



Flipped Learning Action Research – Does a flipped classroom approach really add value?

Written by Michelle Bilby and George Higgitt

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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.

Abstract

The aim of this research was to observe the extent to which learners in further education responded to actively participating in their own learning for GCSE Maths, and how successful this was. The intention of flipped learning was to encourage learners to actively engage with the learning material, i.e., to give them maths topics as pre-learning, through Hegarty Maths, to complete and bring this understanding to the subsequent maths sessions to develop a deeper understanding of the topics through problem-solving during the lesson. There were 2 teachers and 69 learners involved in this research. There was a mix of qualitative and quantitative data used: 3 assessments carried out by the learners; learner data taken from Hegarty Maths on usage; 38 learners responded to the questionnaire and 5 learners were interviewed.

It was observed that: some learners responded effectively to flipped learning; flipped learning had limited impact on some learners and some learners struggled to engage with the concept of flipped learning. It was observed that, generally speaking, the more work a learner completed before a lesson, this could impact positively on assessment marks. However, it also seemed that there are also links to how a learner performs with flipped learning dependent on the vocational course they are studying. However, we must take into account that this was far from a typical year. The lockdown period meant that the tutor could not offer face to face support between sessions, which we believe impacted on the delivery model.

Our findings could have significant implications for approaches to teaching and learning in the future. Directed study and virtual sessions can be offered and encouraged for those that are able, in order to support developing independent working skills quicker than more traditional methods of teaching. This research shows that some learners struggled with the concept of flipped learning and would therefore require closer supervision, or alternatively, looking at whether functional skills maths is a more suitable qualification. There can be further research based on this, looking at how learners perform with GCSE maths in comparison to a similar level of maths in functional skills.

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Introduction

Leicester College is a Post-16 Further Education College with three large campuses based in the centre of Leicester. Due to the circumstances of COVID-19, we had to rapidly rethink the way we delivered mathematics. We were only going to see the students for one lesson a week and they would work remotely another lesson. Prior to the pandemic, we had seen students for two 1.75-hour sessions. Due to social distancing, we were now only able to have 12 students per class. On 5th January, the UK was placed in lockdown and this ended 16th April; this was the period of time where we carried out our research into flipped learning and the impact it had on learners. As a result, all sessions during this period were carried out online. Nevertheless, we wanted to use a flipped learning model to encourage learners to come to the session prepared, in order to make the online sessions as effective as possible. We also wanted to achieve several other objectives:

- increase students' motivation by completing self-led tasks.
- help students to gain confidence in their skills.
- prepare the students better for their GCSE exams.
- develop other skills that could be transferred to support other subjects and the skills needed for the workplace.

Prior to this project, and the pandemic, our maths resit results sat below the national average at 19%.

Our learners

As a college we offer both GCSE and functional skills. GCSEs are offered to all 16-18 study programme learners entering with a previous grade 3 and are available on the three main campuses. 16-18 students without a grade 3 are provided with an opportunity to sit an entry assessment to verify readiness for GCSEs if they wish to study this instead of functional skills. The majority of our learners are 16-18 and on a full-time study programme but we also infill 19+ students. We also offer an online GCSE in mathematics and L3 Core Maths is offered to students wishing to study maths beyond Level 2 to support progression to HE.

We encourage our staff to engage in a wide variety of CPD to support improvements in pedagogy and vocational knowledge. Maths and English are a priority at Leicester College, and we aim to equip our students with the skills they need to succeed on their vocational programme and prepare them for the next stage whether this is further study or employment.

Our research

By the term “flipped learning” we refer to learning completed prior to the class to prepare for and support material covered in the session.

The largest challenge we have with forced resit students is their lack of involvement in the learning process; they tend to be passive learners. Coming from school, a typical grade 3 learner has been very much spoon-fed, and they have often lost faith in their own skills. Resit students often display signs of disengagement and lack motivation, often with no interest in pursuing the subject. They are frequently entrenched in failure. Our job is to give them hope, self-belief and encourage them to engage, whilst taking the next step of assuming responsibility for their own learning.

We have found through our own observations that clear communication is important to success with flipped learning and, all tasks must intricately link to direct teaching activities, so students can see the benefit in completing the tasks.

We also wanted to match the pedagogy to the technology and new environment that we found ourselves operating in. We aimed to find an approach that would be effective if we were teaching remotely; seeing students in class; or using a blended model. Due to the uncertainty of working during a pandemic, we needed a flexible model that could be adapted.

We needed to spend time revising our curriculum offer and planning flipped learning tasks that linked to the classroom activities and would help the learners to make progress.

Literature Review

As stated previously, **flipped learning** is a type of blended learning, which aims to increase engagement and learning by having the students complete work independently before the class so they can use the time in class, with the teacher, more effectively.

