockdown on their mental, psychological and physiological well-being. (Labrague, 2020)

Covid-19: Digital Competency/Access to Technology

Another barrier to learning, which has emerged as a result of the contingencies put in place to tackle the practical issues associated with the pandemic, lends itself to the nature and challenges of online learning. Whilst many Higher Education institutions have become accustomed to a 'digital transformation' in recent years, learning that takes place at Further Education colleges heavily relies on face-to-face, instructional, content delivery. Indeed, in theory, moving delivery online creates opportunity for "the flexibility of teaching and learning anywhere" (Hodges et al, 2020, p.2). However, in the face of a global crisis, Bozkurt and Sharma (2020) argue that it is imperative to distinguish between "online distance education" and "emergency remote teaching" due to the differences in their design and purpose. For as Bozkurt and Sharma (2020) remind us:

"While distance education has always been an alternative and flexible option for learners, emergency remote teaching is an obligation, which means that we have to use different strategies and approach the case with different priorities" (2020, p.2).

For example, online distance education courses are provided following rigorous instructional design and planning, “often using a systematic model for design and development” (Branch and Dousay, 2015, cited in: Hodges et al, 2020, p.3). Emergency remote teaching, on the other hand, aims:

“not to re-create a robust educational ecosystem but rather to provide temporary access to instruction and instructional supports in a manner that is quick to set up and is reliably available during an emergency or crisis” (Hodges et al, 2020, p.6).

As a result of this transition, access to technology and digital competence have become unprecedented challenges to the learning of GCSE mathematics. Learning online is entirely dependent on access to technological devices and the internet. As noted by Adedoyin and Soykan (2020), this dependency combined with “the provision of the equipment was a big challenge for institutions, faculty and learners (2020, p.4). In addition, in order to access the content provided via online means, learners must possess a sufficient level of digital competence; that is:

“the group of skills knowledge and attitudes needed when using ICT and digital devices to perform responsibilities, such as problem solving, information management, collaboration with respect to effectiveness, efficiency and ethics” (Adedoyin and Soykan, 2020, p.5)

Research from Lehman and Graesser’s (2012) ‘Confusion and complex learning during interactions with computer learning environments’ study found that, when familiarising themselves with technical subject matter (new software, online programs etc), learners experienced a range of ‘learner centered’ emotions. In particular, when working with low levels of digital competence, learners were found to regularly experience “obstacles, failures, and the resultant negative emotions such as anxiety, confusion, and frustration” (Lehman and Graesser, 2012, p.185).

Affect Issues Specific to Cambridge Regional College (CRC)

Restructure of Mathematics Department

In our particular FE setting, a recent restructure of the mathematics department into vocational teams has meant that there are fewer opportunities to stream students. This has led to many mixed ability classes, often incorporating entry level learners in GCSE classes, negatively affecting learner confidence and self-esteem. This emerging picture of more pronounced student disengagement positively impacts the research. It gives us the opportunity to expand the research into whether student engagement coaches are effective in raising motivation and engagement of GCSE mathematics resit students.

Geographic Location

An additional factor that may inhibit engagement is the college's geographic location in Cambridge – a place renowned for its academic achievement. Professor Adrian Smith (2017) in his ground-breaking article explained that an area which is renowned for academic achievement could affect student motivation, engagement or anxiety, when they believe they do not meet the expected standard. He goes on to say that the regional and sub-regional differences in attainment and participation in 16-18 mathematics will require more targeted and rigorous responses in these areas.

Supporting Student Engagement

There is a need to break the cycle of negativity around mathematics, if we are to improve achievement going forward. These disengaged, demotivated students will one day become parents and teachers themselves influencing new generations of mathematics students. Attend any parents evening and there will inevitably be negative attitudes around mathematics. It has almost become the 'norm' to be proud of poor mathematics achievement as Carol Taylor, director of operations at NIACE said "*the UK had a "huge numeracy problem" but many people saw being poor at mathematics as a "badge of honour"* She went on to say that the problem was, in part, a cultural one: *"No one would dream of boasting that they couldn't read, but many people stand on platforms, write in blogs, appear on radio and television, admit to friends and colleagues, proudly showcasing our inability to handle everyday mathematics" (2011).* However, the GCSE acts as a gatekeeper for individuals to progress, lack of the qualification can prevent students pursuing chosen courses and careers. As a nation, it is imperative this begins to change, if we are to maintain being a player on the world stage.

In this section, first CRC's previous year's action research is outlined, then the literature on how to improve student engagement is reviewed, with a particular focus on one-to-one coaching.

Building on CRC Action Research 2019-2020

McIntosh and Shaw (2017), define the characteristics needed to sustain engagement as the internal factors of self-management including goal setting and emotional control (the ability

not to dwell on negative experiences or over-react to situations as well as the need for a support network, whether formal or informal. There have been many attempts at CRC to tackle the issue of disengagement and demotivation of mathematics students over the years, with little impact. Last year, given the opportunity to carry out a research project that had the potential to be effective in tackling this issue, a new team, closely connected to the mathematics department, were set up. Following on from Marshal and Johnston-Wilder's (2017) study, the researchers developed sessions involving workshops for staff and for students which focused on the skillset needed to develop mathematical resilience (see, for example, Johnston-Wilder et al., 2016; Marshall et al., 2017). They also discovered that there was a necessity to work 1:1 with learners who had a more urgent need. A team of student engagement coaches provided flexible, individualised support to learners that were particularly disengaged, anxious or demotivated. On the whole, this was a success but with many issues around coaching staff recruitment, and then the Covid-19 pandemic, the results were not on a large enough scale to robustly understand its effectiveness. The plan this year is to build on these findings.

Definition of Coaching

Coaching within educational contexts has been recognised as a powerful tool for the academic, professional and personal development of students, teachers and senior leaders. Whilst coaching takes various forms, the concept is commonly conceived as a means of facilitating “learning using active listening and inquiry and providing appropriate challenge and support” (Devine et al, 2013, p.2). A plethora of research exists in support of the benefits coaching can provide across the board of education; this includes academia-based improvements, such as improved GCSE examination results (Passmore and Brown, 2009), as well as developing skills “that go beyond the traditional academic subjects to enhance wellbeing” (Devine et al, 2013, p.2) such as ‘cognitive hardiness’ (Green et al, 2007), mental resilience (Campbell and Gardner, 2005) and the use of coping strategies (Seligman et al, 2009). However, as discussed earlier, there is little in the way of coaching in Further Education Colleges.

