CENTRES FOR EXCELLENCE IN MATHS

CENTRE FOR MATHS EXCELLENCE

Grimsby Institute

Can education move on from standard teacher delivery to a facilitated "Maths Your Way" approach with intervention in GCSE maths resit?

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Thank you to everyone who supported us throughout the year.

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.

Summary

Facilitated learning has been adopted by our maths department this year. We wanted to explore a year of student led learning with intervention and regular assessment opportunities, to identify the difference in engagement to standard delivery.

We also wanted to explore how we can use an initial assessment (IA) for each topic with in the Focused 15 in order to identify gaps in knowledge and adhering to the mastery approach of re-teaching and assessing before continuing learning. We explored modularising learning in intervention, utilising an IA approach, paying particular to our core topics, FF01 – Types of Number FF02 – Using Number, will this help the student in future lessons because the knowledge has been gained.

Students, unless agreed upon with their vocational tutors, were only allowed to access intervention if they had free time. We did not want to encroach on timetabled sessions and checked every students timetable to ensure they were free.

In order to reduce contamination, post-COVID organisation of timetabling has continued, where students have 2 or 3 very full days and no sessions on the remaining. This meant that accessing intervention sessions was difficult for students who live out of town and commute, making it a struggle to attend on off-days; students with work or commitments outside of college also found struggle.

Within our college, we have some areas that have chosen to add an hour slot a week to their timetables for study time, and this will be used as a slot where the students can come and receive intervention at a pre-allotted time. We hope that trialling this will run smoothly and maths won't be over looked when the students approach their study time slot.

We found an issue with bad behaviour when students were being "sent" to our intervention sessions for punishment for bad behaviour, being late to main aim etc. This caused a barrier in its own right as vocational staff were identifying maths as something negative. In order to help students confidence, we need to make a subject accessible, and if the initial reaction is negativity, the student will disengage and show more resistance to learning. The overall experience of maths should be positive across the whole college, bringing an end to the negative culture surrounding maths. By vocational tutors taking an active role in understanding their students' full journey, they will be able to boost their own understanding of maths, improve their ability to embed, and promote the vast range of uses that maths has in industry and in life.

Contents

Background

Introduction

The Centres for Excellence in Maths is a DfE funded project charged with the research and development of teaching and learning in maths in Further Education. There are 21 Centres across England which are hubs for action research, training, innovation, and the sharing of successful practice over the whole FE sector.

In 2019, over 180,000 students in Further Education were entered for GCSE Maths because they had not reached a “Standard Pass” – grade four – at secondary school (Joint Council for Qualifications, 2019). Of those entered, only one in five achieved a grade four in maths. (JCQ, 2019). After entering Further Education wearing a label of failure, students often find themselves in a cycle of resits. Most are only released from this by turning 19, rather than achieving a pass (Bellamy, 2017). This policy has drawn a large amount of negative attention.

Who We Are

Grimsby Institute is part of the recently formed TEC Partnership. The Partnership presently comprises the Grimsby Institute, University Centre Grimsby, Scarborough TEC, East Riding College, Skegness TEC, The Academy Grimsby, Career 6, Modal Training and NET.

C4ME (Centre for Maths Excellence) is the name of Grimsby Institute’s Centre – we emphasise the FOR part of the programme, highlighting that our entire raison d’être is to look FOR that excellence.

C4ME is based at the Institute’s Nuns Corner campus in Grimsby. The Institute serves areas which rank very highly for economic, social, or educational deprivation, recruiting a substantial proportion of its learners from three wards which rank in the top four of these measures. The catchment of the Institute includes many areas where unemployment is higher than regional and national figures. (Ofsted, 2020)

Over fifty percent of 16 to 19-year-old learners who enrol at the Institute have not achieved the benchmarked GCSE grade 4 (or C) in English or maths. (Ofsted, 2020)

In 2021/2022, the maths cohort consisted of around 900 learners, with the vast majority of these enrolled onto GCSE maths, as opposed to functional skills.

What We Want

It is recognised that students who are enrolled onto a GCSE maths resit course have covered the material before, and that the resit course should build upon this prior learning to develop each student's gap in knowledge. We previously developed a new Scheme of Work for GCSE Resit – "The Focused 15".

Our aim is to create a lasting toolkit for practitioners to use. We will do this through investigating the ways learners engage with their maths learning, and finding different methods of teaching and facilitating that allows a learner the best opportunity to achieve.

