

Centres for Excellence in Maths (CfEM)



The effect of small group intervention by teachers through Maths Labs (Northampton College) and Maths Clinics (Harlow College) on learner engagement and achievement.

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Action Research Project

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Abstract

The purpose of this study was to explore the effect of small-group intervention on learner engagement and overall achievement of 16-18-year-olds GCSE resit learners, implemented by Harlow College via Maths Clinics (MC) and Northampton College via Maths Labs (ML). It is a delivering strategy to support post 16 learners who have not yet achieved a grade 4 in their GCSE maths and have been made to re-sit GCSE at College following the government decision that students who do not achieve a grade 4 at the age of 16 should continue to retake the exams until they reach the age of 18. Harlow and Northampton Colleges continued to expand and develop on this approach to support learners who struggle with mathematical concepts within their normal lessons following a successful trial last year.

There were some changes in both colleges in approach due to the outburst of Covid-19 pandemic which forced the delivery of lessons to be online rather than face-to-face. MC approach was to keep the identified learners behind after normal lessons and the same teacher did further work with them, hence giving them an opportunity to go over what was taught in class that day or work on the topics that the teacher has identified as their weak areas.

Whereas, for ML, learners were either referred to go or through self-referral, learners went to another room (Lab) to work with a different person (coach) on any area they felt they needed help with.

Since all lessons were delivered online MC started timidly and didn't gain much momentum and hence only 15 learners finally took place in the project, because it was difficult for teachers to build a meaningful rapport with the learners. Three teachers took part in the MC this year, supporting and encouraging learners to improve on their engaging and learning of maths. It was seen that 13 of the 15 (87%) learners achieved a grade 4+ at their end of year assessment after the Awarding Body ratification. It should be noted that these 15 learners were struggling a lot or had maths anxiety and so for them to achieve a grade 4 was remarkable.

About CfEM

Centres for Excellence in Maths (CfEM) is a five-year national improvement programme aimed at delivering sustained improvements in maths outcomes for 16–19-year-olds, up to Level 2, in post-16 settings.

Funded by the Department for Education and delivered by the Education and Training Foundation, the programme is exploring what works for teachers and students, embedding related CPD and good practice, and building networks of maths professionals in colleges.

DfE created 21 Centres for Excellence in Mathematics (CfEM) in England to research ways of delivery a step change, improving the above statistics. Harlow College is one of the 21 CfEMs and is trialing innovative approaches in carrying out this task. Harlow college has succeeded in recruiting 14 network partners including FE college and sixth Form colleges who are teaching post-16 GCSE re-sit Maths, so that together we can work collaboratively to achieve greater success.

Introduction

Harlow College are currently working in collaboration with Northampton College on a continuation of an Action Research that was started last year, exploring the effectiveness of 1-2-1/small group interventions on Level 2 maths resit students.

Northampton College has approximately 1700 learners studying maths as part of their study programme. The College has over 800 apprentices who continue to study maths as part of their apprenticeship. The provision ranges from pre-entry to Access with the majority of students studying at GCSE level.

Harlow College has 1300 learners 16-18 years of age studying maths ranging from E3 to L2 FS or GCSE re-sit, and a further 300 Apprentice studying maths as part of their course framework.

Harlow College decided to enrol learners with a grade 3 onto the GCSE resit programme, and learners with a grade 2 or 1 on functional skills level 2 or 1 respectively. On the other hand, all maths students at Northampton College are enrolled directly onto GCSE re-sit programme irrespective of the grade they start with. Each college meeting the government requirement in different way.

GCSE attainment in Northamptonshire is below national average. Of the top 30 main feeder schools, only 40% (12) achieved above the national average of 53% GCSEs Grades 9-4 or A*-C whereas, 60% (18) achieved grades 3-1 or D-G. Half of the main feeders only achieved at, or below, the floor standard of 50%. For example, both Daventry secondary schools achieved below the floor standard. Consequently, significant numbers of students need to continue to study maths post 16. Similarly, GCSE attainment of Harlow College's four main feeder schools of grade 9-4 is 31% and 69% grade 3-1, these results are similar across the country. As a result, most learners coming into FE Colleges have to re-sit their GCSE maths as required by the government.

As stated above, FE learners have failed to achieve the desired grade 9-4 in Secondary School, and often multiple times, for a variety of reasons, including negative prior experiences with learning, peer pressure and lack of confidence (Education and Training Foundation 2014). Therefore, many of them feel as if they are a failure and, hence, they lack confidence and are disengaged from maths. These issues are not limited to Harlow and Northampton College but are a country wide problem.

The action research on small group intervention consists of two projects and a continuation of last year's action research on 1:1/small group intervention via Maths Clinics (MC) and Maths Lab (ML) at Harlow and Northampton Colleges respectively. ML and MC seek to assist learners in a one to one or small group tuition linked to their normal teaching as this has been shown to be more effective.

Maths Clinics (MC) approach was carried out last year by one teacher and has been extended to two more colleagues making it three teachers. The Action Research (AR) lead at Harlow was the one teacher who experimented the approach last year and is working with the two other colleagues and hoped to increase the number of learners from 30 last year to about 90 this year.

Maths Lab (ML) is also a continuation of research from last year with a nominated AR Lead who is not a maths teacher but liaising between teachers who recommend learners to attend

the labs, which are staffed by independent retired maths teachers supporting independent studies. They estimated that the number of learners to attend the Labs would be 100 bringing the total of learners taking part in the action research across both colleges to 250.

Background

Learner outcomes in GCSE maths resits in FE sector are of importance to all colleges and society to ensure that the UK workforce has sufficient quantitative skills for an increasingly data-driven and technology-rich future. The national achievement rate of grade 9 – 4 or A*-C in Maths of all secondary schools in England is about 40% and the the past rate of post 16-18 GCSE maths res-sit within the FE sector sits at under 20%.