Recent progressions in the adoption of coaching within these contexts, according to Griffiths (2005), has influenced a shift in the traditional teacher role “from that of instructor to one of facilitator” where combined coaching strategies such as “self-regulation, the use of questioning, problem-solving opportunities and feedback” (2005, p.3) are utilised. Indeed, in theory, this emphasis on learning techniques, in addition to the teaching of content, can create a unique opportunity to further develop the teacher-student relationship. However, it is important to acknowledge the difficulty relating to the maintenance of these relationships when students are persisting with disengaged and disruptive behaviour in the classroom – a common issue faced by FE teachers in Mathematics GCSE resit classes.

Whilst the utilisation of one-to-one coaching in educational contexts is somewhat limited in comparison to other agencies of society (Griffiths, 2005), research into different coaching approaches and the potential benefits they could offer in this setting is promising. These are outlined below:

Solution-based

Solution-based coaching was the focus of Campbell and Gardner’s (2005) research study into the effects of coaching on year 12 participants, whereby their findings indicated an

enhancement of “students' problem-solving skills, coping skills, resilience, well-being, study skills and learning goals to achievement as well as decreasing depression” (Devine et al, 2013, p.1383). Coined in response to a dissatisfaction with the overwhelmingly problem-focused nature of traditional coaching, solution-based coaching holds the view that the coach is fundamentally capable of solving their problems if they are equipped with the knowledge and tools required to do so, e.g. solution construction, personalised goal setting and action orientation (Cavanagh and Grant, 2010). It should be noted, however, that due to the small sample size used in Cavanagh and Grant’s (2010) study, the significance of these findings cannot be overestimated.

Behavioural

Parallel in its focus on problem-solving, behavioural coaching has been found to be effective in reducing exam anxiety and increasing test performance in secondary school students (Grant, 2001). Based upon “a goal focus and action-orientation”, the behavioural approach has been recognised as easy to both learn and apply (Devine et al 2013), thus making it an accessible form of coaching which can be utilised by various professionals. However, both approaches have been criticised for their short-term focus and their failure to acknowledge deeper-rooted issues which could be impacting the student’s progress. Devine et al (2013) highlights that, despite their ability to provide a range of short-term advantages, these approaches, when used alone, are unlikely to influence “long term learning and sustained change” (2013, p.1383).

Cognitive-behavioural

For this reason, cognitive-behavioural and other blends of coaching techniques have been found to be effective in the personal and academic development of learners. Based on the premise that our reactions to negative experiences are a result of the way we perceive an event/situation as opposed to the event/situation itself, cognitive-behavioural coaching focuses on “examining and re- evaluating some of our less helpful views [so that] we can develop and try out alternative viewpoints and behaviours that may be more effective in aiding problem-solving” (Neenan and Palmer, 2001, p.1). Cognitive behavioural coaching was found to have a positive impact on senior high school students in Australia as part of Green et al’s (2007) research study into the effects of evidence-based life coaching. Teachers were trained in coaching techniques before delivering them to students via ten individual face-to-face coaching sessions. Not only did this form of coaching help develop the “students’ coping skills and resilience”, it also highlighted “increased wellbeing, […], decreased levels of depression, the development of study skills and personal learning goals which contributed to enhance performance” (Devine et al, 2013, p.1386). Another key finding was an increase in ‘cognitive hardiness’, i.e. the ability to recognise opportunity for adaptation and change in the face of stressful situations (Kobasa and Maddi, 1977) – a key component of resilience (Bonanno, 2004).

Summary

It is widely acknowledged in the research that students resitting their GCSE are often disengaged. This can be evidenced through several distinguishing patterns of behaviour, including poor attendance in class, anxious and demotivated learners. These factors can be

directly attributed to the subsequent poor attainment of resit students. As outlined above, the situation has been exacerbated by the pandemic. One-to-one coaching is a promising solution to this situation. The general consensus in the literature on coaching literature is that combining approaches in order to be flexible and cater to the needs of the individual is usually most effective (Devine et al, 2013). There is, however, an absence of research relating to how coaching techniques can be applied to post-16 learners. This action research aims to help fill the gap.

Methodology

The aim of this study was to provide a safe space for disengaged and demotivated mathematics learners whereby a Student Engagement Coach (SEC) could support them to explore their past and current experiences of mathematics, identify and overcome any barriers to engagement and to help them develop mathematical resilience. The Action Research Group (ARG) consisted of five teachers and three SECs who were employed to coach students who had been referred by their mathematics teacher. This coaching would be made available in both group settings and in one to one sessions outside of the mathematics class, dependant on the needs of the individual student. The coaches and lead teacher attended the Coaching for Mathematical Resilience course run by Sue Johnston-Wilder to acquire the skills to support mathematics anxious learners and develop their coaching skills. As discussed in the literature this course was created from a study by Marshall and Johnston-Wilder (2017), who developed sessions involving workshops for staff and for students which focused on the skillset needed to develop mathematical resilience (see, for example, Johnston-Wilder et al., 2016; Marshall et al., 2017). They also discovered that there was a necessity to work 1:1 with learners who had a more urgent need and therefore designed a coaching course.

Coaching strategies learned and subsequently practiced included, but were not limited to, pastoral support, academic support, coach and teacher collaboration, one to one conversation's about mathematics experience, in class support, reframing and anxiety management. The research design stage was a very much collaborative process, between the teachers and coaches involved in the action research, particularly in relation to the development of coaching strategies. Due to the disruption of COVID-19, it became paramount that different strategies were trialled and improved throughout the year so that they would meet the ongoing needs of our students. Using an iterative cycle approach was invaluable in trialling interventions, reviewing as a group to modify and trial again. Weekly coach meetings, with AR teachers often in attendance, played a pivotal role in ensuring that the strategies were regularly evaluated and refined, using different perspectives of participants.

