Case study 2: Thomas

Contents

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1. Context:

The School:

The school is a larger than average Roman Catholic comprehensive school situated in a conurbation on the outskirts of a major city in the North East of England, UK. In 2011 it successfully applied for academy status. This allows the school greater flexibility in terms of curriculum development as academies do not need to follow the English National Curriculum.[1] At the time of the FaSMEd project there were 1637 students on roll, 49.8% of which were male and 50.2% female. The students attending the school travel to it from a wide area which encompasses the Church diocese. Most students are of White British backgrounds and have English as their first language. The proportion of students with English as a Second Language (EAL) is growing but currently stands at 6.7%. The proportion of children eligible for Free School Meals (FSM) is slightly below average (10.4%) and similarly the number of students with a Special Educational Need (SEN) is below average[2]. The school results in terms of national tests are above average.[3]

The school has mathematics and computing specialist status and receives placements from the National College of School Leaders for aspiring head teachers. The school has many links with local universities and has, over the years, participated in many research projects. This outward facing work is considered to be important by both the senior leadership team and the governors of the school.

The maths department is made up of 15 teachers. As an outsider, when you visit the maths department staff room, you notice how positive the relationships are between the teachers. It is common for all of them to sit and eat lunch together around a large table and discuss both personal and work-related matters (researcher observation). Thomas comments in his interview on how 'there isn't a competitive nature between the teachers, no one has something good and is going to keep it back, everyone is like I just did this and we e mail round and share things' (interview 2, Appendix 3).

The teachers plan on a week to week basis and have a scheme of work that they follow throughout the year. Individual teachers decide on the detail of the lessons depending on the needs of classes they are teaching.

[1] Academies are publically funded independent schools and do not have to follow the National Curriculum of England https://www.gov.uk/types-of-school/academies

[2] All statistics obtained from the Department for Education (DfE) Performance tables: http://www.education.gov.uk/schools/performance/

[3] See Data dashboard Appendix A

The Teacher:

Thomas trained as a teacher in 2009/2010 but has only taught 2 full years since then. First he taught in the academic year 2010/2011 and then started at his current school in 2014. He is now in his third year of teaching. In between teaching posts, he did some supply work and also community youth work/running after schools clubs. Although he uses technology a lot in his day-to-day life, prior to the FaSMEd project he would not use technology a great deal when teaching:

> *'I wouldn't say I was comfortable to use it in every lesson or with every group that I taught' (interview 1, Appendix B).*

The reason he cited for this lack of use of technology in his lessons, was a lack of confidence, especially using technology with classes of 30 where it might be difficult to solve problems if things went wrong. Despite these reservations he had been involved in another research project involving graphic calculators where he would send out quick surveys, polls and designed problem-solving games. He had also used 'Plickers' (https://plickers.com/), an app which allows teachers to create quizzes and which provides instant feedback to the teacher.

The students:

The students who took part in the FaSMEd lessons were a low ability (Set 5) Year 7 class (aged 11-12 years). Having recently moved up from Primary School, the class were still 'very dependent on the teacher' and working independently and even quietly was 'quite a challenge' (teacher interview 2 appendix C).

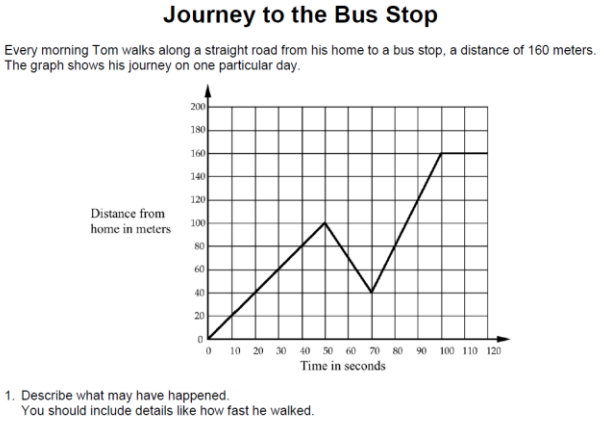
2. Tasks and resources used

Outlined below is a brief synopsis of the tasks and resources used. It is based on the teacher reports (TR), lesson observations and researcher notes. The full details of the lessons are discussed in the 'lessons' section.

Task 1: Interpreting Distance-Time graphs

Year 7 students (aged 11/12 years, set 5); 20 students in the class

The task was undertaken over 2 lessons which took place on the same day: 2nd February 2015 11.20 a.m.-12.20 p.m. and 14.05 p.m. – 15.05 p.m.



Thomas considered the task devised by the Mathematics Assessment Project[4] to be very 'intuitive' and an improvement on how he had introduced the concept of distance-time graphs in the past. Usually he would ask the students to look at the lines on a graph, talk about what they mean and then and 'build a story'. He felt that giving the students the already existing stories to match to the graphs was much more effective and got the 'kids engaged straight away'.

Prior to the first lesson, Thomas gave the students the pre-task worksheet 'Journey to School'. He asked them to complete the task independently and anonymously. Thomas then took away and analysed the responses to identify any misconceptions. The only alteration that Thomas made to the existing resources was the removal of one of the distance time graphs and its story which he felt was ambiguous.

In the first lesson he began with a quick starter activity. He provided a distance/time graph and three stories and asked them to work out which story matched the graph. The students worked independently using whiteboards for their working. An initial vote was taken followed by a discussion and then another vote. Thomas did not tell the students which was the correct answer as the aim of the main part of the lesson was to work this out for themselves.

The students were put into pairs to work on the matching activity: graphs to their stories. As the students worked Thomas took photos and manually fed the answers into an excel spreadsheet which was also projected onto a screen in the classroom. This was updated several times during the lesson.

After 10-15 minutes when none of the class had all of the questions right, Thomas brought the class together and displayed some key questions 'to help them think about what the graphs were showing'.

The second lesson started with a recap of the discussion at the end of lesson 1. The A3 laminated cards and stories were given out again and the students asked to start again from the beginning. The students worked in pairs and then Thomas brought the class together.

At this point he introduced a piece of equipment that he usually uses to teach this lesson: a data logger paired with a graphical calculator. He used this to re-enact the

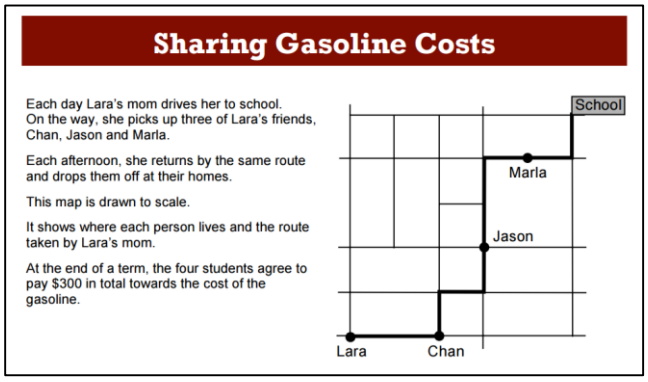
[4] http://map.mathshell.org/lessons.php?unit=8225&collection=8

stories with the students and is a clear example of how technology can enhance the FA process.

As a plenary task he gave the students a GCSE past paper question (the national exam taken by 15/16 year olds in England) and asked them to redo the initial pre-assessment task.

Task 2:Sharing Costs Equitably: travelling to school[5]

Thomas started with the pre- assessment task which he used to identify the common misconceptions. All of the students split the cost either 3 or 4 ways. Some realised there was a difference in the distance each person travelled but could not work out what that would mean for the cost. There was also some confusion over the distance actually travelled versus the distance from the school. The realistic narrative associated with the task i.e. that a mother was picking up and taking several children to school also meant that some students felt the child of the person driving the car shouldn't pay at all. Thomas therefore changed it to a taxi journey with people being picked up at different points.



He then took them outside to physically 'walk' the route, taking equivalent numbers of spaces in relation to the diagram. Back in the classroom, each child was given a barcode on a laminated card and then using the website called 'Plickers', he asked multiple choice questions to which the students had to answer a, b, c or d. By the end of the session the students all had an amount that they would pay. Back in the classroom the students were asked to scale up their answers and Thomas introduced the idea that this was a question about ratio. None of the students had realised this, despite only having been taught ratio the week before. The students completed the task.

Task 3:Selling Soup

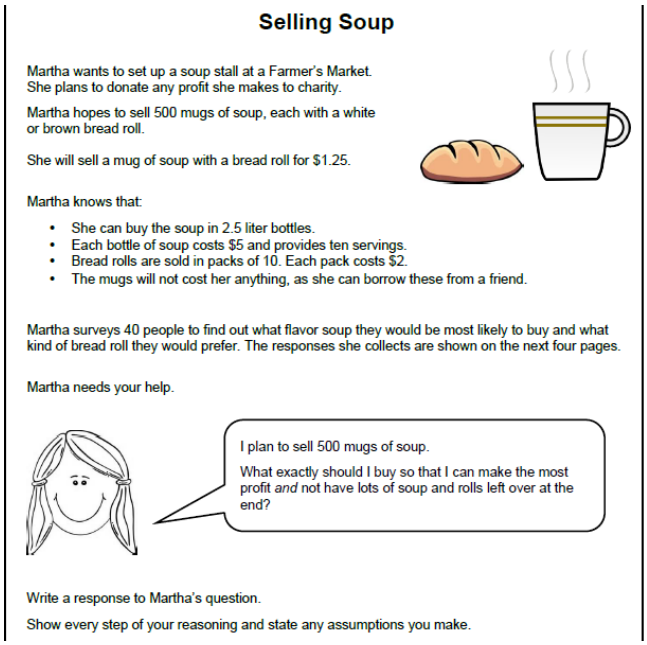
Year 7 students (aged 11/12 years, set 5); 20 students in the class

The task was undertaken over 3 lessons, this example was the middle one on: 22nd June 2015 11.20 a.m.-12.20 p.m.

The lesson followed the plan set out in the Mathematics Assessment Project[6]. This lesson was the second in a set of three lessons on this topic. Prior to this students had been set the pre-assessment task to complete at the end of another lesson. The lesson

[5] http://map.mathshell.org/lessons.php?unit=6200&collection=8
[6] http://map.mathshell.org/lessons.php?unit=6100&collection=8

was recorded using the IRIS[7] system which provides a static camera and another which tracks the teacher with a review being available online. The lesson was also observed by a university researcher.



Selling Soup

Martha wants to set up a soup stall at a Farmer's Market. She plans to donate any profit she makes to charity.

Martha hopes to sell 500 mugs of soup, each with a white or brown bread roll.

She will sell a mug of soup with a bread roll for $1.25.

Martha knows that:

- She can buy the soup in 2.5 liter bottles.
- Each bottle of soup costs $5 and provides ten servings.
- Bread rolls are sold in packs of 10. Each pack costs $2.
- The mugs will not cost her anything, as she can borrow these from a friend.

Martha surveys 40 people to find out what flavor soup they would be most likely to buy and what kind of bread roll they would prefer. The responses she collects are shown on the next four pages.

Martha needs your help.

I plan to sell 500 mugs of soup.

What exactly should I buy so that I can make the most profit *and* not have lots of soup and rolls left over at the end?

Write a response to Martha's question.

Show every step of your reasoning and state any assumptions you make.

The main features of the lesson involved the students reviewing their responses to the pre-assessment task which had been reviewed by Thomas with responses provided by the lesson plan and working with a partner to improve their response by creating a poster to demonstrate a solution.

Thomas also included the opportunity for students to respond to a multichoice quiz using the Plickers[8] system which provided a useful way for him and the students to review the data they had used to devise their answers to the task. Thomas used this opportunity to confirm which was the correct data and to ask the students for the methods they had used to collect it (always tally charts). At the end of the lesson Thomas distributed iPads and used them for a Socrative quiz which sent out the questions provided by the resource materials. However, there was insufficient time left for the students to respond effectively and Thomas repeated the quiz at the start of the following lesson.

Task 4: Security cameras

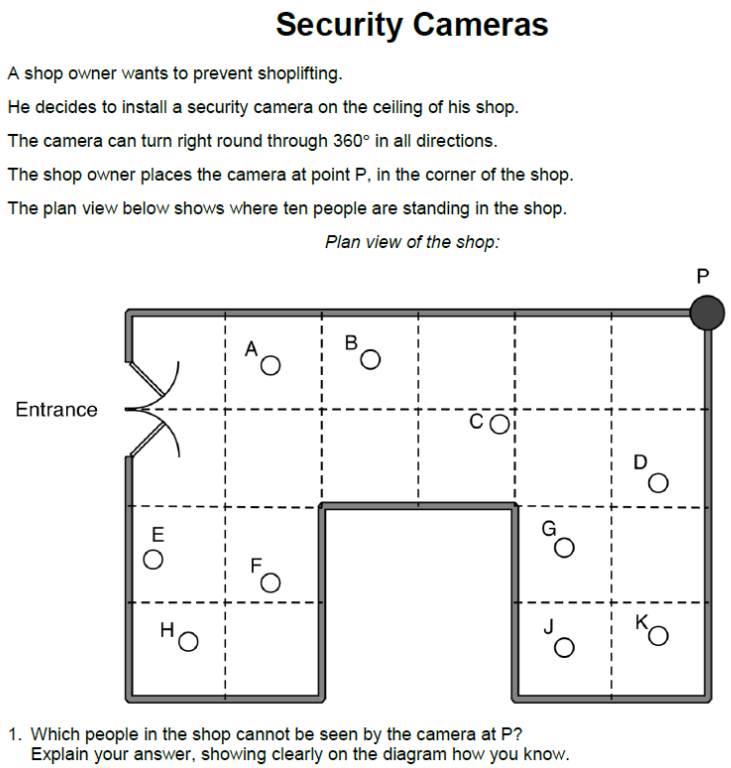
Year 7 students (aged 11/12 years, set 5); 20 students in the class

The task was undertaken over 2 lessons which took place on the same day: 2nd March 2015 11.20 a.m.-12.20 p.m. and 14.05 p.m. – 15.05 p.m.

[7] http://www.irisconnect.co.uk/

[8] https://www.plickers.com/

The lesson used the resources provided by the Mathematics Assessment Project[9]. The lesson was the first of two sessions and was observed by a university researcher. For the first lesson Thomas decided to provide the initial task at the beginning of this lesson and to provide feedback to the students during the course of the lesson through a variety of methods. He set the students working on the initial activity individually and after about 10-15 minutes collected their responses. He then handed out large laminated sheets with the plan diagram for the students to work in pairs on devising a solution. The students were also given iPads.



Security Cameras

A shop owner wants to prevent shoplifting.

He decides to install a security camera on the ceiling of his shop.

The camera can turn right round through 360° in all directions.

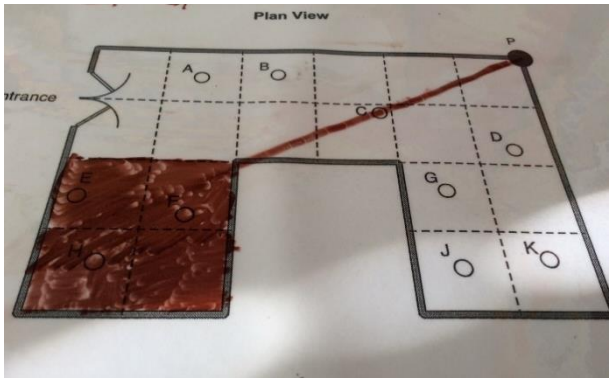
The shop owner places the camera at point P, in the corner of the shop.

The plan view below shows where ten people are standing in the shop.

Plan view of the shop:

1. Which people in the shop cannot be seen by the camera at P?
   Explain your answer, showing clearly on the diagram how you know.

While the students worked on the laminated sheets he quickly skimmed through their initial responses and attached a copy of the 'key questions' provided with the resources with relevant questions highlighted. This strategy took his attention away from the class, with the consequence that not all students were on task for this time.



The return of their initial response with his feedback did not get much attention, since by this time students were working on their shared response to the task. However, the provision of large laminated sheets allowed students to quickly demonstrate to the rest of the class their responses when selected by Thomas, who was quickly able to scan the pairs for a variety of approaches. Students were also asked to use the iPads to capture images of their work which was then displayed through the projector and use of Airplay software. Discussion about the optimum position for the camera and how to quantify this through

[9] http://map.mathshell.org/lessons.php?unit=6305&collection=8

calculating percentages was afforded by these strategies. This brought the first lesson to a close.

The second lesson was focused on students creating a poster of their solutions to share with the class.

