CENTRES FOR EXCELLENCE IN MATHS

Introducing flipped learning: how did GCSE maths resit teacher and students respond?

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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.

Summary

A perennial concern of the maths teachers at our setting is that there is not enough time in a GCSE resit course to fill all of learners' gaps in knowledge and give them practice in higher-level thinking and problem solving. This is especially relevant in the post-covid years, where education has been disrupted and learners' familiarity with the broad GCSE curriculum may be even more patchy. We knew that flipped learning had worked well in higher education and had seen some success in FE. We were curious to see how teachers might respond to shifting introductory teaching out of the classroom to free up more time for problem-solving in class.

We ran two cycles of flipped learning, 5 and 8 weeks long with 11 teachers delivering to all their GCSE classes. In the first cycle teachers assigned tasks that consisted of watching videos and completing quizzes in an online platform. In the second cycle more structure was put in place and 'thinking questions' were introduced to encourage problem-solving in class. We used surveys and interviews to gather data. We found that teachers felt uncomfortable abandoning introductory teaching in the classroom where learner completion of the flipped learning tasks was low. Targeted CPD and a structured approach helped to build teacher confidence in persevering with flipped learning. Lasting changes to pedagogical approach, however, is likely dependent on learner engagement, and so developing learner self-study habits is a sensible complementary activity to the introduction of flipped learning.

Contents

Background

Our college

Greater Brighton Metropolitan College (GBMet) is a further education college in the South-East of England offering vocational qualifications and access-to-university courses across five different sites in Brighton and Worthing. We are a CfEM (Centre for Excellence in Maths) and have conducted action research and CPD programmes for the last 4 years with the aim of improving teaching and learning in our college and in our network colleges.

Outcomes for learners have improved consistently over the last 3 years, with GCSE higher pass rates of 4 or above at 36% for the 2020-2021 academic year (2021-2022 results pending at the time of this report). Learners receive two face-to-face maths lessons a week (2 x 1.25hours) supported by 1 hour of self-directed study. In cross-college student surveys learners reported positive views on the Maths provision, with 98% of students saying the resources were good and 86% reporting the quality of teaching and learning was good. Despite positive experiences in the classroom (and online) attendance in Maths is consistently below the college's target of 95%.

Our learners

There are around 1200 learners in the 16-19 age group enrolled onto GCSE maths at GBMet. Students are based across all five sites. This academic year was the first full year of face-to-face classroom teaching since the first lockdowns of the Covid pandemic, however cases of covid and self-isolation regulations continued to have an impact on both learner attendance and staffing levels.

There is a high level of SEN among our resit learners and declared mental health issues. Teachers report high levels of maths anxiety, test anxiety and general anxiety in their classes – the latter having been exacerbated by the pandemic and the isolation of lockdown.

Why Flipped Learning?

One key aim of the college is to improve attendance and engagement in maths so that learners have the best chance of success. To that end, we are looking for ways to make up for interrupted educational experiences due to the pandemic and of reducing the anxiety learners feel about being in class and resitting their exams. We are also interested in developing the confidence and independence of our learners so that they can develop self-study habits that will allow them to access life-long learning.

The demands of delivering the extensive GCSE maths curriculum in one year has been a perennial problem in FE GCSE resits. This challenge has only grown in the aftermath of several lockdowns and two rounds of centre-awarded grades. Post-pandemic, GCSE resit teachers at GB MET are finding that there are more gaps in students' knowledge generally and that there is a wider variance of knowledge, ability and confidence among students with the same prior attainment.

Flipped learning offers the opportunity to fill learners' gaps in knowledge before they enter the classroom, so that learners can feel more confident and engage more, and precious class time can be used for deeper-level learning.

Literature Review

What is flipped learning?

Flipped Learning is a style of teaching wherein students access information and complete tasks that introduce a topic before they attend a lesson. The lesson is then focused on more in-depth exploration of the topic, involving higher-level thinking and problem-solving.

Maggie O'Scanaill's (2020) distinction between flipped learning and a flipped classroom is useful. Flipped Learning is different from the Flipped Classroom, which involves a much higher level of independent learning within the classroom. In a Flipped Classroom, for example, a teacher might simply spell out the learning objectives and point out some useful resources and it is up to the students to teach themselves the content. In Flipped Learning the lessons are still very much guided by the teacher and rely on teacher feedback.

The introduction of Flipped Learning into the wider educational sphere is largely credited to Jon Bergman and Aaron Sams who founded the online hub Flipped Learning Network (FLN) in 2012 and wrote the book "Flip Your Classroom: Reach Every Student in Every Class Every Day". Although the word 'classroom' is included in the title of this first influential book, the FLN website is focused on the concept of flipped learning, spelling out the 'four pillars' of an effective approach:

Flexible Environment
Educators create flexible spaces where students choose when and where they learn. Additionally, educators who flip their classes are flexible in their expectations of student timelines for learning and in their assessments of student learning.

Learning Culture
In a Flipped Learning model, in-class time is dedicated to exploring topics in greater depth and creating rich learning opportunities. As a result, students are actively involved in knowledge construction as they participate in and evaluate their learning in a manner that is personally meaningful.

Intentional Content
Flipped Learning Educators determine what they need to teach and what materials students should handle on their own. Educators use Intentional Content to maximize classroom time in order to adopt methods of student-centered, active learning strategies, depending on grade level and subject matter.

Professional Educator
The role of a Professional Educator is even more important, and often more demanding, in a Flipped Classroom than in a traditional one. During class time, they need to observe students, providing them with instant feedback and an assessment their work. While Professional Educators take on less visibly prominent roles in a flipped classroom, they remain the essential part that enables Flipped Learning to occur successfully.

(Flipped Learning Network, last accessed January 2021)

It is useful to consider the flipped learning approach in relation to one of the cornerstones of pedagogy - Bloom's taxonomy. Many teachers will be familiar with a revised version of Bloom's taxonomy, which describes the different stages of cognitive learning.

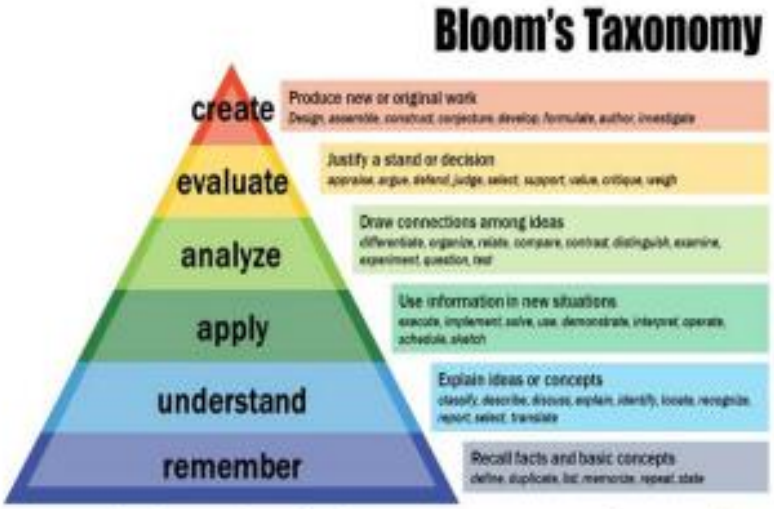


Figure 1.2. A revised version of Bloom's Taxonomy for cognitive learning.

Source: https://cft.vanderbilt.edu/guides-sub-pages/flipping-the-classroom/

We can use this structure to consider the kinds of cognitive activities that happen inside the classroom and outside the classroom in the traditional versus the flipped model of learning:

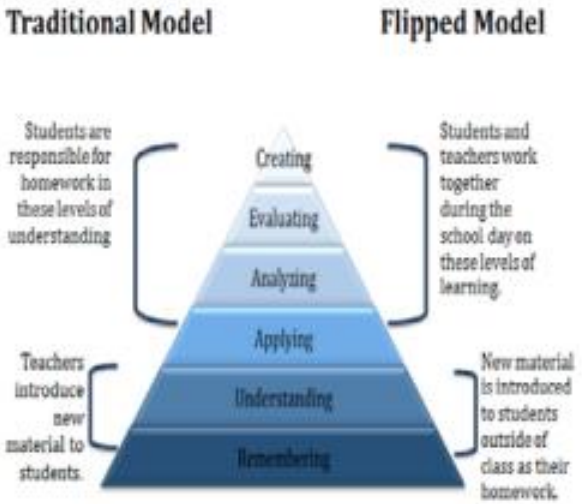


Figure 1.3. Bloom's Taxonomy related to traditional and flipped learning.
Source: (Bloom, 1956).