We were going to see our learners less, our classroom time was going to be effectively halved, how could we make sure that we used every moment with the students most effectively?

We initially read the research completed by Shireland Collegiate Academy and Khan Academy who had used flipped learning (European Schoolnet, n.d; NESTA, 2015). It supported everything we were looking for. Content was removed from lessons, allowing teachers the chance to focus on higher order skills. At Shireland, flipped learning was carried out across the whole school, and introduced to staff and students; they then delivered it, invited feedback, and refined the process of flipped learning. When reading the benefits of flipped learning, we wholeheartedly agreed. We wanted to give students more control; we wanted them to become more independent learners.

As with any key question in education, in this case the impact of flipped learning on the delivery of problem solving in mathematics in further education, there are a significant number of sub-questions that need to be considered. Teaching maths in FE is a more complex issue than just showing students how to solve different maths problems. Highlighted here are some of the questions we intend to address. How do you teach maths to someone who has spent several years preparing for an exam they have already failed at least once? How do you teach someone maths who does not want to learn? How do we support a student to complete prior learning and come to the class prepared? How does a teacher understand, assess, and support student cognitive ability in maths? How does a teacher support a learner with misconceptions in mathematics? How does a teacher support a learner with developing independent/research skills? To what extent is Hegarty maths an effective platform to support independent learning? What is the impact on students' anxiety levels if they complete the flipped learning and come to class prepared? The main focus of the investigation is the impact of flipped learning on the learner and, by reflecting on these questions it will be possible to develop the research to assess levels of success in learning.

In the ideal world learners would be better able to support each other and would embrace technology to support this. How a learner uses maths within college-based maths practice can differ to how they use it in real life situations. The college environment is consistently associated with finding exact answers, working with worksheets, and sitting at a desk with a pen, pencil, ruler and calculator; this can impact a learner's progress. As Oughton (2018, p. 15) pointed out, real life maths issues are created by the individual themselves to achieve objectives and as a result, the individual will apply their own processes and calculations to achieve their objectives. This dissociation of numeracy between the college and the real world is an issue that needs to be addressed by the tutor. Numeracy is an inherent part of the world in which we live and numeracy taught in the colleges needs to address this situation; something that will be addressed in this investigation.

Nevertheless, the challenges found at Shireland Collegiate Academy we could agree with. Staff must buy in and preparation was key. Their results were impressive:

- There was a twenty percent increase in students completing homework.
- There was an increase in outstanding lessons being observed.
- Engagement was increased in class and differentiation in class was improved.

What could we learn from them?

“Does a ‘flipped classroom’ approach add learning value?” by Kelly Cliffords (2018) is a study on pre-registration nursing students. The study was completed as there was felt to be a need for more practical classes so this could allow more time for this. The benefits of a flipped classroom approach have also been positively discussed by Hawks (2014), who stated that when it was used with nursing students in higher education, both students and staff had positive teaching and learning experiences. Both experienced increased engagement and the added value of more in-depth discussions in the classroom that may not have necessarily occurred with a traditional lecture approach (Hawks, 2014). Further, Fulton (2012) discovered that course failure rates had decreased from 13% to 6% after introducing a flipped classroom approach.

However, a study by Missildine et al (2013) wanted to further explore the correlation between using the flipped classroom and student grades and student satisfaction. Their study concluded that satisfaction was less with the flipped classroom approach as students deemed it ‘extra’ work, even though grades had improved (Missildine et al, 2013). This notion of ‘extra work’ by the student could be potentially avoided by discussing the expectation of the students prior to commencement (HEA, 2017). This was one of our concerns. How do we stop the learners perceiving this as extra work and convince them that by engaging in the simpler tasks before the class, then the class time could be spent on more challenging activities - that the learners may have traditionally struggled with? Especially if we ran out of time in class and these were then finished as traditional homework, something that our forced resits students are notoriously bad at.

One of the things this research highlighted was the importance of the students understanding the benefits of flipped learning and having their expectations set from the outset. The students also need to be prepared. They also recognised how some students are not ready for self-directed learning. Some learners experienced anxiety and frustration at being taught this way. I feel that this may be many of our learners. How can we support them with this and facilitate this change in them? One of the big benefits of flipped learning is it could revolutionise classroom practice by allowing students the opportunity to explore their own knowledge rather than being spoon-fed by the teacher. My question is, will this work for resit students or do most of them need more direction?

The Flipped Learning research report by NFE and Nesta is a small-scale qualitative study exploring how flipped learning can work in UK classrooms, with an emphasis on maths. It took place in 2014-15 in nine schools. Teachers again used prepared materials from Khan Academy. The key features of this study were:

- Homework was used to deliver new content and to prepare students.
- More use was made of online learning.
- Teachers spent more time in class coaching and facilitating learning.