3. Work with teachers

It was intended that the teachers would actually plan all of the FaSMEd lessons together, however in the end they 'didn't do as much planning together as we would have liked to'. This was largely down to time constraint issues. They did pick which topic they would all do, but 'went off and did out own thing with it'. More successful were the review sessions where the four teachers came together to discuss what they had done and which technologies had been trialled. Each teacher would describe what they had done and what worked well. As a consequence they would learn from one another:

> *So if I, for example, have carried out the lesson and made a resource or found something which did not work very well, I can say "well this happened and I had to go down this route to overcome that". (interview 1)*

Thomas also describes how much he enjoyed the cluster meetings (see below) where he was able to hear 'other people's experience of what works in the profession and what hasn't'. (interview 2). There was also a sense that he learnt things that he could bring back to his own department, although appreciating that it wouldn't 'necessarily suit them to do the same things' as the other schools they were working with.

In terms of future improvements to the professional learning process, Thomas reported that he would build in more time for teachers to plan together and more opportunities to meet with people from different schools and to observe their lessons. He feels that a large 'community of teachers working in collaboration' is important so that they have the opportunity to learn from one another – how they teach students of similar levels, how they use technology etc. equally he feels though that it is important to learn from 'other people's mistakes'.

The four FaSMEd teachers have cascaded their work and findings out to the rest of the maths department during CPD sessions and some of the lessons are being incorporated into the maths schemes of work. Also built into in the schemes are the post lesson review meetings- this will mean that the department will ' see if we can improve resources or the structure of the lessons to make them better.' (interview 2). The tasks identified as going into the schemes are: interpreting distance/time graphs, sharing costs equitably: travelling to school and security camera.

University support

Local cluster meetings took place during the intervention phase of the project, which was an opportunity to bring our three participating schools together for information

giving, knowledge exchange and good practice sharing. Three such meetings took place and all were organised and facilitated by the research team.

The first was held at Newcastle University where we discussed the outline and purpose of the project and participants were encouraged to ask questions about any aspect of the project. The two following meetings took place at the two case study schools. One took place part way through the intervention phase and allowed the different schools to share and compare their own experiences of conducting specific activities. The last meeting took the form of a review, or de-brief, where teachers form all three schools were encouraged to explore what went well, what did not, and what they had learnt and would potentially take forward in their future working. These cluster meetings were a rare, but valued, opportunity for schools to meet together.

Thomas commented on the support offered by the university, and that he knew if there were any issues he could 'e mail right away'. Because of the structure of the review meetings which was always attended by a member of the research team, he also 'knew there was support there'. However he felt that because he was working on the project with 3 other teachers in his department he did not need to rely on the university for support. Had he been working on it alone though, 'he would have been in contact a lot more'.

What was clear was that having planned review meetings attended by the research team meant that the teachers were not tempted to 'put this FaSMEd thing on the back for a bit' because for example there were tests coming up. The meetings ensured that the teachers kept up to date with their teacher reports and data collection.

Teacher –teacher support

Although one teacher from another participating school set up an online discussion forum, this was not well used. Thomas stated that he preferred to meet people 'face-to-face', although appreciating that such meetings can be difficult to organise. The value of face-to-face meetings is that discussions can 'spark ideas in others heads'.

Thomas also realised that meeting teachers from different schools was important because it enabled him to 'get a fresh approach on things' as he was conscious that he worked in a department that was very 'tight-nit.'

Of the two types of meeting though: in-school review meetings and between- school cluster meetings, he found the former more beneficial as the long term nature of them meant he 'could still have time to change things and develop things'(interview 2).

4. Classroom teaching

Thomas is an enthusiastic teacher with a high level of competency and a keen desire to undertake innovative teaching. Prior to the FaSMEd project he did not use technology a

great deal in his lessons, despite the fact that he uses technology a lot in his own day-to-day life and is considered by others in the department as a 'tech whiz kid' (interview 1)

> *'I wouldn't say I was comfortable to use it in every lesson or with every group that I taught' (interview 1).*

He would take some classes to the computer suite to do maths but used a limited amount of technology in his lessons as the school only had netbooks which were very slow.

The reason he attributed to his reluctance to use technology was a lack of confidence especially when teaching classes of 30 where it might be difficult to solve problems if things went wrong. Yet despite these reservations he had been involved in another project involving trialling graphic calculators. He would use these to send out quick surveys, polls and designed problem-solving games. He had also used 'Plickers', an app which provides instant feedback to the teacher.

He described himself as a teacher who would play it safe and not take too many risks, but felt that involvement in the research allowed him to be more experimental. The meetings with teachers from other schools seemed to scaffold his growing desire to take risks:

> *We need to try things [….] you have to take the risk initially and see if it pays off for you. Otherwise I think you'd just get stuck in a rut of teaching the same ways and hoping that the results will improve.*

In terms of formative assessment prior to FaSMEd, Thomas adopted a range of approaches in order to be able to understand the learning of all of his students and plan his next steps. Although questioning was his predominant approach, he was aware that 'not all students are comfortable to answer questions vocally or to be putting their hands up [….] sometimes you have to use other methods that are not as intrusive, things like using mini whiteboards where everyone can respond and no-one feels under pressure' (interview 1).

Usually his response when a student gets stuck is to help them immediately (interview2), which he describes as the general approach within the school.

He describes it as 'natural' for a teacher to ask questions and get feedback which is then acted upon. Technology just helps to make this 'a lot more time efficient' (interview 2). When using Socrative Thomas would use it to submit their answers which both became a focus for class discussion but also allowed him to see who had understood what. An extra bonus was that the information provided by the students could be downloaded into an excel spreadsheet, making planning for the next lessons more efficient. In the case of the FaSMEd lessons this enabled him to adapt his teaching more quickly and either move them on, or in the case of struggling students 'differentiate the work for them' (interview 2).

Despite being initially reluctant to take part in the FaSMEd project, Thomas was extremely positive about the benefits of taking part in it. He had a 'big light bulb moment' with respect to using pre-tasks and the impact that this could have on planning the next lessons more effectively. He also loved the structure of the lessons i.e. moving from independent work, to paired work or group work which then enabled the students to' start building on their own learning [….] and compare the different opinions they have between them' (interview 2). However when asked what the main highlight of involvement in the project was, he stated:

> *Working with my colleagues in developing this and the feedback sessions when you guys come in and talk things through'.*

Taking part in the research project means that Thomas feels he has demonstrated to the Senior Leadership Team at the school that he is innovative and likes to 'think outside of the box' and is therefore not just a 'bog standard teacher' as he is willing to try out new ideas.

5. Lessons:

The following descriptions are based on the teacher reports, researcher observation notes and video footage.

Task 1: Interpreting Distance-Time graphs

This is clearly a concept development lesson[10]. Thomas gave the students the pre-assessment task 'Journey to the bus stop' and asked them answer these independently using 'any prior knowledge they had or anything they could work out from the information given on the worksheet' (TR). These were filled out anonymously. After 15 minutes these were collected in and after the lesson the teacher reviewed them in order to help him plan the introductory lesson.

The misconceptions he identified were that some students thought the graph represented 'a physical journey i.e. climbing a hill' (TR) and others thought it represented different speeds of walking. On the basis of this analysis Thomas examined the pre-existing task resources and removed one of the distance time graphs which he felt was ambiguous and not suitable for the class. This perhaps indicates that Thomas thinks that the use of these materials should avoid those which need some discussion to resolve and that students learning is fostered by providing 'clear' cases. This is a fairly common approach by teachers, particularly where the students are thought of as struggling with the content.

The main activity task took place over two lessons on the same day: 11.20 a.m. - 12.20p.m. and 14.05p.m. -15.05p.m.

[10] http://map.mathshell.org/guides/map_cc_teacher_guide.pdf

In the first lesson Thomas began with a starter activity, with a similar graph to the pre-task but with three stories provided this was displayed via a projector. The students completed the task independently on mini – whiteboards and then voted on which story they thought represented what the graph was telling them. This could be said to be using the tools provided for 'sending and sharing' albeit with 'low tech' resources apart from the digital projector. At this point only two students had the correct answer, the rest had all chosen the physical representation answer. The teacher asked several students to explain the reasons for their answers. This was followed by a class discussion and further vote. Here Thomas could be seen to be employing formative assessment strategy B. Some students changed their answers, although Thomas felt this was more because they assumed that having being asked to vote again that their initial answer was incorrect. Another 2-3 minutes of class discussion took place and a final third vote. At no point did Thomas tell them the correct answer- he wanted 'it to be something that would drive them towards finding the correct answer for themselves during the lesson which followed' (TR).

The students were then put into pairs and each pair given a laminated sheet with the 9 graphs on and the stories which were to be matched with them.The additional 'tables of values' were not given out in the first instance- these would be used as an extension activity if required. Thomas also knew from experience that providing too many activities at one time caused confusion and 'off-task behaviour', so he kept to a simpler structure at this point in the lesson.

Thomas then used his ipad to take photos of the work as the students progressed. He manually fed the answers each pair had into an excel spreadsheet. This process was fairly time-consuming, but it did allow the students to see 'in real time' which answers of theirs were the same or different to their peers - this allowed them to 'refine their answers' (TR) and demonstrated an example of FA strategy D.

The students worked on this activity for 10-15 minutes and then because none had successfully matched all of the graphs to their stories, Thomas brought the whole class back together. He displayed some key questions designed to 'help get them thinking about what the graphs were showing' (TR):

- Why are some lines steeper than others?
- Why are some lines straight and others curved?
- What does a horizontal line mean? This question needed to be clarified as some students did not know what "horizontal" meant)
- What are the axes measuring?
- Where does the journey start and finish?

Thomas then sent the students back advising them to look for graphs which contained horizontal lines and to find stories which mentioned a stopping or waiting period. By matching these up first it reduced the number of choices they had to work with in the

first instance. This scaffolding helped the students who were particularly struggling as it gave them something concrete to look for on the graphs. Here we can see Thomas using FA strategy C.

This pattern of independent work or paired work, drawing the whole class together and asking students to explain their understanding at various points in the lesson is a common practice that Thomas exhibits during his lessons. It represents a continuous cycle of formative assessment, whereby Thomas establishes which misconceptions the students have through questioning or in the case of the FaSMEd lesson through displaying the students' data in real time; and then acts upon it.

Lesson 2

At the start of the second lesson Thomas began with a summary of the last lesson and then gave out the graphs and stories again. He asked the students to redo the exercise but this time asked the pairs to explain and justify to each other why they had matched up certain cards. This time the students were more confident when completing the task and is an example of FA strategy D. Thomas then brought the class together again and asked some of the pairs to explain why the graphs looked how they did. This strategy serves several purposes- it encourages individuals to verbalise concepts and explain their understanding, it allows the teacher to see who understands and it also shows students that they can learn from each other and do not need to always rely on the teacher.

Thomas then introduced a piece of equipment that he usually uses when teaching this concept- 'a data logger paired with a graphic calculator' (TR). This measures the distance of an object from its 'tracker' and plots a distance-time graph which can be projected on a screen in the classroom. Thomas demonstrated how this worked and then drew on the whiteboard one of the graphs that the class had been working on. He then asked the students to 'trace out as accurately as possible, the same lines on the graph' through 'physically walking the journey' in the classroom (TR). Many students volunteered to do this and attempted to walk towards and away from the tracker to try and recreate the shape of the graph. The errors that occurred provided Thomas with the opportunity to address misconceptions. One example of this was when a student moved too quickly and created a much steeper line than was on the original graph. Thomas asked 'what will the next volunteer need to do to make the line less steep?' and hands went up and explained s/he would need to move more slowly.

This use of an activity that enables the students to physically engage with a maths concept is a common feature of Thomas' teaching and is a very clear example of technology supporting the formative assessment process – students get immediate feedback via the display as to whether their motion matches the pre-set graph or not and could be said to be an example of FA strategy E, since students, via the technology, can correct their own understanding. This could also be (arguably) an example of

technology providing an interactive environment where students are able to become owners of their learning.

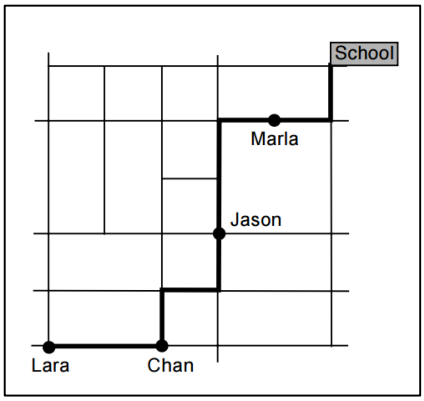
Thomas ended the lesson with two assessment tasks. One was a GSCE question on distance time graphs and the other was the initial pre-assessment activity which they had to try to do again.

Task 2: Sharing Costs Equitably: travelling to school

Thomas started the lesson with a quiz using 'Plickers' (https://plickers.com/), an app which provides instant feedback to the teacher. Each student was provided with a personalised barcode on a laminated piece of card and then Thomas posed multiple choice questions on the board which the students had to vote on:

- Who lives the furthest away?
- Who lives the closest?
- Who should pay more?
- Who should pay less?

Each question had a multiple choice answer on the screen and the students were asked to vote for the answer they thought was correct e.g. a) Lara, b) Chan etc. The students voted by holding their cards in the air and Thomas scanned these with his phone. The app provided Thomas with bar charts of the total responses plus the individualised answers. These results were then discussed by the class. This is a good example of technology being used for 'processing and analysing' in the support of FA strategy B and D. The advantage of this technology is that it is only the teacher who requires a device, the students just need large copies of the codes, in this case, pasted in their books. However, the interaction is strictly limited to a choice of one out of four alternatives and seeing the class outcomes displayed. While this has some potential, and in the hands of a resourceful teacher is a useful tool, it is limited to what can be done with multi-choice quizzes.



Thomas wanted to 'drip feed very slowly' the different concepts required to complete the task so that his students would not get confused. He achieved this through asking these questions which introduced the mathematical ideas to consider in very small steps. This is in keeping with his ideas of scaffolding students' learning and is very common with teachers who perceive their students 'abilities' to be limited. It could be argued that this approach is in conflict with the underlying philosophy of the Mathematics Assessment Project and indeed, FaSMEd (See position paper on this issue). It is an issue which did

not readily become addressed by the project and would need much further professional development.

After the quiz, Thomas introduced a practical activity which he hoped would enable the students to really begin to understand what the task was asking them to calculate. Providing opportunities for the students to physically act out mathematical concepts is a strategy that Thomas (as discussed earlier) frequently adopts in order to aid understanding and is arguably an important modification of this genre of tasks since, for many students, these graphical representations are highly abstract and difficult to understand. The students were asked to stand at points on the playground that represented the distances on the task worksheet. They were each given a whiteboard and asked to write on this how much they would pay for each step they were taking. This helped them to understand that a person living further away from a destination should pay more towards any travel costs. This is a useful low tech tool which is supporting Thomas use of strategy E which could fit into the 'sending and sharing' scheme of the Fasmed framework.

Once back in the classroom, the students worked on scaling up the answers from outside. At one point Thomas put the names of the characters in the task on the board with colons in between:

Lara: Chan: Jason: Maria

The students suddenly realised that the task involved ratio. Thomas was actually surprised that they had taken so long to realise this as they had been working on the topic of ratio only the week before the FaSMEd lesson. He explained why he thought this was the case to his colleagues in one of the review meetings:

> *It shows you they're so used to a certain type of question and certain type of solution, that they can't piece together these real life situations.*

Task 3: Selling soup

This is clearly a problem solving activity, involving a non-routine, unstructured task which requires students to apply their mathematical thinking in a real world context. This was the second in the sequence of lessons, students had completed the pre-assessment task in the previous lesson and answered a Socrative quiz based on the data for the task.

The lesson was recorded using the IRIS system and was observed by a university researcher.

Thomas returned the students' responses to the pre-assessment tasks to them, annotated with his questions drawn from the MAP materials. Students were asked to reconsider their answers. The task was displayed on the board using the digital projector. After a short pause to brief two students who had been absent for the

previous lesson he announced a Plickers quiz which provides a multiple choice response system using codes which the pupils stick into their books – the orientation of the code corresponds to a choice in the quiz and Thomas used his mobile phone to scan the codes. This is a good example of technology being used for processing and analysing. In this case the questions and responses were mainly used to ensure that all students had obtained the correct data from the task. Thomas input was to confirm which responses were correct and to ask students which methods had been used to obtain it. It could be argued that this was an example of FA strategy A.

The next stage of the lesson involved students working in pairs to produce a poster to display their solutions to the task, with Thomas circulating and providing input and questions to the pairs as they worked. Pairs working in this way could be said to provide an example of FA strategy D and Thomas questions and interactions were an example of FA strategy C.