This year we focused heavily on assessing learners and developing initial assessments based on The Focused 15. This allows us to direct a learner in towards the correct targets to improve learner outcomes in GCSE resit maths on their personal learning journey.

Literature Review

When the CfEM project began, the C4ME team looked in depth at mastery methods of teaching from origin and how that model could be applied to the modern student within our area's demographic (Bell, et al., 2020). We found this important because the typical maths student we encounter is demotivated towards education but are focused on their social growth, unable to focus on studies due to having to work or caring for family, and overall the student is from a deprived background (Ofsted, 2020).

We explored Bloom's (Bloom, 1968), Morrison's (Morrison, 1924) and Carroll's (Carroll, 1963) application of a mastery method of teaching and learning and how we could fit it into the GCSE resit classroom where time is restricted to two one and a half hour sessions per week. We felt that the scheme we needed to follow to help struggling students needed to be much smaller than the standard GCSE Maths objectives. We created a scheme of work called The Focused 15 (Bell, et al., 2020 [2]) to establish a way that the student is still gaining the knowledge that they need in their weaker areas as opposed to equal time over all objectives.

Pre-pandemic, the Department for Education published a policy recognising the potential for technology in education (DfE, 2019). Our college uses a "Curriculum 2030" as an innovative strategy (JISC, 2021) to equip our students with the skills they will need for their chosen industries in the future. Upper management in our college decided to move maths and English to a facilitated approach for the academic years 2021-2022.

A facilitated approach that consists of students working individually through a course at their own speed and being assessed regularly against the objectives they have completed learning in. This does unfortunately leave a grey area for the teacher as their role becomes undefinable due to a varied role (Crockett, M. et al., 2005).

We now offer a "Maths Your Way" approach, meaning that the student can work online (whilst being present in the classroom), through workbooks/worksheets, in groups or individually, all with delivery at the beginning of the lesson. Cognitive Flexibility Theory (Spiro et el., 1988) suggests that there will be a need for varying representations of methods for the promotion of understanding. argue that using a facilitated approach will help identify varying methods that students utilise for understanding due to the nature of the varying tackling of objectives (Feltovich et al.,1996).

This year we offer willing students intervention support sessions for maths. These are one-hour sessions outside of timetabled lessons where students can attend and focus on areas

that they are weaker in. The need for intervention with resit students is necessary as the student has completed the full GCSE Maths programme and have still failed the exam. The cycle of failure will continue without necessary attention and support to address their gaps in knowledge (Amos-Sansam, N. 2017).m

We had, in previous years, established the Focused 15, ran it through another development process and have a final scheme of work that was ready for testing. The COVID-19 pandemic made this increasingly difficult, almost impossible, to rigorously test through trial (Pokhrel, S.et al., 2021). As stated before, our students come from a socially and economically deprived demographic and this was made much more apparent through the various lockdowns that occurred. Many students were without technology (computer/tablet/phone), even those without an internet connection. Grimsby only has 89.5% of residents connected to an internet source, this is the 4th lowest connection statistic in all of England (Office of National Statistics, 2021).

We will use this understanding to explore and develop a handbook that will be used side-by-side The Focused 15 to support the individual student with their journey through GCSE maths resit.

Methods

Getting Learners

In the weeks prior to term starting we created a Microsoft Bookings form where students, staff or ourselves could book in students for a 60-minute slot with a maths coach. The time and date would be confirmed by the student and checked against their timetable to ensure they were not already scheduled to be in lesson.

We then created a QR code that linked to this form. We had it on posters throughout the college. Each Curriculum Manager, Success Coach and Maths Tutor in the college were also given a laminated QR code to keep in their rooms or offices to refer a student with.

We ensured we got to as many lessons in the first few weeks of term to advertise our services to as many maths learners as possible. We also worked with the rest of the maths team to make sure they were fully clued in on the process.

A C4ME ethos is that progress towards a passing grade should be incentive enough, so when we were encouraging students to attend our intervention sessions we had to regularly plug our services within lesson, by speaking with teachers, by visiting vocational areas and by students self-referring.

We faced a few challenges like fluctuating commitment levels from students and timetabling. Timetables have been filled out for the two or three days the students are on site for, this meant that accessing intervention sessions were difficult as some students live out of town and commute, making it a struggle to attend on off-days, students with work outside of college also found struggle. Upon reflection, some areas that have chosen to add an hour slot a week to their timetables for study time, and this will be used as a slot where the students can come and receive intervention at a pre-allotted time. We hope that trialling this will run smoothly and maths won't be over looked when the students approach their study time slot.

