

What components of an effective digital maths provision positively affect motivation and engagement of GCSE and Functional skills learners?

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OUR PARTNERS



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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.

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Introduction

About the college

The EKC Group is a family of six colleges on the south east coast of Kent. In total, we have around 70 mathematics teachers and 12,000 learners across the group. Our action research group consisted of representatives from each college within the EKC Group as well as our network partners: North Kent College and Mid Kent College.

Under normal circumstances, there are two options for maths learners within the EKC Group: the full year option or a fast-track route (for Functional skills students) / intensive route (for GCSE students). The fast-track/intensive option route is offered to motivated students or students who are strong on entry e.g. returning students who are only a few marks away from passing etc.

The EKC Group moved towards a digital maths and English provision from September 2020 as a direct result of the COVID-19 pandemic. COVID-19 Government guidelines limited face to face delivery in most educational institutions around the country, which prompted the Group to make digital provision an important part of its Quality Improvement Plan (QIP) for 2020-21.

After consultation with Principals and Heads of Maths of all six EKC Group colleges, it was proposed that maths tutors only have face to face contact with those students on the intensive model for GCSE or fast track for Functional Skills alongside online learning via webinars. As the EKC Group has made Digital Learning an important part of its QIP this year, we would like to use this Action Research to contribute towards the evaluation of the provision by the end of the academic year in 2021.

16 – 18 Vocational Study Programmes English / maths

Route GCSE & Fun Skills Full Year Model Maths and English	Episode/Chapter 45 mins (pre recorded)	Work Submission following Episode/Chapter Century/Hegarty	Digital Seminar 2 x 30/45mins Teacher led Suggested groups of 8
Assessment Checkpoints completed in vocational classes/ or online submission 3 times per year*			
Route GCSE Intensive November sitting FS Intensive on demand.	Episode/Chapter 45mins (pre recorded)	Work Submission following Episode/Chapter Century/Hegarty	Face to Face Seminar AM/PM session (3 hours) Suggested groups of 4

Research Focus

This action research project ran alongside the EKC Group's 2020-21 QIP, which allowed us to work closely with the newly appointed Digital Learning Development Manager, to monitor the progress and evaluate the impact of digital maths provision.

The outcomes of this project will help us identify what works best for an online maths delivery model and will allow us to review strengths and weaknesses by the end of the academic year 2020-21. The report may influence the future of maths and English provision across the Group as well as the delivery of other vocational subjects.

Our aim is to share our experiences and good practice with the larger CfEM network of FE colleges as well as our network partners.

Most maths teachers within the group are quite apprehensive about this new way of working and are aware that there will be many challenges ahead. That is why, we decided to make digital learning one of our action research focus for the CfEM project.

Teachers across the EKC Group are currently going through a digital training programme, divided into three strands, depending on their expertise, and starting points. The EKC Group has recently published a framework of minimum standards for online and digital learning. It is important for the EKC Group that all students, no matter what programme they are on, receive a consistently excellent experience when they're being taught – so the framework will allow everyone to ensure that they are delivering the best possible teaching in this new environment.

We had 7 teachers across the group, around 80 students and 2 network partners involved.

We tried out best to have fortnightly meetings with the ARG and monthly meetings with the Network Partners.

As well as the size of the EKC Group, completing the action research came with serious challenges. There were different delivery models across the Group. Digital skills of both students and staff were a major barrier, not to mention digital poverty. Interestingly, the OFSTED blog of 15 July 2020, looking at online provision within the FE sector confirmed all these challenges and we just had to find solutions and move out.

Despite all these, we also had the opportunity to run an Action Research Workshop at the Kent FE Conference on February 10th to outline project to staff from the EKC Group and network partners.

Literature Review

Our main research question was influenced by the following reports: *Education Endowment Foundation (2020) Remote Learning. Rapid Evidence Assessment*, London: Education Endowment Foundation and the *Overview of emerging country-level response to providing education continuity under COVID-19; Best practice in pedagogy for remote learning report*; London 2020, Education Development Trust.

Most of the research reviewed within the EEF 2020 report evaluated remote learning within the secondary and higher education sectors, and there is limited academic research that assess the impact of online delivery within the Further Education (FE) sector.

We can hypothesise that the engagement and motivation of students aged 16-19 is likely going to be less than adult learners but we hope that this project will help us identify the best strategies to improve the situation and outcomes through a digital maths provision within an FE setting.

As a Group, we have also been using the ETF Digital Teaching Professional Framework (<https://www.etf-foundation.co.uk/wp-content/uploads/2018/11/181101-RGB-Spreads-ETF-Digital-Teaching-Professional-Framework-Short.pdf>) to develop our online provision. A Digital Development Programme (DDP) was designed and implemented across our 6 colleges in the summer and all teachers were giving initial training based on that framework. The DPP is constantly evolving to suit the needs of our teachers and learners.

Techniques for Student Engagement Online

Engaging the Online Learner and Continuing to Engage the Online Learner by Rita-Marie Conrad and J. Ana Donaldson.

This article reviews theory and literature to be considered in achieving engagement of learners when designing an online course. Each chapter discusses in-depth its objective in a digestible manner for those new and unfamiliar to the theories of teaching. Identifies sources of further reading such as

The first chapter of the article looks at “What techniques for student engagement should be considered by the online course designer or instructor?”

It provides an overview of techniques that have been documented in research studies to improve or increase student engagement in online coursework. The chapter first reviews strategies based on the early work of Moore (1989, 1990) and then proceeds to review the research on strategies that may impact engagement with attention paid to when they work, where they work, and for whom.

The third and fourth chapters are paired in the sense that the third chapter discusses the strategies and techniques that produce engagement (the first and second columns in Figure 4) and the fourth chapter discusses research.

Pedagogical practices of NetNZ teachers for supporting online distance learners,

Kwok-Wing Lai, College of Education, University of Otago, Dunedin, New Zealand

This article provides a qualitative review of staff responses at interview and in questionnaires on the practises employed at a successful online course community operated by a cooperative of rural schools in New Zealand.

A supportive online learning environment entails teachers using effective pedagogical practices to meet the needs of their students and developing a positive teacher–student relationship to foster learner motivation and engagement. This paper reports a study investigating how 32 secondary teachers in New Zealand taught their online distance classes and how they related to their students.