Source: https://core.ac.uk/download/pdf/328025416.pdf

The relatively uncomplicated stages of remembering and understanding information can be achieved through watching a video or reading a well-designed information sheet or set of slides. A highly-trained teacher is not necessarily required for this input. Students can even practice applying the knowledge through simple questions or tasks, ideally with feedback so they can understand where they have applied it successfully. This frees up classroom time and teacher instruction time for the higher-order applications, analysing, evaluating and - crucial to Maths learning - problem solving.

What are the benefits of using flipped learning?

The flipped approached is used extensively in higher education environments to accelerate learning and there is some evidence that it is beneficial to students studying mathematics at A-levels. One teacher of an A-level further Mathematics course found that,

> "The lessons were enhanced and much more dynamic with students cooperating and collaborating to solve challenging problems. My role in lessons became much less didactic and more interactive."

The same teacher found that,

> "Within lessons, students were more interactive and less passive in their learning. They arrived at the lesson with questions and queries and immediately they were involved in the lesson. *This did mean that the students needed to be able to recognise and articulate their queries*" (Hayes, 2019) (emphasis added by report author).

This does not generally fit the profile or our maths learners at Greater Brighton Metropolitan College, many of which have anxiety, ESBD or communication and language issues. Further, students on an FE GCSE resit course have had at least one experience of examination failure, if not two or three. This begs the question: Can we come close to replicating these experiences for students who often lack confidence generally and specifically in their mathematical abilities?

Studies on these cohorts are few and tend to be smaller scale, but the evidence is encouraging. For example, recent research at Nelson and Colne College Group including Runshaw College was conducted with FE GCSE resit learners and "showed that student confidence was higher when learners completed Flipped Learning prior to lessons" (Gothard and Ramsden, 2021). Our own research will explore how teachers can capitalise on these gains in foundational knowledge and confidence to encourage rich learning in the classroom.

What are the challenges/pitfalls and how can they be overcome?

The action research studies conducted in the UK recently illustrate the particular challenges and considerations involved in using flipped learning for GCSE Maths resits in an FE setting.

One important consideration is that more able students seem to engage more. Action research conducted at Leicester College in 2020/21 found that students studying for the higher papers spent over 4 times as much time on Hegarty Maths compared to learners studying for the foundation papers with mean averages of 26.23 hours and 6.42 hours respectively (Bilby and Higgitt, 2021). One of the recommendations of the Leicester study was to implement a programme to improve students' mindsets to help lower-ability students engage in flipped learning more.

The action research conducted at Leicester College also found that “flipped learning does not work for every student.” They uncovered a need to provide face-to-face and virtual sessions to support students who cannot work independently (Bilby and Higgitt, 2021).

Action research conducted at Nelson and Colne College Group and Runshaw College revealed different responses among teachers, which had an impact on the engagement levels of their students and in the experience of students in the classroom. The teachers whose actions reflected a high level of buy-in - creating posters to put up over campus and regularly promoting the tasks to students both verbally and electronically - enjoyed a much higher engagement rate than those teachers who displayed less positive attitudes towards the initiative when in focus groups. The manner in which teachers managed students’ non-completion of flipped learning tasks when they were back in the classroom also had an impact on how students viewed flipped learning in general, as some “students commented that their teacher would recap Flipped Learning anyway, so it became pointless to complete the tasks prior to lesson” (Gothard and Ramsden, 2021).

How did all of this inform our approach?

We built on the findings of other research to design our flipped learning intervention:

- CPD session by experienced flipped learning practitioner to build teacher confidence
- Drop-ins for face-to-face or virtual support for students with additional needs
- Individual pathway on Century for learners to fill gaps and gain confidence alongside the assigned flipped learning
- Century platform allowing assignments to be created centrally and assigned flexibly - to avoid workload issues
- Immediate feedback to students from Century platform
- Slides distributed to team to share with students
- Letter to parents to take advantage of at-home support

We considered the scope of other research to guide our own line of enquiry

- Benefits to learners already proven so focus on how teachers adapt their approach in the classroom

What does the literature say about the types of activities that teachers are ‘freed up’ to do?

A quick look at the collaborative resource hosted on Mr. Ashton’s Maths website reveals teachers sharing a wide variety of classroom activities to follow-on from flipped learning. Some are aimed at getting students to reflect on and consolidate what they learned from videos such as producing a poster or a mind map. Others are aimed at testing or highlighting the knowledge gained from completing the flipped learning tasks, such as an introductory quiz or ‘entry interview’. The suggestions of most interest to our research are those that nudge students towards the top half of Bloom’s pyramid - tasks that involve discussion, analysis, collaboration and problem-solving. Some examples from Mr. Ashton’s resource include:

- “Straight into GCSE questions” but crucially in groups of 4 to create a more collaborative activity.
- Peer Instruction - students working in small groups preparing a presentation or poster to be used for teaching other groups in the class
- Students creating exam-style questions of varying degrees of difficulty

From our literature review, then, we were clear on the potential benefits of a flipped learning approach but also some of the limitations, especially when applying the approach to GCSE

resit cohorts. We had some insight into how maths teachers across the country were using the ‘freed up’ classroom time to enhance their students’ learning experiences. Our research would explore what choices the teachers at GB MET would make in response to a flipped learning approach.

Methods

We conducted two cycles of research that were iterative, using a mix of quantitative and qualitative approaches. In our first cycle we explored the attitudes and beliefs of both teachers and students, shared examples of good practice with teachers, encouraged teachers to trial incorporating flipped learning into their teaching practice and then measured their response to that experience. In the second cycle we provided more guidance and structure to improve the effectiveness of the flipped learning delivery, and again measured the teacher experience as well as capturing the student experience.

Students were informed that the flipped learning intervention was part of a research project, were told how their data would be used and were given the option to opt out of their data being used in the project. All data was held in documents that were only accessible to action research group members and was anonymised when used for analysis or reporting.

Our data collection included Google Form surveys as well as tracking of Century usage by students and one teacher interview. Data collection is described by the table below:

Data Collection	Means of delivery	Number of respondents/participants
Student Survey 1	Google Classroom	71
Teacher Survey 1	Email/Meetings	11
Teacher Survey 2	Email/Meetings	7
Century usage data tracker	Data from Century	653
Teacher Survey 3	Email/Meetings	10
Student Survey 2	Google Classroom	33
Teacher Interview	Online interview	1

Our main research aim was to explore how teachers adjust their pedagogical approach within the classroom to enhance deeper-level learning, based on the results of their students' flipped learning self-study sessions. Research objectives included:

- To gauge how effective flipped learning is in developing both fluency and understanding of key ideas among students before they attend maths classes.
- To provide professional development opportunities to improve teachers' skillsets and confidence in valuing and building on students' prior learning.
- To increase the use of rich collaborative tasks and learning activities that develop students' problem-solving skills.
- To determine whether low stakes quizzes at the beginning of lessons provide incentive to do the flipped learning tasks.
- To investigate how flipped learning and AI-enabled individualised online learning pathways can support the development of self-study habits.
- To explore the potential of the AI of Century Tech in informing teachers and college leaders of topic-specific difficulties thus informing lesson planning and sequencing.

Results and Discussion

Cycle 1 - Intervention

The main research focus in Cycle 1 was to gauge teacher and student expectations and beliefs in relation to flipped learning, then trial some flipped learning and measure responses to it.