Many learners continue to experience an uninspiring mathematics lesson in which learning is limited to memorising and practising maths procedures, with little understanding of their applications, purpose or underlying concepts resulting in a large proportion of disaffected learners (Foster 2013, OFSTED 2021 and Nardi and Steward 2003). It should be noted that negative experiences of mathematics are not limited to England. Skovsmose (2011) highlights the dominance worldwide teaching approach in which teachers demonstrate mathematical procedure to students who then complete a series of almost identical closed questions. As a result, large numbers of children and adults exhibit anxiety towards, and alienation from mathematics, which is commonly perceived by the general public as 'dull, irrelevant, useless and often harmful' (Grootenboer 2013 p. 324).

At Harlow, for example, the grade 4+ pass rate is above 35% due to the new teaching approaches that we have introduced which are more dialogic, but we are still working on the approach to perfect it, and also wanting to try other strategies such as effective questioning techniques. However, about 30% of learners who had previously achieved a grade 3 are achieving a grade 2 or below and it seems as though we are un-teaching the learners, but we believe that this is due to the gap between the end of their last lessons at school and the time they start at college during which they forget the skills learnt at school, so when they start with us they are no longer working at grade 3. This is illustrated from their diagnostic assessment at college where most of them with grade 3, achieve Entry level 3 or less, and during in-class assessment most say that they no longer remember. To most effectively explore issues surrounding the poor attainment of grade 4+ at GCSE resit a subset of literature has been selected based on its relevance to the research question.

Literature Review

GCSE maths resit learners are learners who have failed GCSE Maths at least once and are required to re-sit GCSE by government law that was passed 2nd of July 2014. As a result, all General FE colleges and Sixth form colleges are doing all they can to help these learners to achieve the desired grade 4+. Since the change in law in 2014, the FE maths GCSE resit results nationally have been around 15% to 18%. In colleges the situation, as exemplified by Bellamy (2017), is one where learner feelings are of fear, anxiety and anger towards mathematics due to their previous failure and previous experiences of maths lessons. The pedagogic approaches used are often only transmission and didactic requiring learners to memorise most of the content.

We aim to explore the impact of 1:1/small group intervention as research, though not in the FE sector, shows that this type of intervention is beneficial to students. For example, Chappell et al. (2015) explored the impact of extra tuition of middle school students in two U.S. schools in relation to their grade achievements compared to those students exposed only to usual classroom teaching. Forty-nine 11-year-old students from one of the schools and seventy 12- and 13-year-old students in another school received extra tuition during the 2013/2014 academic year. All students who took part were students who had achieved grades below the passing grade. Their study 'supports that extra tuition of maths helps learners to achieve a better grade', though there are limitations to the relevance of this work to FE in England.

Karsenty (2010) reported on a two-year case study from a single school. The case study worked with 53 students from secondary school in an urban area in Israel. Their approach was to use non-professionals in giving students with previous low grades extra tutoring. The case study showed a considerable increase in pass grades. 47 of the 53 learners that took part improved their grades. The case study noted that some of the factors that were most influential to the success of learners included volunteers' ability to maintain warm and supportive relationships with students, professional development for the volunteers on mathematical curriculum and pedagogy, most students selected for the case study were those with no learning disabilities, and the willingness of volunteers to embrace learning mathematical resources. We intend to evaluate the impact between teachers to see if the relationship between teachers has an effect. Jankvist and Niss (2015) reports on an intervention designed to train experienced maths teachers as 'maths counsellors'. It is particularly aimed at students with problems with learning mathematics concepts. It is aimed at KS3 students and is based on reasonable quality evidence. No concrete findings are available as yet, however, there are some initial positive outcomes.

Betts et al. (2011) reported on a large-scale, high-quality study on the effectiveness of the California Mathematics Diagnostic Testing Project (MDTP) on students' mathematics achievement. This study describes the use of a diagnostic mathematics test to provide detailed feedback on a student's readiness to move on to a given course in the next academic year. It presents high-quality evidence from large numbers of 11- to 14-year-olds. The authors found that high quality formative/diagnostic testing, if used systematically, can support learner gains, primarily by providing teachers with the knowledge they need to identify and address specific student weaknesses in mathematics. However, simply providing diagnostic tests as a resource available to teachers does not appear to provide the same improvements.

Many of learners continue to experience an uninspiring mathematics lesson in which learning is limited to memorising and practising maths procedures, with little understanding of their applications, purpose or underlying concepts, Foster (2013), OFSTED (2012),

resulting in a large proportion of disaffected learners, Nardi and Steward (2003). It should be noted that negative experiences of mathematics are not limited to England. Skovsmose (2011) highlights the dominance worldwide teaching approach in which teachers demonstrate mathematical procedure to students who then complete a series of almost identical closed questions. As a result, large numbers of children and adults exhibit anxiety towards, and alienation from mathematics, which is commonly perceived by the general public as 'dull, irrelevant, useless and often harmful', Grootenboer (2013), p. 324).

Aim/Research Question

To what extent does 1-2-1/small group intervention through Maths Lab or Maths Clinics help to develop mathematical underpinning skills for our GCSE resit learners?