Thomas distributed iPads at the end of the lesson and attempted to undertake a Socrative quiz. However insufficient time had been left for students to work through the quiz which was based on the questions provided by the MAP resources. The quiz was completed the following lesson.

This lesson provided few clear examples of FA in action and fewer of how technology could support it. However, the students appeared to make progress in developing their posters and remained engaged for most of it.

Task 3: Security cameras

This activity involves both problem solving and concept development. It is a fairly unstructured, non-routine task, but also involves the development of understanding of percentages. In this lesson, Thomas attempted to use the pre-assessment task at the beginning of the lesson and return it to the students using feedback provided by the resources while the students were engaged in jointly developing their solutions. This innovation, which might be thought to be more efficient in teacher time (using the lesson to provide the feedback rather than doing it in his teaching preparation time) or be a tactic where the teacher has not had time to give out the pre-assessment task was not completely successful. One problem was that the students had mentally moved on from the initial task and were engaged in developing solutions with their peers so it was difficult to regain their focus on the feedback provided. Another was that since Thomas necessarily needed to focus on assessing the students' responses, he could not simultaneously engage with the class, resulting in a range of 'off task' behaviour.

Thomas had constructed large A3 laminated sheets for the pairs of students to work on with dry wipe pens and this appeared to work well. Students were able to draft and redraft their solutions and also easily share progress with the rest of the class by holding them up to display their work, an example of FA strategies B and D. Here we have a fairly 'low tech' tool which provides good support for formative assessment.

As the lesson progressed iPads were distributed and students were asked to capture their work using the iPad camera. These images were then displayed on the class digital projector via 'Airplay' software so that students were able to explain their solutions to their peers and Thomas was able to provoke discussion through probing questions. This provided good support for FA strategy B and is a good example of technology used for 'sending and sharing'. This ended the first lesson. The second lesson (which was not observed) provided students opportunity to develop their solutions as posters and compare them with the samples of student work for comparison and discussion.

6. Students' Perceptions

The discussion of the students' perceptions is based on the following data: the analysis of the Q sort and 1-1 interviews with the 6 students who undertook the Q sort (Appendix D) and the analysis of a student questionnaire (Appendix E). The interviews were analysed thematically with the categories driven by, but not limited to, the questions being addressed by the FaSMEd research project. The themes identified are outlined in Appendix G.

Student	gender	age
1	male	12
2	male	12
3	female	12
4	male	12
5	female	11
6	female	12

The attitude of the students to mathematics was very positive. The results of the Q sort and interviews revealed that they all understood that maths is an important part of day-to-day life and also that many jobs require knowledge of maths. All of the students for example agreed or strongly agreed with the statements:

> *Mathematics makes sense in the real world*
>
> *Mathematics is used in everyday life*

In one interview a student described how he uses maths 'pretty much every day':

> *Student 1: If I have any left over money from lunch then I will go to the shop and buy something. And sometimes in the morning on the weekends I will go and get some milk for my parents.*
>
> *Researcher: what is the maths you use then?*

Student 1: adding up change

Similarly all of the students could identify jobs that require an understanding of maths: being a teacher, working in a shop, working with computers:

> *Student 4: I think it will help in my future life because I do like computers, so my job might be something to do with them and technology, so I will need to use maths for that, for example binary*

There was also a very strong view expressed that maths was for everyone and not just clever people. All of the students disagreed or strongly disagreed with the statement:

> *Only gifted people understand mathematics*

The students explained their reasoning for this:

> *Student 4: Yeah you don't have to be gifted to learn it, there are easy parts and hard parts to maths.*

> *Student 2: you can always learn something by practising*

In terms of technology and its use in maths lessons, there were very positive views expressed in the Q sort activity. There was agreement with the statements that 'using technology is fun' and that it is 'useful' and also that it can help the teachers to 'find out where we are in our learning'. A more complex picture however appeared when the data from the interviews was analysed. The positive aspects of technology that were discussed related to the ease of use and the ability to share ideas:

> *Student 6: when we write up ideas, we bring ideas together and see what's good about it.*

One student also described the formative assessment potential that it offered:

> *Student 3: Yeah, it is a lot different being on the Ipad than being on paper. There is an app that the teacher sends stuff through to and then we can draw on it and then when we send it back the teacher goes through it and looks at what other people have said. The teacher compares them, there is always that one answer that is better than everyone else's, we find out from other people's decisions.*

What came across in the interviews also however were some of the negative aspects of technology use. Firstly in contrast to the Q sort activity where all of the students disagreed with the statement 'using technology in maths is frustrating', all 6 of the students gave examples of difficulties they had experienced. Some of these related to technical issues:

> *Student 5: it is frustrating, it'll turn on and off and your work isn't saved and you'll lose it*

Others related to the fact that the technology became distracting for some students:

> *Student 2: I get distracted with it. Sir will say just leave the ipad and I will just be clicking the button on and off. That's what I do at home, I'll just keep playing*

> *Student 3: No it does get quite annoying, like if you're working in partners and they are being silly and they don't know your things, then they might not share them, so everything gets reset and you might not get them in your head. It is sometimes frustrating.*

One student also commented on how using technology made her nervous because 'the teacher puts it up on the board and then it's embarrassing when you get it wrong' (student 6).

What came out very clearly form the Q sort activity and interviews, was that the students felt there was a need for a balance when it came to using technology in their lessons. There was an understanding that it offered a change from 'what we normally do' (student 2) but that the role of the teacher was very important:

> *Student 4: the teachers have taken courses and everything. The teachers are always going to tell the truth whereas technology doesn't always. Talking verbally is easier and is quicker than typing with technology, even though the teacher may be helping someone else out as well. So it is a balance between the teacher and the use of technology.*

The evidence from the student questionnaire (Appendix X) shows that the students considered the FaSMEd lessons to be enjoyable (91%), different (98%) and helpful (93%). Of the two case study schools submitted by Newcastle, these were the most favourable results across all three measures. The interview data offers a more detailed picture of why this was the case. One student commented on the fact that they were given the chance to 'solve every day problems' which when they were an adult and were given 'a similar problem to the FaSMEd, it would be easier to overcome it' (student 2). This view was supported by a second student who stated that 'the FaSMEd ones are more realistic and practical and they require more thought' (student 1).

The students also noted the amount of group work they were asked to do which provided the opportunity to work with and learn from others. Although as student 6 highlights, group work was felt to have both advantages and disadvantages:

> *It is more fun and we can work in groups and help each other. But I don't like it how the teacher chooses the groups that we have to be in*

This was a common sentiment expressed by all of the students that they preferred to work in groups with their friends, although student 4 did acknowledge that 'you might start having a chat with your friend because you know them well'. What was interesting

was that there was a real awareness of how the teacher was grouping the students, despite him not having openly articulated this:

> *Researcher: When you go into groups does the teacher decide who is in which group or do you?*
> *Student 1: The teacher puts us on tables and puts us into specific groups.*
> *Researcher: do you know why each person is put into that group?*
> *Student 1: Yeah, I think it is because they put the more intelligent people with the not so smart people to help them. But sometimes it is just the same groups and grades together.*
>
> *Researcher: were you told that?*
> *Student 1: No I just kind of worked it out*

7. Key findings:

Value of the assessment tasks: This was a 'big light bulb moment' as it enabled Thomas to plan his next lessons more effectively.

> *We can skip out the bits the kids already know and would have just zoned out on anyway*

Thomas commented that these tasks made him more time efficient because he was not teaching what they were 'pros' [professionals]at, but just what they were struggling with. Thomas found that by the end of the FaSMEd project the students realised that during the pre-assessment task they could write as much as they know on the subject without being judged and that the aim of them was for the teacher 'to gauge their knowledge'. The teacher noticed a big difference in how the students completed these tasks over the months:

> *When I gave it out normally after 5 minutes everyone is bored and looking round. But this time everyone worked on it solidly for fifteen to twenty minutes in complete quiet. (teacher interview 2)*

This response would seem to demonstrate the inhibiting influence of marking on trying things out and risk-taking.

The structure of the lessons was considered to be highly effective as the students move from independent work to paired or group work. This structure enables the students to build on their own knowledge but also learn from others. The paired/group work and seeing examples from the whole class encourages them to be critical and consider their own answers and whether they 'have shown all the workings out?' Thomas felt that this would be very helpful when the students went on to take exams where they need to show the examiner 'their full workings out'. (interview2)

This focus in the tasks on developing criticality through cycles of evaluation was something that Thomas felt was mirrored in how the teachers worked- 'we evaluate what we have done and how we can make it better next time. It's definitely got us into a cycle of thinking that way.' This is a skill that Thomas feels is generally missing in maths where it's much more about just getting the 'right answer'. Comparing and contrasting ideas to see the best way to work something out is something that he feels is missing in maths teaching and yet the research project highlighted the value of this.

Taking part in the FaSMEd lessons 'challenged' Thomas as a teacher and made him reconsider 'what my role is in the classroom' (interview 2). The task required him to be a 'facilitator for the learner' which he found this difficult because he was not used to stepping back and allowing the students to work independently. However he acknowledged that participating in the project had increased his confidence as he was taking more risks and it was 'freeing him up from the single sort of vision' of what teaching looks like (interview 1).

This new role also created difficulties because the students were very 'needy and dependent on the teacher' even by the end of the project. This neediness continued despite being encouraged in every lesson 'to ask a friend to help, to work in a pair or as a team before you come straight to the teacher'. Thomas felt this was largely the result of the fact that the students were so 'used to asking the teacher and getting an immediate response from them' (interview 2). In order to change this, he felt it would be necessary for the department and whole school to address this.

This new way of working was also difficult for the students and Thomas felt it was hard to 'change their mind set' (interview 2). As an immature set of 11/12 year olds there were also issues over the paired/group work with arguments over who didn't want to sit next to whom. This was an ongoing issue for Thomas who was keen to use the information gleaned from the pre- assessment tasks to pair more able with less able partners so that the 'one that is stronger and more able' would be able 'to help the peer assessment'(interview 2). He acknowledged that in some cases this was not possible. Interestingly he felt that this was less of an issue with his older students who would grumble but 'wouldn't put up that much resistance' (interview 2).

Technology:

The teachers expressed the view that it is important to have a balance of technology use within a lesson and not create the expectation that tools like ipads will be used all of the time. It also needs to be beneficial to the students and not just a way to allow teachers to be more efficient with their time management. This was a sentiment agreed with by the students, who still valued the relationship with their teachers. This is very much in keeping with the views expressed by the teachers and students at case study school 1.

The cost of technology came up as an issue at several points in the interview with Thomas i.e.the fact that any form of technology whether ipads or Chrome books etc. is a big investment and so it needs to be done wisely. He states that it is equally as important to invest in training to give teachers confidence and not just tell them to 'go away and see what it can do'. He describes this need for teachers to be confident because many students are very 'technology savvy' and so teachers wouldn't want to 'look a fool in front of the kids' (interview 2). You also need to be able to know how to fix things quickly if things go wrong. There is evidence of this in one of the video recordings of one of the other FaSMEd teachers where a student shows the teacher that on classflow there is an undo button which enables the user to edit work easily when they realise they have made mistakes.

With the FaSMEd teachers having trialled Socrative and assessed both the affordances and constraints offered by it, the maths department then proceeded to trial a range of other Apps- ones that would enable them to make the lessons 'more interactive'. These included quizzes and revision sessions that are based on competitions. As a group the teachers they are looking to see 'what is on the market' (interview 1) to see which would be the most effective.

The evidence from all of the data sources, highlights that the use of technology in maths lessons is not an easy option and there are several issues which arise that can cause difficulties:

- The technology does not always work which can alter the flow of a lesson as it can 'take time to resolve things' (teacher interview 1) with the result being that for Thomas he found being part of the research project 'a burden' (interview 1)
- It takes a while for both students and teachers to learn how to use the technology effectively and efficiently.

Appendix A: school data dashboard

School Data Dashboard

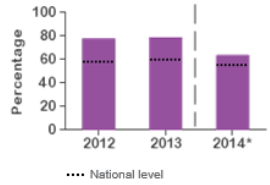
Ofsted

How are pupils doing in exams? (Attainment)

Overall

In 2014, 63% of all pupils attained five GCSEs grade A*-C including English and mathematics.

Percentage of pupils who attained five GCSEs grade A*-C including English and mathematics



*2014 results are not comparable due to changes

In 2014, the school's result was in the middle 20% of similar schools' results, and in the top 40% of all schools.

Comparison with other schools

Similar schools		All schools	
Highest		Highest	
2nd quintile		2nd quintile	■
3rd quintile	■	3rd quintile	
4th quintile		4th quintile	
Lowest		Lowest	

English

In 2014, 69% of pupils attained grade A*-C in English (EBacc).

Percentage of pupils who attained grade A*-C in English (EBacc)

*2014 results are not comparable due to changes

In 2014, the school's result was in the bottom 40% of similar schools' results, and in the middle 20% of all schools.

Comparison with other schools

Similar schools		All schools	
Highest		Highest	
2nd quintile		2nd quintile	
3rd quintile		3rd quintile	■
4th quintile	■	4th quintile	
Lowest		Lowest	

Mathematics

In 2014, 74% of all pupils attained grade A*-C in mathematics (EBacc).

Percentage of pupils who attained grade A*-C in mathematics (EBacc)

*2014 results are not comparable due to changes

In 2014, the school's result was in the top 40% of similar schools' results, and in the top 40% of all schools.

Comparison with other schools

Similar schools		All schools	
Highest		Highest	
2nd quintile	■	2nd quintile	■
3rd quintile		3rd quintile	
4th quintile		4th quintile	
Lowest		Lowest	

Science

In 2014, 63% of pupils were entered for science (EBacc) and 89% of these attained grades A*-C.

Percentage of pupils who attained grade A* to C in science (EBacc)

*2014 results are not comparable due to changes

In 2014, the school's result was in the top 40% of similar schools' results, and in the top 20% of all schools.

Comparison with other schools

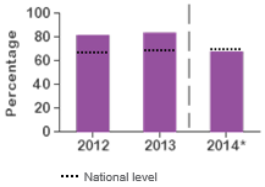
Similar schools		All schools	
Highest		Highest	■
2nd quintile	■	2nd quintile	
3rd quintile		3rd quintile	
4th quintile		4th quintile	
Lowest		Lowest	

Are pupils making progress?

English

In 2014, 67% of pupils achieved expected progress in English.

Percentage of pupils who achieved expected progress in English



*2014 results are not comparable due to changes

In 2014, the school's result was in the bottom 40% of similar schools' results, and in the bottom 40% of all schools.

Comparison with other schools

Similar schools		All schools	
Highest		Highest	
2nd quintile		2nd quintile	
3rd quintile		3rd quintile	
4th quintile	■	4th quintile	■
Lowest		Lowest	

Mathematics

In 2014, 70% of all pupils achieved expected progress in mathematics.

Percentage of pupils who achieved expected progress in mathematics

*2014 results are not comparable due to changes

In 2014, the school's result was in the top 40% of similar schools' results, and in the top 40% of all schools.

Comparison with other schools

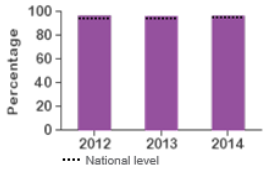
Similar schools		All schools	
Highest		Highest	
2nd quintile	■	2nd quintile	■
3rd quintile		3rd quintile	
4th quintile		4th quintile	
Lowest		Lowest	

How good is attendance?

Overall attendance

In 2014, the attendance rate at this school was 95.8%.The attendance rate has increased by 0.3 percentage points since 2013. The attendance rate is in the top 40% of all schools

Level of attendance at this school



Comparison with other schools

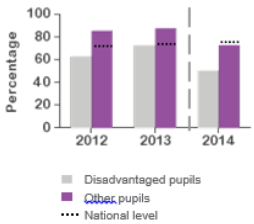
All schools	
Highest	
2nd quintile	■
3rd quintile	
4th quintile	
Lowest	

Closing the gap between disadvantaged and other pupils

English Expected Progress

In 2014, 50% of disadvantaged pupils achieved expected progress, while 72% of other pupils achieved expected progress.

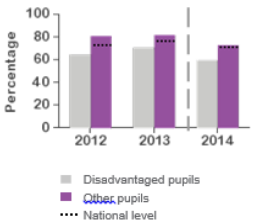
Percentage of pupils who achieved expected progress



Mathematics Expected Progress

In 2014, 59% of disadvantaged pupils achieved expected progress, while 72% of other pupils achieved expected progress.