There was also an issue where the intervention sessions were being used by vocational areas as a punishment. The students would attend the sessions with negative attitudes, disruptive and on a few occasions unacceptable behaviour. Unfortunately, vocational staff were identifying maths as something negative. In order to help students confidence, maths needs to be identified as an accessible subject, and if the initial reaction is negativity, the student will disengage and show more resistance to learning. By vocational tutors taking an active role in understanding their students' full journey, they will be able to boost their own

understanding of maths, improve their ability to embed, and promote vast range of uses maths has in industry and in life.

Topic Based Initial Assessments

We created 15 topic based initial assessments, each one linked to a particular topic within the Focused 15. They were made to be 20 marks each so they could be done and marked in a single intervention session.

When a new student would arrive for additional maths we would start out by identifying what topics they needed to work on; the teaching staff in the maths department used Century Tech this year, so we were able to look at students IAs, what topics they had been working on, what scoring they got, and what we could work on face-to-face.

Based on this information, we gave students an IA, and completion the maths coach would go through the initial assessment with the student identifying gaps in their knowledge and the focus for their intervention.

The student would then work on those targets via instruction, workbooks, videos whatever method works best for that individual student. Once the student felt they had mastered that topic they would retake the assessment to check that they have mastered it. This was all kept track of in a spreadsheet on SharePoint.

We felt it important to continue with the ethos that we have across out “Maths Your Way” facilitated approach within lessons. We wanted students to have a say in the way in which they learn.

We found that overall, students missed direct delivery. Our students indicated that they were able to ask questions more freely and they could work through and be shown where and why they made mistakes.

This isn’t to say that all students felt this way, but on a few occasions we had students who began intervention sessions being assign specific “nuggets” on Century Tech, and progress monitored that way. The students would then receive support from a maths coach and start finding it easier to work through questions on paper to show thought process and get direct feedback of their working out.

Confidentiality is Key

In all discussions that we had with students, they are only identified to relay the information back to their tutors and vocational areas. For our research, students were told beforehand that they would be case studies. However, any information that is discussed will go forward anonymously if they consent to it. This was not an issue for our students as, once they understood that the research conducted could help future students in their position, they were more than happy to contribute towards our research and findings.

Case Studies and Findings

Case Studies

We have chosen eight of our learners at random from all the learners who attended at least one intervention session in the year to do case studies on. From these we wish to identify patterns relating to attendance, motivation, engagement, progress, barriers to learning and ultimately how to improve the interventions for future intervention sessions.

These studies will explain the process of the student signing up, their session summary, their progress, and any key information that occurred.

All students who used our intervention sessions were put in student ID number order, given a corresponding number, and then put through a random number generator.

Student 1:

This learner's parent contacted C4ME expressing concern with her progress in maths. This learner achieved a fine grade of 1.83 in her initial assessment, which slightly decreased to 1.67 by her winter mocks. In the next two sets of mocks since her referral to C4ME she progressed to grade 2.6 and then further to 3.12. She started attending one session per week in November and soon picked up a second session. She attended every week and worked using workbooks and teacher delivery. We initially struggled to find a second time slot for this learner as her time table was so full. However, as she had already achieved a grade 4 in English she had 2 slots available in which she could attend while her peers were in an English session. There were some sessions where learners had been brought to attend an extra maths session as a punishment by their vocational tutors, this learner chose

to leave these sessions as those learners created a hostile environment that she did not want to be in.

Student 2:

This learner, and one of her peers were brought to attend a session of extra maths as a punishment for poor behaviour in lesson by their vocational tutor. The Maths Hub was quite busy when the learners arrived. Both learners were given an initial assessment linked on FF01 – Types of Number. This learner worked on it quite well at first, but was constantly distracted by her peer who complained about being there. Her peer's complaints got distracting for other learners who were there voluntarily so she was eventually asked to leave. Student 2 then became combative. For the sake of the other leaners she was asked to leave. Had she been learning there voluntarily I believe she would have gained far more from the session. She never chose to come back and we reminded the vocational areas that we are not to be used as a punishment. We are here to provide support to learners.