In order to understand both what was happening in the intervention and why the research adopted a mixed methods approach. This incorporated a combination of qualitative and quantitative data collection methods. Pre-intervention, qualitative data was collected in the form of teacher referrals. Action Research teachers were given a list of possible criteria which helped them identify any disengaged/demotivated learners in their classes. From here, they were then able to refer learners for coaching using the predesigned referral form (see Appendix A), making particular reference to learner behaviour and attendance. The second form of qualitative data was collected through the use of reflective journals. Coaches used the journals throughout the year to reflect on each coaching session with learners, and note any progress made. Not only did this allow us to collect data which was rich in detail, but the journals also acted as a central communication hub for both SECs and mathematics teachers to access information regarding learner progress.

In line with Cope's (2014) observation that triangulation helps facilitate the validity of data, quantitative data was also obtained to triangulate our results. As Cope (2014) highlights, the triangulation of data helps develop "a broader understanding of the phenomenon of interest" by converging information from a number of different sources. At the end of the academic year, attendance data was collected to compare learner attendance prior to working with a coach and after. In addition to this, students were asked to complete a post-intervention questionnaire. Whilst the questionnaire was predominantly quantitative in its format, consisting

mainly of multiple-choice questions, learners were also given the option to add any additional comments at the end of each question. The number of learners/coaches/mathematics tutors who took part in each data set can be found in the table below:

Data collection method	Coaches	Mathematics tutors	Learners
Referrals	-	5	35
Reflective journals	3	5	28
Attendance data	-	-	23
Post-intervention questionnaire	-	-	16

Fig 1.0 Number of coaches/mathematics tutors/learners involved in each method

To aid communication between the action research teachers and the coaches a OneNote Notebook was created (see Appendix B). This was invaluable as a way of not only communicating but storing all data in one place and all teachers and coaches had access. The processes were made as simple as possible, with reflection templates, automated alerts for referrals, self-populating sections and clear instructions. It also meant that we could access everything from home, vital in Lockdown 2.0. This communication aid was invaluable as it was rare that the action research team could meet as a whole group due to timetabling issues.

Ethical Considerations

In order to comply with ethical research regulations, a number of procedures were employed to ensure learner safety and confidentiality. This included creating a participant information sheet for the post-intervention questionnaire (see Appendix C), gaining written informed consent from learners who took part in the video interview for the AR presentation, anonymising learner names when analysing data from the reflective journals and ensuring that access to the OneNote Notebook was restricted to members of the Action Research Group (ARG).

Qualitative Data Analysis

To help understand both what happened when the intervention was implemented and why events occurred, the qualitative data collected was described using a thematic analysis. Thematic analysis is a method of systematically identifying and interpreting patterns in the data (Clarke and Braun, 2014). Using a grounded approach, the data was interrogated through the generation of codes. These carefully designed codes formed the building blocks for the emergent themes (see Appendix D for an example). This rigorous analysis provided a robust framework to both organise and report on the data.

Results and Discussion

Referrals & Reflective Themes

A thematic analysis of the teacher referrals and coaches' reflective journals revealed five main themes: Evidence of disengagement/ demotivation; Reason for disengagement/ demotivation (mathematics and non-mathematics related); Coaching strategy; Barriers to engaging with coach and Outcomes. Throughout this discussion a number of quotes will be shown from both the referrals forms and reflective journal entries, these were chosen as they represent typical or frequent entries.

Prior to the pandemic and online lockdown learning Hume et al's (2018) qualitative research showed that reasons for disengagement could be split into four main barriers to learning

1. "Not viewing Mathematics and English as relevant to one's future
2. Having a fixed mindset (i.e. believing that their abilities are fixed and cannot be improved upon)
3. Being afraid of looking stupid in front of their tutors and peers
4. Lacking social support for one's learning" (Hume et al, 2018, p.18)

All of these are representative in our own qualitative data, highlighting the continued need for interventions that address these barriers to learning.

Theme - Evidence of Disengagement/Demotivation

The data suggests that evidence of disengagement can be broken down into five main subthemes: low attendance, lack of focus, lack of response online, avoidance techniques, and signs of anxiety.

Evidence of disengagement/ low motivation	**Definition**
Low attendance	Low attendance in mathematics, including online and face to face.
Lack of focus	Distracted, engaging with peers, little or no work completed.
Lack of response online	Not replying to Teams messages or emails. Being in the mathematics session but not communicating in any way.
Avoidance techniques	Checking phone frequently, avoiding eye contact, hood up or hat on. Distracting the teacher off topic.
Signs of Anxiety	Visibly uncomfortable, avoiding eye contact, tense body language, appears withdrawn.

Fig 2.0 Breakdown of Subthemes for evidence of disengagement/ low motivation

It is important to note that often these signs of disengagement would overlap, with many learners displaying more than one indicator at any one time. For example, it is evident from the analysis of the Reflective Journal, that this learner was displaying a combination of avoidance techniques and signs of anxiety:

"He appears to be using distraction techniques of wanting you to focus on something other than his work.

When pushed he seems anxious about his ability and has started to say he will definitely fail this year."

Throughout the academic year, coaches identified a number of common avoidance techniques during class observations; this included learners checking their phone frequently, avoiding eye contact with staff and peers, using clothing to create a barrier and attempting to distract the teacher.

Theme: Reason for Disengagement/Demotivation

Whilst each learner's mathematics journey is unique to the learner, it became apparent that the reasons some of our learners were disengaged with mathematics could usually be split into two categories: mathematics related and non-mathematics related. Although these categories are treated here as distinct, it is also recognised that many features across the categories were interdependent.

Reason for disengagement/ low motivation (mathematics)	**Definition**
Gaps in knowledge	Being confused with the mathematics content.
Lacks confidence in ability	Comments made by learner about own ability, for example asks 'Where would I ever use this?'.
Questioning application of mathematics	Learner doesn't see the point in learning mathematics.
Dissatisfaction with current grade	Grade lower than the learner feels it should be.

Fig 3.0 Breakdown of Subthemes reason of disengagement/ low motivation (mathematics related)

Reason for disengagement/ low motivation (non-mathematics)	Definition
Fear of judgement	Learner not wanting to answer questions in front of class.
Mathematics environment	This environment included teaching style, physical space, number of peers.
Online learning	Support for learning needs, style of learning, visibility of answers to peers, technical skill.
External issues	Access to equipment, additional learning needs, mental health, personal circumstances, negative history of mathematics.