Percentage of pupils who achieved expected progress



Appendix B

First interview with case study teacher: Thomas

I: So – first question: Before the Fasmed project, what was your experience with using technologies within your lesson?

M: Um – when I first did my teacher training and within the first year of full time teaching I used technology to an extent. I wouldn't say I was comfortable to use it in every lesson or with every group that I taught. But where I was confident with the class – that they would take to it – I would do so.

I: What sort of technologies?

M: I was involved with Texas Instruments – I used the graphical calculators in sending out quick surveys – using quick polls – even designing little games for them to work through – problem solving things. But I again I think it was the extent to which Texas could be used – I did not know all the different realms where it could be used. So I was only comfortable with what I knew – because if they got stuck I would not really know how to get through that issue, so I would not say I was overly confident with it. In my day to day life I use technology a lot and I am fairly familiar with it and how it works and how to solve problems when I was faced with it. But when you are faced with a class of 30 kids all using the same stuff and things going on in different corners of the room, it's a different matter. And especially in your first year of teaching when you don't want to be wasting a lot of time in class, because you know you have got to get things done and you have got work to get through. So sometimes you are reluctant to use it in case things don't go well.

I: Outside of those projects, did you use it day to day in your class?

M: We had a system called 'Clickers' – I think we still do have it, which is basically a way of making choices: A, B, C and D and it is timed so that whoever gets first gets the most points. I have used that a few times as an incentive in a recap lesson or a revision lesson just to get through lots of stuff at once. But it would not be a daily thing, I would not use it in the class all the time.

I: OK, um, and how comfortable were you with using formative assessment in a lesson?

M: I think I probably used formative assessment a lot more than I realised. Because a lot of the time you get things [indistinct] thrown around and you have to go and do [indistinct] things and it is not like whether you are doing it or not. So yeah I have been using it a lot even without knowing whether it would just be questioning sessions in class or matching exercises even down to getting them to do quick questions about things at the end of the lesson and marking them to see how well they understood something and that helping me to plan for my next lesson based on that. So yeah, I think I have been doing it a lot more than I realised I had and I do feel comfortable with that. I feel comfortable in the context of the classroom today – questioning session to get students' feedback that way. Realising as well that not all students are comfortable to answer questions vocally or to be putting their hands up or be pro-active about this. Sometimes you have to use other methods that are not as intrusive, things like even using the mini-whiteboards where everyone can respond and no-one feels under pressure, I would use that quite a lot as well.

I: Since becoming involved in the project, how have your ideas about formative assessment developed?

M: It has definitely given me food for thought with regards to – just even the pre-assessment task where you work out where the class is at even before you start the lesson. And that allows you to gauge where it's going to go. It lets you be much more efficient with your time as well – being able to assess them prior to teaching the lesson and skipping out things which maybe they are already are pros at and then focusing on things which they all seem to be struggling with. So that has really been an eye opener for me and using the technology I suppose in a number of lessons as well has been a learning curve I would say. Initially it was exciting to get the things like the Ipads and stuff like that. When you come to use them it raises issues, it can be frustrating, especially with the time it takes to resolve those things. But, I think, and I have been speaking to other members of the department as well, it obviously takes time to get familiar with it and for the students to get familiar with it and that's a learning curve for them as well. But we need to be more open to just try things out and sometimes fail at them at the first hurdle but to learn from that and then to do things differently the next time. So I have enjoyed being involved because I have been given the freedom to not do things right the first time – I did not feel under pressure that I had to – so I have learned a lot about formative assessment and the use of that alongside technology to make lessons a lot more efficient and structured.

I: So outside of the classes you have been doing Fasmed with, have you used any of the techniques?

M: Yes, just recently, I have used this new application with Clickers, and I have given all my classes bar codes to stick in their books and it is a way for me – because I now have a bank of questions stored on the website – a way for me to go in – initially I was just setting them easy questions, just to get them used to using the technology, but now I am being a lot more thoughtful about which topics I pick. Even for revision and stuff and what things they struggle with the most and we get through lots of questions and learn from the responses. It is good that they can see what everyone else is choosing as well and the talking points which come out of 'Well most people said this but one or two people said this and why do you think they have thought that, because it is not just one person who has made a mistake?'

I: How do you manage that – where you have a diverse range of responses in the class?

M: In general, it has been the case, that most of the kids, because it is quite a competitive – they all see who has answered the quickest – they want to be getting it right as well as getting it right fast – you tend to get the right response from most of them – and if there is any variation we do take time to talk about that we don't just go onto the next question. We say 'Why has that person?' – and it does not necessarily need to be the person who has got it wrong who answers that – other people will have come to that conclusion. And so the next question may well be very similar to the last – and so have they now got it right – learning from previous discussions? It's nice that they can appreciate the conversation side of things in class as well – it encourages them – the people who would not normally put their hands up to answer a question will discuss why someone else has got it wrong a lot quicker. So that has been a learning for me.

I: Just a technical question: is that an Android app or an Iphone app?

M: Well, I have it on my Iphone but I am sure you can get it on other systems as well.

I: Moving on to the issue of planning and reviewing lessons. How do you normally do that within the department?

M: We plan on a week to week basis and have a scheme of work that we follow throughout the year to cover certain topics so when we come to the end of the term and set end of term tests it is based

on topics that we have all covered so the whole year can do the same tests – albeit at different levels. So we would loosely base our lesson planning on that prescribed scheme of work, but depending on the level of set we are teaching we can decide to not go into as much detail or extend it to go into more detail and a higher level, depending on what set we have got. So I would use that a lot of the time and with a class like we are doing Fasmed with I would not focus on the harder topics I would focus on the basics, whether it would be algebra or number or whatever it is I would focus on the basics and get them mastered as opposed to getting lots of different aspects of it in. Because if we have the foundation in, in the future we can build on that.

I: Do teachers ever get together to plan lessons?

M: From time to time there would be collaborative planning in the department, especially if you have a year where there are parallel sets. In years 7 and 8 and the teachers who teach similar classes would say 'What are you planning to do with your set?' And they might swap resources and that which is quite nice. It is a big department, so there are lots of ideas flying around. A lot of the time, if I was to make a resource I would put it on the shared area and send an email to say where it is and what I would use it for. I have even done that with some of the Fasmed lessons that I have prepared laminates and stuff for where I know that they can be used over and over again. So I have said that these are some of the Fasmed lessons and these might be nice for the functional skills task at the end of term – so why not just have a go at it and I have done that as well.

I: So this would be for the teachers who are not involved with the Fasmed project?

M: Yes, they can make use of that then and everything is prepared for them then and they can have a look at the lesson plan and use the resources. The Fasmed lessons are good in the sense that you can set them off on it and they can see where to go themselves without anyone having to lead on it.

I: Do you ever get a chance to review how lessons have gone?

M: We would not review much in a collaborative setting – I would look at the lessons I have done at the end of the day for planning for future lessons the next day or later on in the week.

I: Individually?

M: Yes. I would think to myself 'Did we get everything covered that we needed to?' And then move on to what we need to plan for the next lesson and if we haven't then I would adapt what I have planned for the next lesson by focusing on an area that we struggled with and getting that sorted before we move on to something else. So I will review my teaching and I am sure other teachers would do the same. With the Fasmed lessons it has given us an opportunity as a team of four, because there is four of us doing it, to sit down and say what went well – 'What did you do?'. Because some of us are behind, depending on what is going on – there may be testing with different year groups – some of us fall behind in the schedule. So, if I, for example, have carried out the lesson and made a resource or found something which did not work very well I can say 'Well, this happened and I had to go down this route to overcome that'. Other teachers can take from that and take from that experience and then find whether it worked with their classes.

I: How has that worked out?

M: It has really been good. I mean, even the likes of Richard sharing different applications that he has been using with his class and us introducing it to our classes. The sharing of the experience and the sharing of the resources that we all use differently is vital, I think, and us all becoming more familiar with using technology and becoming more comfortable with it. For example, if David is

struggling to get 'Airplay' up on the board he will just pop into the staff room and if I am there I will help him to do that. So we support each other quite a lot through that and we all know that it is very new and that it is the first time we have been using different apps and that. So we don't feel under pressure to know everything, because we are all there to support each other as well so that is a nice dynamic within the team.

I: Is this sort of learning group encouraged as part of school policy?

M: During CPD it is something we are encouraged to do – we sometimes get departmental time when we all come together – we have had some CPD sessions on the new GCSE exam and how that is going to affect teaching and things like that. Sometimes we will sit down and plan certain parts of the scheme of work together as a team where we are arranged in pairs. I think as a whole school policy it would be on a voluntary basis – Tuesdays are our compulsory CPD time and then Thursday, there would be certain days put on by the ASTs and that for people to attend if they wished. Again that would depend on whether people have the time to do that – depending on what plans they have made. So I do not know whether it is whole school, it is definitely encouraged within the CPD sessions – it is just down to different departments doing different things.

I: OK – what is your experience of working on a research project previous to this?

M: I don't think I have been part of a research project previous to this. Apart from Texas Instruments which was more tied to the conference and being part of using the technology in the classroom – it was not really a research project where there would be an outcome from it. We were just given the calculators to use to see how they could improve the teaching and learning and we were free to do that. There was not such an outcome as such, we did not have to log or anything like that. So this is the first time I had to do something like that. Initially I did not want to be a part of it, it was just that David asked me to come on board as a tech whiz kid, if you like, because I was using technology quite a lot and so I agreed. And then finding the lessons and so on was fine, it was like a breath of fresh air to do these different types of lessons. But then it became at a certain point a burden, I suppose, because, for example technology would not work as you would like it to and so you would find that you had wasted a lesson where you could just have been doing a normal teaching lesson, covering the scheme of work. So when things didn't go right it was tough going and it was I could not wait to see the end of it. But now that recently we have got Shareware installed, that is going to be very useful, and when you are able to do things like that and kids are able to start talking about their work and display it for everyone else to see you think well it is actually worth it – all the hard work. The highlights for me have been working in conjunction with the other teachers and have time to sit down and review what we have done and to hear feedback and to hear that they are having the same issues or that they have had the same successes. So I have really enjoyed it – it hasn't been an easy ride the whole way along but it has definitely been one where I have got more from than I have put into it – to be honest.

I: Do you see that having an impact on your teaching in future?

M: Yeah definitely, I would like to be involved in other research projects that are similar, based on technology and the same sort of things that we have been doing with Fasmed. It makes me more confident with [i] this class that I do Fasmed with isn't the best class that I have by a long stretch, they can be loud and rowdy and boisterous and you have sometimes got to rein them in at times. Sometimes I have not had the Ipads in class, not had any sort of technology based things, we have just been working as we normally do because those such as can cause them to be a bit more silly and things like that. It has given me a lot more confidence with saying 'It's ok for everything to be not in

my control within the classroom'. If they are working in pairs, if they are working in groups for things to be a bit louder than they normally are. So it's freeing me up a bit from the sort of single vision of this is what teaching to well this is – I am just facilitating this lesson instead of teaching from the front and it has definitely encouraged me to be a bit more adventurous in my teaching style I suppose.

I: If you were going to do the project again, is there anything that you would do differently?

M: Because I appreciate the time we have with the four of us and two of you, the lessons, I really appreciate that time, again, in the planning because a lot of the time spent on these six lessons we have done we have decided on what we are going to do, I like the way we have planned it ourselves. And yes we may have shared resources and stuff like that prior to the lessons, but we haven't actually talked about what will this lesson look like – how long will it take, because we have found the timing and that has been the biggest issue – where things have run over and naturally we expect them to run over because we want to see a conclusion to it and we can't just pluck it away from them and we want it to an answer or an end point. But I would like to sit down with the teachers involved and possibly plan these lessons in advance, put together resources and say, these are the things we could use, these are the technologies we could use and this is how long we think this will take. I would love to I suppose if I was going to do it again, try to get more people in the department involved and we could share our experiences of how it worked the first time and what things we could avoid to make it flow a lot better. So yeah, I mean, I would be interested in doing things differently if I had a chance to the next time. I think that is just in the realms of working with the other teachers in the project at all of the stages of the lessons.

I: Is there any chance of these activities being integrated into the departmental work in the future?

M: Yeah, I definitely think we are thinking about putting them into the scheme of work. Obviously I have been putting things onto the shared area, so they are already there for people to use if they want. David has also mentioned the website in CPD with the department, so people know about that as well. I would not say that people would be eager to do the Fasmed lessons unless we were to do a session with them to take away any doubt or fear they might have. Because if David had said to me here is a website, go on and try out six of these lessons, I would have been very reluctant to be a part of it, because if I knew I was going to be part of a team, working together on it, that would have encouraged me more. So it is almost like you do not want to be on your own, doing something, you would rather be part of a team were you could be supported. For me the support has been a big part of it, encouraging me to go on with it.

Appendix C

Final interview with the case study teacher: Thomas

Q1: how did the students respond?

Answer: I think they enjoyed them on the whole because they get to do things a little differently than normal in class. I think in our school, usually if the kids get stuck the teachers help them immediately. So having to be set off on a task for you to independently work on things, and when they get stuck they could ask a friend to help or work in a pair or as a team before you come straight to the teacher. In my class I was just writing up the report from the last lesson we did and I commented that they were still very needy and dependant on the teacher, so instead of asking anyone else for help they would go straight to the teacher; because they are used to asking the teacher and getting an immediate response from them. I suppose this is something we need to change as a department and as a school, getting them to find other ways to get an answer to things without coming to see me. They have enjoyed the style of lessons but it has been a challenge for them as much as it has been challenge for me. The children haven't been given that immediate help, so they think 'what is my teacher here for?', if it is not to help me or give me the answer. So it has been challenging on both sides, to get the message across and for the kids to see that and respond to it and develop themselves throughout the six lessons that were taught.

Q2: so that challenges how they see you in your world in the classroom and how they see each other…

For me it is trying to be more a facilitator for the learner, rather than an actual teacher because we want to see how much knowledge they have and working from the basis of this. So it is how we can structure our lessons based on the kids' knowledge. So it is not so much about teaching the material, but letting them learn the material independently. I think it is just a mind-set, it is a low year group, year seven, so they have just come up from Primary school, and so they are still very dependent on the teacher. They have quite low ability as well so it is probably a problem they have to work independently and even to work quietly is quite a challenge for them. But it has been a really interesting journey for me and the last one we did, the pre assessment task, when I give it out normally after five minutes, someone is bored and looking around. But this time everyone worked on it solidly for fifteen to twenty minutes in complete quiet. I just said write down everything you can tell from this and put it in words, put down calculations. At the end they found that what they did is what they have to do in an assessment task. It is just for me to gauge their knowledge on it, it is not the case of I am going to take it in and mark it and so they are not afraid of writing anything that may be wrong down, they just write everything they know. So they are getting into the habit of that, this is something we are talking about as a department, trying to introduce a pre assessment task for each topic that we do. So we aren't starting on the complete basics if the class is already up to speed on that, so it is using our time wisely, means we can plan effectively as well.

Q3: So you think they are more used to the method that you use now?

Yeah definitely, they are more used to the lesson's structure. Initially it was we are going to be using the iPad's, it was more focussed on what they were going to get out of it, but now they know they might get to use them because I haven't had them out in every single lesson, so they know that you can do FASMED lessons without them. But when they are out, they are starting to become more

familiar and the novelty has worn off, now they know there is a use for them and they are not there to just be played with. So yeah they are getting into the mind-set of this is how things happen and maybe this is something we can develop into all of our lessons. This kind of structure, where they have to work independently to do things.

Q4: in terms of the use of the technology, you didn't have iPad's before, what kind of technology did you use?

We have extensive use of computer suites, I hadn't taken this class to the computer suite before, and so this would've been brand new to them as well. Although in some other lessons they may have used them, especially in ICT obviously. I hadn't used that with them, but within the department we also have a class set of netbooks, like mini laptops, however they are quite hit and miss and slow, so we don't tend to use them as much anymore. We do also have some interactive calculators, but again I hadn't used any of that with this class prior to the FASMED lessons. So although in school they have seen technology being used, so they understood the concept, but never got to have ago themselves before now. Technology wise, it was a big learning curve for the staff, we have been taking a lot of risks, this was to find out what works and what doesn't, bringing it in in the following years. So for us it was really good, we have been searching for things, maybe not based on everyone having an iPad, but a teacher iPad that can be passed around and interacted with. So it is about did the iPad's have an effect on the learning, could have it been done with just one or none at all. So it is about being critical about technology, and thinking has it really made that much of an impact, usually we think we'll just use it because it is there and that's all. But you have to think what the goal is, is it to help them learn, that was a big light bulb moment, milestone moments.

Q5: have there been moments where you think they have been added value to the lessons?