These classes were administered by NetNZ, an online distance education community. An online survey conducted in 2016 found that NetNZ teachers used inquiry-based practices including flipped learning and knowledge-building pedagogies to support agency, autonomy, collaboration, and community development. They also used synchronous and asynchronous communication technologies to overcome barriers of relationship building in online settings. NetNZ was unique in delivering distance education in the New Zealand context in that it used a community approach to encourage a more active participation of its member schools and teachers in delivering distance courses to secondary students.

From Motivation to Engagement: The Role of Effort Regulation of Virtual High School Students in Mathematics Courses, Kim, C., Park, S. W., Cozart, J., & Lee, H. (2015).

Findings state that learners with higher effort regulation abilities outperform their peers and can maintain it for longer – even for learners with low intrinsic values. They suggest ‘Volition theories and models’ as a means of improving effort regulation. They also report that intrinsic value, while helpful, is not necessary to succeed; teaching students how to optimise contexts for themselves will help them reshape tasks into something more palatable. They conclude that high levels of effort regulation prevent a loss of pride—keeping students focused on their tasks.

Methods

Initial Phase

The Action Research Groups were created to include representatives from each college within the EKC group as well as our network partners: North Kent College and Mid Kent College.

Students' groups were also identified within each college as illustrated in the table below:

Business Unit	Staff involved	Research Group
Group	Shabana Raman Matthew Byrom	Project Lead
Ashford	Sahil Sood	GCSE x 1
Broadstairs	Kim Hart	FSL2 x 1
	Terry Jenkins	GCSE x1
Canterbury	Phillip Hooks	FSI2 x1
	Luke Williams	GCSE x 1
Dover	Kinga Spicer	FSI2 x 1
Folkestone	Barry McLaughlin	GCSE x 1
Sheppey	Kelly Hough	FSL2 x 1
<i>Mid Kent College (network partner)</i>	Nabil Mugharbel	GCSE x 1
<i>North Kent College (network partner)</i>	Michaela Seasay	GCSE x 1

Meetings

- We had fortnightly meetings with the Action Research Group and monthly meetings with the Network Partners from September 2020 and June 2021.
- The EKC Group hosted an Action Research Workshop at the Kent FE Conference on February 10th to outline project to staff from the EKC Group and network partners.
- There were regular briefings to the Executive team and Principals about the progress of the Action Research.
- Meetings minutes were disseminated via Teams after each Action Research Group meeting.

Data Collection Instruments

1. First survey (MS Forms) set of data to gauge teachers' and learners' perception of online lessons
2. Second survey (MS Forms): students and teachers, to review their opinion on digital maths lessons.
3. Two sets of data to compare staff's perception and confidence when delivering online lessons.
4. Monthly reports from Digital Platforms
 - CENTURY TECH monthly usage data
 - MathsWatch usage data (from North Kent College)
5. Observations of learning walks and team-teaching sessions of lessons across the Group.
6. Attendance data
7. Assessment Checkpoint 1 (October) and 2 (February) data

Please note that we will not be sharing Assessment and Attendance data as appendices because of data protection and the results have been anonymised to prevent bias.

Results and Discussion

Group Results

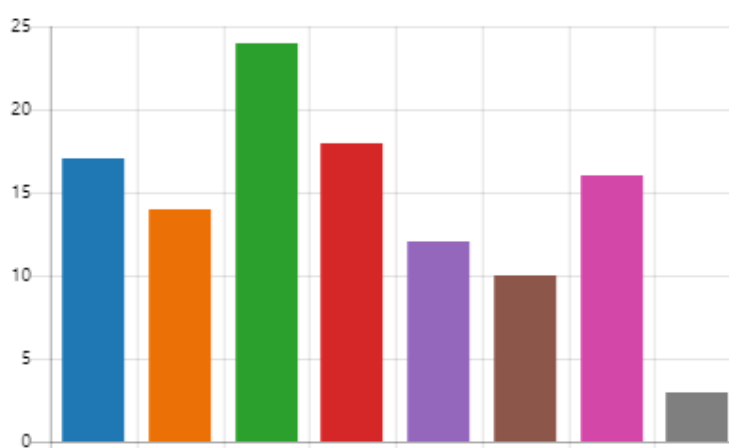
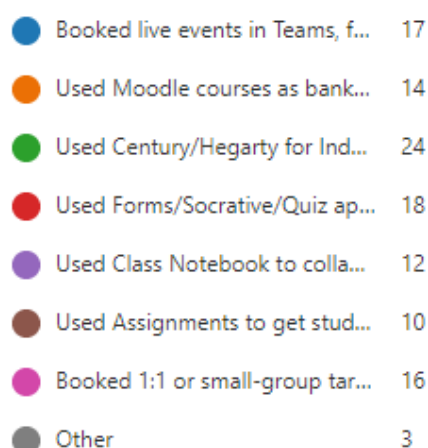
Teachers' feedback – September 2021

This bar chart shows the implementations of the various digital platforms in our provision from September 2020. At this point, all maths lessons (except the November GCSE resits classes) were online.

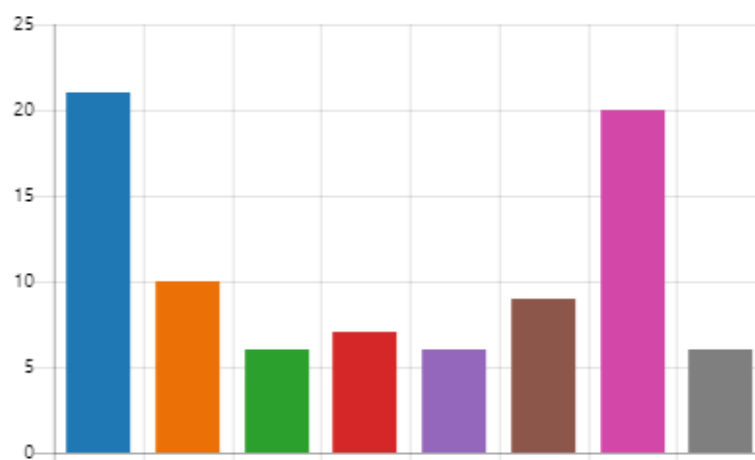
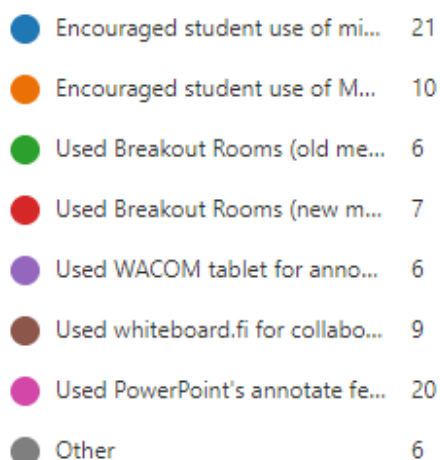
Most of our teachers used Hegarty and CENTURY as independent learning tools. During lessons, the use of Microsoft forms were embedded and students engaged well with Class Notebook on Teams.