Methods

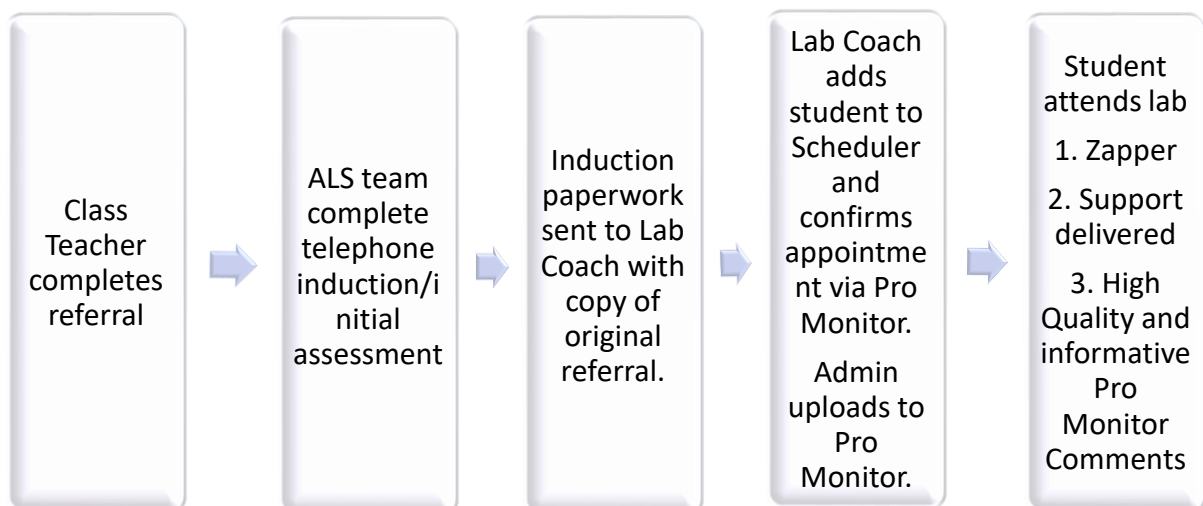
These disengaged learners may need to be supported in various ways to develop self-confidence and resilience in mathematics. We recognise that there is no easy fix, however we thought that one way to start building learner confidence was to identify gaps in their knowledge through analysing existing data and in-class assessments in order to focus our teaching on those areas with 1-2-1s or small groups of learners, whilst also reinforcing areas they “can do” for knowledge retention and to give them a safe space for them to be able to understand that it is okay to make mistakes and learn from them.

So, what we strive to achieve in this research is to help disengaged learners by demonstrating the relevance and application of mathematics in a more focused way, illustrating to the learners that they can do mathematics. Thereby raising their confidence of these already disengaged learners, whilst at the same time providing a rich, safe and stimulating learning environment. The Action research group agreed that due to students not retaining information, they will try implementing short, regular sessions for optimum impact.

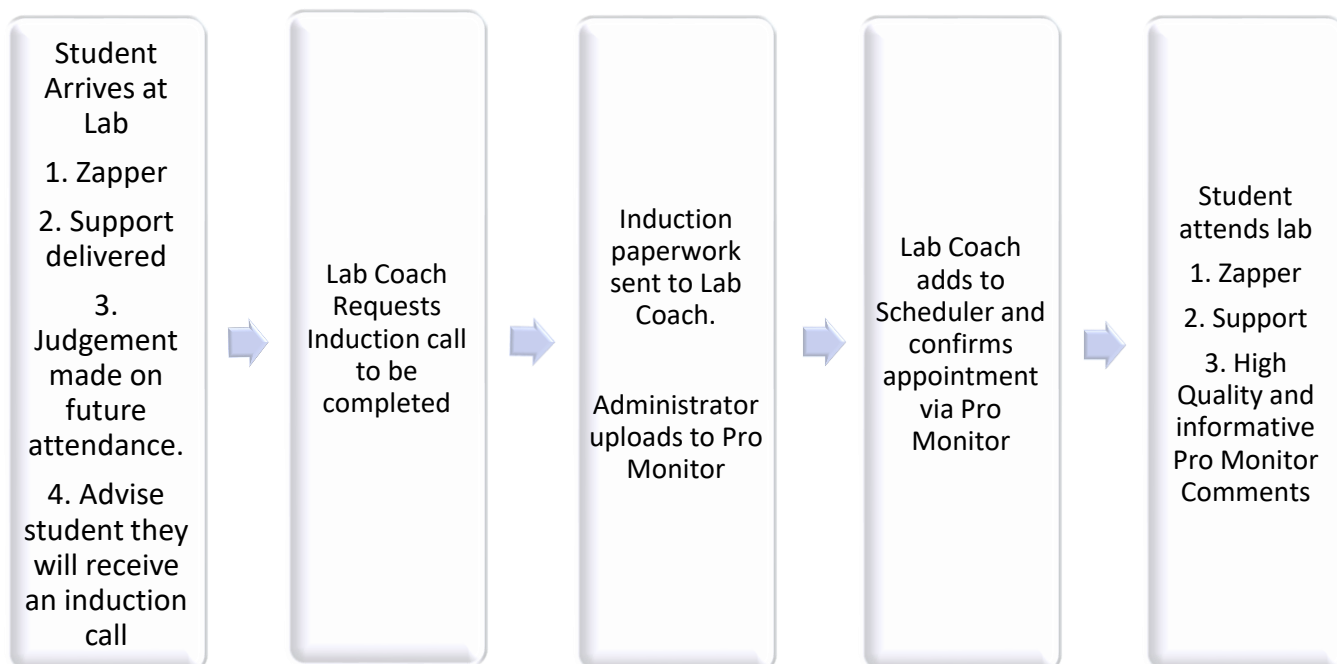
In this research we used a spiral approach where we worked in stages, evaluated each stage before continuing. Below is the referral process of Maths Lab at Northampton.

Maths Lab Process at Northampton

Teacher Referral Process



Learner self-referral



Maths Clinics at Harlow

Maths Clinics (MC) approach was based on assessment of learner gaps by their teachers and invited the learners with similar gaps in knowledge to attend extra sessions after/before their main sessions with the same teacher who teaches and assess them. However, Maths Labs (ML) at Northampton was done through a referral process where teacher refer learners to attend a ML to work with maths teachers who are not their usual maths teachers to complement their learning in class and discuss any challenges they may be facing in their lessons.