The impacts on teaching and learning were as follows:

- There was more time for practising and applying knowledge.
- It allowed for higher level discussion.
- There was more time and opportunities for collaboration.
- The learning was very student led.
- There was more time for individualised support for students.
- Teachers had more chance to understand how each student learned.

There was also an impact on student engagement with maths. This was:

- More engagement by students
- Better understanding of the topics by students
- Learner confidence was increased.
- Students had a greater awareness of their strengths and weaknesses.

- Students progressed quicker.

The challenges raised identified were as follows:

- Issues with access to technology.
- Finding the right resources for flipping.
- Some students will not engage.
- Some students just prefer face to face.

It was encouraging to read that most teachers wanted to continue with some sort of flipped learning. This raises the question of how we overcome these issues.

They recommend:

- Encouraging learners to book a library slot if they have no Wi-Fi.
- The organisation needs a directed study policy – this is a concern- we do not have one at Leicester College. Is this going to be an issue?
- Possible workshop style sessions if students need help to get into the routine of pre-learning.
- Increasing their confidence in the first 6 weeks will help them to complete the work.
- Getting students who had completed the work to support the less able.

The key benefit that they found is that students can spend as much time as they need on the flipped tasks. In the class this could often be rushed but at home it is at their pace.

In the flipped classroom by Derek Raine and Sarah Gretton they investigate how the flipped classroom matches the established principles of good teaching. They completed two tables showing the principle of good teaching on one side and how it was fulfilled on the other side. They concluded that flipping could support good practice.

This research was done with university students studying physics, engineering, maths or bioscience and there are lots of references to US Universities, which somewhat limits its relevance to FE in England, but many transferable conclusions are very useful.

They concluded that when flipping you should:

- Keep it short- ideally video based.
- Encourage students to prepare- they advise being ruthless and do not cover the material if some people have not done it. Otherwise, there is no reason for the percentage that have done it to continue doing it.
- Expect participation by setting clear tasks, giving clear direction, making tasks manageable and if necessary, scaffold.
- Encourage attendance by providing opportunities for students to discover what they do and do not know. Ensure that higher level material is covered. Ensure a cycle of learning by following up on issues or questions raised by students.
- Ensure students buy in to the process.

Prior to this research, there was the concern of access to digital technology and the possible impact on learning remotely, especially when there has been no choice due to the impact of Covid-19 and lockdown. The concerns included: some learners only using mobile phones, which can limit the ability to access the required information successfully and efficiently; some learners may need to borrow laptops from the college to carry out their work. This could also suggest that there may have been other learners, who may not have access to decent digital technology, either missed out on the opportunity to borrow a laptop or felt that they could not ask for personal reasons.

Several researchers and teachers in education have highlighted these issues when teaching using a blended learning method (Johnson, 2013, pp. 60-62; Tosun, 2015, p.646). Learners in these scenarios also commented on areas such as difficulties with self-motivation, not being

able to get effective support from the tutor and relying on a video that you cannot interact with. In these cases, self-discipline and self-motivation are skills that many learners are still developing. Part of the role of the tutor, therefore, should be to support this within the respective subject and holistically.

Some of these issues appear to be more problematic due to inequalities that exist in education, particular with problems that have been highlighted by the impact of COVID-19 and lockdown measures. Several of the authors cited above have written about blended learning, flipped learning, and learning online in ways that support the issues raised in this research, which can also lead to further research into the impact of online learning and inequalities in education.

In 2019 the Labour Party had promised free broadband as a public service in their manifesto, in order to support all communities, noting its importance as 'an essential utility', improving 'people's quality of life', and being 'at the cutting edge of economic and social change' (Labour Party Manifesto, 2019, p. 7; labour.org.uk, November 2019). In response to COVID-19 a government sponsored publication noted the 'digital divide' (Baker, 2020). This publication noted the concerns between people who have access to digital technologies and those who do not. Several factors were highlighted about the inequalities associated with the digital divide, such as socioeconomic status and the lack of understanding of internet safety and fraud. The main factor that a training session attended by members of the ARG on Motivation and Engagement highlighted was related to home-schooling and access to a reliable and affordable internet connection. This was also highlighted by Blundell (2020, pp. 309-310) when he evaluated that there are significant gaps in learning between children from 'better-off' families and children from 'worse-off' families. Children from better-off families had better access to private tuition, online classes and chats which are more productive than just being given access to more 'passive' education tools. Furthermore, it has been emphasised that between January and March 2020, '9% of households that containing children had no access did not have home access to a laptop, desktop PC or tablet', as well as 'school closures are likely to have widened the attainment gap between disadvantaged children and their peers' (Baker, 2020). Baker also noted the link between free school meals and computer access: in a survey carried out in April 2020, '1 in 5 children eligible for free school meals had no access to a computer at home'. Overall, there is a clear indication of deeply concerning issues when it comes to disadvantaged learners due to access to digital technologies. At Leicester College, there is a variety of support offered to learners. One of these is access to a laptop. I have observed at Leicester College difficulties some learners have had whilst trying to engage in an online lesson or using online educational tools with their mobile phones and using mobile data. I have noticed an increase in the level of engagement when a learner has been given a college laptop to use.