From the list below, what online strategies did you start to deploy from September 2020?

[More Details](#)

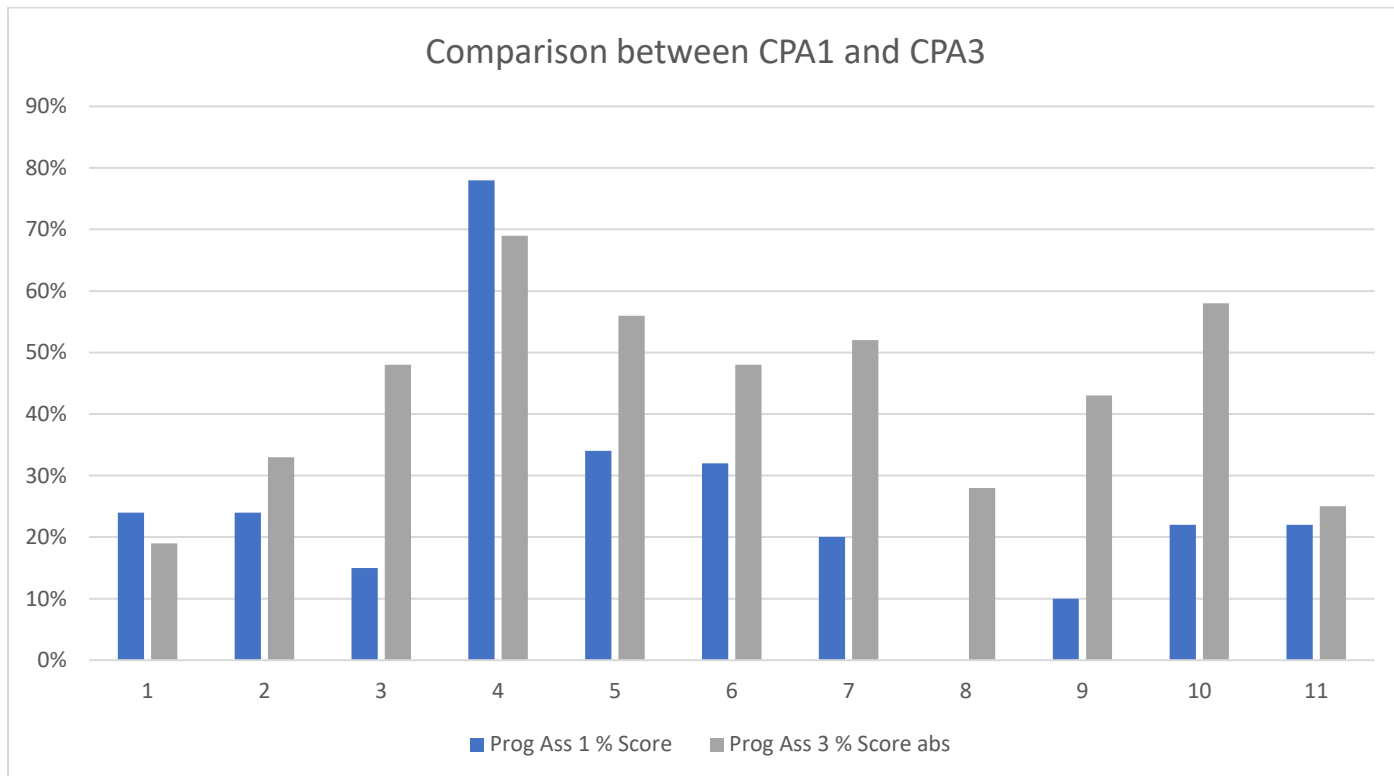


However, when the same survey was conducted in March 2021, after the second lockdown, the picture was different. Teachers were engaging their students more and were also encouraging to use microphones and cameras in live lessons. However, the lessons became less interactive and more teacher led with PowerPoints taking over the lessons. This change in teaching strategy was also observed in learning walks.



College Findings

On a more granular level, progress was evident when the achievement data for Assessment Checkpoint 1, sat in September 2020, was compared to data from Assessment 3, sat March 2021. The teacher from college 1 felt that her students reacted very well to online lessons. This teacher also went on to receive Teacher of the Year award – which is further evidence that our practice and delivery were getting stronger.

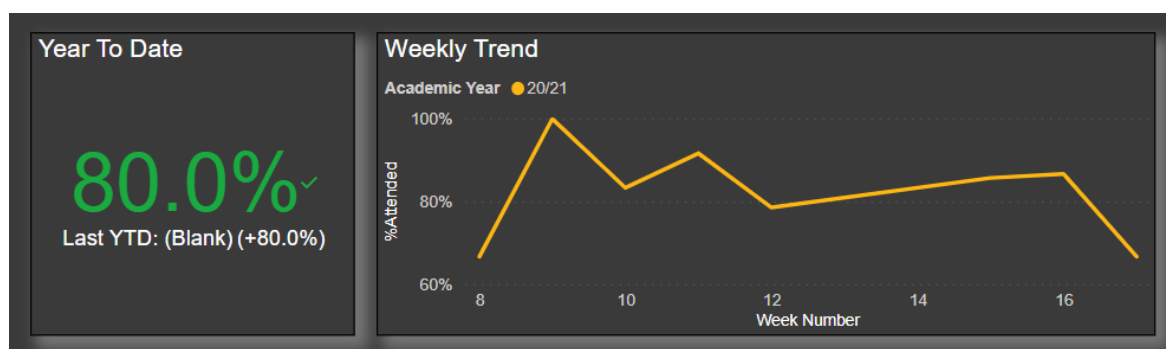


College 2 used two approaches to their delivery.

