CENTRES FOR EXCELLENCE IN MATHS

Evaluating the impact of diagnostic teaching for learners studying Functional Skills Mathematics

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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

In the 2020/21 academic year, maths leaders at the 6 colleges of East Kent College Group (EKC Group) in England set out to improve outcomes for its Functional Skills learners by exploring diagnosis of knowledge gaps, determining a student per class each month who is nearly exam ready and dedicating time to develop that student's fluency in mathematics concepts prior to taking the exam. Functional Skills maths assessments are sat on-demand, whenever students are ready. Action research approaches were used to explore ways in which teachers could best do this in practice, with the evidence indicating the following findings for our College Group:

- Where diagnostic teaching was implemented effectively, with teachers and students clearly understanding the purpose, this had a positive impact on functional skills outcomes.
- Where additional training and support was requested prior to implementation, implementation was more effective.
- Smaller colleges were able to implement the change more quickly and see results in outcomes.
- Leaders across all colleges named a diagnostic approach as the strategy they wanted to continue with in 2021.
- The pandemic significantly impacted on this project and the project outcomes.

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Introduction

The EKC Group is a large organisation that consists of a variety of business units; this action research has been conducted across our 6 colleges.

The aim of our project was to improve student outcomes in functional skills by adapting and improving the way we teach by diagnosing student gaps in knowledge and responding by teaching to those gaps.

This project was agreed by Principals and led on by Vice Principals, working with Heads of maths and supported by some exceptional practitioners.

It was thought imperative that this project was named as a college priority in development plans – so that all parties focused all their energies on implementing this change aiming to bring about improved student outcomes.

When students enrol with us, we used their qualification on entry to determine their study route. This ensure students are working to a qualification that will ensure progress from their starting point. This is shown by our study routes diagram below.

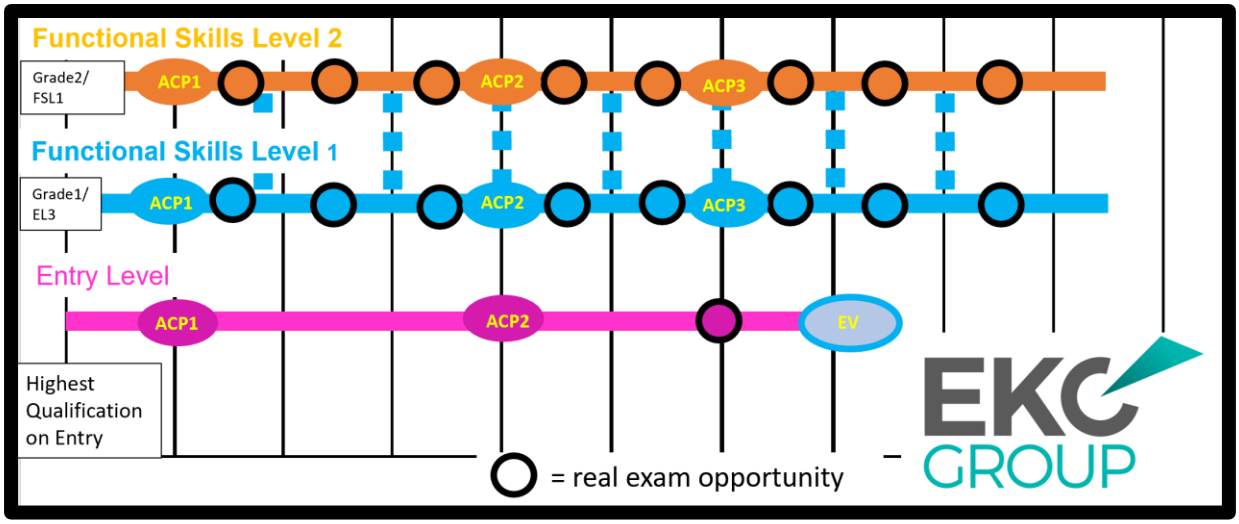

Figure 1

We have 3 standardised Assessment Checkpoints (ACPs) that are used across the College Group that provide us with predictions about student progress, allowing timely intervention to identify which students are close to being exam ready. The ACPs also identify who will need more support and provide us with the information to support students to complete a question level analysis (QLA) – see example below.