Methodology

Healey (2000, p.172) argues that to improve teaching effectiveness, teachers need to be thorough in collecting evidence, which includes an effective ability to reflect, inquire, evaluate, document evidence, and communicate. Well informed and proactive teachers, who support and develop critical thinking skills, should be able to reflect, and communicate their practices and theoretical understanding.

Healey argues that evidence shows how lecture/curriculum design impacts on a student's learning (2000, p.175). The maths taught in the classroom needs to be made as relevant as possible to students. Tasks need to be engaging, challenging, and developed to respond to the needs of the student. Techniques need to be updated as ideas and technologies improve. Developed assessment practices and methods are important. To what extent are you teaching learners to teach themselves (learning to learn)? This is something that will be evaluated when carrying out this investigation. By developing appropriate questionnaires and interview questioning, it will perhaps be more possible for this research to show a better understanding of the impact of flipped learning on the learner; this is qualitative data. The advantage of using qualitative methods is that they allow the active involvement of the researcher/teacher, as they observe how students respond to different situations. As such, it is possible to reveal the thinking and attitudes of the student (Griffiths, A., 2019). Therefore, it has the added advantage of providing a more complete understanding of what is being investigated than a quantitative analysis. As a result of its open-ended nature, it is possible to develop the investigation further; this is an investigation based on observations and experiences, which means there is a possibility of following up with further investigation. It is also a method that has a higher response rate compared to others.

Seale (1999) emphasised the importance of the quality of qualitative research. His article evaluates the criteria required to determine what he observes as good quality qualitative research, from a philosophical point of view. Criteria he evaluates include validity, reliability, transferability, dependability, fairness, and triangulation. All of these criteria, if followed, are designed to produce credible research. By following the criteria as illustrated by Seale, it will be possible to support an investigation that is less likely to be bias, even considering biases which can be observed in human behaviour, which includes researchers. In education that can develop a greater understanding of issues and challenges in education. This understanding of bias leads to the awareness of the disadvantage of qualitative research.

Even though it is a good method to use, it is important to be aware of the disadvantages, in order to minimise corruption of the data collected. There is the risk of researcher bias and subjectivity when setting up the resources, collecting the data and observing the students. Different researchers considering the same investigation will have differing opinions on what is important, which can lead to gaps in the research. For instance, the subjectivity of the researcher can be a result of their own political, social, or cultural bias. Seale considers the philosophical issues of researching (1999, p. 471). A researcher will have their own moral and social code which can affect the impartiality of the investigation they are carrying out. The data would therefore need to be analysed carefully, to maintain the reliability of the investigation and the researcher. Furthermore, to give further impetus to the research, quantitative data will be used in the form of assessment data, and data taken from the online educational tool, Hegarty Maths. This research, therefore, will be using quantitative and qualitative data, which is a mixed methods approach.

Mixed methods research (MMR)

By using a mixed methods approach to research in response to the impact of a flipped learning approach to education, the aim is to compare learner assessment results with learner experience. By using different methods of data collection, i.e., qualitative, and quantitative data it may be possible to provide a more complete analysis of the impact of flipped learning in this context than a single method approach. It has been suggested that MMR can provide a less bias approach to the research and therefore an 'increase in accuracy of the data and reliability through triangulation' (Cohen et al, 2018, p.33).

Questionnaires were given to learners based on their experiences of online learning. Some learners were interviewed to give a more in depth understanding of personal views of online learning. The educational online tool Hegarty Maths was used, collecting only the learner data from when it was used during lockdown (05/01/2021 – 16/04/2021). The assessment data comes from 3 assessments that the learners carried out during the 2020/21 academic year: Assessment 1 in December 2020 after several weeks of teaching; Assessment 2 in April 2021 shortly after lockdown due to Covid-19, so virtually all teaching and learning was carried out remotely; Assessment 3 in May 2021 after a few weeks of teaching. The assessments were the AQA GCSE Maths exams for June 2019.

Confidence sampling was used for the participants, who were the learners of two teachers for the academic year 2020/21. Of these, 69 were learners taking the foundation assessment (45 male, 23 female and 1 gender fluid), and 7 learners were taking the higher foundation (7 female and 2 male). Of the 69 learners in this research, 14 did not complete all 3 assessments. This research, therefore, will focus mainly on the 55 learners who completed all 3 assessments as the aim of this research is make a clear link between the learning carried out in classrooms and the learning carried out online and link them to the 3 assessments. Furthermore, 38 learners responded to the questionnaire and we conducted 6 learner interviews.