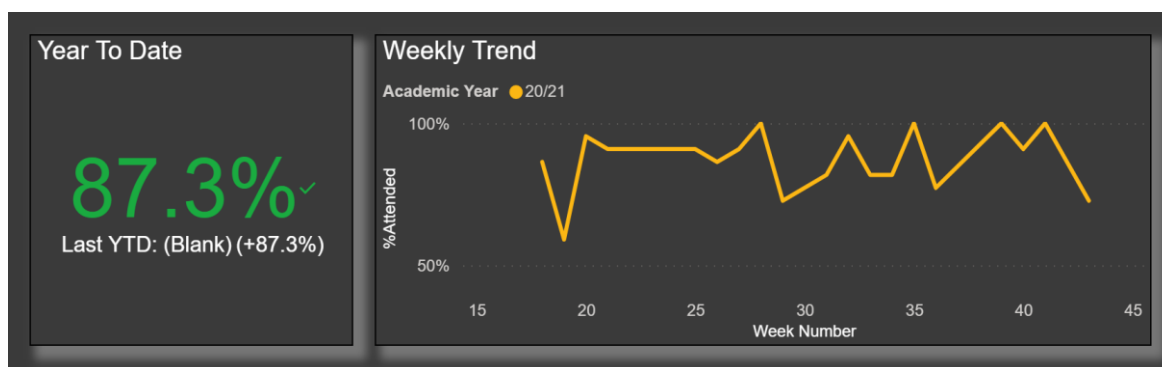
They started with a seminar model, with big class sizes and no interaction - as opposed to interactive lessons where students could have their microphones and cameras on. The seminar model allows teacher/students interaction via the Q&A function and comments are private, i.e. students cannot read each other's messages and then moved on to a single tutor model, which was more personalised and interactive.

They compared attendance and achievement.

Seminar/Webinar Model Attendance (Fig. 1)



Single Tutor Model Attendance (Fig. 2)



From Fig. 1 & 2 show that attendance improvement after the Seminar/Webinar teaching model was replaced with the Single Tutor Model. College 2 reports that decreasing class sizes and having a single tutor run classes allowed more time to:

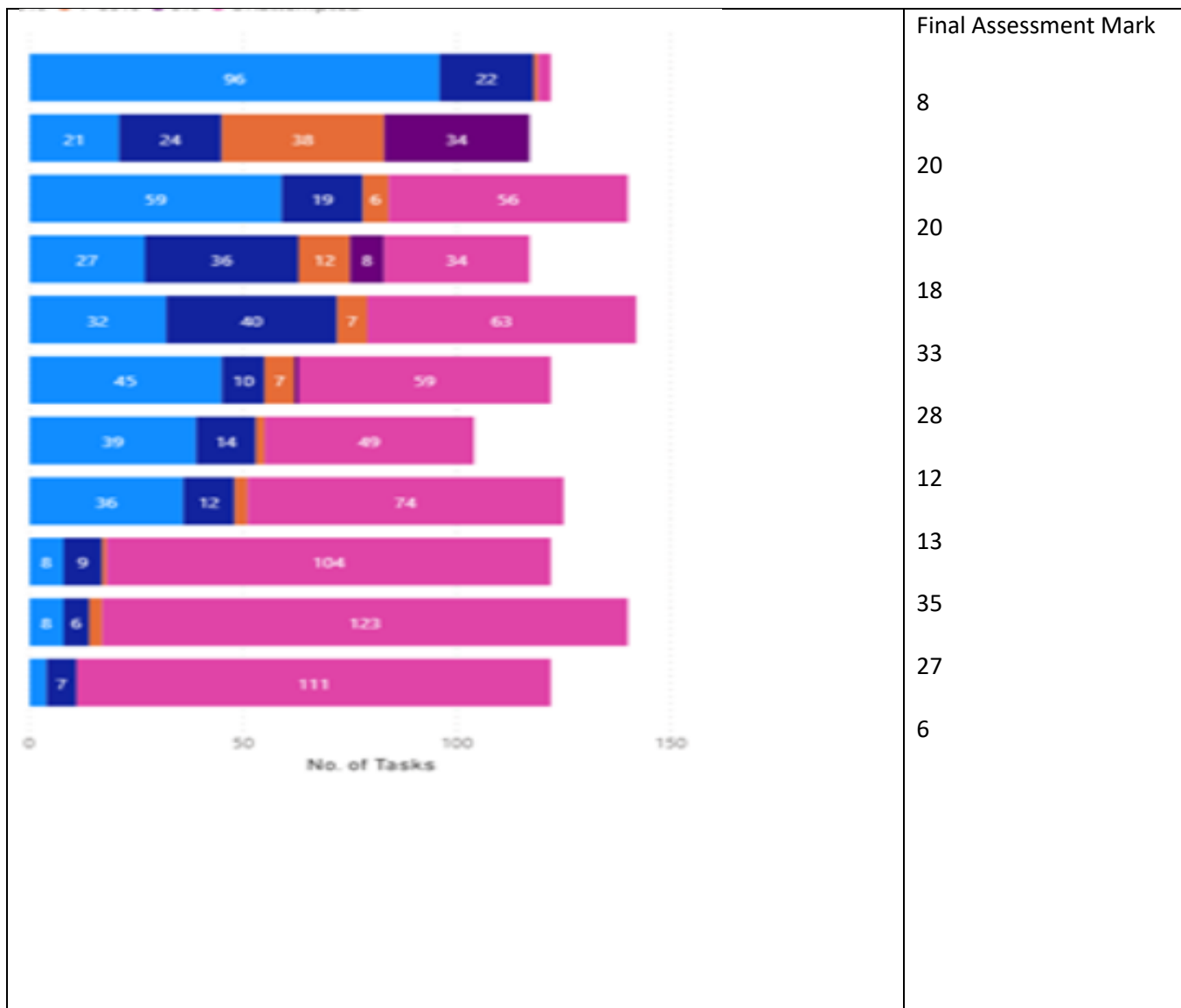
- Address non-attendance.
- Assist with IT issues preventing access.
- Tackle timetable overlaps.
- Provide individualised feedback.
- Track learner progress.
- Liaise with department/safeguarding/parent/guardian.
- Differentiate learning outcomes.
- Build rapport

HEGARTY – Web-based platform

College 2 also compared percentage completion of online independent study tasks, sorted by the number of tasks attempted and the final assessment results (Assessment checkpoint 3). There appears to be little to no correlation here.