Fig 4.0 Breakdown of Subthemes reason of disengagement/ low motivation (non-mathematics related)

Mathematics Related

One of the most significant findings across both qualitative data sets was that gaps in basic mathematical knowledge seemed to play a significant role in learner disengagement, with the majority of our disengaged learners having a number of topical gaps. Not only did this prevent them from being able to grasp GCSE concepts, but the reflections suggest that this caused frustration for some learners, and for others it has caused them to have significantly low levels of confidence in their mathematical ability. As a result of this, it appears that many learners tend to disengage as a way of avoiding this issue. This issue is clearly exemplified in the following journal entry:

"Student is a very capable and polite learner but really lacks in confidence in both himself and his ability. He requires regular praise and reassurance otherwise he disengages."

There is also the possibility that the learner has gaps in knowledge because he lacks confidence so disengages, creating a vicious cycle if not addressed. This lack of self-belief was also evidenced through the regular use of self-depreciating language, both in class and during 1-1 coaching sessions:

- *"there's no way I can do this"*
- *"I'm stupid at mathematics"*
- *"I just don't see the point. I'm never going to be able to get my mathematics, I always freak out in the exam and mess it up"*

These comments concur with Huma and colleagues research (2018) that disengaged learners often have a fixed mindset (i.e. believing that their abilities are fixed and cannot be improved upon). This language was often used just before the learner would begin to withdraw, suggesting that a relationship existed between the learner's lack of confidence in a given moment and the likelihood of them subsequently becoming disengaged. This was also supported by coach reflections:

"When presented with something which challenges him, however, student tends to withdraw quite quickly"

A second mathematics-related reason for disengagement/demotivation identified from the data relates to questioning the application of mathematics. Some learners didn't see the

relevance of mathematics in their everyday life or chosen vocation and therefore were not motivated to engage with the subject or are using this as a justification for their lack of engagement.

"Student asked why we needed to learn about finding the area of compound shapes and when would she use this in real life. This was asked in a negative way and showed her frustration at what she perceived to be a waste of time learning"

"Poor mindset towards mathematics – hates it, doesn't understand why she needs it etc."

Non-Mathematics Related

There also appeared to be a number of reasons for learner disengagement which were not related to mathematics. For example, one of the biggest barriers to engagement this year related to online learning difficulties. Many learners struggled with accessing lessons, the style of learning and often their lack of technical skills. As discussed by Adedoyin and Soykan (2020) learners need to bring many skills to the table to access online learning, "the group of skills, knowledge and attitudes needed when using ICT and digital devices to perform responsibilities, such as problem solving, information management, collaboration with respect to effectiveness, efficiency and ethics…" (Adedoyin and Soykan, 2020, p.5). Research from Lehman and Graesser's (2012) found that in particular, when working with low levels of digital aptitude, learners were found to regularly experience "obstacles, failures, and the resultant negative emotions such as anxiety, confusion, and frustration" (Lehman and Graesser, 2012, p.185).

This disruption could often lead to learners missing a number of lessons, thus causing them to be behind on content, as demonstrated below:

"Online learning has proven extremely difficult for the student – the first couple of weeks her attendance was extremely poor, trying to catch her up is proving a bit difficult"

Engagement with online mathematics lessons created a number of additional challenges with regards to fear of peer judgement. The nature of online teaching on Microsoft Teams meant that, if a learner were to contribute during a lesson, they were to either turn their microphone on and verbalise their thoughts to the class, or contribute using the chat function. A number of learners disclosed to their SEC that this created unnecessary anxiety as they were not comfortable speaking aloud in an online environment, nor did they like typing into a chat which remained on the platform once the lesson had finished.

This fear of judgement extended to the physical mathematics environment upon return to campus (post-lockdown), with the coach reflections suggesting that many learners do not feel comfortable answering mathematics questions verbally in front of their peers. For some students, this was a mild issue. However, for a handful of students worked with this year, this fear could often be debilitating and caused negative emotional and physical responses. A number of examples include:

- *"She explained that she hated getting asked a question in front of her classmates and this is what makes her feel anxious"*
- *"She hates taking part in quizzes, etc as, even though she is anonymous on there, she still feels that people will be judging her for getting it wrong"*
- *"This seemed to make sense to the student which led him to explain how he gets anxious about getting things wrong in front of his peers (particularly in mathematics as he lacks confidence in his ability) and therefore finds it easier to avoid giving answers"*

These debilitating fears are substantiated in the literature. Hume et al (2018) for example state that a key barrier to learning was being afraid of looking stupid in front of their teachers or peers.

In addition to this, the data also revealed that there were a number of factors which contributed towards a lack of engagement in mathematics this year which were not necessarily related to the mathematics itself, nor the mathematics environment. External issues include, but were not limited to, mental health issues, peer influence, a lack of equipment, the COVID-19 pandemic and general personal circumstances.

Theme: Coaching Strategy

The solution to the challenges of disengagement was the use of coaches. Referring back to the literature, Campbell and Gardner (2005) research study found that effects of coaching on year 12 learners indicated an enhancement of "students' problem-solving skills, coping skills, resilience, well-being, study skills and learning goals" (Devine et al, 2013, p.1383).

Whilst the SECs adopted a more solution-based, learner-centered approach to coaching, there were a number of coaching strategies which were commonly used in tandem with each other. This included one to one conversation's with learners about their previous experience of mathematics, academic support, anxiety management, coach and tutor collaboration, pastoral support and reframing negative beliefs and language. In this sub-section the results of these strategies are discussed.

Coaching strategy	**Definition**
Encouragement from coach	Positive language, reminding them of their ability, no judgement, celebrating mistakes.
Coach and tutor collaboration	Conversations about learner progress, wellbeing concerns, approach to take, initial contact.
Academic support	Academic support online and face to face, one to one and in class.
One to one conversation about mathematics experience	Previous experience, validating feelings, providing a safe space.
In-class support (online and face-to-face)	Pastoral, checking in on mind sets, encouraging a safe learning environment, modelling mistakes in a positive manner.
Reframing	Changing the way learners view mathematics and their experience. Explaining where and when they will need mathematics and the importance of it.
Anxiety management	Strategies for coping with anxiety e.g. in lessons or assessments.