Explanatory Sequential mixed method approach

The assessment 1 and 2 data were collected first, then the questionnaire was handed out, for learners to consider the effects of online learning, then assessment 3 data was collected. Lastly, interviews were carried shortly after assessment 3. The quantitative data was analysed first then the qualitative data was analysed to help explain the quantitative data.

Confidentiality

All data was anonymised. Only personal data that is necessary will be collected and data will be coded. We will be using pseudonyms/codes when writing up or referring to the assessments completed by learners, questionnaires, and interviews. The learners are aged between 16 and 19, so safeguarding issues will be dealt with as required. If any information that has been gathered indicates harm, to participants or others then this will be shared with the appropriate safeguarding.

Aims

- The key question is, does a flipped classroom approach really add value?
 - Identify the difference in marks/grades between assessments where classroom-based learning was given, and assessments where online sessions were given.
 - Identify the extent to which learners used Hegarty Maths to support their online learning.
 - Identify issues and challenges learners faced with online learning.

Results and Discussion

Assessment Data Analysis

Table 1 shows a breakdown of all learners who carried out the assessments during the research period. There were 69 learners in total included in this research. However, 14 of these learners did not complete all 3 assessments. As seen in the table, the pattern of mean average marks between the 3 assessments is the same for the 69 learners as it is for the 55 learners, i.e., Assessment 2, which was carried out shortly after lockdown was lifted is noticeably lower. This indicates that learners on average did not do as well when learning online.

Of the 55 learners who completed all 3 assessments, 44 did better on assessment 3 than they did on assessment 2; this is 80% of learners. On average, learners achieved a score of 8 marks higher on assessment 3 compared to assessment 2.

What is also noticeable is the difference between male and female learners, and the Engineering, and Health and Social Care learners. On average, male learners scored 7 marks higher in both assessment 2 and 3. At first glance this suggests a gender divide when learning mathematics as a retake exam in further education, however, this changes when the vocational courses, engineering, and health and social care are factored into the equation.

Engineering is generally dominated by male learners, and health and social care is generally dominated by female learners. The mean scores drop when only health and social care learners are isolated as a group of maths learners. When female learners are also factored into the engineering learners, then the mean scores increase. This suggests that the vocational study programme a learner is carrying out is a clear indicator as to the mathematical capability of the learner. This is further highlighted by the learners carrying out the higher assessment.

The higher assessment is far more difficult and was only offered to those learners who showed their mathematical capability early in the academic year. Table 2 shows that 5 of the 7 learners were female, and the two highest scores were from engineering learners. Also, what is perhaps important to note is that 5 of these 7 learners speak English as a second or other language (ESOL) and their marks suggest they should all pass with a grade 4 or higher; this contrasts with learners taking the foundation assessment where the assessment results suggest no more than approximately 25% would gain a grade 4 or higher.

Table 1 – mean average scores of the 3 assessments carried out by the learners in this research.

	Assessment 1 (marks out of 80)	Assessment 2 (marks out of 80)	Assessment 3 (marks out of 80)
69 learners who carried out the Foundation Assessment	32	26	30
55 learners who completed all 3 assessments	34	29	37
The 38 male learners who completed all 3 assessments	35	31	39
The 16 female learners who completed all 3 assessments	32	24	32
The 1 male and 12 female health and social care learners who completed all 3 assessments	29	21	26
The 25 male and 3 female engineering learners who completed all 3 assessments	38	33	43

Table 2 – shows all learners who took the higher assessment.

Sex	VOC Area	Assessment 1 (marks out of 80)	Assessment 2 (marks out of 80)	Assessment 3 (marks out of 80)
F	Engineering	45	39	49
M	Engineering	38	43	40
F	Business	8	14	20
F	Travel and tourism	31	35	26
F	Business	16	16	12
F	Science	31	34	30
M	Engineering	19	11	24
Mean		26.86	27.43	28.71

Hegarty Maths (HM) Data Analysis

Table 3 indicates the level of commitment learners have on average to online learning, over the 14-week lockdown period. The data clearly shows that the learners carrying out the higher assessment are far more committed, motivated, and capable with online learning as seen by the number of hours they have spent using HM, and the numbers of questions answered and answered correctly. Also noticeable is the lower averages of the health and social care learners compared to the rest of the data. The health and social care course is dominated by female learners (in this sample all but 1 learner is female) but the mean average increases significantly when all female learners are considered. The data also suggests that female learners, as a whole group, on average are more committed to online learning than male learners.