They have been moments where I have thought this would have been better if we didn't bring these in today, they have been defining moments to me. Because It feels like we have the Ipad's we may as well use them in every single FASMED lessons, we'll let the kids become familiar with them, and but there's times where it takes so long to get things working, that it takes out from the learning in the lesson, so that is a down side, that's why the FASMED lessons have gone from two planned lessons to four a week. We've had to really think of timing, if we put this into the scheme of work, we wouldn't be able to do this. We have moments when the IPADS have been great and I think back to last week's when I gave them a work sheet based on 3D shapes, I gave them the Ipad's and said right go and ask Google for the answers and I am not going to tell you anything. You are going to do this yourself, so they come and say 'sir I've got this. And some of them use it in a really clever way, so they have this sheet with a table of 3D shapes and they literally Google 'table of 3D shapes', and they just copy from that. But there are kids that individually put each shape in, so there are so many different ways you can do this. They are are ones that a more computer savvy I suppose, so they'll be able to find stuff a lot quicker. But it is about real life, if they don't know the answer to things they Google it straight away, if they're out and about. So why aren't we making more use of that in the classroom, and letting them learn things themselves. Thinking about using this with the year 10's, five or six of them, same sort of idea, having a worksheet, and they typed in the questions word for word into Google. And they were getting lots of different answers, and I was like how is this applicable to the worksheet, look at the title of things, this questions was quite a wide scope, and they were just writing down everything Google was telling them, they need to be able to pick the useful bits of information out. And this is what we'll be teaching them, how to get the useful bits. What is useful, Google tells you all sorts of things you don't need to know about, so I suppose they

are using them now in a more independent way, whereby before it was me sending them questions and expecting a response and now they go off and do their own thing with it, so they can lead their own learning. So it puts me in more of a facilitator role than a teaching role.

Q6: would you continue using Socrative, would you use it again over time?

No, we raved about it from the start, it is a quick way to get the whole class's feedback, get results immediately so you can compare them. There's so much discussion with the class because without them even knowing who gave the wrong answer or how many people said this and how many people said that, they can say why there are so many different answers to this if we are all looking at the same question. And that just sparks off discussion within the class, they think about well I think this answer but obviously someone else thinks differently, so why are we thinking along different lines? I think it is a really good way to record data as well from an administrator point of view, for teachers you have to do a lot of marking and recording things in your planner with the help of Socrative and other apps like that, it is downloaded for you, it is just there in excel. So it takes a lot of time that would have been used planning away, so it helps to be able to plan for next lesson based on that feedback. So I think the technology is just making it more efficient on the teacher side of things and there are other apps we have seen from using Socrative, which makes the lessons a lot more fun and interactive with the kids, competitive even. We are starting to move away from the likes of Socrative to those other apps, creating quizzes and end of topic revision sessions and you can see yourself getting through twenty or thirty questions with kids, when they would've struggled to answer ten on paper. Just because it is a timing thing, it puts a bit of pressure on them, because they are competing against their class mates. The competition element means all the class get really into it, it is a case of who is going to be on the leader board. So that has been an eye opener for us when we have said what is on the market here that we can be possibly using with this and we have signed up to many apps now and registered with them, because we thought we might as well try them, especially in this last couple of weeks. If it falls flat on its face it is fine and if it does work then it is something we have got for September.

Q7: so I guess that is all linked to the assessment part, being able to assess where the kids are at and that is something you said before you want to incorporate into future lessons.

Yeah I think we do do it, I know that I do, even without noticing sometimes, without knowing that I have just done an assessment. If you are being observed they say at the end 'that was a really good way of showing an assessment' and I'm like did I? I didn't realise I was doing it because it just comes naturally as a teacher. You just ask a few questions and get some feedback from the class. The technology makes it a lot more time efficient, I can just leave Socrative open on my computer screen, and say is there anything we need to go over from the first part of the lesson and the feedback says I can move on because they understand it now. So you learn to re-structure your lessons within the lesson time, instead of having to wait till the end and thinking what is the next lesson going to look like, and wasting the second half of the lesson when you could have been teaching. So with regards to formative assessment I think the technology is great on the teacher's end of things. We can adapt quicker and change things quicker. I suppose it can benefit the kids as well because you're moving them on at the pace that they're giving you feedback at and you can pick out the ones that maybe struggled more and put in more direction for them and differentiate the work for them and it'll make it a bit easier.

Q8: in terms of how things can be improved on the assessment or the technology side, are there particular things you want to look for as you move forwards.

The only thing that springs to mind really is that because we have tried so many apps we can see as teachers where apps can be improved, and where ideas can be combined to create an overall better app that incorporates everything. So we are thinking about let's get programming and make our own. But things like we've tried a website called Class Flow and it was very much hit and miss, it didn't always work the way you wanted it to, and when it did work it didn't work for all the kids. So it is sort of an app where you can slides to the kids, and they can annotate the slides and then send them back, so you can have this ongoing conversation. You can send the slides to all of them, but it was a case of it worked for some and not for others. So a lot of the lesson was taken up having to log off and log back on again and just sort of technical things that help the flow of the lesson. So it is things like that that we learnt from and moved on from, we find things that did the same sort of job, so it is a case of developing what works and what doesn't at the time. So that is the only thing I can think of regarding improving things. With regards to formative assessment, I think it is a case of the pre-task assessment was a big winner for us and we have talked extensively about how we are going to incorporate that into everyday life next year, given the kids this pre-task, them looking at it at the end of the week, so it helps to plan the next weeks lessons, based on what they have said and the knowledge they have already. So we can just skip out the bits that the kids already know and would have just zoned out on anyway, because they get bored very quickly. So that for us was a big light bulb moment as well I suppose, seeing that something so simple like putting a worksheet together can make you gain so much from it, to see where your class is at in that moment of time, so you are able to plan based on that. I think that is something that we will definitely be doing next year.

Q9: Have you used the FASMED stuff in non-FASMED lessons?

Yeah, I love the structure of it, and out of the 5 or 6 lessons we have done I definitely used all the resources because generally I would make a class set of laminates and we use them time and time again. The resources that I have made for the FASMED lessons, I have been able to use them with other year groups that haven't been taught any FASMED lessons. I think haven done it with my year 7 group, the group that I as chosen for, I have learnt so much from them and how to structure the lessons differently if I did them again. So knowing how the lessons are going to go and the questions that are going to come up, so I know how to address them quicker, it helps the flow of the lesson as well. The structure of the lessons is really nice, as in that they are individually working on things, then they pair up or go into groups and they are starting to build on their learning. And then they can look at each other and compare the different opinions they have between them. Then they can look at the example responses and see what other students have said, so if they get stuck it might help them and if they do have a solution they can compare and see which the best out of all of them is. So it really is about being critical of your work and saying 'yes I have been able to achieve this, but have I done it in the most efficient way, have I shown all the workings out; if someone was to come in and ask what this question was about, would I be able to tell them, and know exactly where I was going with it?' so it is really helping them to see what the end goal is, for them it is the exam; so do they have the clarity in the exam to show the examiner their full workings out. So it's really about have I shown them the structure and the all the points of how I have answered this question, and how I have reached the answer on my own. I think that is a really good skill for them to have and to build on and being able to work through that process. I suppose it is just a cycle of evaluating that and then coming back and changing it and evaluating it again. It is the same for us as teachers, we evaluate what we have done and how we can make it better next time. So it has definitely got us into a cycle of thinking that way.

Q10: and that is a useful process that you want to use across year groups? Along with the pre-task?

Yeah definitely, I think as secondary teachers we need to start off with the year 7's coming in and getting them used to doing this work and getting them in the mind set of being critical of your own work and going back. Even looking at what level they are working at, and the success criteria and for them to say what level I can actually work at, and setting them targets in order for them to reach the next level. So just wanting to be better than what they were before and building on their work. I suppose a sense of resilience as well, as kids go they just think once they have the answer they are done and they'll sign off on that. But you sort of think, well three of you have the right answer, but who got the answer in the best way? So we are building up a sense of looking at each other's work and comparing and contrasting the answers. The skills that they use they can use in lots of other subjects. When I was at school we had a lot of compare and contrast in English and Geography, and Maths was very much like if you got the right answer it doesn't matter how you got there and there was no sort of pride in the actual process. So as a maths teacher I think it is something we need to change and develop and that could lead to other subjects.

Q11: what would you say is the most beneficial aspect to the project?

For me personally working with the team in our maths department, the four teachers that we have and working together on the FASMED, and the development we have had together. We did a CPD presentation last week to the rest of the department and shared what we have done with FASMED and the different things we have discovered. Whether it was the apps, websites or the technology and just the excitement that that caused within the department. And they were saying they were going to try some of it out, and I was saying make these two weeks important because it is not just a walk in the park and to give them easy tasks to do and it is to take risks. And as I say they won't remember when they come back in September and they will probably have new teachers anyway, so I doesn't matter how it looks at the end of the day. It is about how we can incorporate this into your everyday practice, to make it really efficient so it flows really well. Also, for teachers, time is precious and whenever you finish all your lessons at the end of the day you have a pile of marking to do and you're planning for the next day as well, if you can have that all done online or on excel spreadsheet, it reduces the extra admin you have to do. It means you can focus on getting the next lesson up to scratch and how you want it to be. I think the kids just love the number of ideas that are being introduced, and it is not just get a pen and we're going to work through this book, there are lots of different aspects to the lesson. It is sort of like they don't know what is going to happen next and it spikes interest and intrigue when you introduce something new into the lesson, it could be the Ipad's or me scanning barcodes on my phone or something like that and all the answers come up on the screen. So it is a bit like 'what is he going to do next type of thing', the feeling in the Maths department is that we want to all be using this and to all make the most of what we have got. The reason why I love this school and the department so much is that no one holds back, everyone is like I just did this and we email round and share things. It isn't a competitive nature between the teachers, no one has something good and is going to keep it just for their own classes, everyone shares their practice and it is for the benefit of the whole school and all the kids. The highlight for me has just been working with my colleagues in developing this and the feedback sessions when you guys come in and talking that through. We have little chats in the hallways and the staff rooms about what we have done and what has gone well. But actually thinking well what were the processes you went through in the classroom and did you have the same struggles as me. And at the end of that we feel secure and safe, but with some teachers it's harder because you think that they will be critical and like you are being observed so you don't want to do something wrong. But the fact that we are all making mistakes that we can all learn from and then we would give a heads up to the rest of the department saying I tried this, it didn't work out, and you may want to try something slightly different?

Q12: so you have all been quite experimental haven't you?

Yeah we definitely, the four of us take a lot of risks, generally we wouldn't because we like to play it safe sometimes us teachers.

Q13: what would you identify as difficult in the project, or what would you do differently if you were to repeat the whole project again?

I think it has been difficult for me to get myself on top of things such as doing the report after the lessons and stuff like that. The extra work that is there, I love doing the lessons and I love saying the feedback from the kids, but whenever you have to try and recall what happened in the lesson, it makes it easier if you have used recorder, you can review the lesson again and see exactly what you have done. But, it is trying to recall every single moment, and what the kids say, and putting their individual quotes in. So, this would be the hardest thing for me, also having to find the time to do all of this at the end of the day, when you have 5 or 6 lessons to prepare for tomorrow. I don't know if that could be developed or improved into a format that is computerised or a format that is like questionnaires, so it is easier for teachers to go through and tick a box or rate something. I was speaking to another teacher and I find that I'm usually just writing a transcript of the lesson, literally what happened, a flow by flow sort of thing and I am not sticking to the head line or paragraphs. So I always feel as if I'm just telling you what happened in the lesson, rather than rating it and giving you any useful information. Again that's for you to decide what is useful, but that for me is the most difficult part of it. One of the other things in regards to the kids in the classroom is that it is hard to get the kids into the mind-set of these different types of lessons because they are structured in such a certain way, and they are used to doing things a different way. So to get them out of that and into a different form of a lesson can be a challenge, behaviour wise, especially the class I was working with, there was a lot of issues like 'I don't want to sit next to him' and 'I don't want to work with her' and I suppose it is that sort of immaturity level that is coming through from the year sevens because they still have their friendship groups and people they don't necessarily want to associate with. So it is struggling between being firm with them and telling them 'right, so this is who you are working with' and setting up the groups of who is working together compared to letting them pick their own groups and who they want to work with. So it is a development of rotation around the classroom and everyone working together using team work. So that has been a struggle with this class, but I don't think the struggle is solely with this class. Even with my top set year 9's, when I put them in pairs there is always some sort of disagreement that they want to work with their friends. They wouldn't put up that much resistance as the year 7's would, but they do under the breath comments that you would have to contend with. Across the board I think it is all kids want to choose who they work with. Sometimes what we do for the pre-assessment task is we pair up those that one answered that well and the other didn't, so there is a bit of dialogue between them and we want that one that is stronger and more able to help the peer assessment. And help the one that is weaker and you try and do this as much as possible, but sometimes it is just impossible when it comes to relationships. So that is a dynamic we have had to struggle with throughout the project.

Q14: how has the professional learning been useful?

Well I think we didn't do as much planning together as we would have liked to, most of the time the planning was just picking what the next topic was going to be and then we went off and did our own thing with it. So in hindsight if we had to do it all over again, we'd probably ask for some more free time to have a couple of hours to sit and plan and get our resources, so we could try and teach it as

much like each other as possible. And to see what obstacles you came up against and be able to develop from there as well. I love the review meetings and hearing other people's experience of what works in the profession and what hasn't. But, if we were able to put that back into a cycle for the next time, I think that would make things a lot more concrete and how things should go. And being able to do the planning part of that would be to a great benefit I suppose. Overall, I would like to have more time to meet up with teachers from different schools as well, I think because I love so much working with the other teachers, I would like to see how other schools do things differently and what access they have to different technologies and what they using. At George Stephenson, some of the teachers were talking about using Google Drive, we have access to that and we use for our emails and documents. But, we don't use it as much as we could with the kids. So getting the kids involved in that and seeing how you would do that would really aid us. I suppose having that larger community of teachers with different skills working in collaboration as well.

Q14: so you would like more time to see other teachers, would you want to see them in their classrooms?

Yeah I would like that as well, it comes down to time at the end of the day, being able to get time off from your own school and then the time to go in observe another school. But being able to go and observe a lesson before you did it and vice versa, so they would come and see my lesson before they did it, so we could learn from other people's mistakes so you don't make them yourselves. I suppose that is what the whole write up is and telling the CPD what our dos and don'ts were. It is because you want people to do these lessons more effectively and without all these bumps along the road. So definitely observing other schools and seeing how their kids deal with it and even comparing the ability levels of the kids would be really useful.

Q15: So you have shared the FASMED process with the rest of your department, has it been a gradual process, have you done the CPD thing or has it been mainly at the end?

I think at the start it felt like it was just the four of us doing FASMED and people didn't really know much about it because they hadn't volunteered to take part and they had just avoided it. As the time went on we had our lessons and reviewed them, we talked about it more at the lunch table in front of the other teachers and then people got a lot more inquisitive about what FASMED was and what we were using the Ipad's for and stuff like that. And they started asking questions, so there was a lot more of a scope for conversation about it. Jonathon who was there at our last meeting, he asked if he could come in and observe the lessons as we did them, because he is very much into using technology in the classroom and how that improves learning. So he wanted to come along and see what other schools were doing, especially the likes of George Stephenson and their feedback from it and to find out a bit more about the programme in general. So even like this morning before you guys came in, we were talking about what would be the next thing we introduce into the department and whether it would be Ipad's or Chrome books or what line we'll go down. He is always on the mind-set if you are going to invest a certain amount of money on technology then you should invest the same amount on the training of the staff because a lot of the time you just get given things and say right go and have a play and see what you can do with them. But I think it is confidence as well with teachers, they don't want to stand at the front of the classroom and look a fool in front of the kids who are very technology savvy, and more so than us sometimes. So you want to know if something goes wrong you can fix it quickly and it is not going to eat into the time of your lesson. I think it has been a great experience for us and the rest of the department over time has taken more of an interest towards it, especially when it came to last week when we did the CPD, they realised that the combination of all of these lessons had led to us having these brand new resources to use in any lesson and not just with the FASMED structure. But, the fact that we are

trying to put certain lessons into the scheme of work as well, people are going to get the chance to teach these FASMED lessons and the pressure of having to do review meetings afterwards and incorporate them into their everyday teaching and see how they go. It means we can review them as a department and see if we can improve resources or the structure of the lessons, to make them better.

Q16: do you know which lessons…

The distance time graph is definitely going to go in there, which is one we have been talking about from the start. Possibly the journey to school, splitting things into a ratio and also thinking about security camera's as well.