Student 3:

Student 3 asked her maths programme leader to make a referral to us for extra maths sessions in September. However due to her timetable not being finalised and her having commitments outside of her timetabled college hours we were unable to organise any sessions until mid-October. She attended multiple sessions in the half term prior to the November resit exam also. In the New Year, her timetable changed once again, and she was no longer able to attend any additional sessions due to a lack of time. This reflected in her New Year Mock where she only achieved a fine grade of 2.6 compared to her fine grade of 3.09 in her earlier Winter Mock. Thankfully, she progressed further in the year and achieved a fine grade of 3.92 in her final mock exams.

Student 4:

Student 4 first attended an additional maths session in early May as he had forgotten his Personal Protective Equipment and could not undertake his practical work. This learner found the session so helpful that he asked to organise more sessions for the upcoming weeks, with added motivation due to the looming exams. He attended regularly for the following weeks and spent all day, with regular breaks, from 9am to 3pm the days before

both of his exam doing additional maths sessions. He also came in at 7:30am on the morning of both exams for last minute revision.

Student 5:

This learner was referred to us by her maths tutor due to poor attendance and engagement in maths lessons and having regressed from a fine grade of 2.38 in her initial assessment to 1.92 in her Winter Mock. Her attendance in extra maths sessions was sporadic and eventually she stopped coming altogether, she also was referred to one of our maths motivators due to her lack of attendance she never got any benefit from it. Unfortunately, despite our best efforts to give her all the support we could offer she plateaued and achieved a grade 1.75 in her New Year Mock and 1.8 in her Spring Mock. Her overall maths attendance was 78%.

Student 6:

Student 6 was part of a cohort of sports learners who were regularly brought to do additional maths as a punishment for poor behaviour. The group would refuse to do any work and would spend the session on their phone or a laptop on social media or YouTube. They would be loud and distracting to learners who were there voluntarily. So much so that some learners who had previously expressed how much they liked the extra sessions stopped coming altogether due to their poor behaviour. We kept asking their vocational tutor not to use us as a punishment as it was disadvantaging the learners who were motivated, however they kept being brought down each week. Eventually they relented but this learner wanted to continue to make use of our services from time to time. He came multiple times of his own volition when he came across topics that he struggled with in his main maths sessions. He said he got so much more out of the sessions when he was choosing to come rather than being forced to come.

Student 7:

This student was referred to us by his maths tutor when he noticed that he was struggling in lesson. The learner attended every week but does have memory difficulties which caused him to miss some sessions. We worked with his success coach to ensure he did not miss more sessions. This learner came to us with an initial assessment grade of 1.17. He regressed in the winter mock where he got a grade of 0.8. In the New Year mock he

achieved a grade 2.07, we think this might be due to with his short-term memory issues as he had a revision session immediately prior. Unfortunately, he only achieved a grade 0.74 in his spring mock.

Student 8:

This learner came to the maths office in September expressing that she always struggled with maths and wanted as much help as she could get this year. The very next week she was set up with an additional session in place for her. She attended every week for the remainder of the year. Although she was quite good at attending she was very easily distracted, unless you were sitting with her in a one to one basis she would lose concentration and go off task. As the year went on the session got busier and busier leading to her receiving less one to one teaching and this had a negative effect on her progress. In her initial assessment she achieved a grade 1.92, in her Winter mock she achieved a grade 1, which lowered to grade 0.76 in her New Year Mocks and finally 0.57 in her Spring Mocks. She was also referred to a maths motivator in an attempt to help her keep on task in maths lessons but due to timetabling conflicts this was eventually cut short.

Findings – Challenges

Retaining students we found to be difficult, most of the students didn't want to access services because of time/stigma/effort etc. And some times vocational tutors and maths tutors encouraged students to attend, and so the student would appease for a session and not return. This was unfortunate, but as we found its better for a student to not attend if they are unwilling to than being made to.

However, we did find that some of these students would return around mocks and the summer exam series in order to refresh their skills. The previous exposure to the sessions made the student more confident in revisiting.

Within the intervention sessions, we found that learners were very eager to move on to new topics. They would want to start working on a new topic before they had full mastery of the topic they were currently working on.

We felt we needed to keep them motivated to work on the topic at hand, so we tried and found success with showing learners a challenging question from the topic they are working on that they would struggle with due to not being ready to move on. This did require delicacy though as if you showed them something too challenging it could demotivate the learner.

We found that this approach is best supported by “goal-free” questioning. This way we can show a student a question, they can identify what they do know, and then explore the surface of what they don’t know whilst explaining how the knowledge all builds upon itself.