Table 3 – showing the Hegarty Maths data taken from Foundation learners' Hegarty accounts between 05/01/2021 to 16/04/2021, the period of lockdown where learners were expected to carry out nearly all their learning remotely.

	Total Questions Answered (mean average)	Questions Answered Correctly (mean average)	Questions Answered correctly as a % (mean average)	Total Hours of learning (mean average)
Foundation (All)	246	191	74%	6.42
Foundation (Male)	234	177	73%	6.22
Foundation (Female)	291	234	76%	7.30
Foundation (HSC)	243	180	71%	6.08
Foundation (Eng)	271	212	75%	7.20
Higher (All)	830	764	91%	26.23

Hegarty Maths correlation with learner assessment 2

At first glance, there is no identifiable correlation between the amount of time spent on HM and getting a better score on assessment 2, as shown in graph 1. There is no indication that if a learner spends more time on HM that this will improve their grade. Although it is possible that flipped learning and online learning maintained or improved a learner's mathematical skills, it did not impact on improving the assessment outcomes. Breaking this down into intervals, as shown in table 4. According to Table 4, 43 learners carried out less than 10 hours work on HM, of which only 6 achieved the pass mark of 38/80 on Assessment 2. Of the 12 learners who carried out more than 10 hours work online, 6 achieved a pass mark on assessment 2. This gives a clear indication that online learning, with a flipped learning approach can add value to learning. However, as the data in Table 4 also indicates, this may not always be the case. For the hypothesis that 'does a flipped classroom approach really add value' to be fully possible, there needs to be a clear and positive correlation between hours worked, and assessment mark; there is not. The groups that carried out between 6 and 10 hours of learning using HM does not follow this pattern; the average mark is lower than the groups who carried out less work on HM.

There were 12 learners that carried out between 6 and 10 hours of work on HM, and of these 6 are health and social care learners. Furthermore, 2 health and social care learners

also carried out more than 10 hours of work on HM (scoring 26 and 19 on the assessment). As 8 out of 13 health and social care learners carried out more than 6 hours of work on HM suggests that these learners show above average commitment to improving their knowledge of GCSE maths but struggle. As they have already achieved a grade 3 at GCSE maths, this is most likely related to the more abstract concept of mathematics such as algebra and geometry.

Graph 1

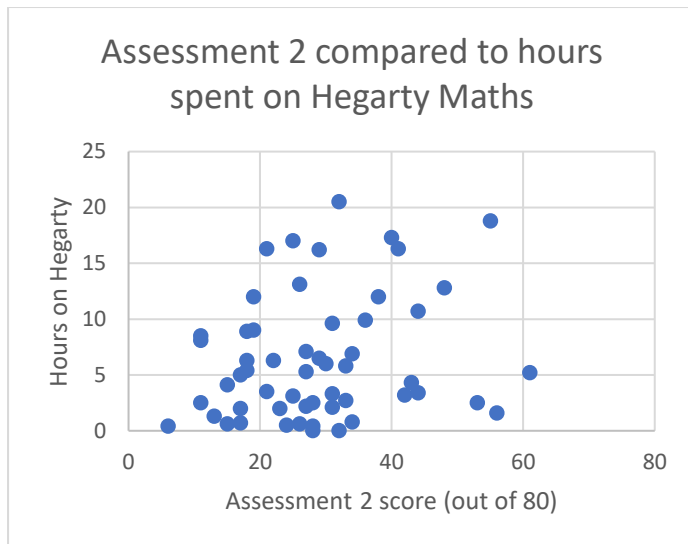


Table 4

Assessment results compared to Hegarty Maths usage in hours (all raw marks are out of 80)									
Interval	$0 < x < 1$	$1 \leq x < 2$	$2 \leq x < 3$	$3 \leq x < 4$	$4 \leq x < 6$	$6 \leq x < 7$	$7 \leq x < 10$	$10 \leq x < 15$	15+
Total results	9	2	8	5	7	5	7	5	7
Raw Marks for each individual learner									
	26	13	31	21	15	22	11	26	25
	24	56	17	31	43	18	27	19	32
	17		27	44	18	34	19	48	40
	28		33	42	27	29	11	44	55
	28		11	25	33	30	18	38	29
	32		28		17		31		41
	6		23		61		36		21
	34		53						
	15								
Mean Averages	23.3	34.5	27.9	32.6	30.6	26.6	21.9	35	34.7
	26.4			31.4		23.8		34.8	

Note: Highlighted figures in the above table are of marks of 38 and above, which is the required mark for a grade 4 for this assessment.

Questionnaire Analysis

There were 38 responses to the questionnaire: 20 male learners, 17 female learners and 1 gender fluid. There were mix of learners from different vocational areas: Business, Engineering, Performing Arts, Health and Social Care, Public Services and Sport. However, most learners came from Engineering and Health and Social Care: 13 and 12, respectively. Therefore, it was possible to make some comparison between engineering learners and health and social care learners. There were 17 questions the learners were asked (**see appendix 1**).