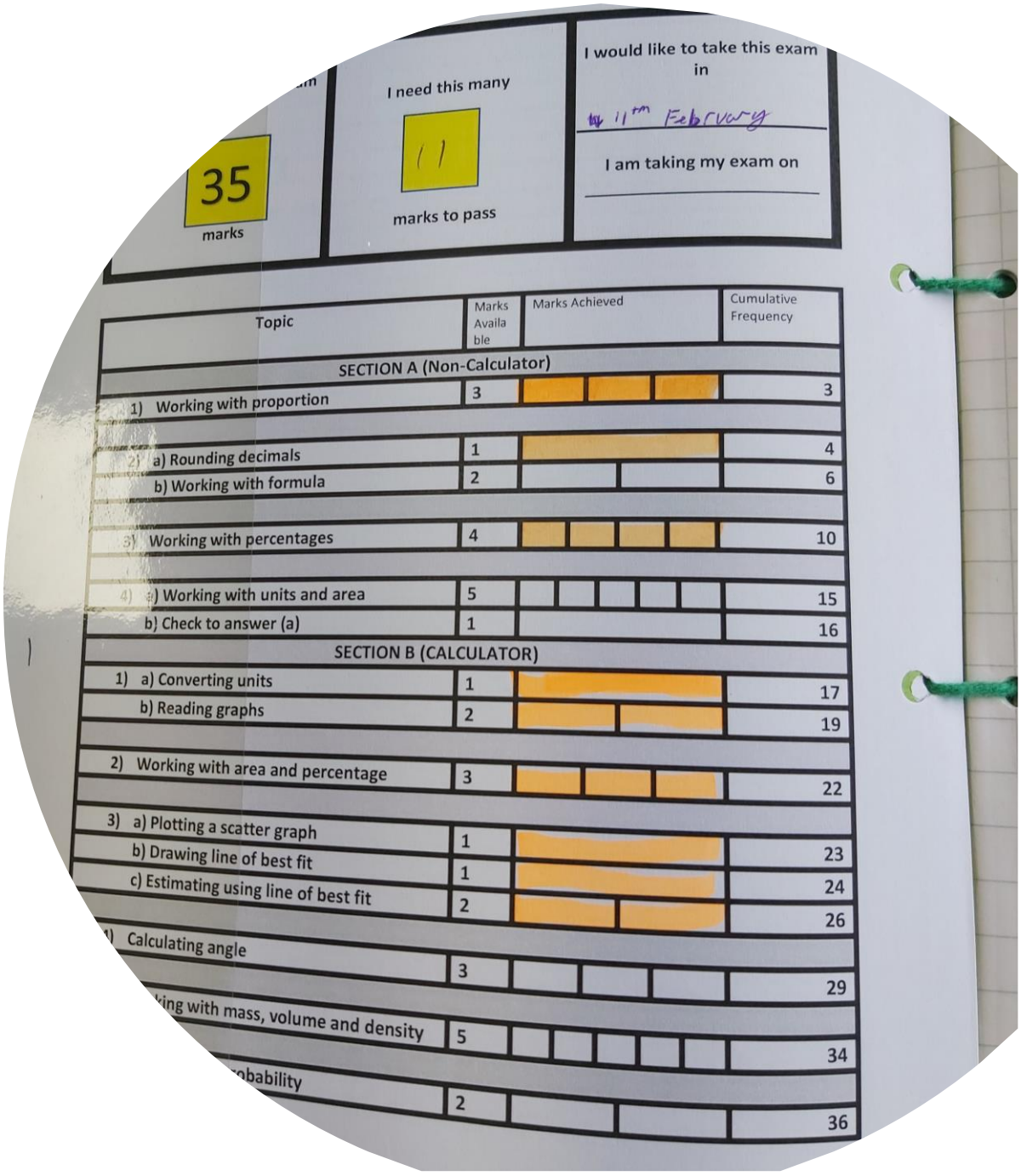

Figure 2.