Comparison between Northampton and Harlow

Northampton College- Maths Lab	Harlow College - Maths Clinics
Designated Learning Space separate from the classroom	Takes place in the classroom environment
Delivered by an Academic Coach	Delivered by the Maths teacher
Students sent to the lab or 'drop in'	Maths teacher identifies students to attend by analysing various student performance data
Sessions take place around the study programme timetable	Sessions take place before or after the Maths lesson
During pandemic – delivery has switched between face to face and online in response to states of lockdown	Sessions have been completely online.

Maths Lab at Northampton

Northampton College has an established 'Maths Lab' which works closely with its Maths team, to provide study solutions for students that need extra support to get the most out of their studies. The lab stems from recent activity relating to a strand of activity linked with the ETF Centre for Excellence project. The Maths lab has experienced a high profile at the college. Since its conception there has been debate around the core function of the Maths Lab, namely whether it should focus purely on exam-based preparation and recall, or whether the nature of the service delivered, should have a stronger focus on longer term skills which students can apply to their future study, employment, and life. All students need to pass their exams - this is a critical element of a course, and the former approach comfortably compliments the GCSE Maths curriculum, featuring a significant element of 'catch-up' work to ensure that students have covered the topics they need to perform to the best of their abilities in their examinations. The second consideration exhibits characteristics more associated with a learning support skills development model. The feeling of mastering a 'skill' is essential for future work and life. Northampton College's Maths Lab is delivered by Academic Coaches, with specialism in Maths, rather than by teaching staff. The activity is not part of a student's study programme hours; therefore, for the academic year 2020/21, the strategic decision was taken to reposition the lab into the college's School of Academic and Vocational Support, which services all learning support provision across the college. As a general rule, students attending the Maths Lab receive 1 hour of support per week outside of the classroom in a designated learning environment. Images of the Maths Lab learning environment appear throughout this report to help provide a flavour of the space itself.

Maths Clinics

Since the AR in Maths Clinics was the continuation of the same project from the last year, the methods for student selection and recruitment, delivery and data collection varied very little. This report looks individually at each of the three stages outlined above and draws parallels to the methods used in the first year of the AR.

MC is a carefully planned and executed learner support plan. There is a contract, or LSA, in place between the learner and the teacher, which constantly changes, evolves and improves as the learner progresses through the maths topics. It is delivered within the same classroom by the same teacher that teaches the learners. It's aimed to motivate learners, improve their confidence because as stated earlier, most of the learners who come to the college have lost their self-confidence and do not believe that they can ever achieve a grade 4+ in mathematics. MC provides a safe space and opportunities for learners to develop their thinking skills and ideas, talk/discuss with their teachers and peers to explore their mathematical thinking and to realise that maths is not just a black and white subject. By encouraging learners to work through their areas of weaknesses, it is hoped that learners would see that they can make progress through small gains from engaging in tasks and activities. This approach has proved to lay a foundation for them to aspire to be at their best.

Effects of Covid-19 Pandemic

The new pandemic guidelines meant that teachers were not able to meet with students face to face, instead, MS Teams was used to set up classes, arrange "meet and greet" and subsequently, deliver MCs. This meant that we were unable to effectively recruit learners until late into the year. The online learning has brought many exciting opportunities; however, it did not help us in forming effective relationships with students,

Each teacher taking part in the MCs has been promoting them in their classroom and in some instances actively insisting that students with specific gaps in knowledge joined MCs. In the absence of GCSE grades, diagnostic and in-class tests results were used to identify students who would best benefit from taking part in the project.

Cycle 1 Research Cycle 1 – Lab Access Routes (Methodology) at Northampton

To gain initial insight into the operations of the Maths Lab, a sample of 7 students and 2 teachers connected with the Maths Lab were interviewed to explore their perspectives on the service and its effectiveness in supporting teaching and learning, in particular, how does the lab compliment the teaching of Mathematics in the classroom. The students were interviewed on the telephone or face to face with social distancing measures in place.

Starting point	Methodology	Purpose
To evaluate the student experience in relation to accessing the lab	Online/telephone/face to face interviews with students that have regularly attended the lab – use of closed, open, and probing questions to produce qualitative data. (Telephone/Skype for Business/Microsoft Teams) Records of response were collated by the researcher.	Evaluate customer service experience, customer satisfaction and inform future process and delivery considerations
To evaluate teacher’s understanding of the lab provision	Remote conversations with teachers that have referred students to the lab. (Telephone/Skype for Business/Microsoft Teams) Records of response were collated by the researcher.	Evaluate teacher’s understanding of provision and capture teacher observations on student performance in lessons since engaging with the service

Last year it was a case study with one teacher who carried out the action research while developing his own skills. This year, this was rolled out to more teachers. So, from October to November the new teachers had meetings with Centre lead and the AR lead to understand how the AR was to be done. How to assess learners and recruit for AR. Given that teaching was 100% online due to the pandemic, some teachers had to acquaint themselves with online teaching and use of MS Teams. The three teachers had to set up slots after the lesson for MC students to stay and work with them. We decided that learners per session will come from the same vocational area and are the learners taught by the same teacher during their main session. Learners from the same vocational areas will feel free to talk to each other because they would have formed a relationship within their main programme of study. We decided that to begin with, each teacher will start with about 2 or 3 learners and then increase the numbers as time went on. This was to ensure that teachers try out the use of MS Teams to get a better understanding of how it works with few learners and also get a better understanding of the learners. This meant that we didn’t start until late October/early November just before the November exams.

At the end of the first cycle, once teachers were ready, a baseline survey was designed by centre lead and it was sent out to all the learners enrolled onto GCSE resit course in both Harlow and Northampton. 80 learners in Harlow responded to the survey, while 110 responded at Northampton.