We used a Google form (Appendix A1) to measure the pre-intervention attitudes of students, promoting the survey to all GCSE resit students through google classroom and receiving 71 responses. As some students might not have experienced flipped learning, we canvassed their attitudes towards homework and then asked how they would feel about a pre-task to complete before class. In this way, the survey was another opportunity to introduce the concept of flipped learning to students and allow them to reflect on the idea. We used a different Google form (Appendix A2) to measure the pre-intervention attitudes of teachers, promoting to all GCSE teachers through email and department meetings. We received 11 responses.

We then assigned flipped learning tasks through the software programme Century Tech, wherein students were asked to complete 'nuggets' that contained some pre-requisite skills to the topics for the week as well as some introductory information or basic application of the topic. Students were expected to complete this in their designated hour of self-directed study per week but exactly when and where they completed the work was up to them. Teachers had access to the results and were encouraged to use that information to inform their planning. We also provided an online workshop with an experienced flipped learning practitioner from Reaseheath College, to give our teachers a chance to hear a first-hand account and ask questions about delivering flipped learning.

Our final data capture in Cycle 1 was to survey teachers on their experiences of trying out flipped learning with their classes. We used a new Google form (Appendix A3) which measured the perceived effectiveness of the intervention in Cycle 1. Seven teachers responded and these results were discussed in a team professional development meeting.

Cycle 2 - Intervention

In response to feedback from Cycle 1, the action research group provided more guidance on how to structure lessons that incorporate flipped learning as well as CPD on rich collaborative tasks. We created a new lesson structure (Appendix B1) with some fixed elements designed to maximise the benefits of flipped learning, such as low-stakes quizzes and 'thinking tasks' as well as some flexible elements that the teachers could use however they saw fit. Low-stakes quizzes were included at the start of the lesson structure so that students who had done the flipped learning task would see an immediate pay-off as soon as class started, and teachers would get a snapshot of where the whole class was with prerequisite skills and basic application of the topic (Example - Appendix B2). 'Thinking tasks' as they were presented to students mostly took the form of goal-free questions that were adapted exam questions or 'naked questions' – that is exam questions with the information structures stripped away so that students would need to discuss and determine what information they would need to answer the question and consider what form that might take and how it might be presented or otherwise obtained. (Example - Appendix B3) We also introduced a learner reflective journal with aim of reinforcing the link between flipped learning and confidence and progress in class. (Appendix B4)

We used Googles forms to measure student experiences (Appendix A4) and teacher experiences (Appendix A5) at the end of Cycle 2 and conducted one in-depth teacher interview.

Cycle 1 - Results

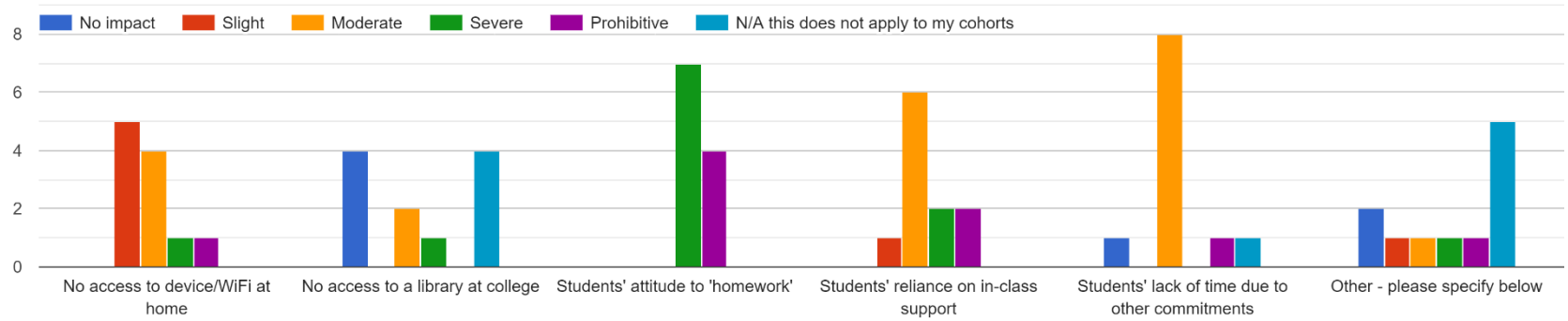
Teacher Survey 1

The results of the initial teacher survey showed that most of the respondents had tried some form of flipped learning before and all could identify some expected benefits from the practice, but teachers expressed concerns about how to manage the process both in and out of the classroom and about equality of access. Only 2 teachers responded they had never tried a form of flipped learning before while most teachers reported having asked students to watch a video and answer some questions before class. The potential benefits to students that teachers most anticipated were: “Encourages independent learning” (100% of respondents); “Useful for some students with additional learning needs to know what’s coming up” (91%); “Gives students more confidence walking into the class” (82%); and “Frees up class time to tackle more challenging problems.” (82%) Teachers felts the biggest barriers to students completing the flipped learning would be students’ attitudes to ‘homework’ (with all 11 respondents listing this as a prohibitive or severe barrier) and student reliance on in-class support. (Fig 1) When given the option to list other barriers that were not provided in the survey, two teachers mentioned student *behaviour* towards homework rather than attitudes towards it, with one stating “Some of my students do not do homework,” and another one saying students were not in “the habit of doing independent work outside of lesson time.” They listed these barriers as prohibitive and severe respectively.

The most prevalent concern among teachers about trying out flipped learning was how to manage the class when some students had completed the flipped learning and others hadn’t (73% chose this) and the next biggest concerns were worries about extra admin, damage to the teacher-student relationship through constant nagging, and inequality of access among students (all reported by 36% of respondents.)

A strong majority (9 out of 11) of the teachers predicted that flipped learning would increase investment and engagement of learners while 8 out of the 11 looked forward to knowing more about learners’ gaps in knowledge ahead of class and spending less time on introductory teaching so they can get on to more interesting problems. Only two teachers responded that they did not feel flipped learning would benefit their teaching, however these same two teachers selected “Will sharpen my focus on prerequisite skills - to include in checks for understanding” in this section of the survey, which perhaps indicates a distinction in their minds between benefits to planning and benefits to teaching. The action research group would argue that improved teaching flows from improved planning. The chart on the next page shows potential barriers to students completing flipped learning according to teachers.

What do you think the barriers to flipped learning might be for your cohorts? (Please indicate the severity of impact)



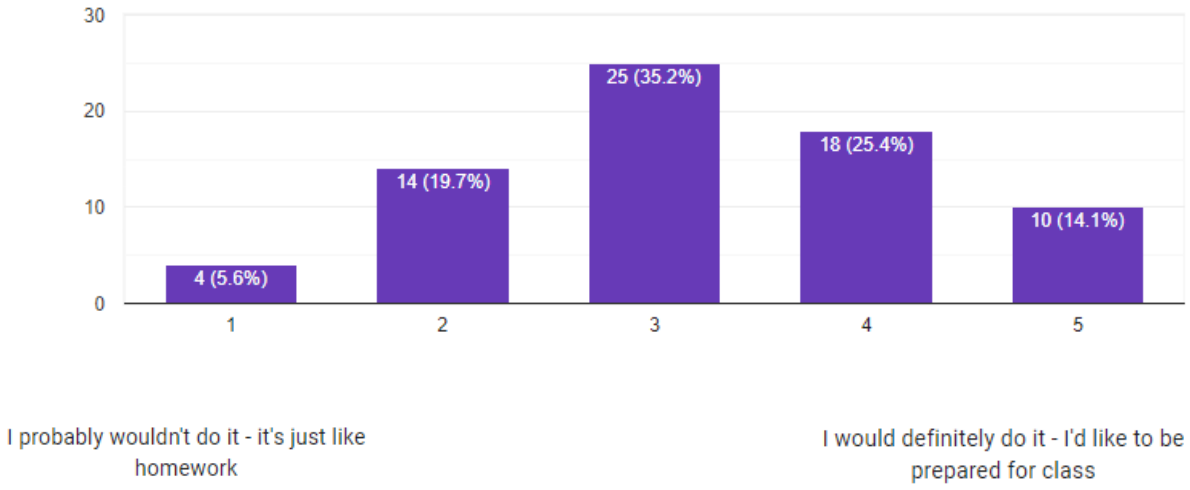
Student Survey 1

Most of the questions on the first student survey referred to homework, assuming many of the students had not yet experienced flipped learning. Homework would be their prior experience of working outside the classroom. Of the 71 students who responded to the first survey around 20% said they never do homework and the same proportion said they always do all assigned homework. 38% of students said they do half or most of the homework they are given. All but 3 students could identify at least one benefit to doing homework, with the most popular benefit being a chance to practice methods (76%) followed by “a chance to see how I work independently” (52%).