Q17: George Stephenson chose distance time graphs and security cameras as what they are going to incorporate into next years, it is interesting to see which one's schools are choosing…

There are ones I think that are just a bit more inchoative for the kids and there are certain ways that we go about teaching distance time graphs (George Stephenson is probably the same) and it is not like FASMED was at all because it was very much like: here is your matching task, do it and we will talk about your results afterwards and we will talk about what they mean in the context of the learning. But we would be going along the lines of: talking about what the lines mean on the graph and build a story from that rather than letting them guess, trial and improvement sort of thing. That was the one I actually gave my year 10's, I gave them questions on distance time graphs and said Google what horizontal lines mean and they would just Google 'what is a horizontal line' and obviously they got loads of answers about that, but it wasn't in the context of a distance time graph, so it didn't tell them anything that I wanted them to gain from it. So those are ones we have always said are great ways of introducing topics because it gets the kids engaged straight away, there are different stories and they have to match them up. With the security cameras question, the room that it sets out, Richard and I were talking about well let us take the security camera element out of it because there is loads of things you can talk about in this. If it was the setup of a bedroom, where would you put all the furniture and there are loads of different things you could do. You could even give the kids this blank canvas and say well what questions could they give you on this and they can start to make up their own questions. So it is getting them to think as well what could I be potentially asked about this and coming up with the more difficult questions and maybe in partners as well, and it is challenging for them as well I think because they have to think along the lines of the teacher or the examiner.

Q18: you have already talked about the benefits of the interaction with teachers outside of school, would you like to add anything to that?

With regards to working with other schools and the staff in other schools, different schools have different approaches through their teaching. The first cluster meeting I attended at George Stephenson, it was interesting to hear what the schools normal approach is to teaching lessons and how the FASMED has changed that for them and even what their assessment methods are. So it was very much things you could gain and bring back to your own department and then discuss because it wouldn't necessarily suit us to do the same things as George Stephenson's, but there are definitely elements that we can learn from and say well there seems to be a good idea there, it seems effective so why don't we try it. The main thing that I have taken from this is that we need to try things, you can't just assume that they are not going to work or that they will work. You have to take the risk initially and see if it pays off for you. Otherwise I think you'd just get stuck in a rut of teaching the same ways and hoping that the results will improve or stay the same or whatever. But, I

think to see as a technology develops, we should be introducing it into the class if we can and to see has it actually been beneficial for the kids to use or is it a tool that is just making us more efficient with our time management. So I think with regards to the other schools, it is just seeing the different structures and policies they have in place on overall basis and not just with FASMED, it is useful for us to see.

Q19: has there been any discussion outside the department on the project, which the senior leadership team?

With regards to us looking at apps and technology in general, Richard and I have been talking about it pastorally, as we both have form classes. There are apps now where you can rate the kids and give them points and merits, you can assign the students to their own little cartoon character and the kids can go online and see what points they have been given from different teachers and then points can unlock features, where they can change the hair colour and eye colour on their character. So we were looking at that as a way to connect with the kids and to keep them engaged and improve on behaviour in tasks and helping each other. But this app also connects with the parents, so they can download the app and see the progress of their kids on a day to day basis or at the end of the week. You can also communicate directly with the parents, almost like a text message but via the app, so it is all very secure. Within our school we wouldn't usually be allowed direct contact with the parents, it is a pastoral thing so the head of year or senior management would usually do that. So there is a discussion there whether the app can be used as a direct link with parents, so this is something that has gone beyond the department policy to a whole school policy and whether it can be implemented. It is just one app that we have come across that we would find useful, there are loads of apps that we could find useful, that we would want to use with the classes. But it is a case of can it get passed the higher members of staff. Just things that would make our lives a lot easier, something that can show the parents what their kids are getting points and merits for and what the bad feedback is from, so it can be talked about in a real time basis, so the kids can know that their parents are finding out these sorts of things, instead of reports coming round every term, when it is too late and not a lot can be done. But, I think the managements in schools aren't as forward thinking as the individual class teachers or clusters of teachers. They think well this could be great and I almost think that we get left behind because we are afraid to take risks, in case something goes wrong, but there could be so much benefit from it, even if there are a few incidents where things go wrong. The benefits would out way the negatives side of things, that is me thinking on an individual teacher basis, I suppose I have the skills to see how this policy is going to work and there is 1700 kids here, so knowing how it is going to work on that scale. We have to work within our limits as well and within the confinements of the school, to adhere to that. So we put it out there and say this is what we have seen and this is the research we have done on it and this is how it has worked, so we just put it out there and hope for the best and get the feedback from it.

Q20: so do you feel happy about having to pass things up to senior management, where it is out of your control I guess, do you feel they are open to new ideas?

I don't know how open they are to them, it would be a guess if I was to say. But I feel I should be comfortable enough to say this is what we have been doing in class and this is what we have come across, what are your thoughts. But at the end of the day the worst they can come back and say is no, but at least they know that I am thinking outside of the box and they know I am a bit innovative and I am not just a bog standard teacher sitting in my classroom doing what everyone else does. So you almost want to be seen putting forward ideas, even if those ideas are shot down every time; there might become a point where I have asked so many times that they will just let me do something. Because I always come back with ideas, and I am always persistent, it is going to benefit

the kids and it is going to make our lives easier, freeing us up to do more productive things, then why not make use of them. I don't see why the parents wouldn't want to be informed.

Q21: it has the potential to revolutionaries the parent child relationship hasn't it? In secondary school the parents can feel quite out of touch of what is happening with their child at school.

Yeah, in primary school the parents came to pick up their kids and the teachers would have a chat with the parents about what had gone on that day. Whereas with secondary you have to wait till parents evening where they get told all this stuff about their kid they had never thought about the kid or some really good stuff that they wish they had known. But if that was on a more real time basis where they are getting that feedback updated and then they can be something about it. There is no point if someone gets a negative referral in November and then the parents don't know about it until February, there would no point in putting in a punishment then because it has gone on so long. I think there is a good and bad thing to this, so that isn't for me to decide obviously.

Q22: how beneficial has the support been from the university?

I knew from the outset, because I had come into this later than the other teachers, I knew from speaking to you face to face and getting the emails, so If there was any issues I knew I could I always email straight away. I knew there was always a structure there, I could always talk to you at the next meeting, so I knew there was support there. I don't think it came to the point where I needed support from outside the department because within it there is a lot of support between us four teachers. I think that is a good benefit of it, having so many invested in it. So we weren't on our own, if I had have been on my own I would have been in contact a lot more, but because there was people in the same boat, it never got to the point where we felt we needed to seek support from elsewhere. So I think we always knew that the support was there, we just never felt we needed to make use of it.

Q23: in terms of us coming in for the reviews and occasionally having the listening's. Do you feel that it helps the structure and without it things would fall off the agenda a bit, would it have helped if you didn't know we were coming in or do you think you would've been motivated anyway to meet?

I think definitely gave us goals to adhere to, so we knew you were coming in, so we would have a discussion about what we had done and put our resources together to discuss what we were going to say and thinking about what feedback we were going to give. I think it gave us things to aspire to or a timeline on how things were going to go. Especially when it came to the cluster meetings because you are there with teachers who are doing the same things. So if you go and you actually haven't done the lessons, and you're trying to make things up on the spot, they are going to see it straight away. So you can't do that, you have to do the lessons you say you are going to do, because it can be so easy for us to say well there are tests coming up for us at the end of the term, so we are going to put this FASMED thing on the back for a bit, so you get into the habit of saying that and forgetting about it, so nothing ever gets done. It gets to a point where you have so much to catch up on that it is impossible. So I think having those dates put in the diary throughout the year helps us to keep up to speed with it. Especially when you come in and ask what have you got planned for your next three lessons or the next lesson and it makes us really think have we actually sat down and spoke about that and we looked at which ones would be good. So it gives us a bit of a push, I would say we are motivated in ourselves to get the lessons done because we have seen the benefit of them and it just gives us a timeline to base it on. So we get our diary out and see we have a review meeting, so we get prepared for that, and obviously everyone's lessons are at different times during

the week. So it didn't really structure things a lot better I suppose, at the start of the year were saying yeah and at the end of the year we are saying yeah. So it was a lot more sporadic.

Q24: was there any other forms of support that you would've found useful?

Someone from George Stephenson set up some sort of online forum, but my experience of them is people sign up to them but never use them. So I prefer just arranging the time for people to meet face to face and getting feedback because I almost don't know how a forum would work. I know that I have signed up to several and have never used them, people just put their ideas in, which could just be fed back to in a meeting. I know it can be hard to find the time for people and to all meet in the same place and even getting the location for it. But I think they are much more valuable than putting things online. But with regards to other support I don't know that there is a better way than to just meet and have a chat about things and then being able to go back and forth between one another, and to ask questions because it sparks ideas into conversations actually, and it sparks ideas in others heads. There was other times where we had review meetings about certain lessons and maybe Richard had started one that I hadn't yet started and he said something about putting the kids names into the example and letting them be part of the problem. Then I got me thinking what if we got the kids to actually act it out and then I planned that for my next lesson, so that idea wouldn't have come across if it had just been posted in a forum or it had been read in an email. So there is definitely something to be said about a conversation, a literal conversation going on in a group or even between two teachers. There has been times where Richard and I have just been talking about different FASMED things and we have come up with different things to feed in that has been beneficial.

Q25: would it have been beneficial if we had created more opportunities for the schools to meet?

Yeah because we are very tight nit within our department and for us to branch out and meet other people is like a new thing. So it is nice to see new faces and get a fresh approach on things, as I said it would be beneficial but I know they are hard to do because of the amount of people involved. But definitely I think more so at the start they get people introduced to each other and then having one at the end is nice as a recap. But they are not as beneficial as the ones during the process because you can still have time to change things and develop things. So definitely those ones are more beneficial, I suppose it is just getting the introduced at the right time, regards to the schools CPD, everyone has their schedules.

Q26: Is there anything you would like to add?

Well I have genuinely enjoyed my FASMED and for me to be able to put that down on my teaching profile and to say that I have been part of a project like this because I know the initial questionnaire was for a case study teacher and I said I hadn't really been involved in any of the projects especially to do with technology. I went to a conference four years ago in London to look at test instruments like interactive calculators and they weren't so much in the UK but America based. So I think they have just pulled out of the market over here. So it is good to be involved in a project that sees the development and not just technology for the kids but for the teachers and it is good for me to say that I have been a part of that. I have really thoroughly enjoyed it, it has challenged me I suppose as a teacher and what my role is in the classroom, to be more of a facilitator sometimes and let the kids come to their own conclusions and make their own findings and things because a lot of time they will do that in the real Lesson: Selling Soup

Appendix D: lesson observations

CONTEXT

School	Academy A			Observer	David Wright	
Class	Year and set	Year 7		Teacher	MARK	
Date & time	Date	22/06/15	Start	11:20	End	12:20
Student numbers	Present	20	Male	8	Female	12
Room layout	Students all seated in pairs at desks.					

LESSON STRUCTURE: selling soup

Time	Activity	T	FA
11:20	The lesson was recorded using the IRIS system. Students have completed a pre-assessment task and Mark has reviewed their responses and provided feedback drawing on the range of responses provided in the support materials. He has also created Socrative polls based the supplied assessment questions and 'Plickers' questions on the factual content of the pre-assessment tasks. (https://plickers.com/) Information sheets distributed on desks prior to students' entry.	T2 T3	TMG
11:22	T Directs students' attention to IWB – 'What we did in the last lesson and this is a continuation of the problem' also notes that the information is on the sheet on their desks. 	T1	
11:24	Students arrive late – 30 seconds to settle down. Reiterates the information on the board and sheet. Announces that he has read through responses from pre-assessment task and that he was impressed with their work but		TMG

	there were further issues which they might need to consider – principally the need to avoid waste and to maximise profit. He says they have 5 minutes to consider the problem again individually and read through his feedback before being assigned to a pair to work together on the problem.		
11:27	Works with two students who were absent for the previous lesson Distributes exercise books with 'Plickers' codes pasted onto the back page. Instructs pupils to think carefully about responses so that others can understand and that rewards are available for constructive responses. Then circulates responding to individual questions.		TMG SPG
11:32	Announces a poll – uses mobile phone combined with IWB to display question to capture Plickers codes in response to multichoice questions. The system takes 2 – 3 minutes to set up and capture responses. Results are displayed and Mark announces that most students chose the correct response.  Second question displayed – responses captured – Mark announces that the majority chose the correct response. Questions one or two pupils about why and how they chose their response. Poses further question and collects response. Again announces that the majority response was correct. Checked, by asking students, how they had decided on their response.	T3	TWC

			
11:42	Explains how he wants students to work together to provide a collaborative response to the problem. Distributes two blank sheets so that students can record their responses – he explains, by giving an example, how that might be done. – Organises pairs.		TWC
12:10	Students work in pairs on problem. Mark distributes ipads – one to each pair. 		SPG TMG STG
12:15	Stops pairs working and starts Socrative poll – takes about 3 mins for students to login – students respond to questions, but no feedback is given.	T2	TWC
12:20	Bell rings for end of lesson.		

TWC = Whole class intervention and questioning
SPG = Student interaction with peers during group work
TMG = Monitoring and assisting individual students
STG = Student interaction with teacher during group work
TSW = Using sample student work

USES OF TECHNOLOGY

Code	iPad/laptop/IWB	Software	Activity	Link to formative assessment
T1	IWB		Display	Diagnostic questions
T2	iPad and IWB	Socrative	Students work on tasks and record answers.	Some collaboration between peers.
T3	Plickers codes and IWB	Plickers	Response to quiz	Possibility of highlighting and discussing misconceptions

REFLECTION

In the first part of the lesson students have the opportunity to reflect on their initial responses to the pre-assessment task and to the teacher's feedback at first individually and then in pairs. There was no whole class discussion about possible misconceptions or the opportunity to see other students' responses apart from the work done in pairs.
The initial quiz, taken from the suggestions on the lesson plan, using Plickers, generated some interest and provided a way for the whole class to check their responses – on the level of factual correctness of data. The Plickers application (once the system was initiated) provided an efficient way to collect student responses, albeit limited to a multi-choice quiz, without having to distribute any technology beyond the codes pasted into the exercise books. The teacher questioned the students on the method they had used to obtain their information so that this was generally available for other students to access – no comment from the teacher to these responses.
The major part of the lesson was then spent on students working in pairs on constructing their responses, however, there was no opportunity for the whole class to share responses or examples of work.
The teacher spent the majority of his time circulating and talking to individuals or pairs about their work. He appeared to be mainly responding to questions rather than initiating questioning.
The Socrative quiz, conducted in the final few minutes of the lesson, provided data which could be used in subsequent lessons about to identify possible misconceptions etc. but there was no time to do anything with it in this lesson.
Analysis of the Socrative data showed that few students managed to respond effectively to this quiz. However, the quiz was repeated in the following lesson and obtained a fuller response.
The teacher informed me that the following lesson was used to share work and responses to the task.

world anyway with the technology that is available to them. Sometimes they think they know everything because they are connected to the internet.