Activities at Harlow throughout the AR

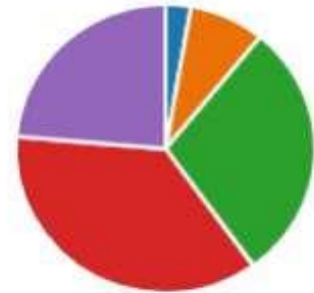
When	Action: (What did you do/try?)	Reflection: (What worked/didn't work?)
Nov 2020	<p>Selection of students A challenge posed by students: "Why me?"</p> <p>Difficulty in buying in Selected a few to volunteer at the start of the term, starting point after Nov exams.</p>	<p>It was hard to sell the idea of maths clinics to students, singling them out of the class. I have chosen to take some students out of the class setting and explained benefits.</p>
Dec	<p>Decision to take student-led approach, where students are main drivers of what would be covered in these lessons.</p>	<p>This approach has worked in the first year of the AR and thus it would be realistic to replicate it across the college.</p>
Jan	<p>Back to selection issue, after getting to know our students, we had better idea who we think would benefit from maths clinics. (i.e student who was shy from asking questions in class but was forthcoming in chats and private settings, close to achieving grade 4 in Nov 2020 but failed, students who performed relatively well in class assessments), ore interested students after the Nov exam results came out.</p> <p>Lesson planning usually aligned with the topic of the week however these are to be changed based on students' needs.</p>	<p>It is an agile approach that is needed to use when selecting students for further targeted support. We learnt that we need to stop and revise our approach and constantly monitor the progress</p> <p>Data is an important driver in informing us who and how to target.</p>
Feb-Mar	<p>The intensity of MC lessons increases as the final assessments approach. Students becoming more tuned in, focused and eager to do well. The communication with the students outside of the MCs has also increased via MS Teams, allowing an active follow up to set activities within the MC sessions.</p>	<p>At this point, students seem to almost become accustomed to being pushed to do more, they seem keener to complete set tasks and come forward with questions if they didn't understand the topics. Increase of one-to-one communication with their MC tutors has also been on the rise, confirming once again the engagement levels of the MC learners.</p>

As part of this research cycle, Harlow College and Northampton College surveyed all students enrolled on their GCSE maths courses to seek student feedback on their current maths course. This data was hoped to be valuable to improve course delivery, but to also provide an insight into the types of activities the students enjoyed or wanted, so as to better inform their teachers in the MC (Harlow) or the coach in ML (Northampton). Below are two outcomes of the results from Northampton similar to those of Harlow.

Data collection – Student Survey – Northampton learners

How much of your maths lessons do you understand?

1 - not at all	3
2	9
3	32
4	40
5 - very much	26

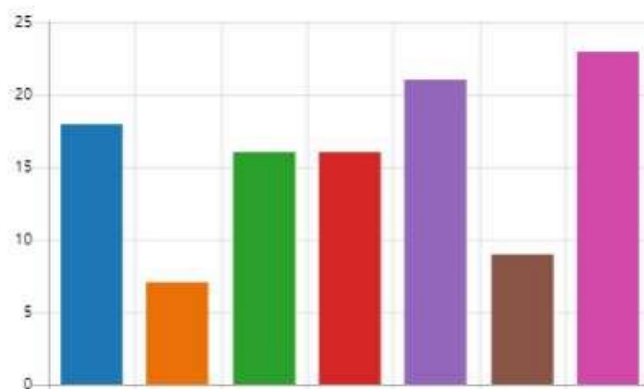


Learners were asked to rate themselves between 1 and 5, and the results above showed that 66 of 110 learners (60%) said they do understand their lessons.

The next question was to determine the topics that teachers or coaches can focus on during MC/ML and as seen below, Algebra ranked highest as the least liked topic in line with the data analysis that was conducted the year before using actual exam results.

I. What has been your least favourite topic so far?

Number - Fractions/Decimals/...	18
Number - Factors & Multiples	7
Number - Indices & Standard ...	16
Algebra - Expanding & Factori...	16
Algebra - Solving Equations &...	21
Algebra - Sequences	9
Other	23



To collect the data on students' perception of MCs, we used the same questionnaire designed in Year 1 of the project, this also would give us a good comparison point of the impact caused by the addition of more teachers and expanding the AR across the college. Students have completed the questionnaires unsupervised, and responses have been collected and stored via Google Forms. In addition, we have conducted interviews of every tutor involved in the research, and the results of these interviews have been stored and recorded in MS Teams.

In Northampton, similarly to Harlow, the first cycle took place during the second half of the Autumn Term of 2020-21, but they chose to analyse qualitative data obtained from student and staff interviews. The main focus was to find out their overall understanding and experience of the Maths lab. The sample learners were those enrolled onto GCSE maths and their respective Maths teachers (4). The findings of cycle one shaped the following research cycle, which will also be evaluated as part of this report. The AR research lead interviewed 7 learners at Northampton.

Evaluation of student/teacher experience

To gain initial insight into the operations of the Maths Lab, a sample of students and teachers connected with the Maths Lab were interviewed to explore their perspectives on the service and its effectiveness in supporting teaching and learning, in particular, how the lab compliments the teaching of Mathematics in the classroom. A sample of 7 students were provided to the researcher. These students were interviewed on the telephone or face to face with social distancing measures in place.

Learner interviews – Maths Lab

The following initial questions were posed to each student:

1. How did you find out about the Maths Lab?
2. Did you talk to your teacher about the Lab?
3. Did you know what the Lab was before you went?
4. Can you remember the first time you visited the lab? Tell me more about that.
5. How does the Maths Lab help you?
6. Is there anything you think we could change about first visits to the lab?

Teacher interviews- Maths Lab

The student's teachers were also interviewed, except for one teacher who was unable to participate. The following questions were posed to each teacher:

1. What is your understanding of the Maths Lab?
2. How do you currently identify students that may benefit from the labs?
3. Your student has attended the lab – do you talk about this with them?
4. Have you noticed any changes to the student's ability to access learning since attending the lab?
5. Are there any specific activities that you think the Lab coaches should deliver to students?