When asked how they felt about working remotely as a lesson for maths (question 3), there was a very mixed response: 11 were confident; 17 middling confidence; 10 not confident. The results also showed that engineering learners tended to be more confident than health and social care learners.

There was generally a negative response to working online as opposed to working in the classroom. Question 12, for example, although most rated online classes as either sometimes enjoyable or enjoyable, what is noticeable is that there were negative experiences amongst health and social care learners; 8 out of 12 of them rated online classes as not enjoyable or bearable. Question 15 shows a clear indication of the negative impact of the pandemic on the learning experience: 24 learners responded as negative or very negative, whereas only 5 view the impact as positive or very positive. This is reinforced with question 16 which indicates most learners found learning online more unhelpful than in the classroom.

Question 4 was striking, showing a learner's ability to access digital technology effectively. 4 learners borrowed laptops from the college; 3 learners only had access to their mobile phone; 8 learners used either their mobile phones or a computer at home. This indicates challenges that some learners face when having to work online due to limited access to digital technology.

However, there was generally a positive response to using Hegarty Maths as an online educational tool. There was some regular commitment to using it, such as the days per week learners used it, how many hours learners used it in one go, how interesting learners found it, how useful they found it and whether they watched a clip more than once (questions 5 – 11 and 14).

Remote Learning Questionnaire Results
Total Responses: 38

	Question	Answers	Total Responses	ENGI	CHSS
1	Which gender do you most identify as?	Male	20	12	1
		Female	17	1	11
		Transgender	0		
		Gender Fluid	1		
		Non-binary	0		
		Other	0		
2	Which is your vocational area?	Business	6		
		Engineering	13		
		PAMU	3		
		CHHS	12		
		UPS	3		
		Sport	1		
3	How do you feel about having to work remotely as a lesson for maths?	Confident	11	5	2
		Middling confident	17	6	7
		Not confident	10	2	3
4	When working remotely, which digital device do you use mostly?	Mobile Phone	11	3	6
		Own desktop computer	5	1	3
		Own laptop	25	9	8
		Laptop borrowed from the college	4	3	
5	How many days a week do you use Hegarty Maths?	0 days	2		
		1 day	3		3
		1-2 days	4	1	1
		2 days	8	2	4
		2-3 days	4	3	1
		3 days	7	4	2
		3-4 days	2		1
		4 days	1	1	
		4-5 days	1	1	
		5 days	1		
		2-5 days	1		

6	On average, how long do you spend on Hegarty Maths in one go?	Up to 1 hour	17	5	8
		Up to 2 hours	15	5	2
		More than 2 hours	4	5	1
		0 (not at all)	1		
7	Do you find the Hegarty Maths clips interesting?	Yes	14	3	5
		Sometimes	16	9	5
		No	7	1	2
8	How useful do you find watching the clips before a lesson?	Not useful at all, I don't understand what is going on	3	1	
		Sometimes useful, I sometimes understand the clips but I can be confused	22	8	10
		Very useful, I go into my lesson with a good understanding of the topic	12	4	2
9	When asked to watch clips before a lesson, do you watch the clip...	1 week	2		2
		2-5 days	2	1	
		1-2 days	24	8	7
		Literally just before	11	5	3
10	Do you watch clips more than once?	Yes	29	11	9
		No	8	2	3
11	What do you do if there's something you don't understand in the clip? Circle any appropriate answers/	Re-watch the clip	26	9	7
		Message my Tutor	16	6	4
		Message my Peers	4	2	
		Google it	23	7	7
		Nothing	1		1
		Other	0		
12	Rate your online maths classes:	1 - not enjoyable at all	5		4
		2 – bearable	7		4
		3 - sometimes enjoyable	11	8	1
		4 – enjoyable	8	4	1
		5 - very enjoyable. I love maths	4	1	1
13	Rate your engagement in your online maths classes:	1 - not interested at all. Would rather be watching Netflix	5	1	1
		2 - sometimes I engage	9	2	4
		3 - I pay as much attention as I can	21	10	5

14	Do you think watching clips before lessons has:	1- Decreased your maths ability	2		1
		2 - Kept your maths ability the same	13	4	5
		3 - Improved your maths ability	14	7	3
		4 – Unsure	7	2	3
15	What has been the impact of the pandemic on your learning experience?	1- Very negative	7	1	3
		2 – Negative	17	8	5
		3 - No impact	6	3	1
		4 – Positive	4	1	1
		5 - Very positive	1		1
16	Do you think that having to carry out much of your learning for GCSE Maths online has been more helpful than learning in a classroom?	Yes	6	4	2
		No	25	11	9
17	Has your relationship with your Tutor:	Improved	14	5	4
		Stayed the Same	18	7	6
		Declined	0		
		Unsure	3	1	1