The most reported reasons for not doing homework were not having time (49% of students chose this), not understanding it (44%), needing support to complete it (27%) and finding it boring (also 27%). Only 10% of students stated that they don’t believe they should have to do work outside of class time – an attitude that the teacher responses suggested was more widespread. 90% of students reported having average or better access to WiFi at home. Most students reported having good access to a suitable device on which to complete online work (not a smartphone), however 9% of students said they did not have a device at home or access to a library. A further 6% said they only had occasional access at home and no access to a library. Given that there is a library on all campuses this suggests that students might not have suitable gaps in their timetable during library open hours.

When asked about the most pressing challenges they face when starting a new topic in class, the majority of students chose “The topic is familiar but I’ve forgotten the method I should use” (55% of respondents) while the next two popular choices were “I am getting too much new information all at once” and “I don't understand the key vocabulary” (31% and 30% respectively). Flipped learning assignments which introduce the topic, cover key vocabulary and remind students of some of the most effective methods should, therefore, reduce these challenges and create a more productive learning experience for students. When asked how likely they would be to complete a flipped learning task ahead of class 75% of students gave a neutral to positive response, with nearly 40% closer to the “I would definitely do it” end of the scale. (Fig 2)

Fig 2 – Learners’ reported willingness to complete a flipped learning task ahead of class



Teacher Survey 2

After trialling flipped learning with their classes for 5 weeks, teachers were again asked to fill out a survey about their experiences. There were 7 respondents. All of these teachers had promoted flipped learning to their classes with the most used promotion methods being verbal reminders in class and reminders on Google classroom. The majority of respondents had assigned flipped learning once a week, with one teacher assigning it every two weeks. Teachers described learner engagement as 'patchy' or 'poor'. One teacher found the engagement rate among regular attenders was 60% but all other respondents reported a small minority of students were completing the assignments. When asked about what adjustments they had made to their delivery in response to flipped learning, 3 teachers said they had introduced regular use of low-stakes quizzes. Two teachers said they spent less time on introductory teaching and the same teachers said they spent more time on challenging questions in class. Three teachers said they had made no adjustment to their delivery citing low completion rates among their students. One of these teachers explained that because so few had done the flipped learning, he felt he had to teach the introductory material anyway (which has been found in other studies to undermine the flipped learning offer and further reduce engagement). The elements of the intervention that teachers felt were necessary for effective flipped learning delivery included clear learning materials included in the assignment, immediate feedback during the flipped learning task, an opportunity early in class to apply the flipped learning and learner confidence in independent working.

These results were discussed in a staff meeting, which allowed the team to clarify some of the intentions of flipped learning and identify strategies to improve its impact. The issue of teachers feeling they needed to teach the introductory material in class anyway was addressed and it was agreed that access to support materials in class and on-demand help from the teacher would be preferable to from-the-front teaching. This allows the students who have done the flipped learning to get on with more challenging tasks while those who haven't will have teacher input and may notice how not engaging has set them back. A theme emerged in the discussion (which had also come up in some of the comments in the survey) that teachers felt there was a marked difference between Grade 2 classes and Grade 3 classes in the ability of learners to work independently. The issue of low learner confidence in independent working and tackling problems without explicit input first was discussed, and teachers expressed a need for training on rich collaborative tasks and challenging tasks that learners can tackle independently in class. We also discussed the need for a consistent lesson structure with flipped learning signposting built into the lesson. All of this feedback informed the new structures we put in place for Cycle 2.

Cycle 2 - Results

Student Survey 2

After 8 weeks using the new structure, students were asked to complete a final survey on their experiences with flipped learning. 32 students responded to the survey. 31% of respondents reported completing all or most of the flipped learning assignments. The most common reasons for not completing flipped learning were not being able to find the time (44% of respondents), not liking the Century platform (19%) and being unclear on which assignment needed to be completed before class (16%). The most commonly reported benefits were: learning something new from doing the flipped learning (41%), refreshing their memory before covering something in class (38%), being able to work more independently in

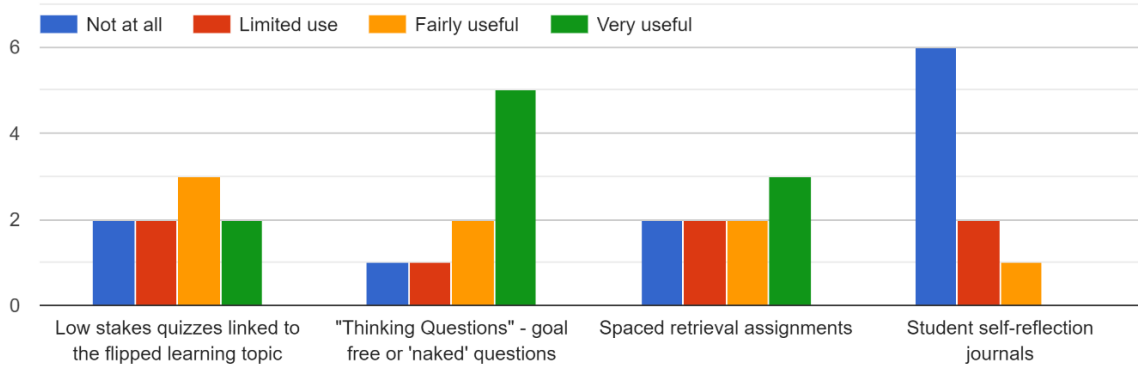
class (22%) and feeling more prepared when walking into class (19%). When students were asked if they had noticed any changes to their lessons since flipped learning was introduced, 34% of learners said that the class spent more time on challenging questions, 31% said they spent less time going over the basics of the topic and 28% said they spent more time thinking about and discussing exam questions (although the last change could have been attributed to Cycle 2 coinciding with the run-up to exams). 12 learners stated that they had noticed no change to their lessons. However, 3 of these learners also selected other options on that same question, such as spending less time on the basics of a topic or doing more challenging questions in class. This suggests that learners either noticed these changes but failed to attribute them to the flipped learning project or interpreted the question to mean what changes had they noticed *to their own performance* in class due to flipped learning, or perhaps some other misinterpretation of the question. There was no discernible delivery link between the 9 learners who unambiguously reported no change to their lessons – i.e. they were taught by a range of teachers across different sites. One thing they did have in common is that 8 out of the 9 learners had previously achieved a Grade 2 in GCSE Maths and were in Grade 2 groups.

Teacher Survey 3

Teachers were asked to fill out a final survey to feedback on their experiences in Cycle 2 of the project. Nine teachers responded. One teacher reported not promoting flipped learning to their classes which was a change from Cycle 1, where this teacher had been promoting flipped learning verbally and on Google Classroom. This teacher also reported making no changes to their delivery in either Cycle 1 or Cycle 2, citing low engagement from learners. It is worth noting that the number of teachers making no adjustments to their delivery dropped from 3 in Cycle 1 to just 1 in Cycle 2. Also, more teachers reported making multiple changes to their delivery in Cycle 2. The majority of teachers reported posting flipped learning assignments once a week during Cycle 2, but two teachers reported posting exam revision tasks instead as exams drew near and some classes were structured around revision activities as opposed to introducing new topics.