For the AR, it was important to compare teacher responses to these questions, alongside initial considerations, to get a feel for the level of shared understanding as to what the ML/MC offered, as a starting point. Since the AR lead was not a teacher, the approach was to help him with his personal learning and understanding of existing processes and activities in order to review the current model. Thereby informing the senior management of what the AR was all about and the impact on teaching and learning with the college.

Results and Discussion

On the 11th of March, Harlow College and Northampton College met online to reflect on their respective surveys. Harlow College had received 79 responses out of 300 potential students surveyed, with Northampton College had received 120 out of 1200 potential student responses.

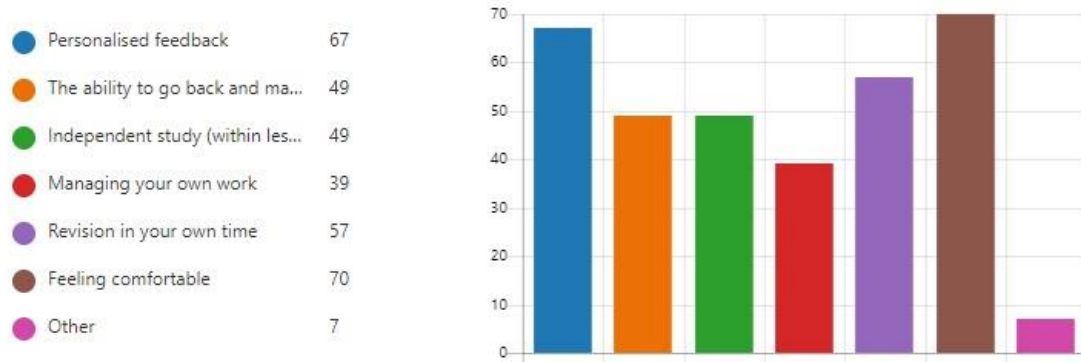
When considering student responses, it is important to take into consideration the differences in Maths delivery between the two colleges. Harlow College delivered its Maths lessons online for the full academic year, whilst Northampton College delivered a mixed model, both face-to-face teaching and online delivery in response to states of national lockdown and the easing of associated restrictions. There were some similarities in responses, but notably, the responses for Northampton College were more positive in respect of student's enjoying their lessons, but within the student responses, comments around online learning were more negative. It could be interpreted that the students at Northampton College were considering their face-to-face experience of lessons when responding, which Harlow College students would not be able to reference.

Discussion of the results from student survey Northampton

Survey questions	Discussion
What do you enjoy the least or find most challenging about maths lessons?	<p>Some students specified topics. The topics appearing most frequently were Algebra, Probability and Fractions. (These topics were also prevalent in a separate question which asked students specifically to name the topics they found to be their least favourite). One student clearly detested Mean, Median and Mode!</p> <p>However, the majority of responses focused on the classroom learning environment or their individual learning styles. For example, students referenced difficulties understanding questions, not enough time to work on questions, and difficulties retaining learning due to their short-term memory.</p>
What would make your maths lessons more enjoyable?	<p>Responses to this question were vaguer, probably due to the position of the respondent in the situation, i.e., they are not the professional tasked with creating a thriving learning environment within the classroom. (One student clearly valued tea and biscuits as being a motivator in their Maths learning – personally, I shudder at the thought of spillages and crumbs)</p> <p>Some responses were more insightful - they offered suggestions focused on different ways of learning, e.g., fun games, making lessons more fun and interesting, doing activities where everyone can join in, practical small groups working together etc. Some responses again required content to be delivered slower, being provided with more time to practice, and for teachers to identify when they hadn't been able to answer a question and go over it again with them.</p>

15. Please tick the top 3 things that you find most helpful:

[More Details](#)



The responses to the question above seemed quite powerful. Out of the pre-determined response options, the pre-dominant selections were:

- Feeling comfortable
- Personalised feedback
- Revision in your own time

This feedback will be used to consider student needs in the classroom and explore how the Maths Lab could help contribute to ensuring these things are in place.

<p>Your teachers want to hear your ideas for making maths lessons better for you.</p>	<p>This question elicited a free response. Disappointingly, a significant number of responses provided little constructive suggestions for improvement, however there were general themes around:</p> <ul style="list-style-type: none"> • Needing more time to learn topics • Lesson pace too fast • Not being put on the spot in lessons • Group activities and retrieval quizzes helpful 	<p>This feedback supports the need for additional time and support specifically for Maths, regardless of how this is delivered.</p>
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Findings from Interviews – Maths Clinics and Maths Lab

Summary of the results from student Survey – Harlow College

What motivates you to attend Maths Clinics?	60% of responses were about wanting to pass their GCSE Maths, the rest ranged between "Teacher motivated me" to " Need of help to understand topic I don't know"
Do you feel that you are making progress and improving your knowledge of maths? How?	Whilst all but one responded positively to this question, it is important to understand what their understanding of progress really is. Looking at their responses in more details, one can deduce a faint tone of positivity about their progress, and this is evident in more of their answers to other survey questions.
What do you like about this type of teaching that takes place during Maths Clinics?	Looking at the responses, it is clear how much learners enjoyed more personalised support, tailored tuition and 121 approach. Students talk about how they " understood difficult topics", " You get more support", " it's more targeted and inclusive".
Would you recommend maths clinics to your friends? Why/Why would not you?	100% of the students took part in this survey would recommend MCs to their friends and colleagues.
Since you have started attending these sessions, has your confidence improved? If yes, please tell us how?	Of those surveyed, 33% feel strongly about this, and agree that their confidence has definitely improved further 27% feel it somewhat and only one feels that their confidence has not improved just yet.

Overall, the responses from the interviews conducted were positive, insightful, and provided some interesting ideas that led to further investigations and also inform the future direction of research. Interestingly, it seemed that the students wanted more than just their weekly allocation in both ML and MC. Students reported that having extra time in the ML/MC to go over areas of work that they found difficult was very helpful to them: Maths Clinics or Maths Lab are very helpful, because they are more relaxed and fewer learners. They are able to discuss their issues without being ashamed that the other learners may laugh at them. They feel that they have full attention of the teacher. They are able to discuss the method used to arrive at an answer.