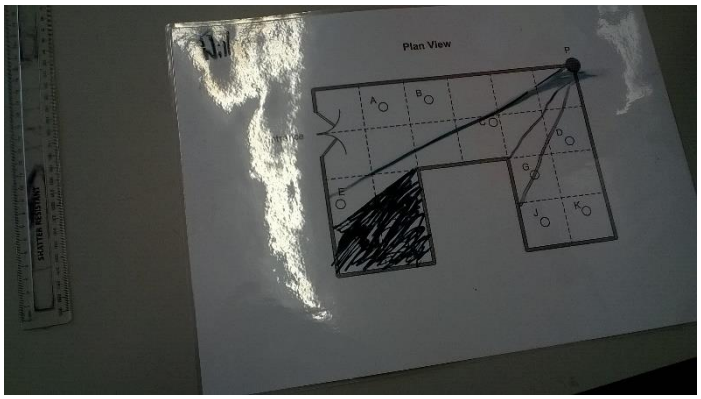
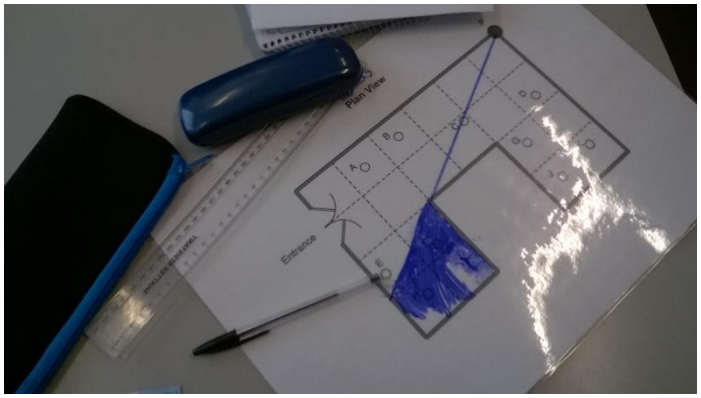
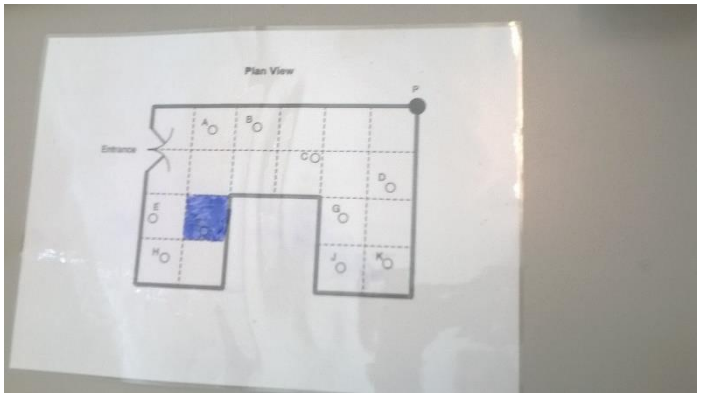
Lesson: Security cameras

CONTEXT

School	Academy A			Observer	David Wright	
Class	Year and set	Year 7		Teacher	MARK	
Date & time	Date	2/3/15	Start	14:20	End	15:20
Student numbers	Present	20	Male	8	Female	12
Room layout	Students grouped in fours (unusually)					

LESSON STRUCTURE

Time	Activity	T	FA
	The initial assessment activity was handed out – to be completed individually. Students were reassured that this was not a test, but 'to find out what you know'. Ipads were distributed to the class while they worked on the task.		TMG
	When tasks completed they were collected and students were then asked to complete a Socrative quiz on percentages. While students worked on the quiz the teacher scanned the initial assessment task and handed it back to the students with key questions (derived from the support materials) highlighted on another sheet. Some students found it difficult to understand what the diagram represented, others what 'line of sight' might mean, some found it difficult to understand how a square on the diagram might represent a percentage.	T! T2	TMG SPG

	A3 laminated sheets were distributed so that students could draft responses in pairs or larger groups and hold them up to show the class.    		TSW SPG
	Ipads were used so that students could take pictures of their work and share them with the class via the IWB projector using 'Airplay'. This provided a useful way of developing a more general understanding of the problem and its solution.	T3	TWC TSW

TWC = Whole class intervention and questioning
SPG = Student interaction with peers during group work
TMG = Monitoring and assisting individual students
STG = Student interaction with teacher during group work
TSW = Using sample student work

USES OF TECHNOLOGY

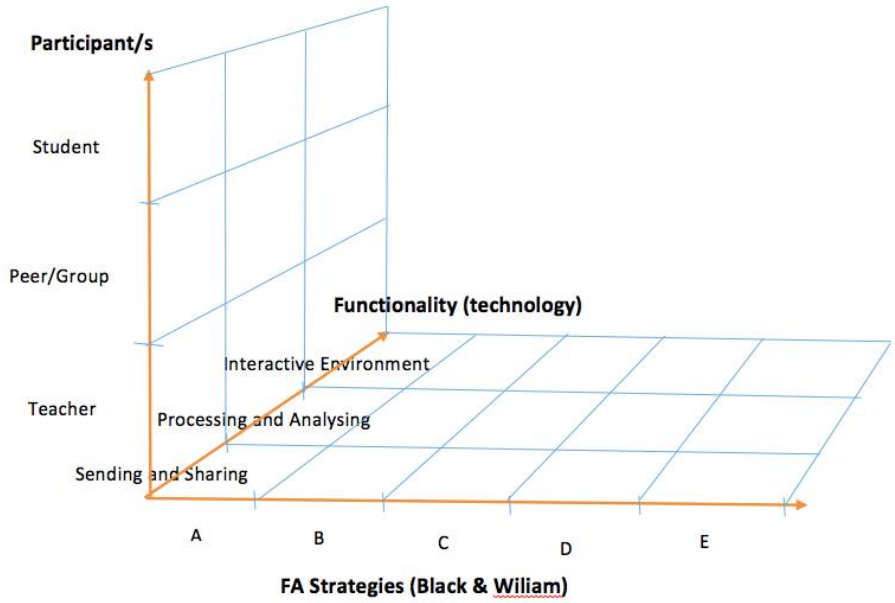
Code	iPad/laptop/IWB	Software	Activity	Link to formative assessment
T1	IWB		Display	Diagnostic questions
T2	iPad and IWB	Socrative	Students work on tasks and record answers.	Some collaboration between peers.
T3	iPad and IWB	Airplay	Display students' work	Students share responses with each other and class

REFLECTION

This class demonstrated some of the issues which need to be addressed if a pre-assessment task is used in the course of a lesson: How can the teacher find time to effectively assess and respond to the students' work while managing a class? (Answer – with difficulty and at the expense of accurate assessment of students responses).
The use of large laminated sheets provided a useful low tech addition to the use of iPads to display student work, although the displaying of photographs of students on the interactive whiteboard also had advantages (larger display – easier to see and access).
The use of photographs also had the advantage of capturing the stages of work so that the process of resolution of a problem could be captured and reviewed.

Appendix E: Frameworks

FaSMEd Framework



The FaSMEd Framework represents categories in three different dimensions:

- the participant responsible for the formative assessment
- the strategies of formative assessment
- the function of technology within the formative assessment.

Participants

This dimension describes the party responsible for the formative assessment:

- teacher
- peer/group
- student.

Formative assessment strategies

This dimension represents the five strategies as described by Thompson & Wiliam (2007) to conceptualize formative assessment:

- A. Clarifying, sharing, and understanding learning intentions and criteria for success
- B. Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding
- C. Providing feedback that moves learners forward

- D. Activating students as instructional resources for one another
- E. Activating students as the owners of their own learning.

Functionality of Technology

This dimension is structured into three categories based the function that the technology performs in the formative assessment:

- Sending & Displaying
- Processing & Analysing
- Providing an interactive environment.

Thompson and Wiliam framework (2007)

	Where the learner is going	**Where the learner is right now**	**How to get there**
Teacher	A. Clarifying learning intentions and criteria for success	B. Engineering effective class-room discussions and other learning tasks that elicit evidence of student understanding	C. Providing feedback that moves learners forward
Peer	Understanding and sharing learning intentions and criteria for success	D. Activating students as instructional resources for one another	
Learner	Understanding and sharing learning intentions and criteria for success	E. Activating students as the owners of their own learning	

Appendix F: student interviews

Student 1

Q1: you said you strongly agree that maths is useful in everyday life, why?

Because I use it pretty much every day and if I have any left over money from lunch then I will go to the shop and buy something. And sometimes in the morning on the weekends I will go and get some milk for my parents.

Q2: what is the maths you use there then?

Adding up change.

Q3: so do you work that out before you buy the stuff?

Yeah, before I even get to the counter.

Q4: do they ever get it wrong, and give you the wrong change?

Yeah, they did once, but I got the right change in the end.

Q5: why do you like exams?

Because it is really quiet, I think they are quite exciting, they are better than doing just work because it is really loud.

Q6: the exams help you to work more, is it important to you?

Yeah.

Q7: how do you feel if you get a slightly lower mark?

It would make me kind of sad for the day, but then I will be more determined to do better in the next test and work harder.

Q8: are your friends like that?

I don't really know, we don't really talk about maths at all, but my friend is in top set.

Q9: what do you like about exploring and experimenting?

I like practical lessons more, because they are more realistic and it actually helps you.

Q10: do you like using technology in the maths lessons?

Yeah, sometimes, it depends, because sometimes it distracts you from what you are doing when using the Ipad's or something when doing the security cameras or something.

Q11: you think maths is relevant in your future life?

Yeah, because I don't really know what I want to do but something to do with computers and science or something else to do with maths. Especially with ICT because I like that.

Q12: you like programming?

Yeah.

Q13: how old are you?

12.

Q14: how are the FASMED lessons different to your normal lessons?

The FASMED ones are more realistic and practical and they require more thought.

Q15: you have to think more?

Yeah, more practically, if someone gives you a question, there is one about this girl and she tried to get all her friends to go to school and we had to budget for the mother towards paying for the school. So her daughter was being taken to school in the car and she might not have to be paying for her because she is sharing a lift.

Q16: what would your normal maths lessons be like?

Most of the time its percentages.

Q17: what are the teachers like in your lessons?

They don't behave that different between the FASMED lessons and a normal maths lesson.

Q18: do they you a bit more to it in your FASMED lesson?

No, it is about the same.

Q19: how is the use of technology different between the FASMED and a normal lesson?

They are a bit different, because I have seen some people get quite distracted.

Q20: they get more distracted in a FASMED lesson?

Yeah probably.

Q21: is it because you don't normally use Ipad's in your lessons or is it because of the way you have to work with people when using them?

I think it is maybe because we work more in groups, but I think if we worked with Ipad's alone or in pairs then it would be less distracting, for most people.

Q22: do you have one each?

No, there is one between two, because there isn't enough.

Q23: what kind of things are people doing when they get distracted?

They go onto the cameras and take pictures of each other, which is a bit weird and sometimes they go on the internet, I have never seen anyone do it but I have heard of it.

Q24: do the people that get distracted go back to doing maths?

When they are told off they do come back to the maths.

Q25: do you like working by yourself and then going off in groups?

Yeah, because other people help you to understand it more, you kind of observe them and see what they are doing.

Q26: what would you normally be given in a FASMED lesson?

Well, it depends because sometimes we are given this sheet, the other week we got one with a girl with soup and we have had another one with a girl and her mum taking her to school. We just get it and have to read it and work through it ourselves and then we analyse it with the teacher, we kind of do it till we get it right.

Q27: when you go into groups does the teacher decide who is in which group or do you?

The teacher puts us on tables and puts us into specific groups.

Q28: do you know why each person is put into that group?

Yeah, I think it is because they put the more intelligent people with the not so smart people to help them. But sometimes it is just the same groups and grades together.

Q29: were you told that?

No I just kind of worked it out.

Q30: do you talk more to your friends in a FASMED lesson or a normal lesson?

If you go with your friends then you learn more in a way because you are comfortable with them and you get along with them better.

Q31: is it harder when you are with people you don't know then?

No, not really, it just isn't as comfortable.

Q32: you aren't strangers with any of them though?

No, I'm pretty much friends with all of them.

Q33: do the teachers just wander around and go and help you a bit?

Yeah, that's what they do, and if I am doing something wrong then they will come and help me or gives us a hint, like rhetorical questions. Like the teacher would ask: 'is that actually right'?

Q34: is that the same as a normal lesson?

A bit different.

Q35: how is it different, do they wander around or stand at the front more?

They stand at the front more and they we would usually put our hands up and we get more help, but in the FASMED he just wanders around and if he happens to stumble across you do something wrong then.

Q36: what has been difficult about the lessons?

Em, we had one that was three weeks long, even though pretty much everyone knew what to do and knew the answer. But I guess it is to help others that aren't so confident.

Q37: so was that quite boring then?

Yeah, kind of. But I still had to do it.

Q38: do you think if it gets boring people trail off a bit?

Yeah.

Q39: do you like a balance between work and technology?

Yeah, not too much technology, because people just tend to get too involved with it and laze off.

Q40: too distracting for some?

Yeah.

Q41: how have they helped your maths?

We usually do a subject before the things, so we know a lot more about it. We do the maths topic to get more comfortable with it.

Q42: so before the FASMED?

Yeah, and then we get more of it afterwards.

Q43: the FASMED has given you more practical skills?

They tell us when to use it and how and it also gets you more comfortable with the subject.

Q44: would you like to do more of these types of lessons in the future?

Em, more but not too much, we still need to focus on normal lessons, to do well in tests. We need a balance because we do kind of need it in a University kind of way and we need to see how everyone works.

Q45: it is important because?

It's important because the university kind of need the information and we also need it to get to grips with the subject. But we have to have it in moderation because some people get distracted and also we need to focus on normal lessons, because we take in a lot of information.

Q46: have you discussed FASMED with other students or teachers in school?

Yes.

Q47: teachers or students?

Mostly students.

Q48: and what do you say to them?

I ask them if they had the same lessons as me and they say yes.

Q49: have most of the year 7's had the lessons?

Yeah, I think most have.

Q50: have you spoken about it at home?

Yeah, I have mentioned it, mainly my mum and dad, if they ask me what I have been doing at school, instead of saying 'nothing', I say we did FASMED in maths. And they asked me what it was and I would tell them.

Q51: when they ask you what it is, what do you tell them?

I say it's a university project and I tell them they are getting information about what we are doing in maths and what we have been up to, like what kind of equations we do., like the soup one.

Q52: they say it is quite different to how they used to work?

Yeah, because my dad used to work at this school and I came home with some homework and he was like: 'what is this?'

Q53: was it a lot harder than he was expecting?

Yeah, he thought it was just like what he had, but it wasn't.

Student 2

Q1: do you think the teacher is important in maths?

Yeah, it is much easier to ask the teachers about things, instead of reading it off one of the Ipads or something.

Q2: you said maths is something everyone can learn?

Yeah, it doesn't really matter because you can always learn something by practicing it. It easier to do if there is a teacher around.

Q3: you like doing the exams?

Yeah, because it would be a lot harder to understand if you didn't know what levels you were at. It easier if you want to get results. You can set targets that show what you need to work on.

Q4: do you enjoy group work?

Yeah because it is better if you work with people you get along with than people you don't get along with because then you will learn less.

Q5: do you think you learn more when you are in a group than when you are alone?

Yeah because you can discuss your ideas, so it isn't just your opinion in your head, you get to discuss it with all the other people in your group.

Q6: do you think the technology helps as well?

Yeah, it helps as well because you get to go on apps that look at things in different ways. It is unique to what we normally do, so it is a change.

Q7: so it helps with your learning as well?

Yeah.

Q8: so you think maths is a tool for other things?

Yeah because when we leave school to do something else it can help you to get jobs.

Q9: so you like using the technology?

Yeah because it is different to what we would normally do.

Q10: is it a combination of using the technology and having a teacher?

Yeah, it is better to have both because there is more variation.

Q11: sometimes it takes longer with the technology?

Yeah, because it takes longer when everyone is trying to get on an app and we might have problems with it. So it is sometimes easier if the teacher just tells us what to do because it takes a long time to set up usually.

Q12: on the whole you think it helps with your learning?

Yeah.

Q13: so you use a lot of technology in your maths lessons?

Yeah, because it is the FASMED lessons, it is different because we use Ipads.

Q14: do you use them in other maths lessons, or just the FASMED ones?

Usually just the FASMED ones to work out the problems.

Q15: so you think maths helps you understand the world?

Yeah, it helps you get more jobs and stuff.

Q16: so you like experimenting?

Yeah, with the Ipads, it helps.

Q17: so you like learning maths using different ways?

Yeah it is good to have a big range of ways we can learn maths.

Q18: so you think maths can be fun and frustrating?

Yeah, it is fun when you overcome a problem, but it can be frustrating when you don't get it right first time.

Q19: so you are quite happy with exams?

Yeah it is just like doing a normal maths lesson with sheets and stuff. It isn't boring compared to what we normally do.

Q20: you are quite happy working with the technology?

Yeah.

Q21: so the teacher doesn't always use the technology, just sometimes?

Yeah, not every single lesson.

Q22: sometimes or mostly use it?

Mostly use it yeah.

Q23: so you have plenty of time to reflect on the lessons?

Yeah and to express your ideas.

Q24: so you do lots of different things in maths?

Yeah, there is a big range of stuff that we do.

Q25: so you don't think maths is best learnt out of a textbook?

Yeah, it is best with a teacher and with the technology.

Q26: You don't like working on your own?

Yeah, I prefer group or paired work much better because you can discuss different ideas and not just on your own.

Q27: you don't think you are born with the ability to do maths?

Yeah, because you would learn better if you were with a teacher. You aren't born with it because then you wouldn't need lessons and practice.

Q28: you think practicing is the most important thing?

Yeah.

Q29: you think anyone can understand maths?

Yeah they can.

Q30: you think there is room to express your ideas?

Yeah, because you get to explain stuff to the whole class.

Q31: you see that maths will be useful in the outside world as well?