The aspects of the new structure that teachers tried out in class the most included the ‘thinking questions (8 out of 9 teachers), the spaced retrieval activities (7 out of 9 teachers) and the low stakes quizzes (6 out of 9 teachers). These were also the three elements of the new structure that teachers felt were most useful, in order of usefulness. (Fig 3)

Fig 3 – Teachers’ views on the usefulness of different elements of the new structure



Most teachers reported that the self-reflection journals were of limited to no use, although comments suggested that introduction earlier in the year and a structured follow-up from the reflection may have improved their impact.

When asked what adjustments they had made to their in-class delivery during Cycle 2, the most common responses were starting the class with low-stakes quizzes, providing more fact sheets and other reference materials in class and concentrating on exam-style questions more (5 out of 9 teachers selected these). The number of adjustments to delivery rose in Cycle 2 as compared to Cycle 1. In Cycle 1 a total of 16 adjustments were reported by 7 teachers (an average of 2.3 adjustments per teacher) whereas in Cycle 2, 9 teachers reported 31 adjustments (an average of 3.4 adjustments per teacher).

When asked about the ability of different cohorts of learners (Functional Skills, Grade 2 GCSE and Grade 3 GCSE learners) to engage with flipped learning, teachers did not report much difference between Grade 2 learners and Grade 3 learners, with the majority of teachers stating they felt both these cohorts were able to engage 'with regular monitoring and reminders'. This contradicted the opinions expressed in the staff meeting at the end of Cycle 1, which is an interesting development. When assessing the ability of Functional Skills learners to engage, however, an equal number of teachers (3) felt that learners would need workshops to develop their self-study skills as the number who felt they would simply need monitoring and reminders. One teacher felt that Functional Skills learners were not able to engage at all. These results, in combination with some of the comments offered freely by teachers, suggests that teachers feel most GCSE students can engage in flipped learning and that the reasons for not engaging are cultural and habitual. One theme in the comments and in feedback in departmental meetings was that learners were not watching the videos and simply completing the quizzes to a low standard as a tick-box exercise. One teacher who taught both Functional Skills cohorts and GCSE cohorts summed it up with the comment, "GCSE students are able to engage, they just refuse to."

Teacher Interview

One teacher, who reported a high level of flipped learning promotion and a relatively high level of adjustment to her delivery agreed to a 10 minute interview. In interview she described how the structure allowed her to split the class into those who had done the flipped learning and those who hadn't:

> "Those that had, I was able to allow them to do a bit more independent learning and they got through a lot more of the structured lesson than those that hadn't. They [*those that hadn't*] needed more 1:1, like 'OK, here we go, let me sit with you, let me explain all of this'…I think it worked quite well because students felt like they were getting more 1:1 with me than they would if I was stood up at the front teaching a full lesson."

She says she wants to make this a lasting change in her delivery.

Discussion

The results of the surveys showed that teachers' beliefs about barriers to flipped learning were not the same as students' reported barriers:

- Access was not as big an issue as teachers feared
- Attitudes were not as negative as teachers expected - students were able to identify potential benefits

- Students said their main barriers were time constraints

Learner engagement did match teachers' expectations however, with a small minority of learners engaging well but most engaging in only a patchy manner or not at all. Partly in response to this, in the relatively exploratory phase of Cycle 1, teachers were less likely to make changes to their delivery, with some teachers making no adaptations and feeling as though they had to teach the introductory materials anyway.

Specific CPD and a clear lesson structure with learning activities and materials modelled for teachers increased their willingness to adjust delivery in Cycle 2. The changes that teachers were making in response to flipped learning were perceptible to students, who noticed less introductory teaching and more time spent on challenging questions.

The benefits that students reported were similar to those found in other studies (such as feeling more confident and prepared for class) and matched, to some degree, the expectations of teachers, such as feeling more able to work independently. Learners also reported changes that matched the intentions of the AR group, namely thinking and discussing more in class. Notably, 41% of learners reported learning something new from the flipped learning, which is a highly desirable result.

Conclusions and Recommendations

Conclusions

Although teachers involved in the research could all identify the potential benefits of flipped learning, there was a high level of professional scepticism about the extent to which learners would engage with it and this was borne out in student behaviour during the trial. Teachers felt a certain level of discomfort with leaving learners who had not completed the flipped learning to 'fend for themselves' as it were and felt the need to teach the introductory concepts anyway.

Providing tailored CPD and a structure that included clear reference material and specific deeper thinking activities increased teacher confidence in adjusting their delivery style. Some teachers expressed a desired to make this a lasting change to their teaching approach, however they felt more buy-in from learners was required. Learners did not reject the concept of flipped learning or homework per se, instead reporting a lack of time and clarity about what they needed to do outside of class and some displeasure with the Century platform. Despite patchy engagement, a small cohort of learners reported the intended benefits and experienced learning new maths concepts outside of the classroom. If we are to increase the numbers of learners who have these positive experiences, some sensible next steps would be to work with learners on time management and self-study habits, as well as using learner feedback to make the flipped learning offer more engaging.

Recommendations

1. Provide CPD to teachers on the cornerstone concepts of flipped learning making explicit the types of changes to delivery necessary. This training should make clear how teachers can reduce introductory teaching and replace it with a differentiated approach.
2. Develop a bank of flipped learning activities that cover the prerequisite skills, introductory concepts, key vocabulary and straightforward application of these concepts. Consider working with students to determine what sorts of activities they might find the most engaging. Develop a complimentary bank of low stakes quizzes to test these concepts at the beginning of class.
3. Provide clear reference materials and straightforward activities in class for learners who have not done the flipped learning. Make it clear that they will receive help when the rest of the class is working on problem-solving.
4. Develop a range of deeper thinking and problem-solving activities to capitalise on the time that has been freed up by reducing introductory teaching. Goal free or 'naked' questions have proven to be useful in our research. Many more examples are available at Mr. Ashton's Maths website.
5. Use clear and consistent communication with students about what flipped learning assignments are due and when. Consider breaking the assignment into two parts that must be complete in order for the assignment to be complete (e.g. watch the video and complete the questions)
6. Provide explicit advice and guidance to students on time-management and provide staffed drop-in sessions for students to access help with their flipped learning.

References

Ahmed, H. O. K. (2016). Flipped Learning As A New Educational Paradigm: An Analytical Critical Study. *European Scientific Journal, ESJ*, *12*(10), 417. https://doi.org/10.19044/esj.2016.v12n10p417

Anon. The flipped learning guide, accessed add date. Available at: https://docs.google.com/document/d/1dO063hh7INsdzT5IjaV-RNhBPw994ndrmWC1t2_lwFI/edit

Bergman, J. and Sams, A. (2019) Flip Your Classroom: Reach Every Student in Every Class Every Day. Visit: https://www.theedadvocate.org/the-four-pillars-of-flipped-learning/

Bilby, M. and Higgittt, G. (2021) Add title. Available at: https://www.et-foundation.co.uk/wp-content/uploads/2021/10/28.-Leicester-Does-a-flipped-classroom-approach-really-add-value.pdf

Brame, C. (2013) Flipping the classroom. Vanderbilt University Center for Teaching. Retrieved [21/01/2022]. Available at: http://cft.vanderbilt.edu/guides-sub-pages/flipping-the-classroom/

Hayes, H. (ed.) (2019) 'Flipped Learning: A Teacher's Perspective. From Curtis, F', Proceedings of the British Society for Research into Learning Mathematics, 39(2). Available at: https://bsrlm.org.uk/wp-content/uploads/2019/09/BSRLM-CP-39-2-6.pdf (Accessed 21st January 2022).