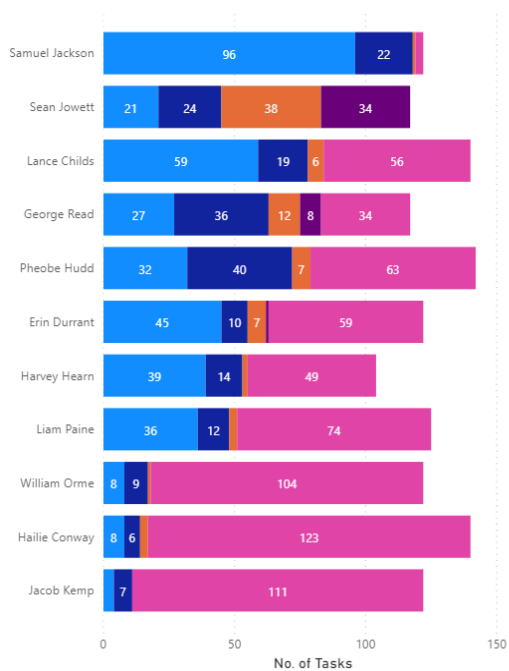
The number of self-directed study tasks attempted does not appear to indicate the level of success in ACP 3. However, the same teacher compared the number of logins to the assessment checkpoint 3 data and reported a positive correlation.

This data is based on 14 learners. 3 passed the Nov resits and 1 withdrew.

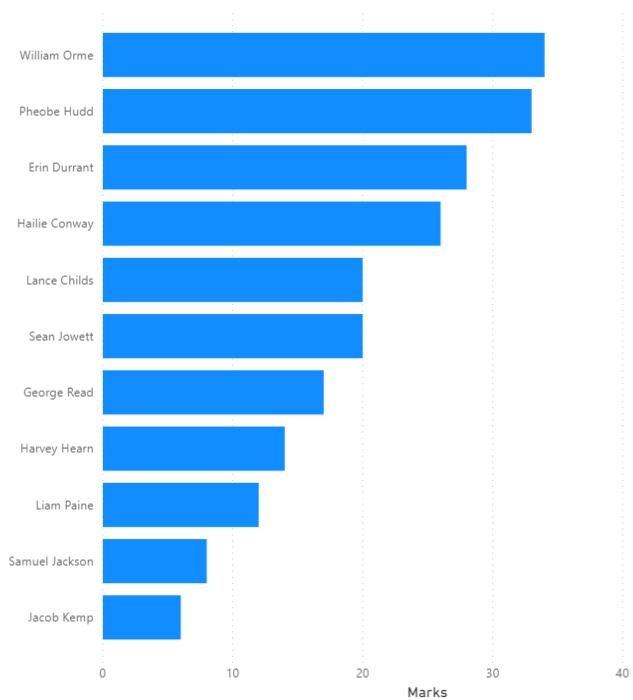


Hegarty Data - No. of Tasks

100% 70-99% 1-69% 0% Unattempted



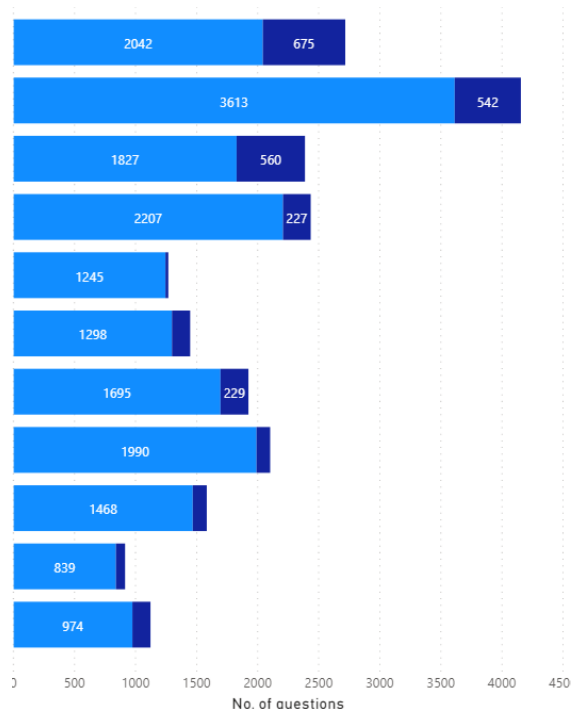
ACP 3



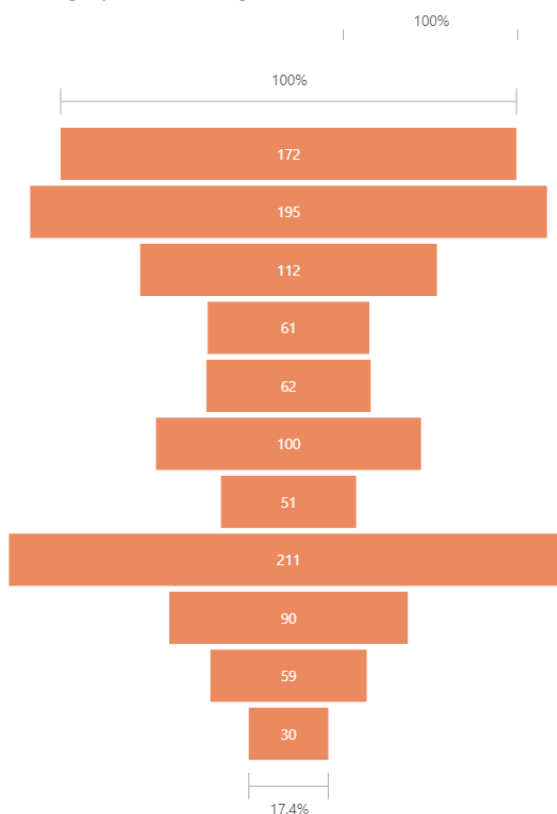
Hegarty Data (Fig. 4) sorted by Total Learning Time

Hegarty Data - No. of Questions Attempted

● Correct ● Incorrect



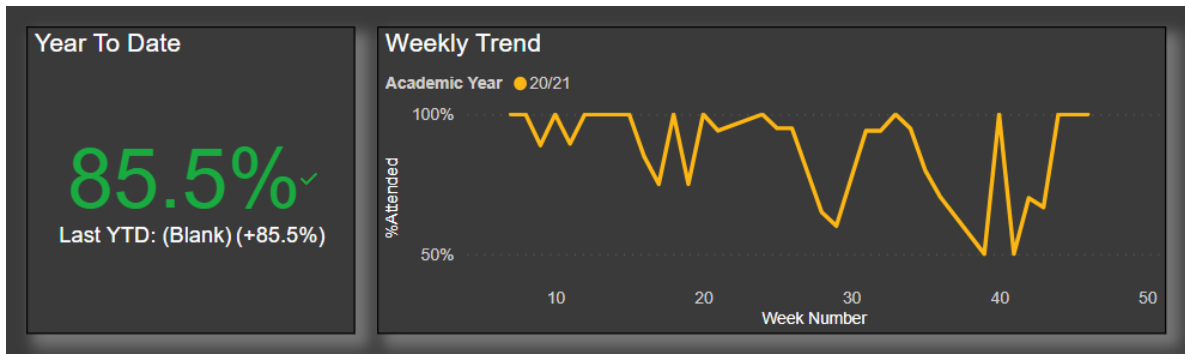
Hegarty Data - No. of logins



The data in Fig. 4 has been sorted by the Total number of learning hours. It appears the frequency of logging into Hegarty has had a larger impact than the frequency of time spent working on Hegarty. College 2 concludes from this that engagement needs to be chunked into multiple events shorter events rather than long single events to be effective.