Fig 5.0 Breakdown of Subthemes - Coaching Strategy

Depending on the needs of the students, one to one conversations between the SECs and learners often occurred regularly. These took place online via Teams chat, and during face-to-face lessons. It appears, however, that it was in one to one sessions outside of class where learners felt the most comfortable to open up to the coach. This is where the SEC could create

a safe environment for the learners and gain an insight into their past and present experiences of mathematics – as specified in the coaches quote below: -.

'Before starting, I reassured the student that this was a safe space where we can take as much time as we need to go through one question. There is no judgement on his ability, and that we could go through as many or as little questions as he felt comfortable. We agreed that if he felt uncomfortable/out of his depth at any point, we could return to a question more similar to the last and build ourselves back up.'

Another coaching strategy which learners responded well to was academic support. This took place during one to ones, online during lessons, and in face-to-face classes. Coaches focused predominantly on breaking down tasks into smaller chunks and asking open ended questions to remind students of their existing knowledge and close any topical gaps.

'After this we went through division. Student explained that he feels 'there's no way' he'll be able to do it. I asked him try just one with me, and see how we got on. I noted how he thought he couldn't do the multiplication, before showing him all of the correct work he had completed to show him how just because he thinks he can't do it, doesn't mean that it is true. Student made a number of mistakes, but overall made great progress and his mistakes were celebrated.'

Arguably one of the most popularly used research guided coaching strategies was anxiety management. This drew heavily on the literature. Many of our disengaged learners displayed signs of anxiety as exemplified by the researchers (Buckley, 2013). This state of discomfort seemed to prevent them from being able to focus/engage with the tasks. Some learners explained that it was the mathematics environment that was making them feel anxious (the size of the class, the exposure, the way it reminded them of their experience at secondary school), whilst for others it was their lack of self-efficacy.

'We spoke about his anxiety surrounding mathematics and he explained that it is the classroom setting/environment which was making him feel anxious, as opposed to the mathematics itself.'

There were a number of ways in which the coaches and mathematics tutors collaborated with the shared aim of improving the learners' engagement. Communication would regularly occur between lessons where discussions were had regarding the learners' progress and potential barriers to learning.

'She explained that she hated getting asked a question in front of her classmates and this is what makes her feel anxious. I have passed this on to her Mathematics tutor who will take this into consideration and only ask the student discreetly so that she feels less anxious in the classroom.'

Pastoral support was a coaching strategy that appeared consistently throughout the data. This occurred across all learning settings and was a short-term strategy which was effective with a number of learners.

Many learners received in-class support, both online and on campus when lockdown was lifted. This included both emotional and academic support, to which most students responded well to.

Reframing learners' verbalised beliefs played a key role in all three of the coaches approaches to support. Many of our learners seem to be limited by a negative, fixed mindset which includes the belief that they are categorically 'bad' at mathematics. We quickly realised that this fixed mindset was stunting their academic growth in the same manner as reported by researchers

Hume and colleagues (2018). In order for them to start learning, this needed to be consistently challenged. This included highlighting their achievements when learners were verbally disheartened by assessment results or their overall 'mathematics ability', and reminding them of how they have tackled similar topics/situations in the past.

'Student said, "I just don't see the point. I'm never going to be able to get my mathematics, I always freak out in the exam and mess it up"'

'Over the past few weeks the student has shown incredible amounts of resilience. Despite this being the fourth time he has retaken his GCSE mathematics, he has left the past few sessions expressing that he didn't want the lesson to end: "Do I have to go back to the workshop? I would rather stay here and do mathematics" '.

Comments such as the one exemplified above indicate the positive impact of sustained positive feedback from coaches.

Theme: Barriers to Working with the Coach

There were a number of external factors at play which, for some learners, either prevented or delayed their engagement with a SEC. This included additional learning needs, mental health issues, sickness and personal circumstances.

Barriers to engagement with coach	**Definition**
External issues	Additional learning needs, mental health, personal circumstances
Timetable issues	Change in learner timetable, change of teacher, timetable not matching up with coach

Fig 5.0 Breakdown of Subthemes – Barriers to Engagement with Coach

Attendance

As discussed in the literature, Sammons et al. (2014 p.63) found that "Learners attendance as rated by Ofsted inspectors was a statistically significant predictor of academic attainment in Year 11". Attendance is a much deeper routed problem in Further Education colleges as discussed by Groot, Sanders & Rogers (2017) "Experimental evidence supports the hypothesis that student motivation is low in FE colleges. Chande et al. (2015) found that average attendance starts at 70% at the beginning of the year, declining sharply over the first term of enrolment." (Groot, Sanders, & Rogers, 2017). Numerous FE learners have gaps in knowledge and understanding due to poor prior attendance, if this pattern continues, gaps never get bridged, knowledge is not cohesive and they are likely not to achieve.

Data analysis of the attendance revealed that 65% of our learners showed an increase in attendance after working with a coach, compared to prior to intervention. However, changes in attendance data cannot always be directly linked to coaching, there were other factors that influenced attendance. There were for example, a number of learners whose attendance was affected by the Covid 19 pandemic, some were bereaved, some had to self-isolate (often on more than one occasion), and some had poor mental health.

Attendance prior to intervention	Attendance post intervention	Reasons for data discrepancy
$\frac{16}{37}$ sessions 43%	$\frac{51}{54}$ sessions 94%	None.
$\frac{44}{44}$ sessions 100%	$\frac{35}{50}$ sessions 70%	Two periods of self-isolation during post intervention period.
$\frac{41}{62}$ sessions 66%	$\frac{35}{50}$ sessions 42%	Mathematics anxiety. Logged in online but unresponsive during session. Once face to face teaching resumed, attendance dropped but attending a 1:1 session weekly with coach building up to classroom participation.

Fig 6.0 Examples of individual attendance figures.