O'Scanaill, M. (2020) Flipped classroom vs flipped learning – know the difference. Available at: https://www.dyknow.com/blog/flipped-classroom-vs-flipped-learning-know-the-difference/

Appendices

Appendix A – Surveys and Data Collection

A1	**Student Survey 1**
A2	**Teacher Survey 1**
A3	**Teacher Survey 2**
A4	**Student Survey 2**
A5	**Teacher Survey 3**
A6	**Teacher Interview Questions**

Appendix B – Teaching and Learning resources

B1	**New Lesson Structure**
B2	**Example of Low Stakes Quiz**
B3	**Example of 'Thinking Question'**
B4	**Student Reflective Journal**

Appendix A1 – Student Survey 1 (Cycle 1)

Homework versus Flipped Learning - student experience

The respondent's email (null) was recorded on submission of this form.
*Required

1. Email *

_____

2. What are your past experiences of homework (work assigned after a class to practice what you have just learned) *

Mark only one oval.

- ◯ I never do homework
- ◯ I sometimes do homework
- ◯ I do about half of the homework I've been given
- ◯ I do most of the homework I've been given
- ◯ I do all of the homework I've been given

3. In your opinion, what are the potential benefits from homework: (tick as many as apply) *

Tick all that apply.

- ☐ A chance to practice methods
- ☐ Consolidates the learning I did in class
- ☐ A chance to see how I work independently
- ☐ A chance to tackle more challenging questions
- ☐ Other: _____

4. Complete the statement: "If I don't do homework it's because...": (tick as many as apply) *

Tick all that apply.

- ☐ I don't have time
- ☐ I don't understand it
- ☐ I need support to complete it
- ☐ I find it boring
- ☐ I don't think it's useful
- ☐ I don't think I should have to work outside of class time.
- ☐ N/A - I always do homework
- ☐ Other: _____

Appendix A1 (cont.) – Student Survey 1 (Cycle 1)

5. What is your access to WiFi at home? *

Mark only one oval.

- ◯ No WiFi
- ◯ Poor WiFi
- ◯ Average WiFi
- ◯ Good WiFi
- ◯ Very Good WiFi

6. What is your access to a tablet, laptop or desktop computer? (not a smartphone) *

Mark only one oval.

- ◯ No access at home and no library access
- ◯ Occasional access at home but no library access
- ◯ No access at home but can access at library
- ◯ Reasonable access at home
- ◯ I have my own device at home
- ◯ Other: _____

7. What challenges do you face when starting a new topic in maths class? (tick as many as apply) *

Tick all that apply.

- ☐ I don't understand the key vocabulary
- ☐ I am unfamiliar with the topic as a whole
- ☐ I can't remember key number relationships
- ☐ I don't know how to interpret the diagrams
- ☐ The topic is familiar but I've forgotten the method I should use
- ☐ I don't understand how to carry out the calculations
- ☐ I don't get enough time to practice simple examples before we move on to more complicated questions
- ☐ We spend too long in class on simple examples and never get to practice harder questions
- ☐ I am getting too much new information all at once
- ☐ Other: _____

8. Flipped Learning means learning about a topic before the lesson starts. Have you ever experienced the following types of flipped learning? (tick as many as apply) *

Tick all that apply.

- ☐ I have been asked to watch a video and answer questions before I attend class
- ☐ I have been asked to read an information sheet and answer questions before I attend class
- ☐ I have been asked to complete a quick quiz before I attend class
- ☐ Other: _____

Appendix A1 (cont.) – Student Survey 1 (Cycle 1)

9. If you are assigned a flipped learning task to do online to prepare for a class how likely are you to do it? *

Mark only one oval.

	1	2	3	4	5	
I probably wouldn't do it - it's just like homework	◯	◯	◯	◯	◯	I would definitely do it - I'd like to be prepared for class

Appendix A2 – Teacher Survey 1 (Cycle 1)

Flipped Learning Teacher Experiences and Expectations Survey 1

This is a short survey to capture information about your previous experiences with flipped learning and your expectations around using it in your classroom teaching this year.

*Required

1. Email *

2. Flipped learning involves getting students to complete a task in their own time BEFORE a taught lesson that will prepare them for the lesson. Have you asked students to complete any of these tasks before a lesson? (tick as many as apply) *

Tick all that apply.

- [ ] Getting students to watch a video and answer some questions.
- [ ] Getting students to read an information sheet and answer some questions.
- [ ] Getting students to research on the internet and answer some questions.
- [ ] Getting students to take a quiz 'cold' - i.e. without any prior input.
- [ ] N/A - I've never asked my students to complete tasks prior to a taught lesson.
- [ ] Other: _____

3. In your opinion, what are the potential benefits to flipped learning? (tick as many as apply) *

Tick all that apply.

- [ ] Introduces key vocabulary and visual models of a topic.
- [ ] Gives students more confidence walking into the class.
- [ ] Allows students to recall past learning in a more relaxed way.
- [ ] Frees up class time to tackle more challenging problems.
- [ ] 'Levels the playing field' in terms of prerequisite knowledge.
- [ ] Encourages independent learning.
- [ ] Useful for some students with additional learning needs to know what is coming up in class.
- [ ] Could cover more topics as less class time needed per topic.
- [ ] I don't know enough about flipped learning to form an opinion.
- [ ] None of the above
- [ ] Other: _____

Appendix A2 (cont.) – Teacher Survey 1 (Cycle 1)

4. What do you think the barriers to flipped learning might be for your cohorts? (Please indicate the severity of impact) *

Mark only one oval per row.

	No impact	Slight	Moderate	Severe	Prohibitive	N/A this does not apply to my cohorts
No access to device/WiFi at home	◯	◯	◯	◯	◯	◯
No access to a library at college	◯	◯	◯	◯	◯	◯
Students' attitude to 'homework'	◯	◯	◯	◯	◯	◯
Students' reliance on in-class support	◯	◯	◯	◯	◯	◯
Students' lack of time due to other commitments	◯	◯	◯	◯	◯	◯
Other - please specify below	◯	◯	◯	◯	◯	◯

5. If you chose 'Other' in the previous question, please describe the barrier below.

Appendix A2 (cont.) – Teacher Survey 1 (Cycle 1)

6. What are your concerns in trying out flipped learning with your students? (tick as many as apply) *

Tick all that apply.

- [ ] Some will not do it and some will - how do I manage that?
- [ ] Extra admin time spent setting and checking on the work
- [ ] Damage to teacher/student relationship through constant 'nagging'
- [ ] I introduce topics carefully - will the flipped learning task have the same effect?
- [ ] I'm worried about inequality of access.
- [ ] Other: _____

7. How do you think flipped learning will benefit your teaching? (please tick as many as apply) *

Tick all that apply.

- [ ] Will sharpen my focus on prerequisite skills - to include in checks for understanding
- [ ] A better understanding of where students' gaps are ahead of class
- [ ] Less time spent in class on introductory work - can get to more interesting problems
- [ ] Students already invested/engaged because they've completed some work
- [ ] I don't think flipped learning will benefit my teaching.
- [ ] Other: _____

8. Would you like to share any more of your thoughts on flipped learning?

_____

_____

_____

_____

_____

Appendix A3 – Teacher Survey 2 (Cycle 1)

Teacher Experiences of Flipped Learning - Cycle 1

Please fill out this quick survey to let us know how the first cycle of flipped learning has gone for you.

Again - your feedback will be anonymised and used for research purposes only.

It would be useful to have this information in time to discuss on the CPD day on February 17th.

Many thanks in advance.

The respondent's email (**null**) was recorded on submission of this form.
*Required

1. Email *

_____

2. How have you promoted flipped learning to your students? (Please tick as many as apply) *

Tick all that apply.

- [ ] I have given verbal reminders in class
- [ ] I have given written reminders in class (on powerpoint slides or the whiteboard)
- [ ] I have posted reminders on Google Classroom
- [ ] I have not promoted flipped learning to my students
- [ ] Other: _____

Appendix A3 (cont.) – Teacher Survey 2 (Cycle 1)

3. How often have you posted flipped learning assignments on Century for your students since January? *

Mark only one oval.

- ◯ Twice a week (mostly)
- ◯ Once a week (mostly)
- ◯ Every other week (mostly)
- ◯ I've tried it once or twice
- ◯ I haven't posted any flipped learning assignments for my students
- ◯ Other: _____

4. How would you describe student engagement with flipped learning?

_____

_____

_____

_____

_____

5. Do you check on Century how your students have got on with the flipped learning assignments? *

Mark only one oval.