Learners also wanted to work on topics that they did not have the prerequisite skills to access. For example, a learner might want to work on FF09 – Simplify and Solve as this is a topic many learners struggle with. However, questions such as “Solve $8(x-2)-3(1-x)=9(x+2)+1$” are completely inaccessible to learners who are not confident in collecting like terms, order of operations or negative numbers. All of which are skills from FF01 – Type of Number and FF02 – Using Number.

Based on this we believe that more time should be spent on FF01 and FF02 as the form the backbone of the rest of the Focused 15.

We did find an issue with bad behaviour when students were being “sent” to our intervention sessions for punishment for bad behaviour, being late to main aim etc. This caused a barrier in its own right as vocational staff were identifying maths as something negative. In order to help students confidence, we need to make a subject accessible, and if the initial reaction is negativity, the student will disengage and show more resistance to learning. The overall should improve to be positive across the whole college bring an end to the negative culture surrounding maths. By vocational tutors taking an active role in understanding their students’ full journey, they will be able to boost their own understanding of maths, improve their ability to embed, and promote vast range of uses maths has in industry and in life.

Findings – What Went Well

We found that intervention sessions gave learners the confidence to make mistakes as a way to identify how to improve, we also found that this method led to learners getting significantly better scores on their second attempt at an assessment.

Learners can see how they are making progress through the Focused 15 through our discussions of their initial assessments and their improved results on a second attempt.

Maths Your Way

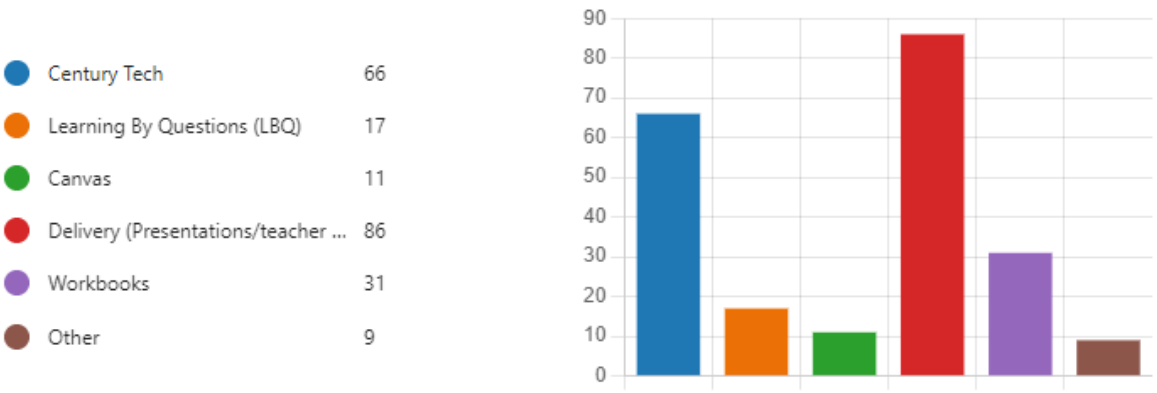
This year we launched Maths Your Way; a facilitated approach to maths, this meant our students worked on the areas that they, as an individual, needed to improve on rather than what the rest of the class were working on.

This year we took on Century Tech and received mixed feedback from students. We found that students who were comfortable with computers and technology (games design, media, photography) were happy using century, but it proved a barrier to some of our more practical students. We launched a “Maths Your Way Survey” towards the end of the year to get feedback from students on the impact of Maths Your Way this year.

The first question was to identify what type of teaching they had benefitted the most from, out of what was available. On the bar chart below, we can see that 20 more students had answered traditional teacher delivery over Century Tech which got 35 more positive responses than workbooks, the next most popular.

2. Which method do you feel your learning has benefitted from the **most**?
(Select one)
(If you select other, please state what form of learning you have used)