They recommend that weekly tasks are set rather than big chunks of work, termly.

Evening Model Attendance (Fig. 9)



The evening class was initially face-2-face in the starting weeks of the academic year. A nationwide lockdown begun on 04/01/21 and teaching transitioned to online. Learners were consulted on whether to return to face-2-face lessons when lockdown measures were lifted in 04/03/21, all but one wished to continue online because of the convenience with work and/or childcare. Arrangements were put in place for the single learner, however, they decided to remain online when informed they would join a different group & tutor.

One learner, a medical practitioner, would connect from a local hospital whilst on call and leave as and when required, knowing the session was being recorded and they could return at any time without interrupting the class.

Hegarty Data (Fig. 10) sorted by No. of Tasks Attempted

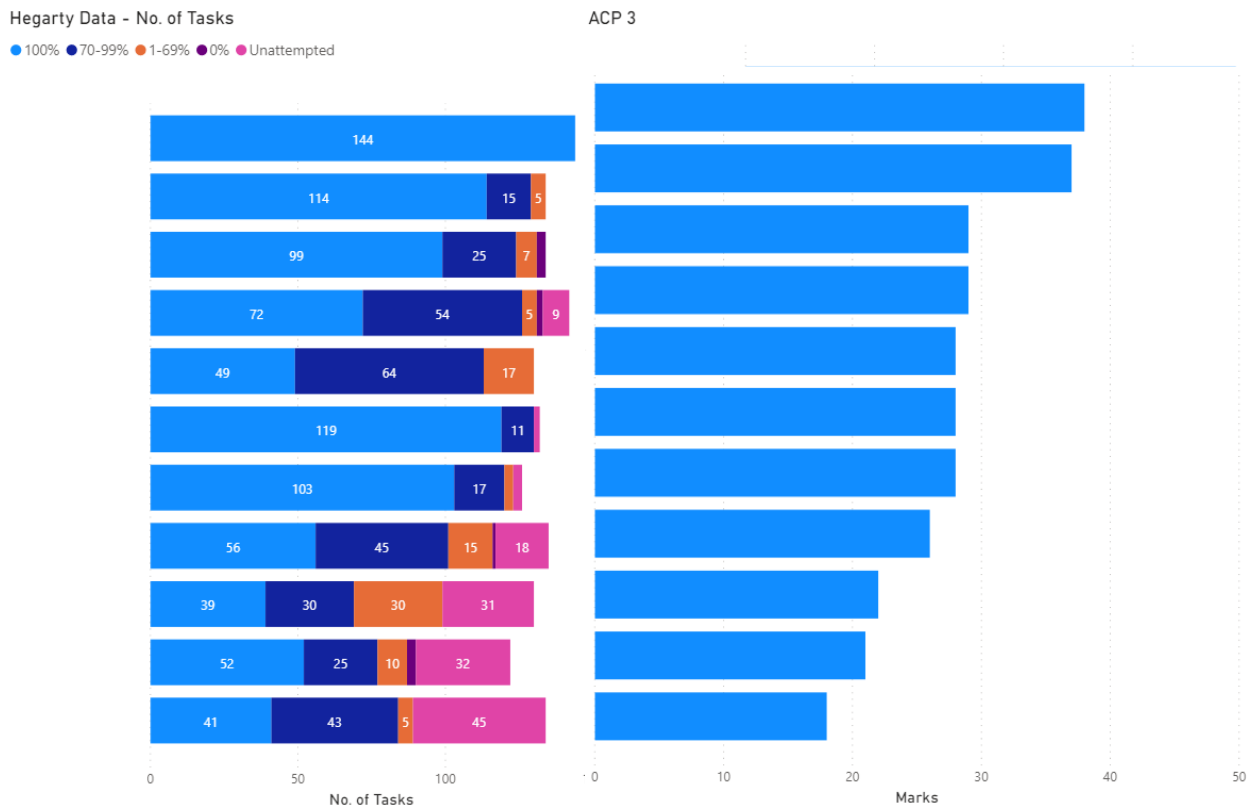
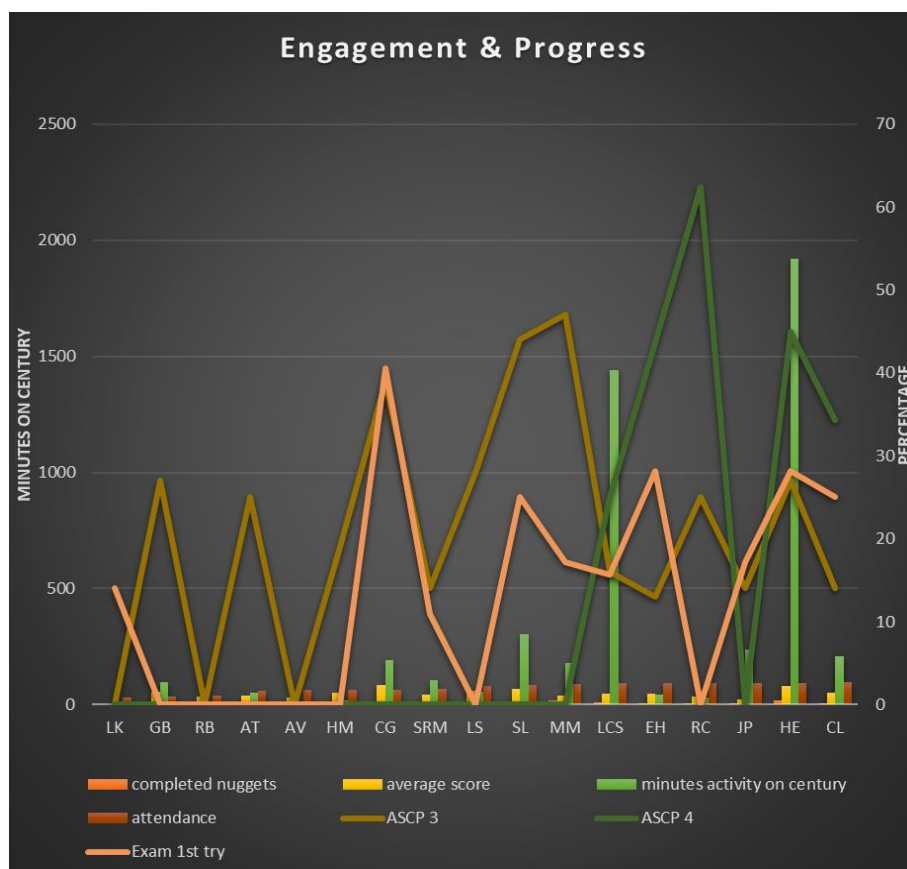


Fig. 10 shows the number of Hegarty Tasks assigned to each learner, sorted by the number of tasks attempted and the same learner's ACP 3 results sorted by total number of marks achieved.