- ◯ Yes - I check their Century scores before each class.
- ◯ Sometimes - I don't always have time to check before each class.
- ◯ No - I don't have time to check Century scores.
- ◯ No - I don't know how to check Century scores.
- ◯ N/A - I don't assign them work on Century.
- ◯ Other: _____

Appendix A3 (cont.) – Teacher Survey 2 (Cycle 1)

6. What adjustments have you made to your in-class delivery in response to flipped learning? (Please tick as many as apply) *

Tick all that apply.

- [ ] I have reduced the amount of introductory teaching.
- [ ] I have adapted my PowerPoint slides to remove basic input.
- [ ] I ask students to do fewer straightforward questions in favour of more challenging questions.
- [ ] I have introduced more collaborative tasks or student-led discussions.
- [ ] I concentrate on exam-style questions more now.
- [ ] I use more diagnostic questions.
- [ ] I start the class with low-stakes quizzes and/or self-assessing activities.
- [ ] I concentrate more on problem-solving.
- [ ] I provide more fact sheets and other reference materials.
- [ ] I have made no adjustments to my delivery.
- [ ] My adjustments depend on whether it's a Grade 2 or Grade 3 class.
- [ ] Other: _____

7. Which of the elements below do you think are necessary for effective flipped learning delivery? (Please tick as many as apply) *

Tick all that apply.

- [ ] Clear learning materials (videos/slides) attached to the flipped learning task
- [ ] Immediate feedback during the flipped learning task
- [ ] Opportunity at the beginning of class for students to apply the flipped learning
- [ ] Differentiated resources to accommodate learners who have and haven't done the flipped learning task
- [ ] Fact sheets for reference
- [ ] Rich collaborative tasks
- [ ] Explicit teaching of problem-solving strategies
- [ ] Learner confidence in independent working
- [ ] Learner confidence in attempting challenging questions
- [ ] Other: _____

Appendix A3 (cont.) – Teacher Survey 2 (Cycle 1)

8. Please describe any training you feel might help you deliver a flipped learning model.

9. Is there anything else you'd like to share in relation to flipped learning?

Appendix A4 – Student Survey 2 (Cycle 2)

Maths Flipped Learning - Student Experience Survey

This is a short survey to get your views on Flipped Learning at college this year.

The respondent's email (**null**) was recorded on submission of this form.
*Required

1. Email *

2. How much have you used Century Tech to complete your Maths flipped learning assignments this year? (please choose only one) *

Mark only one oval.

- ◯ I've completed all the flipped learning assignments before class
- ◯ I've completed all the flipped learning assignments, but sometimes I do them after class
- ◯ I've completed most of the flipped learning assignments (only missing 2 or 3)
- ◯ I've completed a few of the flipped learning assignments (up to 5 assignments)
- ◯ I haven't completed any of the flipped learning assignments - I don't use Century
- ◯ I use Century but just for my Maths self-study pathway- I don't do the flipped learning assignments
- ◯ Other: _____

Appendix A4 – Student Survey 2 (cont.) (Cycle 2)

3. If you have not completed many flipped learning assignments, what has been stopping you? (tick as many as apply) *

Tick all that apply.

- [ ] I have not been able to find the time
- [ ] I was unclear on which assignments I had to complete before class
- [ ] I don't like using Century
- [ ] I don't know how to log in to Century
- [ ] I forgot that I had to do it
- [ ] I didn't know that I was supposed to do it
- [ ] I've had problems getting computer time or wifi outside of class
- [ ] I didn't see the point of doing it
- [ ] I thought it was boring
- [ ] I found the assignments too hard and stopped trying to do it
- [ ] I found the assignments too easy and didn't feel like I was learning from them
- [ ] n/a - I have been able to complete the flipped learning assignments.
- [ ] Other: _____

4. If you have completed the flipped learning assignments, did you watch the video before doing the assessments? (Please click one) *

Mark only one oval.

- ◯ Yes, most of the time.
- ◯ Sometimes, if I was unsure about the topic.
- ◯ I never watched the videos
- ◯ n/a - I didn't do the flipped learning.
- ◯ Other: _____

Appendix A4 – Student Survey 2 (cont.) (Cycle 2)

5. If you have completed the flipped learning assignments, how has it helped you? * (tick as many as apply)

Tick all that apply.

- [ ] I have learned something new from doing the flipped learning
- [ ] I have been able to refresh my memory before we cover a topic in class
- [ ] I feel more prepared when walking in to class
- [ ] I'm able to work more independently in class because I am more secure on the basics
- [ ] Other: _____

6. Have you noticed any changes to your lessons since flipped learning has been introduced? (tick as many as apply) *

Tick all that apply.

- [ ] We spend less time going over the basics of a topic
- [ ] We do more challenging problems in class
- [ ] We spend more time thinking about and discussing exam questions
- [ ] We spend more time thinking about the links between topics
- [ ] I haven't noticed any changes in lessons since flipped learning has been introduced.
- [ ] Other: _____

7. Do you have any thoughts to share about flipped learning?

_____

_____

_____

_____

_____

Appendix A5 – Teacher Survey 3 (Cycle 2)

Teacher Experiences of Flipped Learning - Cycle 2

1. Email *

_____

2. How have you promoted flipped learning to your students since the beginning of March? (Please tick as many as apply) *

Tick all that apply.

- [ ] I have given verbal reminders in class
- [ ] I have given written reminders in class (on powerpoint slides or the whiteboard)
- [ ] I have posted reminders on Google Classroom
- [ ] I have not promoted flipped learning to my students
- [ ] Other: _____

3. Which aspects of the new Flipped Learning lesson structure have you used in your teaching, since it was introduced in March? (tick as many as reply) *

Tick all that apply.

- [ ] Low stakes quizzes that are linked to the flipped learning topic
- [ ] "Thinking Questions" - goal free or 'naked' questions
- [ ] Spaced retrieval assignments
- [ ] Student self-reflection journals
- [ ] Other: _____

Appendix A5 – Teacher Survey 3 (cont.) (Cycle 2)

4. How useful were these elements in supporting effective teaching and learning in your classroom? *

Mark only one oval per row.

	Not at all	Limited use	Fairly useful	Very useful
Low stakes quizzes linked to the flipped learning topic	◯	◯	◯	◯
"Thinking Questions" - goal free or 'naked' questions	◯	◯	◯	◯
Spaced retrieval assignments	◯	◯	◯	◯
Student self-reflection journals	◯	◯	◯	◯

5. Please comment on your answers in the above question *

6. How often have you posted flipped learning assignments on Century for your students since March? *

Mark only one oval.

- ◯ Twice a week (mostly)
- ◯ Once a week (mostly)
- ◯ Every other week (mostly)
- ◯ I've tried it once or twice
- ◯ I haven't posted any flipped learning assignments for my students
- ◯ Other: _____

7. How would you describe student engagement with flipped learning since March?

Appendix A5 – Teacher Survey 3 (cont.) (Cycle 2)

8. Do you check on Century how your students have got on with the flipped learning assignments? *

Mark only one oval.

- ◯ Yes - I check their Century scores before each class.
- ◯ Sometimes - I don't always have time to check before each class.
- ◯ No - I don't have time to check Century scores.
- ◯ No - I don't know how to check Century scores.
- ◯ N/A - I don't assign them work on Century.
- ◯ Other: _____

9. Since March, what adjustments have you made to your in-class delivery in response to flipped learning? (Please tick as many as apply) *

Tick all that apply.