In addition, alternative evidence of engagement was apparent e.g. in being more confident in answering questions, attending a one to one session with a coach or volunteering answers in class. Online learning data also feeds into this figure and as discussed previously, many have struggled for a number of reasons to engage with this delivery. Teachers and coaches have reflected that some learners have a high online attendance but are not engaged in the session, often completely unresponsive once they have logged in, for example, one teacher stated: -

'Student unresponsive today. Stayed on the call about 20 minutes and then disappeared. No work submitted.'

Theme: Outcomes

Outcomes	Definition
Feels more positive about mathematics	Learner makes more positive comments about mathematics work, lesson or own ability.
Increase in confidence/self-efficacy	Learner attempts work without prompting, challenging themselves.
Positive shift in mindset	Learner engaging with coach or teacher, in class or out. Arriving on time to class, arriving with an open mind to lesson.
Increase in engagement	Learner discusses the work in a positive manner, engaged in lesson, work attempted.
Taking an active role in learning	Learner offers answers to questions, and works with peers.
Lack of response/no change	Learner did not reply to coach or teacher online, little work completed

Fig 7.0 Breakdown of Subthemes – Outcomes

Students were asked to complete a questionnaire post intervention (see Appendix E) to capture their experience of working with a coach and whether this had altered their mindset and perception of their mathematical ability. Learners were surprisingly frank in their questionnaire responses, with many of them using the optional boxes to make additional comments about their experience.
When describing their early mathematics experiences:

- Half indicated that they ‘didn’t try’ because they thought they couldn’t do the mathematics
- One indicated they ‘didn’t try’ because they thought the work was too easy
- Six said they did ‘put effort in’ with half of these students acknowledging that they did so even though they knew they still couldn’t do the mathematics, while the remaining three ‘put effort in’ as they felt that this would help them learn more mathematics skills
- Those willing to share other ways to describe their experience said they were ‘annoyed that they had to re-do mathematics’, had a previous negative experience and ‘hated mathematics’ and ‘tried – but were worried about getting things wrong’

When they were asked to reflect on how the thought of mathematics made them feel at the start of the year 70% of learners identified feeling 'stressed', 25% worried 6% were hopeful the remaining were feeling indifferent or unbothered. No learners chose excited.

In contrast, learners were very positive, at the end of the project, about how having a coach in lessons, either online or face to face, made them feel more comfortable in mathematics lessons, reporting:

- "I found it easier to ask questions"
- "It made me feel less anxious"
- "I worked better with someone else there"

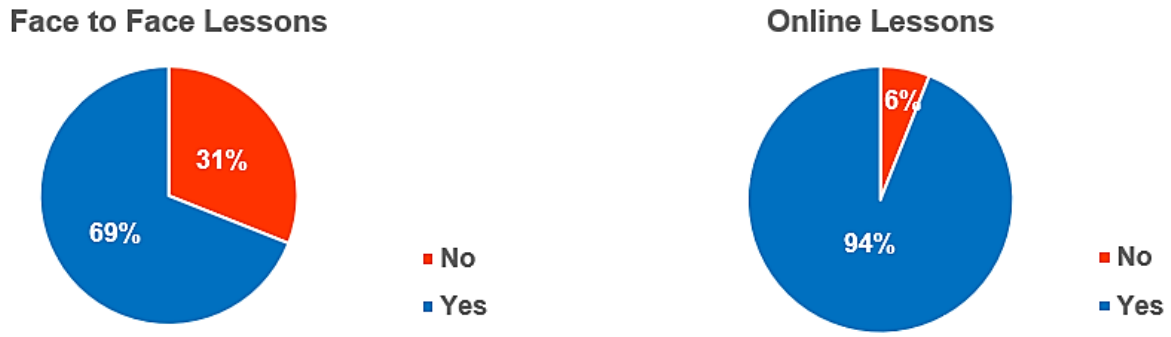

Fig 8.0 Learner response to the question - Has having a coach in your mathematics lessons made you feel more comfortable?

In terms of whether a having a coach present has made a difference to how they feel about their mathematics ability, 87.5% identified that it helped them realise that when they put the effort in, they are better at some mathematics topics than they initially thought. 62.5% reported that it has given me more confidence in their ability. Only one learner identified that having a coach made 'no difference' to them.

Returning to the initial question of how the thought of mathematics made them feel at the start of the year, they were asked how the thought of mathematics made them feel now, 81% of students went from feeling 'stressed/worried' to 'hopeful/excited'. Some of the comments the students left in their post intervention questionnaire are shown in Appendix F - a slide from the CfEM presentation version of this report.

Conclusion

To conclude, our findings identified that coaching was, in the main, successful in addressing learner's psychological barriers to learning mathematics. Coaching strategies included, but were not limited to, reframing, anxiety management, coach and tutor collaboration and academic support. Discussions with learners throughout the academic year, revealed that their reasons for disengagement were varied and therefore support needed to be individualised and learner-centered. Feedback from learners who received this support explained how working with a coach made them feel less anxious and more confident in their ability which, in turn, increased their motivation and engagement. As evidenced, our results and findings were comprehensive and have led to a number of detailed recommendations.

Recommendations

- Addressing the psychological barriers to learning mathematics post-sixteen is key in raising attainment in the GCSE mathematics re-sit cohort. Barriers to learning mathematics are complex, coaching addresses these barriers and gives learners the skills to overcome them. **Employing mathematics coaches in post-sixteen settings** to work with either individuals or whole classes would raise motivation and engagement, leading to more successful outcomes.

- There is a strong need for learners who are taking the mathematics re-sit over a number of years to build their resilience to enable them to re-engage with their learning. **Engagement coaches for mathematics provides the multi-faceted approach** that these individuals need to make progress.

- Supporting neurodiversity in classrooms has been in discussion for some time. However, barriers to learning mathematics and mathematics anxiety are not included in initial teacher training. **Generic teacher training needs to address barriers to learning mathematics including mathematics anxiety**, so that teachers are better prepared to overcome prevailing negative attitudes that have become culturally acceptable in the UK.

- **Further Education settings should increase awareness of barriers to learning mathematics and mathematics anxiety**, offering coaching strategies and solutions to all teaching and support staff. Mathematics is a skill for life and an integral part of all learning, irrespective of the vocation.