A benefit of functional skills is that it is on demand, students can take the exam when they are ready, so at the EKC Group our success criteria is to support more students to achieve their qualification in a timely fashion allowing students to focus on their other qualifications whether it be in English, their vocation subject or the next level of mathematics. This also benefits maths classes by gradually reducing the group size as those who pass leave during the year, so that the teacher can focus on the other students who are yet to achieve. It is overwhelming and unrealistic to provide

individualised attention to all students all of the time, so our strategy is to give periods of highly focused support to students intensively.

In a class of 20, one student is the equivalent of 5% of the class and we are encouraging teachers to identify one student that could be exam ready and support them to sit the exam that month. EKC Group policy is that this should be happening in every class across the college working towards a trajectory that would support 70% achievement by the end of the year. Think of the cohort like an onion and each month peel off another layer and be able to focus on the next layer of students. Identifying who is exam ready and what they need to focus on is done by using the QLA document shown above.

Group goals and desired outcomes

The driving aim for this project was to see improved outcomes for students, with more students passing functional skills than in previous years and the Group performing better than National Average.

We wanted to implement the following changes in practice, effectively:

Practice before the project (in the majority of colleges)	Desired practice
Following a Scheme of Work, in order, regardless of prior knowledge.	Diagnosing gaps in student knowledge & selecting relevant episode.
Teach until Easter, then students take the exam.	Working closely with student to determine exam readiness.
Lots of fluency, few opportunities to tackle wordy problems & exam questions.	Time dedicated to master concepts, then apply & tackle exam material.

Literature Review

The work of A. Bell (1993) provides evidence of a cohort of students who were taught using diagnostic methods achieving more favourable outcomes than another cohort students who received the normal curriculum with no use of diagnostic teaching. In conclusion, Bell lists the following strengths of using diagnostic teaching in this way:

• The work deals with the common student misunderstandings.

• This makes the teachers' daily work more rewarding and effective.

• The discussion helps students to build a well-connected body of knowledge.

However, Bell also describes the following challenges when introducing diagnostic teaching:

• The teaching methods needed may present new challenges for the teachers.

• The students have to learn how to engage in meaningful discussion of key points,

being willing to expose their understanding, even if they fear it may be wrong.

• They need also to learn to listen to other students and to appraise what they say,

without antagonism.

Millar and Hames' (2003) research highlights the importance of responding to the student's needs in the lessons and not making assumptions about what students may or may not have understood or learned. A. Bell (1993) also warns about retention of knowledge and skills. Students may well perform well directly after they have been taught how to do something, but how long will they retain that skill? Making links between topics can provide students with a deeper understanding that will aid longer retention of concepts.

Millar and Hames also detail the effective use of diagnostic questions and teachers' initial responses and their development over time. Although the use of diagnostic *questions* is not a focus for our own study this year, the research by Millar and Hames highlights the importance of a teacher's professional development when thinking about student's misconceptions and how wide spread these are.

The large increase in students requiring mathematics – since 2016, policy in England is that all 16-19 year olds must continue studying this subject (and English) until they achieve a Level 2 Functional Skills (or GCSE Grade 4) or turn 19 years – creates increased demand for teachers capable of teaching the subject. Ofsted identified difficulties in recruiting and retaining skilled and experienced teachers. The implication is a need to develop staff subject knowledge and skills rapidly. (At EKC Group our vocational staff deliver FS level 1 and Entry Level.)

Accessing timely, reliable and accurate predictions for student achievement was vital to the success of this project. As Director of Mathematics, I ascertained that the data available at a Group level was not reliable and so implemented a more robust, reliable, standardised approach to reporting predicted outcomes at regular intervals throughout the year. The impact was all stakeholders are informed about predicted achievement allowing time to implement focused intervention where needed.