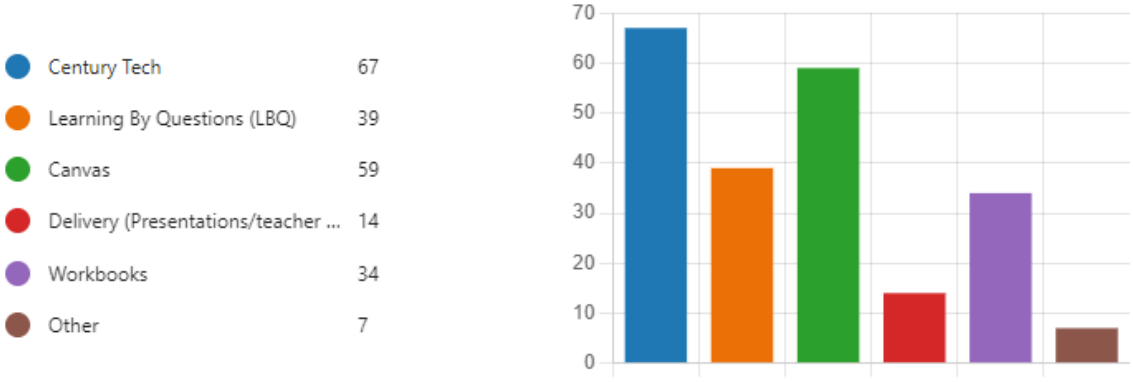
More Details



Conversely, we found that 67 students had chosen Century Tech as the least beneficial to them as can be seen in the chart below. We asked students about this and we found that over all they felt like when they were working on Century Tech in lesson that they had been abandoned and were not getting the delivery that they had expected. We believe that being in a post-COVID world lead to students being less favourable towards Century Tech as they have been without traditional classroom teaching and teacher interaction for 2 years. This has also had a massive impact on their engagement.

3. Which method do you feel your learning has benefitted from the **least**?
(Select one)
(If you select other, please state what form of learning you have used)

More Details



As part of the Maths Your Way survey we also wanted to know if our students knew about all the services we provided and if they had used them. 155 out of 220 students surveyed said that they were aware of the additional sessions with a maths coach but of that 155 only 44 made use of those additional sessions.

We wanted to know why 111 of the 155 did not make use of additional maths sessions despite knowing they were available, so that we can attract more students in future. 108 of them responded. Some students responded that they were “lazy” and expressed regret at having not gone, other stated that they wanted to go home, and others stated that they used Century Tech as additional revision. However, by far the biggest reason people did not go was time and timetabling. This was not too surprising to us as we found throughout the year it was difficult to find a time slot that students were available. Many students were in 3 days a week from 9 to 5 with only a break for lunch. Some students, who have achieved a grade 4 or higher in English, specifically chose to come to additional maths sessions when their peers were in an English session as it was the only time they had available.

This can be seen in the following pie charts and word cloud.

4. Were you aware of the additional sessions for maths that have been running in The Hub all year?

More Details

Yes	155
No	65

5. Did you use The Hub for additional maths sessions this year?

More Details Insights

Yes	44
No	111

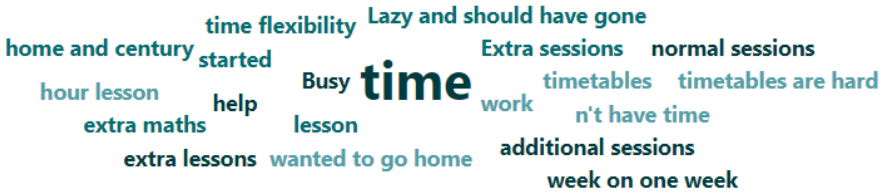
6. Why didn't you attend additional sessions?
(Your feedback will help us understand how we can improve next year)

More Details Insights

108
Responses

Latest Responses

20 respondents (**18**%) answered **time** for this question.



Recommendations and Next Steps

Recommendations

Our biggest takeaway from this year has been that the student must want the intervention. If they are forced to go they end up creating a hostile learning environment. It causes learners who do want to lose motivation or even want to leave. It also causes them to become hostile to your attempts to help them. However, when a student is coming of their own choice they get much more from the sessions.

We also recommend getting learners in to intervention sessions as early as possible. It gets learners comfortable working with new peers that they might not otherwise work with quicker. It also ensures you have more time to work with the student to help them achieve as much as possible.

A facilitated approach is also very positive and well received by students, however, many of the ones we had worked with had some fear of telling their tutor they don't enjoy the way they learn (i.e. not enjoying working on Century, but isn't sure of how to approach the topic with their tutor).

Next Steps

At this point we have some goals for the conclusion of the project. One issue we had was that students started to memorise answers to the topic based initial assessments. As a fix to this we wish to create 4 different versions of the topic based initial assessments. We also intend to create 4 full initial assessments linked to the Focused 15 for rigorous testing of students at the beginning of the year.

We also wish to continue creating Focused 15 "Maths for Professionals Posters" and to deliver a Focused 15 suite package to network partners and a wider scope.

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Appendix/Appendices

Appendix A

Focused 15 Initial Assessments: https://padlet.com/c4me/9olk3wvaubircu77