Logging in frequently has had a positive effect on the number of questions attempted when comparing this data to Sport, however, the adult learners appear to have remained engaged for longer periods of time, this is shown in the data by the number the ratio Number of Questions Attempted: Number of Logins for each student.

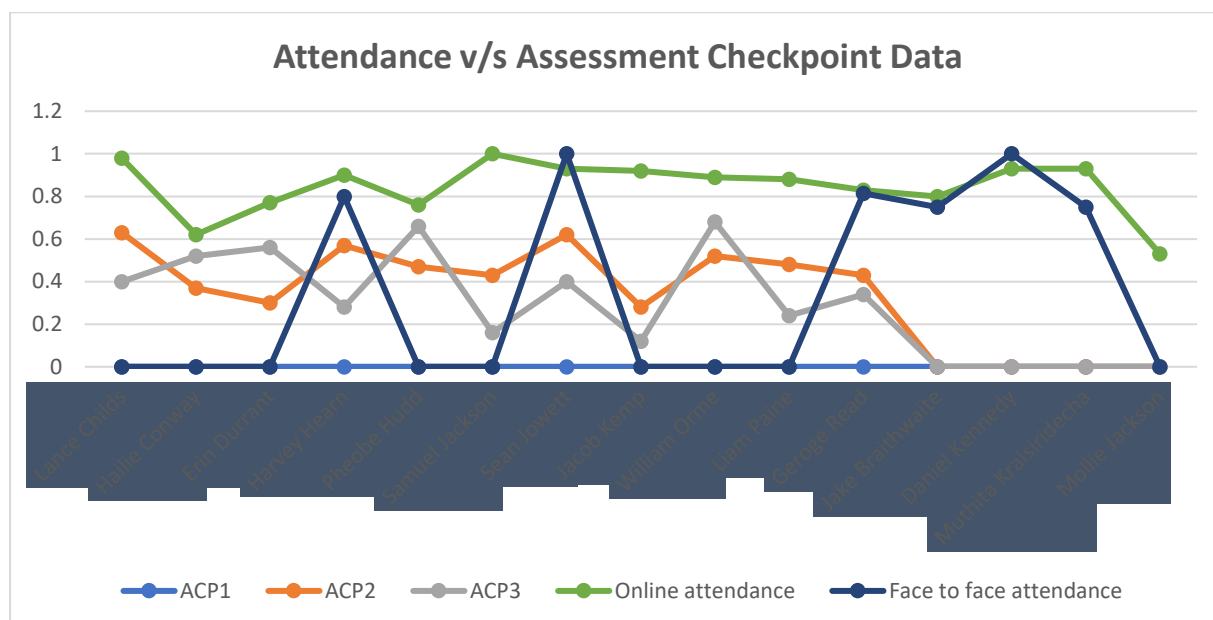
CENTURY v/s Functional Skills Achievement

The chart below shows minutes spent, nuggets completed and assessment scores of 17 learners at College 2, the teachers' analysis of which is that students who completed more nuggets on CENTURY did better in Assessment Checkpoint 3.



Attendance v/s Achievement

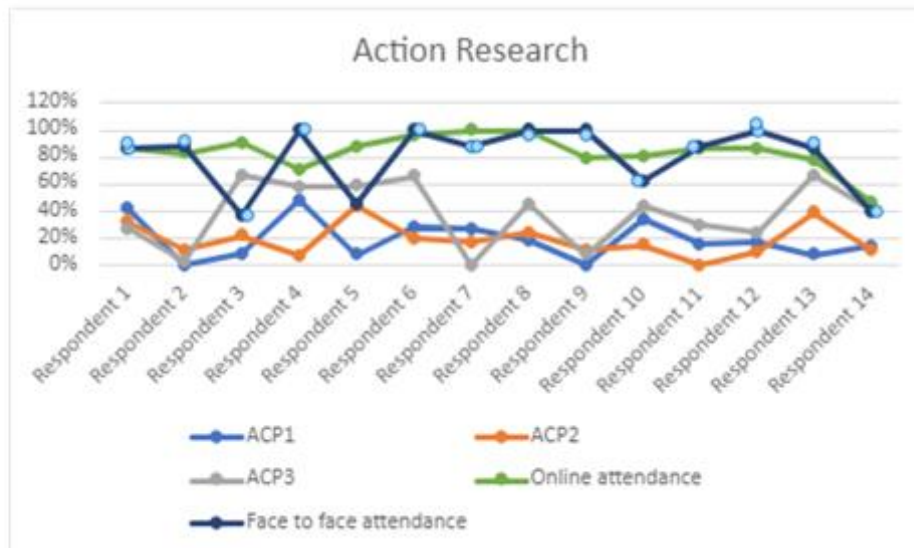
College 2 data indicated that the GCSE cohort's attendance was better online and so were their scores. However, this can be attributed to the lack of supervision. When the students sat their final tests face to face, a dip in achievement was observed. In the line graph below each set of data points along the horizontal axis represents a different learner.