Having considered the recommendations from the DfE's *Making data work (*November 2018), we implemented three data capture points. This is complimented by a mark book where teachers record the percentage achieved on the assessment and class strategies to

ensure teaching is informed by the assessments and students know what they need to do to improve. This ensured that:

- leaders and teachers could make use of reliable, robust predictions to inform timely intervention and to evaluate impact in year
- students, teachers and parents to be provided with accurate predictions and information about gaps in knowledge and understanding, in order to use this information to inform teaching and learning to improve their understanding of the subject.

As a leader of mathematics, I have reflected on the issues outlined above and shaped and adapted my plans accordingly to ensure that I have a clear understanding of the Group priorities and aligns with the Group strategic direction for mathematics. Presenting to governors allowed me to reflect on how to share the anticipated outcomes, plan for implementation and intended impact with Principals and leaders across the Group.

Implementing change needs careful consideration and management and, having considered Ben Mulholland's (2017) critical change models, I chose not to implement a singular approach and instead identified common themes that I thought would support the success of the project. Each model identified the importance of communication, support and education. I believe it is vital to our success that we have regular opportunities to meet to discuss the changes in mathematics delivery with those leading this change. All leaders needed to fully comprehend and believe in the improvements we were making at Group level in order to execute effectively at college level. The leaders involved at a college level are our Deputy Principals.

I drew on Lewin's model highlighting the importance that everyone involved has a person that they can go to for support during the process. It was important that I recognised the structures already in place at the EKC Group and utilised these. The line management structure provided support to every teacher through the Heads of mathematics. I provided additional support to the Heads of mathematics, carefully communicated regularly with Principals to ensure the Group direction complimented and were wholly consistent with each colleges vision and strategic direction.

The Education Change Management Tool Kit (2016) written by New Zealand Post Primary Teachers Association provides insight into change management within an education setting. The authors emphasis that change does not always equate to improvement a pose questions that I considered.

It was crucial to communicate a long-term commitment. Other initiatives were not priority, all energies should be focused on the successful implementation of this change. The tool kit articulates the importance of not continually changing initiatives 'change is constant but constant change can be stressful'.

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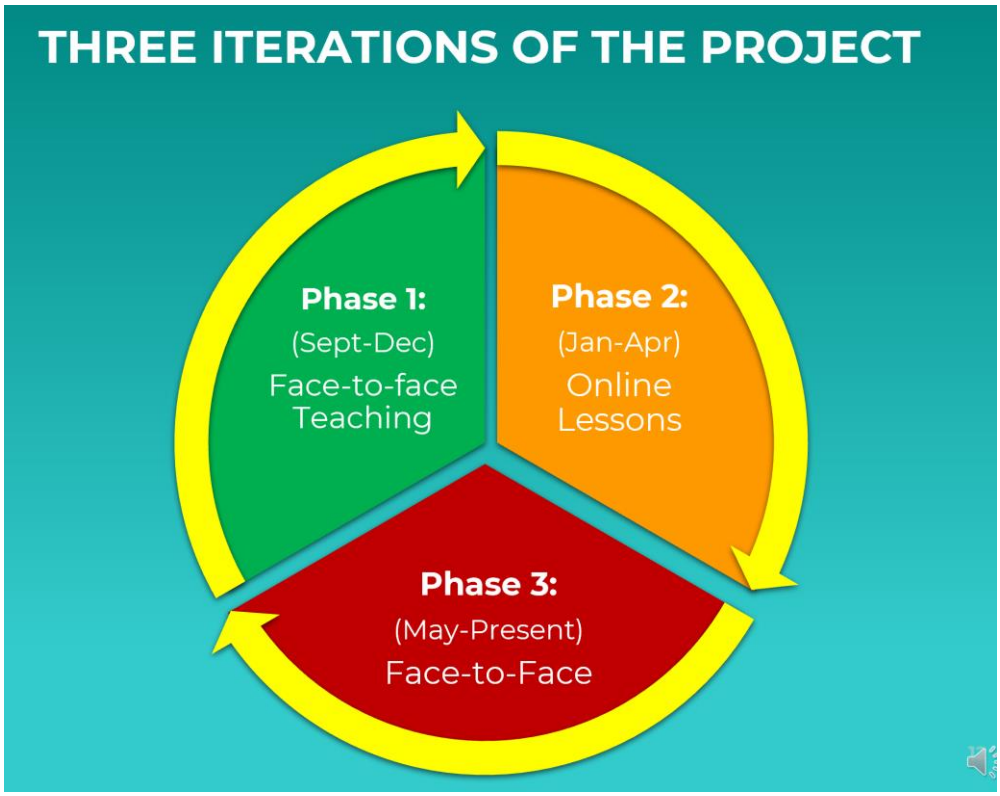
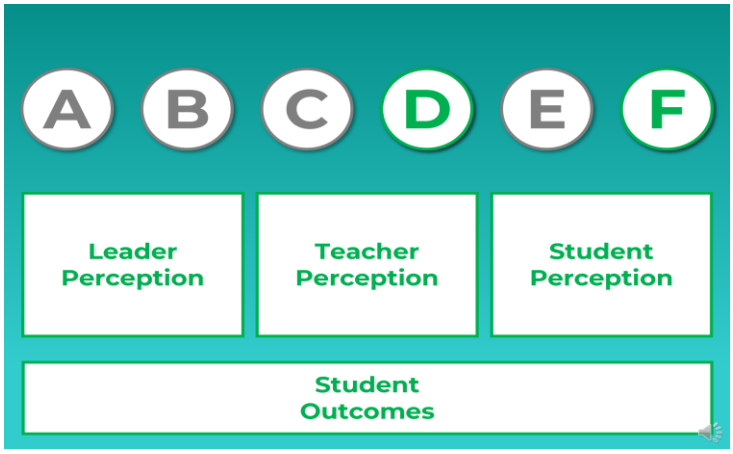
Methods