We found that 87% of learners who took part in the research achieved grade 4+ in line with the research Chapell et al (2015), who found out that learners who received extra tuition in a 1-2-1 or small group intervention were more likely to achieve a better grade. Karsenty (2010) reported that over 88% of students who took part in research providing extra tuition performed better as a result.

In line with research, we found that both in Maths Lab or Maths Clinics, the relationship built between learners and teachers had an influence on learner improvement in mathematics skills. During this small group intervention, dialogue approach is better practiced and learners are provided with a safe space to think through their methods and answers thereby increasing their confidence. We find that when teachers who were not good in maths explained their personal circumstances to learners, the students were more likely to buy into the ideas, and hence develop, resilience and motivation, if the interaction took place in small settings rather than whole classes.

Betts et al. (2011), reported the use of diagnostic testing plays a major role in learner achievement which again supported our approach to assessing learners before referring them to either maths lab or maths clinics.

When learners were asked what motivates them to attend either maths Lab or maths clinics, we got answers such as 'to pass exams', 'to catch up on the topics I am not good at', etc, this implies that most learners do want to achieve a grade 4 but struggles to cope with big groups. They are able to talk through their processes, and their teachers show them how to answer questions in a gentle way. Learners felt that MC/ML staff are focused and explain concepts in a better and slow manner until they understand, since it is more or less a 1-2-1. Learners therefore are more likely to recommend MC to their friends. By so doing recruitment is made easier for the teacher. One of the learners said:

'I would recommend this to my friend because it helps to develop yourself and make an improvement in math.' Another one said, 'yes because I am no longer struggling with maths as I used to.'

'Learners' confidence improved as a result of attending ML/MC. They learn from their mistakes through the focused dialogic approach to teaching. It is much easier to practice dialogic approach during the MC because of fewer learners. Learners feel safe to vocalise their lack of understanding and to open up to discussions, 'Yes I would say my confidence has improved because with questions I thought were difficult turns out to be simpler than I originally thought, and I recognise now what I need to improve upon.'

Comparing ML/MC to their main lessons, learners say that; '*The lessons go so quick and the amount of information we must learn is a lot*'. Whereas in the ML/MC, '*I get help as I can't always remember the full question in class and then everyone has moved on, so I give up*'.

The responses from the learners seemed to indicate that they were experiencing difficulties processing the amount of learning that they were experiencing. Considering that all students were 're-sit' students, it is reasonable to conclude that Maths may not be a natural strength for them. This finding is in line with the Chappell et al. (2015) because their research was carried out with very low-performing students from rural population. The discussions with the learners indicated that in one way or another they felt that they benefitted from additional time to go over work, or that they were struggling with the pace of lessons. When asked how the ML/MC helped them, over 80% of the learners have directly or indirectly referenced time or pace.

About 20% of learners on GCSE Maths resit, have special arrangements for exams suggesting that they face issues ranging from anxiety which is exacerbated by maths to slow processing of information. This is confirmed from some of the learners' responses which were related to how ML/MC had helped them. They described how they had found it difficult to follow their lessons during their main programmed sessions. We could conclude from this that learners find processing mathematical information given during the 2 or 1.5 hours very difficult. It was clear that more information was needed to see if there was a wider trend across a larger population of the student body, therefore a wider survey across the GCSE cohort was recommended for cycle 2. Students reported that the ML/MC provided them with confidence for when they were next in the classroom, particularly with asking questions in class, indicating that they could engage with the learning experience to a greater extent, which was powerful to hear.

Findings from teacher interviews: Common Themes for HC and NH

The teachers interviewed on both ML/MC reported improvements in their students' performance in their lessons. Whilst technical and academic improvement may not have been cited explicitly, their commentary nods to the development of core learning skills and how the student's level of anxiety in their lessons that had notably reduced since attending the lab/clinic. ML/MC has helped learners to be less fearful of failure, giving them more opportunities to learn. This supports the fact and initial idea that ML/MC was aimed to assist learners understand maths not just to pass exams.

MC/ML is somewhere that learners go for help with fundamentals in maths, specific topics, get more tailored support and more importantly the one-to-one attention that students need to help them develop their learning. Teachers may not have enough time in lessons to support struggling learners. Learners receive in-depth knowledge that helps them get over the problems they face with particular topics or concepts. For example, one teacher commented that one of his learners has now become far more confident and asks a lot more questions in class: "He is now more than happy to discuss topics with the teacher. His learning barrier has been broken down" Another noted how a learner has now become more outspoken in the main class, not shying away from answering questions in front of the class, online on camera.

This feedback would support the need for creative and innovative ways to reinforce these particular subjects in the Maths Lab, having some pre-designed activities ready to be used rather than just revisiting past papers. This feedback also supports the thinking around working memory, and the need for additional time outside of the lesson to develop skills.

This feedback supports the theory that the teacher should have ownership of the teaching and learning in the classroom as the student may find it difficult to understand their own learning needs.

This feedback suggests that energy in the classroom is of utmost importance and supports the need for additional time to develop skills, and perhaps using the extra time outside of the lesson to look at Maths differently and introduce alternative and more creative maths-related activities in the ML/MCs.

Conclusions

Results show that MC/ML have a positive effect on students' overall interaction with each other leading to positive increase in student overall understanding and problem solving. Built stronger relationships with their peers and teachers/coaches and enjoyed working in small groups which lead to a stronger positive impression about math.

The basic principle of ML/MC strives to create a learning environment that helps learners develop the ability to develop a better understanding and are able to evaluate concepts through discussions with tutor and peers, rather than passively accepting information from their teacher during main session. The small group learning strategy, in this study, aimed at facilitating conceptual mathematics learning. We have shown above that the MC/ML learning strategy was employed satisfactorily as students made significant shifts towards demonstrating supportive learning behaviours though not many. Students were actively engaged in the teaching and learning processes through discussions (dialogic approach) that foster conceptual understanding.