- ☐ I have reduced the amount of introductory teaching.
- ☐ I have adapted my PowerPoint slides to remove basic input (or I skip slides).
- ☐ I ask students to do fewer straightforward questions in favour of more challenging questions.
- ☐ I have introduced more collaborative tasks or student-led discussions.
- ☐ I concentrate on exam-style questions more now.
- ☐ I use more diagnostic questions.
- ☐ I start the class with low-stakes quizzes and/or self-assessing activities.
- ☐ I concentrate more on problem-solving.
- ☐ I provide more fact sheets and other reference materials.
- ☐ I have made no adjustments to my delivery.
- ☐ My adjustments depend on whether it's a Grade 2 or Grade 3 class.
- ☐ Other: _____

10. What impact has the proximity of exams had on your style of delivery? *

_____

_____

Appendix A5 – Teacher Survey 3 (cont.) (Cycle 2)

11. In your opinion, which of these cohorts of students are able to engage in flipped learning? *

Mark only one oval per row.

	Able with in-college support all year	Able with workshops to develop self-study skills	Able with regular monitoring and reminders	Able to engage independently	Not able to engage in flipped learning at all	N/A - I don't teach these learners
Gateway Learners	◯	◯	◯	◯	◯	◯
Achieve Learners	◯	◯	◯	◯	◯	◯
Fresh Start Learners	◯	◯	◯	◯	◯	◯
Functional Skills Learners	◯	◯	◯	◯	◯	◯
Grade 2 Learners	◯	◯	◯	◯	◯	◯
Grade 3 Learners	◯	◯	◯	◯	◯	◯
Higher Tier Learners	◯	◯	◯	◯	◯	◯

12. Is there anything else you'd like to share in relation to flipped learning?

Appendix A6 – Teacher Interview Questions

Thanks for agreeing to be interviewed.

I have 5 main questions to ask you about your experience of flipped learning and you'll have a chance to add anything you like at the end.

I may ask some follow up questions if I need to know more about your responses to the 5 main questions.

1. Can you briefly outline what your experience of flipped learning has been this year?

2. (If not covered in answer to Q1) Do you have a clear sense of what the intervention was in Cycle 1 and what it was in Cycle 2?

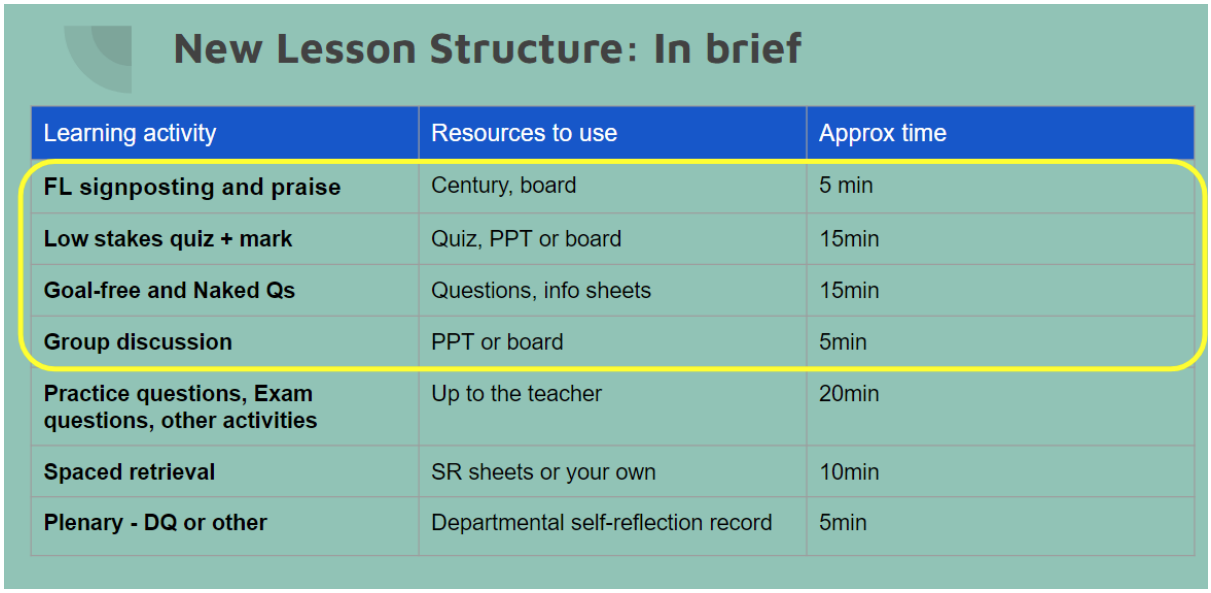
3. How did your experience of Cycle 1 compare with your experience of Cycle 2?

4. What changes did you make to your teaching as a result of the flipped learning project? Will any of these be lasting changes?

5. Do you have anything else you'd like to share about your experience of flipped learning this year?

Appendix B1 – The Lesson Structure, Cycle 2

The elements ringed in yellow were the fixed parts of the lesson designed to maximise the benefits of the flipped learning.



New Lesson Structure: In brief

Learning activity	Resources to use	Approx time
FL signposting and praise	Century, board	5 min
Low stakes quiz + mark	Quiz, PPT or board	15min
Goal-free and Naked Qs	Questions, info sheets	15min
Group discussion	PPT or board	5min
Practice questions, Exam questions, other activities	Up to the teacher	20min
Spaced retrieval	SR sheets or your own	10min
Plenary - DQ or other	Departmental self-reflection record	5min

Appendix B2 – Example of Low Stakes Quiz

Low Stakes Quiz - Scale Drawings

Question	Score
2.8m = _____ cm	/1
70cm = _____ m	/1
Joe is stacking up boxes in a cupboard. The cupboard is 2.6m high. The boxes are 30 cm high. How many boxes can he fit in the cupboard?	/2
1.4m = _____ mm	/1
1cm on a scale drawing represents 50cm in real life. What distance does 6cm on the drawing represent in real life?	/1
On a map, 1cm represents 5km in real life. If two towns are 55km apart in real life, how far apart will they be on the map?	/1
The scale on a map is 1 : 100 000. A lake is 4.5cm wide on the map, how wide is it in real life?	/1
The scale on a map is 1 : 10 000. A bridge is 450m long in real life. How long would it be on the map? Give your answer in cm.	/2
Total Score	/10

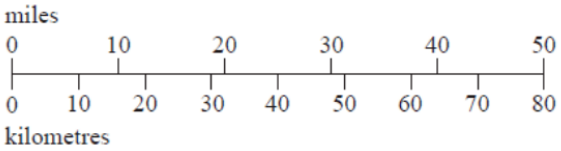
Appendix B3 – Examples of a ‘Thinking Question’

B3.1 – A goal-free question

Thinking Question 1:

Maps and scale drawings; four operations
4 mins 4 marks 1MA1/2F, Nov 2020

This scale can be used to change between kilometres and miles.



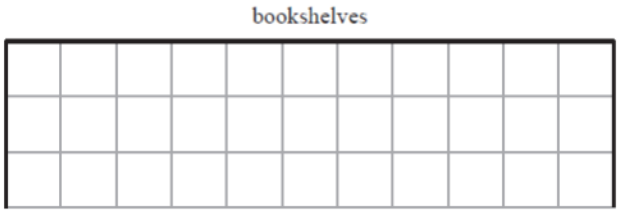
What can you work out?

B3.2 – A ‘naked’ question

Thinking Question 2:

Interpret and complete scale drawing
4 mins 4 marks 5MB3F/01, June 2015

The scale diagram shows part of the plan of a classroom.



What do you need to know to answer this question?

Make a list of the information you would need.

Mr Khan wants to put bookshelves along the complete length of the wall labelled "bookshelves".

(ii) Draw these bookshelves on the scale drawing to show how they will fit.

Appendix B4 – Student Reflective Journal (extract)

Date:	Topic:				
Do you feel the flipped learning helped you in this lesson? (circle one)	Very Much 3	Much 2	Not Much 1	Not at all 0	n/a I didn't do the flipped learning
What really made you **think** this lesson?					
What can you **do** after the lesson that you couldn't do before?					
If you see this topic on the exam, how likely are you to attempt the question? (circle one)	Very Likely 3	Likely 2	Not likely 1	I would skip it 0	Why?
Next steps: How will you continue to improve your understanding of this topic?					