We have considered this project as three iterations, influenced by the pandemic and our delivery mode. For this action research report, we can draw most evidence from Phase 1. During phase 2, our priorities changed with a second lockdown and phase 3 has been a very complex time which has felt very challenging especially with the disparity between Functional Skills and GCSE. Nationally, it is very clear that functional skills outcomes are very low and this is the case in the Group, however, phase 1 indicated early success with the project.

We collated evidence from a range of sources: we surveyed and interviewed students, teachers and leaders about the effectiveness of the diagnostic teaching approaches being tried out and compared functional skills results across the group.

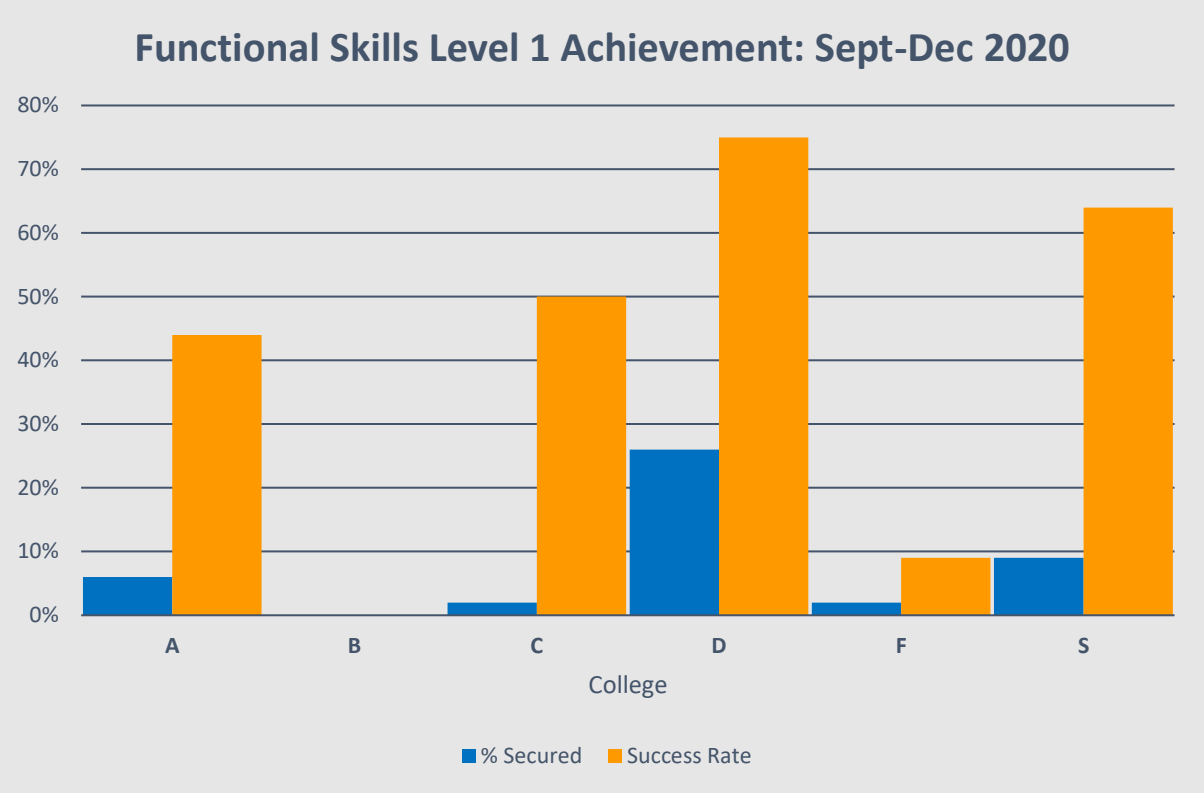
The graphic below has a letter A to F to represent each college/site, the three groups whose perceptions matter and goal of improved student outcomes.