- **Coaches should be sourced from existing staff** who are experienced at working with learners within a Further Education setting. It takes time for those new to Further Education to become familiar with the nature of learners and the most effective strategies to engage them. **Engagement coaches will require training** in recognising barriers to learning mathematics, including mathematical anxiety and interventions that build mathematical resilience.

- **Use a communication aid** that is accessible by all. Using one resource that stores all data, reports and research saves time. Make use of templates, automated forms and spreadsheet population to maximise efficiency.

Moving Forward

In the next academic year, the project aims to expand on the coaching role and create pairs of coaches and teachers who will prepare and deliver lessons together. The coach will focus on the emotional needs of the learners, the teacher on the academic needs to ensure that learners are in the correct mindset to enable learning to take place. The research will focus on the Construction and Motor Vehicle vocational areas at Cambridge and network colleges as this is currently the lowest attended and motivated area in regards to mathematics. Expanding the reach to other colleges, will allow the project to provide further insight into the need for engagement coaches in post-sixteen mathematics resit programmes. Included in this study will be room staging, to create a space that is different to that experienced in mathematics classes at school to begin addressing any mindset issues from day one.

The long-term aim of the project is to observe whether employing coaches as part of mathematics teams influences teaching and raises motivation and engagement of learners. The guiding research question is: Would a 'hit team' of coaches work, in getting groups back on track when they become disengaged, with coaches moving from group to group modifying teacher behaviour and learner resilience? Regardless of outcomes, for mathematics teachers to understand the need for coaching for mathematical resilience in learners would be an enormous step forward in raising motivation, engagement and ultimately attainment.

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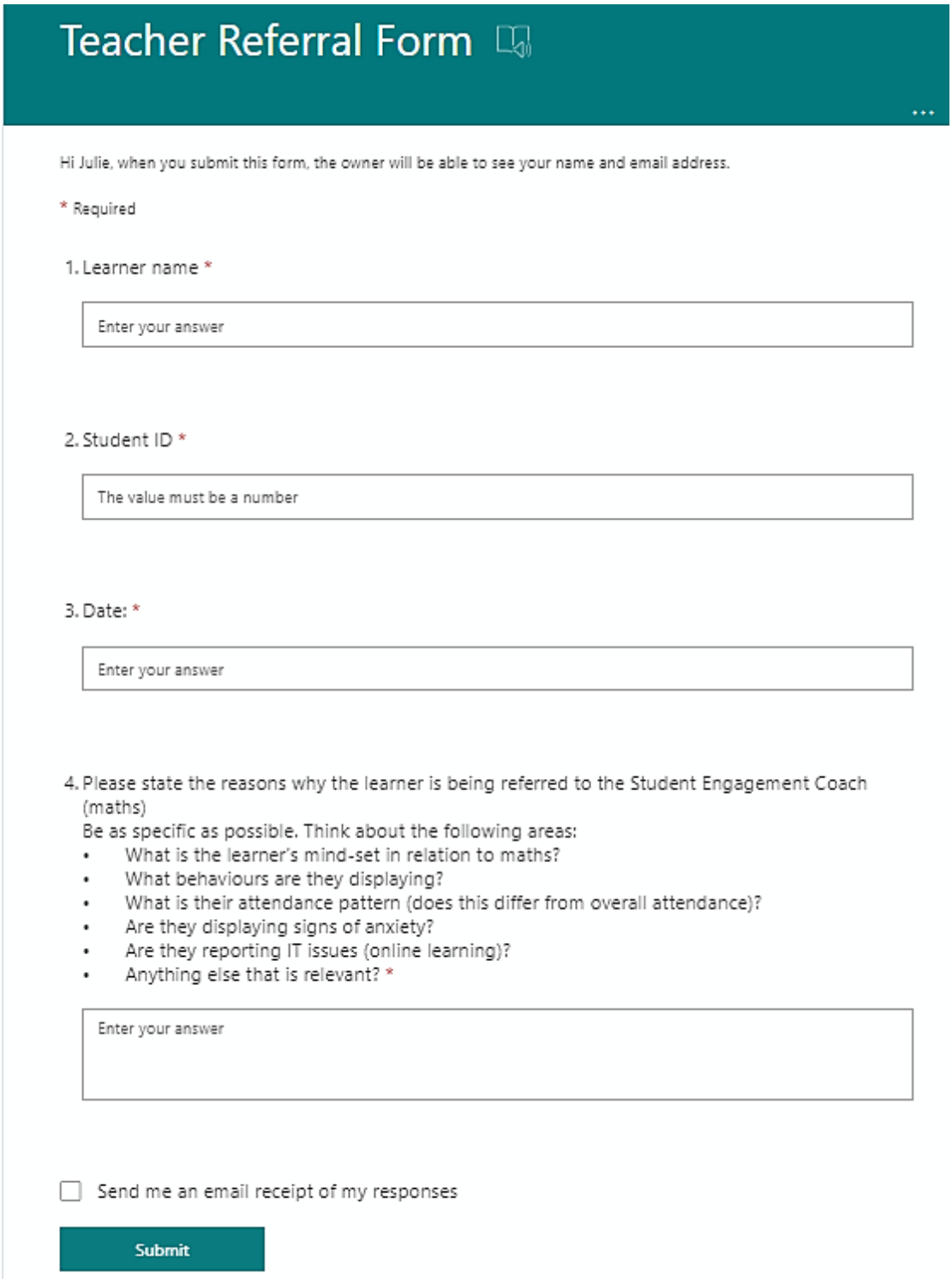
Appendices

Appendix A - Teacher referral form



Teacher Referral Form

Hi Julie, when you submit this form, the owner will be able to see your name and email address.