Functional Skills Cohort – College 2

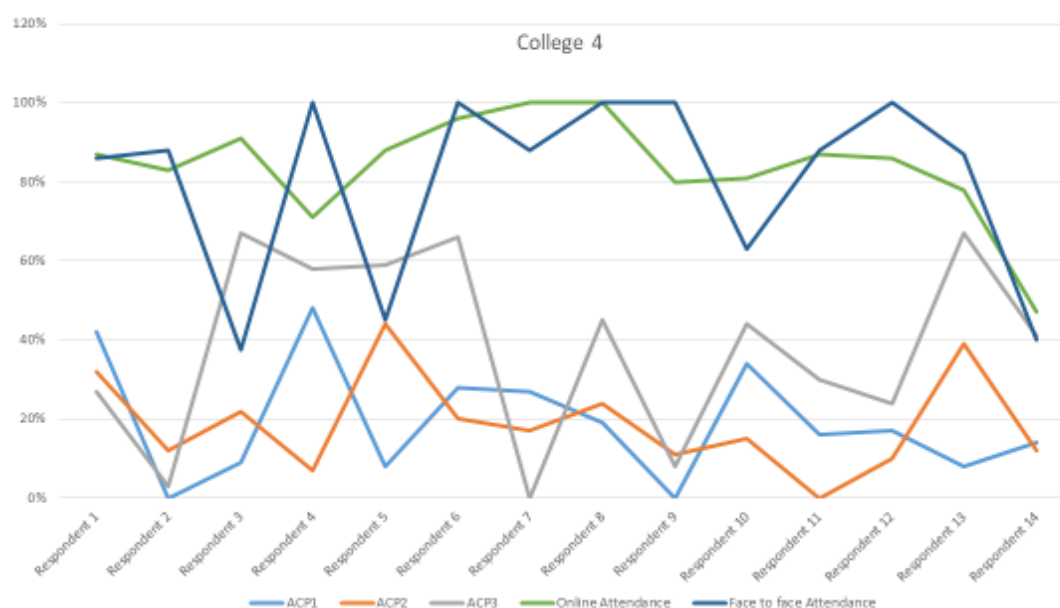
Data showed that good attendance does not reflect any better scores in Assessment checkpoint 1 or 2. Attendance only affected the final scores due the fact that the classes were face to face for that assessment. For all the desires to do face to face learning, only 3 out of 14 students attended post lockdown.

COLLEGE 3 – ATTENDANCE V/S ACHIEVEMENT



College 3 data showed that students did better in Assessment checkpoint 1 and 3 because these were paper based and face to face. ACP2 was completed on CENTURY. So, it is interesting to note the negative correlation between digital assessments and achievement for that college. College 3 is a much smaller college where students have more time with their teachers and therefore feel more secure in class.. The attendance for face to face lessons was higher than in online lessons.

COLLEGE 4– ATTENDANCE V/S ACHIEVEMENT



As with college 3, college 4 reported better face to face attendance in comparison to online lessons and better Assessment checkpoint 3 assessment data, when the test was paper based and face to face. The correlation between student numbers and engagement and motivation very interesting and this can mainly be attributed to the rapport between students and teachers.

Network Partners

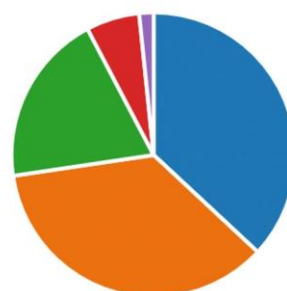
Both colleges delivered a blended approach from September to December 2020, prior to the second lockdown. The Head of Maths recorded video lessons for students to access during periods of self-isolation. Their data showed that their teachers felt upskilled since the first lockdown. During the second lockdown, Zoom was used for lessons, visualisers to model answers for synchronous delivery and Mathswatch, a web-based platform, was used for asynchronous delivery.

Their students preferred online lessons to face to face delivery although they could not show a strong positive correlation between attendance and online lessons.

How useful have you found Mathswatch this year to help your learning ?

[More Details](#)

Extremely useful	158
Somewhat useful	153
Neutral	84
Somewhat not useful	26
Extremely not useful	7



They will continue to use a Mathswatch but are currently investigating the use of CENTURY tech after taking part in this action research.

A number of barriers to effective digital maths provision were identified during data analysis. These were mainly identified during learning walks in lessons, across the Group. To summarise:

- 1) Teachers are still relying heavily on PowerPoints during delivery.
This will be addressed by more internal CPD, delivered across the Group.
- 2) There are many students who still do not have the appropriate technology to connect to lessons.
This has been/will continue to be addressed through bursaries and device loans.
- 3) Students are still not confident with using TEAMS inbuilt features such as Class Notebook but in cases where both teachers and students have mastered the feature, lessons are more engaging.
This will be addressed by providing more support and training providing to students in face-to-face tutorials to help them access these platforms.

- 4) Many students are still struggling or not willing to engage with the various platforms being investigated.

We will be further investigating the reasons for this and put in place appropriate support strategies to improve engagement.

- 5) Most students find navigating between the meeting and other learning platforms difficult mainly because of proficiency or because they are on phones.

This point is closely linked to (2). If students are allocated/loaned devices, then they will be able to better navigate through the various platforms during lessons.

*

Conclusions and Recommendations

Conclusions

The following conclusions can be drawn using the data gathered from the surveys, meetings and learning walks across the Group:

- Students prefer to be in smaller teaching groups.
- They prefer Teams Meetings rather than Live Events.
- They have mostly been using the 'Chat function' to engage in most lessons.
- Engagement is better where teachers use breakout rooms to facilitate discussions.
- A blended model within lessons, using web-based platforms such as Century, Hegarty works better for students. In general, the data suggests that students prefer online learning, but those attending smaller colleges perform better in assessments done face-to-face and on paper than online.
- Teachers are now more confident than they were during the first lockdown and are more willing to engage with online learning platforms.
- Students prefer to have their cameras and microphones off, especially if not prompted by the teacher, which has a significant impact on teacher-student rapport.
- Engagement with web-based platforms such as Century Tech and Hegarty improved over the year but engagement was better in smaller colleges. There was little or no evidence found of positive correlation between usage of these tools and performance in assessments.
- Engagement is better in lessons/college where teachers have met students personally in college prior to lockdown.

Recommendations

As the pandemic lingers and the world continues to adapt to cope, the EKC Group, like most educational institutions across the country, is hoping to go back to face to face teaching from September 2021.

We recommend that key, successful elements of online delivery are retained to encourage motivation and engagement, namely:

1. Teaching groups are allocated Microsoft Teams Classes irrespective of delivery model. This will also be a good backup should there be another lockdown.
2. Two-way communication on Teams between students and teachers should be encouraged to build rapport and give timely and effective feedback – visual via cameras on, text via private and group chat functions, etc.
3. The use of Microsoft forms and other such features to reduce printing in support of the Group's QIP environmental targets
4. Continue to embed platforms such as Hegarty and CENTURY TECH for independent learning and individualised learning plans as these were well-received by learners, while acknowledging that students will need separate and additional support for assessments, ie exam technique.
5. Further CPD on digital delivery and the use of web-based platforms for all staff and new students to maximise engagement and motivation.

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