Results and discussion

The outcome data in Phase 1 saw 2 colleges that had saw a significant increase in the numbers of students passing Functional Skills before November compared to previous years and as measured by progress from ‘secured’ to ‘success rate’. See chart below. Staff thought that the improvement was a result of using diagnostic teaching approaches including QLAs.

- College D college saw 26% of their learners achieve a pass by November 2020.
- College F also saw an increase with 9% of their cohort securing a pass before November 2020.



After analysing the surveys of leaders’, teachers’ and students’ perceptions, it was evident that diagnostic teaching was extremely well embedded at the two colleges where significant improvements were identified in Phase 1. In these two colleges, students could clearly articulate the purpose of the QLA and teachers described the QLA as informative. One staff member said it was “invaluable”.

Through interviews at these two colleges it was very apparent that there had been a significant change in the way these teachers taught, implementing the diagnostic approach to support learners.

Unfortunately, in the other colleges, although diagnostic teaching had been implemented it was clear that this was yet to be adopted by all. The surveys highlighted that among these students and teachers there was a lack of understanding of how the chosen diagnostic approaches could impact teaching with some viewing it as just another task from leadership.

The two colleges that had most success are smaller colleges and this may attribute to their success, as often it is faster to implement change successful in our smaller business units. However, these colleges had requested additional support early on in the form of team teaching and additional training to really understand how to implement the new approach. This additional investment was also described as one of the reasons for success.

Below are some quotes from teachers at the two most successful colleges that identify effective practices associated with Question Level Analysis (QLA) .

“Meaningful discussion takes place following completion of the ACPs, and learners are prompted to refer back to this in conjunction with Century. Many of my learners have been complimentary about the 'visual' nature of the QLA” - Teacher, D College

“QLA used to highlight student focus areas for revision, whole group weak areas and readiness for exam entry.”- Teacher, D College

“This is invaluable when it comes to lesson planning and learners taking responsibility for their learning and revision”- Teacher, S College

Conclusions and recommendations

1. Early indications are that diagnostic teaching can be a very successful strategy and have a positive effect on functional skills outcomes

2. The effects of the pandemic and the move to online teaching in January had a negative impact on outcomes in all colleges.

3. Where implemented effectively, leaders, teachers and students embrace diagnostic teaching and it is an informative and invaluable tool.

4. More needs to be done to embed in our larger colleges, however leaders have seen the impact and are commitment to continuing to implement diagnostic teaching and the use of the QLA.

References

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