* Required

1. Learner name *

Enter your answer

2. Student ID *

The value must be a number

3. Date: *

Enter your answer

4. Please state the reasons why the learner is being referred to the Student Engagement Coach (maths)
Be as specific as possible. Think about the following areas:

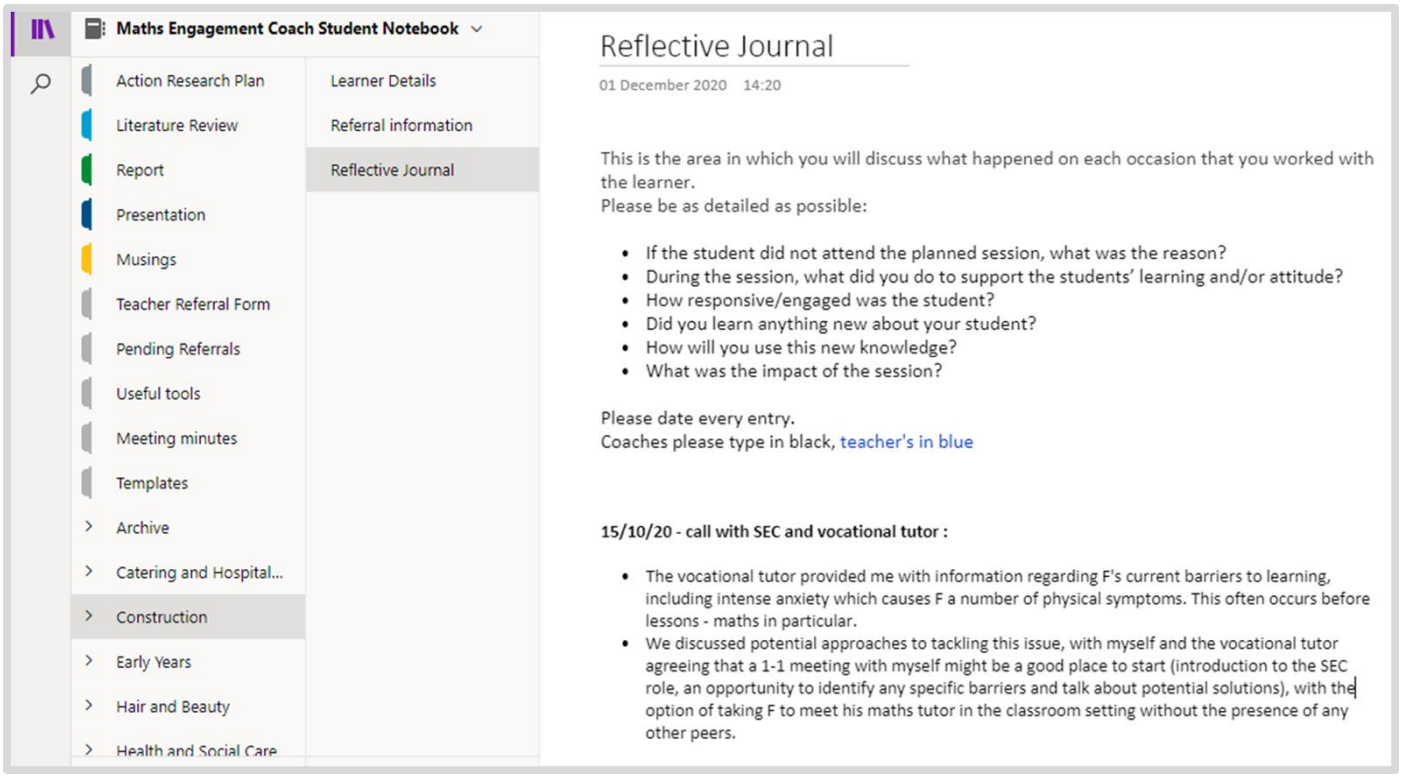
- What is the learner's mind-set in relation to maths?
- What behaviours are they displaying?
- What is their attendance pattern (does this differ from overall attendance)?
- Are they displaying signs of anxiety?
- Are they reporting IT issues (online learning)?
- Anything else that is relevant? *

Enter your answer

Send me an email receipt of my responses

Submit

Appendix B - OneNote as a communication aid



Appendix C - Learner consent form

Cambridge Regional College

FORM OF CONSENT
for the use of
VIDEO

I……..(name) consent to Cambridge Regional College and its employees to use my image in video format taken on ..... for the Centre for Excellence Project presentation.

My consent shall be given on the strict understanding that the video shall be will be used to represent Cambridge Regional College on The Education and Training Foundation website. Under no circumstances shall the video be used by other parties or for any other purpose without my further written consent.

Signature:…… Date:……

Appendix D – Coding for emergent themes

Evidence of disengagement/low motivation	Low attendance	Low attendance in maths, including online and face to face.
	Lack of focus	Distracted, engaging with peers, little or no work completed.
	Lack of response online	Not replying to Teams messages or emails. Being in the maths session but not communicating in any way.
	Avoidance techniques	Checking phone frequently, avoiding eye contact, hood up or hat on. Distracting the teacher off topic.
	Signs of anxiety	Looking worried, closed body language, wide eyed
Reason for disengagement/low motivation (maths related)	Gaps in knowledge	Being confused with the maths content.
	Lacks confidence in ability	Comments made by learner about own ability.
	Questioning application of maths	'Where would I ever use this?' Doesn't see the point in learning maths ability
	Dissatisfaction with current grade	Grade lower than they feel it should be.
Reason for disengagement/low motivation (non-maths related)	Fear of judgement	No wanting to answer questions in front of class.
	Maths environment	Teaching style, physical space, number of peers,
	Online learning	Support for learning needs, style of learning, visibility of answers to peers, technical skill.
	External issues	Access to equipment, additional learning needs, mental health, personal circumstances, negative history of maths
Coaching strategy	Encouragement from coach	Positive language, reminding them of their ability, no judgement, celebrating mistakes
	Coach and tutor collaboration	Conversations about learner progress, wellbeing concerns,

Appendix E i) – Beginning of the learner feedback questionnaire

Maths Questionnaire

This short questionnaire will ask you to reflect on how you have found maths this year at college.

There are no right or wrong answers. This is about **YOUR** experience, and everyone's experience is different.

Your answers will be anonymised so please be as open and as honest as you can. Your feedback is **extremely** helpful!

Thank you :)

Appendix E ii) – A question from learner feedback questionnaire

Think back to the beginning of the college year. Which words best reflect how the thought of maths made you feel?

(Select all that apply.)

- [ ] Excited
- [ ] Hopeful
- [ ] Indifferent
- [ ] Worried
- [ ] Stressed
- [ ] Other (please use box below)

Appendix F – Some quotes left by learners in their post intervention questionnaire (as shown in CfEM presentation of this project)