Interviews Analysis

There were 5 interviews carried out. From the assessment data and the Hegarty Maths data it is important to get a personal perspective about learning online, especially comparing the experiences of higher assessment and foundation assessment learners. The interview was based around 8 questions:

1. How have you engaged with Hegarty Maths during lockdown and online learning?
2. Did you find it helpful? Please explain why.
3. If you had to study GCSE maths again using online learning, what would you want to see done differently?
4. What barriers did you find to learning?
5. What do you think would help to overcome these barriers?
6. To what extent did you feel less anxious if you had completed the pre-reading/revision before a session?
7. How did you find Hegarty as an aid to learning? What were the advantages and disadvantages from your point of view? Had you used any other online resources previously?
8. Any additional comments that you would like to make in relation to the study of GCSE maths this academic year?

A number of positive and negative experiences were identified from the interviews. Negative experiences related to learner support requirements, such as dyslexia or dyscalculia, in which case Hegarty Maths was “too overwhelming” and “too interactive”. It was noted by one learner that they believed mental health issues had increased because of Covid-19 and lockdown. Therefore, there was a preference for paper resources. Where a learner used a mobile phone to carry out online learning (either due to preference or lack of suitable digital technology like a laptop), a learner complained of migraines/headaches when used too much. Other negative comments included: “Housebarassment”; “crippling loneliness”; “you can’t ask questions to video” [sic]; the internet connection could be “glitchy”; no immediate support from teacher.

On the other hand, some learners were far more positive about their experiences with online learning. It was noted that they “enjoyed the technique” [of flipped learning]. There was the feeling of being less anxious about completing reading or revision prior to an online session as part of the flipped learning experience. They had a positive experience with using Hegarty Maths, finding the videos that assist with learning the various topics helpful; this was a typical response. One learner had used the online learning software “Explore Learning” whilst at school, so was used to this style of learning. Even though the internet connection could be ‘glitchy’ and therefore communication was not clear, it was possible to text the tutor via teams. One learner did feel at an advantage to some other learners because they pointed out having very supportive parents, who could minimise distractions and could be involved in speaking to the teacher with greater ease due to the increase in online meetings via Microsoft Teams.

Conclusions and Recommendations

Conclusions

Based on the research carried out at Leicester College, and the literature reviewed to inform our practice, we have changed the method of delivery for next academic year. During this research, only selected members of staff actively promoted flipped learning- next year the entire team will be promoting this. Our new delivery model will comprise of one two-hour face to face delivery and one 1.5 hour of directed study. Learning from this year we acknowledge that flipped learning does not work for every student. Therefore, we have timetabled this flipped session, so any student that is not able to work independently will either be brought in for an additional face to face session or will be offered a virtual session to support them. This can then be reviewed regularly and as learners mature and feel able to work independently, they will be offered another opportunity to try this again.

We also acknowledge that some of our learners need additional support to guide them to be independent learners. We see an opportunity to address this by working on their mindset. We have identified that the Steve Oakes, GCSE Mindset Programme would support our learners and help us to address this issue.

Our research also shows that there is a curriculum divide. The data shows that in some instances, even when the learners are completing the flipped learning and taking an active role in the learning, we are not managing to convert this to a grade 4. This has happened during virtual delivery and when we have had face to face lessons. This does make us question the rationale that all grade 3 learners must continue to study a GCSE. This is college policy due to the condition of funding. We believe that certain cohorts are not able to cope with academic maths (abstract concepts) and that a functional skills qualification may be more suitable for these learners. We would like to be able to offer both qualifications to a small cohort next year to test this theory. If a grade 3 learner continues to achieve a grade 3 then we are limiting their progression. However, a grade 2 learner could achieve a functional skills level 2 and then be able to access higher courses. This does not seem to be fair.

We also believe that the use of digital technology is essential as learners progress through FE. We need to offer a flexible model including digital learning to support our learners as they progress to the next stage of their work or education.

Recommendations

- We review if GCSE is the right qualification for every grade 3 learner. We would like to offer a trial cohort functional skills and GCSE questions for each topic to review which questions the students have the most success with and the potentially enter them for both qualifications.
- We will work with curriculum areas to support the delivery of the Steve Oakes GCSE Mindset programme to the curriculum areas that we have identified as consistently not being able to achieve a grade 4 in their final exams. This will help students to understand the benefits of achieving maths and support them to adapt their mindset to support this achievement.
- We will offer a flexible model that adapts to the students' needs so they can have one lesson and work independently if this works for them, if not will have the option of an additional face to face lesson or an additional virtual lesson.

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