However, the success of small group learning lessons depends on good planning, effective implementation, and careful monitoring of its execution. The teacher or coach should: understand the principles of small-group learning, be capable of eliciting appropriate learner behaviour in every phase of small-group learning, and have a variety of skills, a full understanding of the whole syllabus from which s/he can be able to explain all concepts should a learner ask. Effective intervention within a small-group depends on learners' ability to participate productively. For this purpose, learners should be made aware of the benefits, of these methods and the strategies of learning that are being used in that particular setting. Thus, the implementation of small group learning strategy, or any other new strategy for that matter, should proceed with careful explanations or training of the students about the it, so that learners can buy in to the process. This AR has explored into the contributions of small group learning in promoting learners' involvement in learning, enhancing their conceptual understanding, and boosting their mathematics achievement. It could be considered as a springboard for a broader research project in small-group instructional strategy for both GCSE re-sit and FS.

Recommendations

Maths Clinics (MC)

- We recommend the Maths Clinics to be made part of the delivery process from September 2021
- Adequate training to be provided to all delivery staff (Relationship building, planning and delivering teaching materials)
- Student Selection to be informed by available data, however it is advisable that all students are given choice to participate in MCs, should they wish to.
- Further research is needed in establishing true impact on potentially larger cohort to investigate correlation strengths between students attending MCs and achievement.

Maths Labs (ML)

- To introduce and promote teacher referral as the predominant access route to the lab
- To introduce a service based initial assessment to 'induct' students onto programmes of support and identify appropriately skilled staff to complete this activity and introduce it into the induction process
- To survey all GCSE Maths students on their experience of lessons and conduct workshop discussions to analyse responses
- Seek advice from the relevantly qualified specialists to explore the use of a working memory test to explore student ability and inform delivery of support. The specialist should, ideally possess a knowledge of specific learning difficulties and the impact of working memory on how students learn
- Develop a CPD programme for Maths staff in relation to understanding individual needs
- Assess ongoing customer satisfaction by reviewing the new arrangements and the overall experience of using the lab. Issue a simple yet comprehensive survey/facilitate a focus group to all students that allow them to provide frank feedback on their customer journey from referral to the last session attended to inform further changes more organically

A wider research project involving more participants and researchers is recommended to consolidate the results.

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Appendix A

Learner interview – Maths Clinics

Q1 - What motivates you to attend Maths Clinics?

Q2 - Do you feel that you are making progress and improving your knowledge of maths? How?

Q3 - *What do you like about this type of teaching that takes place during Maths Clinics?*

Q4 - Would you recommend maths clinics to your friends? Why/Why won't?

Q5 - Since you have started attending these sessions, has your confidence improved? If yes, please tell us how?

Q6 – Is there anything you would like us to improve in our delivery of these Maths Clinics?

Appendix B

Name:

Questionnaire

Answer the questions below **honestly**.

Question 1.

1. Which college do you attend?

USP

Harlow

Northampton

Colchester

(As a dropdown)

2.

Tick one box per row. 1= not at all. 5 = very much

	1 Not at all	2	3	4	5 Very much	I don't know
a. How much do you enjoy your maths lessons?						
b. How difficult is maths for you?						
c. How much of your maths lessons do you understand ?						

you do you enjoy maths lessons?

Which topic do find hardest or most challenging?

(Mark - List Topics here and ask them to tick their favourite topics)

Which do you find simplest?

(Mark - List Topics here and ask them to tick their favourite topics)

Which have been your least favourite topics so far?

How do you find the use of Blutick?

How much time do you spend using technology (Blutick, Century, other) to help with your maths?

Your teachers want to hear your ideas for making maths lessons better for you. Please identify something that will improve your maths lessons.

Please indicate the top three things do you find useful?

Personalised feedback
The ability to go back
Independent study
Managing your own work
Revision in your own time

Appendix C

1. What types of things have you done when you have been in the Maths Lab?
2. How has the Academic Coach helped you?
3. What do you think are the benefits of going to the Maths Lab?
4. What would you say is the best thing about the Maths Lab?
5. What could the Maths Lab do better?
6. Have you learned any skills that you have been able to use in your lessons?
7. Has the Maths Lab made you feel more or less confident in class?
8. Do you think you have learned any life skills that you will be able to use in the future?

Appendix D

Harlow College MC student questionnaire

The image displays two screenshots of a Google Form titled "A short questionnaire about your Maths Clinics".

Left Screenshot:

- Header: A short questionnaire about your Maths Clinics
- Section Header: A short questionnaire about your Maths Clinics
- Question 1: What motivates you to attend Maths Clinics?

- Question 2: Do you feel that you are making progress and improving your knowledge of maths? How?

- Question 3: What do you like about this type of teaching that takes place during Maths Clinics?

- Question 4: Would you recommend maths clinics to your friends? Why/Why won't?

- Question 5: Since you have started attending these sessions, has your confidence improved? If yes, please tell us how?

Right Screenshot:

- Date: 17/08/2021
- Header: A short questionnaire about your Maths Clinics
- Question 6: Is there anything you would like us to improve in our delivery of these Maths Clinics?

- Footer: This content is neither created nor endorsed by Google. Google Forms

Appendix E

Harlow College MC teacher questionnaire

Q1) How do you find the MCs?

Q1a) Operational effectiveness and administration?

Q1b) Do you think the fully online approach worked well? Y/N and why?

Q1c) Can you see this working in the actual classroom, and how would you want to run it?

Q2) From your perspective, what do the MCs do for the learners? What do you understand the MCs to be 1) for the students and 2) for yourselves?

Q3) As a result of having delivered MCs, has your teaching practices changed? How?

Q4) What did not work and if anything, what would you like to see changed in the MCs for the future?