Yeah, it helps with jobs like shop keepers, because they need to add up money. It is not just in lessons it is in like in different jobs and stuff where you would have to learn maths to get good jobs.

Q32: so you think it is important for your future?

Yeah.

Q33: how old are you?

12.

Q34: what have the FASMED lessons been like?

They have been like giving us an everyday problem, like money, and over a few lessons we would have to discuss how we would solve it and by the end we would put all of our answers together and figured out the best answer, and which would be the correct one.

Q35: has it been different to your normal maths lessons?

Yeah because in primary school it would just be like text books and just answering sheets. But this gives you a chance to solve everyday problems, not just ones that are written done in front of you. Problems that aren't in front of you, you have to think about it and answer them.

Q36: is it unusual the amount of technology you use?

Yeah, we didn't normally use technology until the FASMED lessons, we have been using the Ipads and things like that.

Q37: have you always done group work?

Yeah, we do more group work than we used to do, it is good because we get to do more explaining, which helps you.

Q38: what do you think is useful about the lessons?

In the future when you are an adult, if there was a problem that was similar to the FASMED, it would be easier to overcome it and find out the best way forward because the lessons help you with the future.

Q39: have you always been comfortable using technology and working in groups?

Yeah, we use it every day so it is fine. And when you are with you are family it is like working in groups and using technology because we use it at home.

Q40: has there been anything difficult about the lessons?

Normally when you first see the question it would seem difficult, so when you start off it is hard but then you find a method that works and eventually you can figure out the answer. It can be quite overwhelming and be hard to get passed and you can break down all the different points, you can look at all the different information and break it down, it can be easily thought about.

Q41: so it is good if you're in groups?

Yeah, everyone has I say in it and then sometimes when you can't think of an idea than other people might have already got it, it is easier.

Q42: does it help your understanding of maths?

Yeah, because we have to lots of different maths methods like division and multiplying, you don't just use maths to get through them.

Q43: would you like to do more of these types of lessons in the future?

Yeah, because instead of having really hard sheets, it makes it easier to do when you think of it like an everyday problem. It makes them easier to do in the future because it is easier than just doing normal lessons.

Q44: does it motivate you to do more maths?

Yeah it makes it more interesting, instead of just like numbers on a page which is quite boring. The everyday problems is what makes it more interesting.

Q45: have you talked about the FASMED lessons with anyone else outside your class?

Yeah, like with my friends don't do them, so I normally tell them about the different lessons we have been doing and how I have done it. Lots of them find it really intriguing, so it is good.

Q46: have you discussed it at home?

Yeah, I have talked to my parents about it, told them about the different questions we have been doing. So at home I talk to my parents and my brothers.

Q47: what do they think about it?

They think that it is improving my report and my levels.

Student 3

Q1: is maths one of your favourite subjects?

It is not my favourite, but I do like maths.

Q2: you can see that it is going to be relevant in your future?

Yeah.

Q3: what kind of things do you imagine you would use maths for?

Well, if you wanted to work in a shop then you'd have to work out money and if you were a teacher you would have to know your maths in different subjects.

Q4: do you think maths helps you to understand other things?

Yeah, because maths will help you because you need to learn it as most of your life you'll have to use it in different things.

Q5: you think maths will help in later life?

Yeah.

Q6: so you enjoy going to maths?

Yeah.

Q7: what is good about the technology you use in maths?

It is a lot different to just writing on paper because if you think about it, it is like saving paper. Because you have get things and keep sending them back, it easier because you are not really writing, as it is online and you are using a keyboard.

Q8: you find it easier?

Yeah.

Q9: do you find it easier than handwriting things?

Yeah.

Q10: and the teachers get to see it quicker?

Yeah, if it is on the Ipad then the teacher could go on and have a look at it.

Q11: you also like talking to the teacher?

Obviously being a maths teacher he will know a lot more, it is much easier because say if you were searching stuff up on Google it'll be a little bit harder because it might not have the detail you wanted, and the teacher might give you that detail.

Q12: you think you are born with mathematical understanding?

Yeah, obviously like when you are born you understand a little bit of maths and that will progress.

Q13; you think you can learn more and develop?

Yeah.

Q14: do you think anyone can learn maths?

Well obviously if someone is disabled then you obviously can't stop them learning maths, because if they end up not getting legs, then it is going to be hard for them to try and get a job because they won't know maths or anything.

Q15: you like exams and feel they help you to know where you are at?

Yeah.

Q16: you don't get worried about exams?

No, I do get worried, but once it is over and you get your answers back then it is quite nerve wracking, but it is good to know where you are at.

Q17: do you think the technology helps you to understand where you are?

Yeah, it does have a couple of apps on the Ipads that do help.

Q18: you like working with friends and in groups, do you think that helps your understanding?

Yeah, it is much easier in groups.

Q19: you like working at something until you get it right, persevering?

Yeah.

Q20: do you agree that maths is sometimes right or wrong?

Yeah, I didn't really know what that meant, but then I thought that sometimes maths can be right or wrong.

Q21: is that when you discuss your answers?

Yeah.

Q22: maths helps you to think logically, in order?

Yeah.

Q23: anything you would like to pick out from the disagree column?

Well, I am not nervous in maths.

Q24; so you're happy to give things a go?

Yeah.

Q25: you prefer to work in groups than on your own?

Yeah.

Q26: you're not frustrated by the technology?

No it does get quite annoying, like if you're working in partners and they are being silly and they don't know your things, then they might not share them, so everything gets reset and you might not get them in your head. It is sometimes frustrating, but not most of the time.

Q27: you are quite happy to do exams?

Yeah because it might get you quite far in life.

Q28: so it helps you to learn?

Yeah.

Q29: you are happy to use technology and think anyone can learn maths?

Yeah.

Q30: you think you will use maths a lot in your future?

Yeah.

Q31: how old are you?

12

Q32: can you start to tell me a bit about your FASMED lessons?

We looked at someone who was selling different products like soup and bread. It was quite hard to do but it was fun because we got to work in groups and I really liked it.

Q33: are they quite different to your normal maths lessons?

Yeah because we normally just learn about different subjects each day, but since we have started to do the FASMED we have got into a routine where we come in.

Q34: is it more about problem solving?

Yeah, we have problems like someone who wanted to sell over 500 soups and have none left over so she had to work out how much she wants to raise for charity and how much she wanted all together with none left over. It was really problem solving.

Q35: have you been using more technology than normal?

No we have a got a sheet that we just put our workings out into that had all the problems on.

Q36: have you done other FASMED lessons like security cameras?

Yeah, we did have cameras that followed the teachers when we learning about the soup.

Q37: do you remember the time-distance graph one?

Yeah. There was one where she was driving to school to pick up people.

Q38: in all those types of lessons have you been using technology?

Yeah we used the Ipads.

Q39: have the Ipads been useful?

Yeah because it is technology and it was easy because you can draw on it, so it makes it easier.

Q40: do you like using technology in lessons?

Yeah.

Q41: did you do more group work in those lessons?

Yeah well when we were using the Ipads we had to be in pairs or working in a small group just for a couple of lessons for the FASMED things you did.

Q42: so more group or pair work, not so much on your own?

Well, no at the beginning of the lesson we weren't on our own there was the teacher but we would get our own ideas and then share them afterwards.

Q43: what did you think about working in groups and sharing your ideas?

Yeah it is much easier because if you have some ideas that are good but then someone else has another idea that is in more detail than it can help.

Q44: what has helped you in the FASMED lessons?

Well I think the problem solving has been useful and working on your own and in groups, it is hard but it does help a lot. It has helped me learn yeah.

Q45: what has helped you learn maths?

The calculations and the different techniques we can use.

Q46: what kind of techniques?

We didn't really use the timetables that much because we mainly doing algebra. But when we started going into that it was like having more than one idea and putting them together and comparing ideas.

Q47: what has been difficult about the lessons?

Sometimes it can be hard because some people have much better ideas than some people. Sometimes the ideas are hard to understand.

Q48: anything else?

When I first saw it I was really confused, there were little charts that people were ticking off and there was also a survey which is really hard to get the information from.

Q49: so do you get little surveys on the Ipads?

Well there were little boxes with the soup that people had ticked, it was a bit confusing at first but after a couple of lessons we started to be able to work it out.

Q50: would you like to do more of these lessons?

Yeah, they took a lot of time but it was really good and it helped.

Q51: how did it feel after spending all that time to work it out and then getting the right answer?

It felt really good, the teacher asked if we wanted to do it again and most people said yes.

Q52: have discussed the FASMED lessons with other teachers or friends?

Yeah, there is a group of people that I hang out with and I do discuss it with them. I have just told them about the different things we have been doing.

Q53: have you talked about it at home?

Yeah, to my mum and about the FASMED lessons.

Q54: is there anything else about FASMED you want to say?

Yeah, it is a lot different being on the Ipad than being on paper. There is an app that the teacher sends stuff through to and then we can draw on it and then when we send it back the teacher goes through it and looks at what other people have said. The teacher compares them, there is always that one answer that is better than everyone else's, we find out from other people's decisions.

Q55: do you think that helps?

Yeah, because when you are in groups someone might have a question that is related to their answer. When you are comparing everyone's then it is much easier because you get different ones.

Q56: do you discuss that as a class?

Yeah.

Student 4

Q1: so you think that maths helps you to understand the world?

Gravity involves maths which is also science at the same time, because you have to calculate where the ball is going to land or the force that is put on the ball when it is thrown. So that is why I think maths is important.

Q2: do you think maths will help you in your job or your future life?

Yeah, I think it will help in my future life because I do like computers, so my job might be something to do with them and technology, so I will need to use maths for that, for example binary.

Q3: you don't think there is just one way of learning?

Yeah, if you are going to learn maths it is best to learn it diversely, in every way possible, because you get a better understanding that way.

Q4: do you think it is something everyone can learn?

Yeah, you don't have to be gifted to learn it, there are easy parts and hard parts to maths. Some parts are actually really fun like activities such as calculate the colour, which is always a good idea. I think technology can actually help teachers understand more, they can keep a record of what is going on and they can always keep things recorded on the board, no matter where they are.

Q5: you think exams are boring?

Yeah, they're not the best bits of maths.

Q6: you agree that maths is seen as connections?

I would agree, it is a chain of methods really, some things require a chain of things like having to work different things out a certain way, and it is as if it is a different language. It is done systematically and using logic, if you have one plus one it isn't three is it, you have to think logically. You have to think cleverly about what you are going to say and answer. That is why I picked that.

Q7: you like using the technology and you feel it helps you to understand things?

Yeah, even though there is easier access to your textbooks and other books, it is easier to find stuff out on sites like Google. But the only downfall to that is you can't always believe what they tell you online, most of the time it is correct.

Q8: so you think maths is fun but frustrating?

Yeah I have got mixed feelings about it.

Q9: are you quite comfortable using the technology?

Yeah, because most of time I am on technology, I do find more of a comfort with it. I do feel comfortable when using it, although I get stuck at points. I have put collaboration in the middle because I can work in a group but I am not very good at it, I just sit there doing nothing wondering what I should do with this collaboration.

Q10: so group work can be challenging?

Yeah, because you have got different minds to work with and you have to accept other people's ideas and see how you can merge them with your own to get the correct answer out of it.

Q11: do you think overall it helps you to learn more?

Overall yeah, if everyone there has their own general idea of what is going on, and then you can learn from them, which is exactly why you are collaborating. I put working with friends under that because it does depend, you might start having a chat with your friends because you know them well, but if you and your friends are more concentrated on the actual subject then it can help more but that isn't always the case.

Q12: so you shouldn't always be with your friends, in other groups as well?

Yeah. Even though I think maths is frustrating I do understand most parts. I feel like I can do it generally.

Q13: you think exams are boring but they do help you to learn more?

Not that I do to well in them, but they do help us work more even though they're boring.

Q14: is it kind of motivating?

Yeah, I suppose so. I work harder before the exams.

Q15: you do think it requires repetition?

I don't think it can be boring because even though it is repetitive you do climb up a ladder in the end. The level goes higher even though you are adding and subtracting the same numbers. You are adding values on to it.

Q16: so you are adding to your understanding?

Yeah.

Q17: so you think the technology helps the teacher to understand where you are at?

Yeah, they can keep a record of everything.

Q18: can you understand better what you have got to do?

Yeah, you can connect the technology to the board, so you can show everyone without having to get out the Ipad's and show everyone on a tiny screen.

Q19: Do you think it helps when you are working in a group as well?

Yeah, I think it can help, arguments do get stirred up because it isn't something that happened a lot in primary school. People get amazed by the technology, so it can cause arguments but it does help.

Q20: you are using the technology quite a lot now?

Yeah and if it keeps going eventually it will get old and it can stop arguments after a while.

Q21: do you feel it helps to find out yourself?

Yeah, I can find out either way but with technology I know how to use it more and my handwriting isn't that good.

Q22: the technology helps with handwriting and presentation?

No I don't think it helps with handwriting, but it helps with presentation because I don't have to think about my handwriting, that is one reason I like it. I am not very comfortable with my handwriting at the moment, I will have to practice but yeah that is why I like technology. You can read over it and change stuff easily as well.

Q23: so you think the teacher is important in learning?

Yeah, the teachers have taken courses and everything. The teachers are always going to tell the truth whereas technology doesn't always. Talking verbally is easier and is quicker than typing with technology, even though the teacher may be helping someone else out as well. So it is a balance between the teacher and the use of technology.

Q24: do you think maths is something you develop and work at?

Well, no one is born with a certain thing, or not most of the time because like with babies they don't learn the language they just sort of take it in and that is exactly what I think about maths and English, you just take stuff in and that is how you gain your knowledge.

Q25: so you didn't like maths in the past but now you do?

Yeah, I didn't like it in the past because I was terrible at maths, I do like it now because it helps with other applications.

Q26: But now it is different because?

I am older and I have a much better understanding of what I like and dislike.

Q27: how old are you?

12

Q28: tell me a bit about the FASMED lessons?

It is fun because you get to see both sides and it was a good experiment, I think everyone enjoyed it because it was better than normal everyday maths lessons.

Q29: was that because it was a bit different?

Yeah.

Q30: how is it different to your normal lessons?

You use more stuff basically because normally we would use the textbook. But the clever thing is they haven't just used Ipad's and other technological stuff, they have actually got this paper coding on the textbooks and you can scan the code and find out the answer. So it is cool because it is experimental.

Q31: has it been different in terms of the amount of group work?

Yeah it has actually, even though I am not very good in groups it has been different to normal yeah.

Q32: do you think you have improved?

Yeah I think I have improved quite a lot actually. I have got a better understanding.

Q33: so if the teacher says you are doing group or pair work are you dreading it still?

No I am fine with it.

Q34: what has been most useful about the lessons?

For me it is understanding both sides and the improvement I have had. It is good to know that we were chosen to see what could be changed.

Q35: so you like being part of the research project and helping other people to understand?

Yeah.

Q36: so you think your learning has improved?

Yeah, so it is a win win.

Q37: have you found anything hard about the lessons?

Yeah, the soup stall I didn't have a clue, I got to a point where I just broke and didn't have a clue, but other than that it was fine.

Q38: do you think the lessons have helped your understanding of maths?

Definitely because you have got both sides, you know the way you learn best.

Q39: so it is because you have learnt so many different ways of learning?

Yeah we have used collaboration, technology and both together, we have basically got everything we can learn with.

Q40: would you like to do more of these types of lessons?

Yeah.

Q41: have you talked about the FASMED lessons with anyone outside your class, students or teachers?

I have mentioned them, I am pretty happy that we have done this, it is a lot different to what we have done normally.

Q42: have you talked to your parents or family members about it?

Yeah I have mentioned it.

Q43: and what do they think about you taking part in the research?

They think it is alright, they think it is pretty difficult. But they see it as a way to help me understand better.

Student 5

Q1: why did you put the one about technology up at the top?

Because it is easier to use and get your head around.

Q2: you think it presents the work better, so you can learn it easier?

Yeah, it is better.

Q3: why did you put that using technology in maths is difficult?

Because it is frustrating, it'll turn off and your work isn't saved and you'll lose it.

Q4: so it feels like a waste if you lose your work?

Yeah.

Q5: do you always find it difficult?

No not always, sometimes I can just turn it off and on again, but if it does it over and over again then I can get angry.

Q6: do you find maths in general difficult?

Yeah to me it is. I've never liked maths.

Q7: why?

Because I am not very good at it.

Q8: do you not think you can get better at it?

No, I don't think so.

Q9: you don't think technology works that well?

No, not really.

Q10: when it is working at its best what does the technology do?

Makes it easier to do the patterns and stuff.

Q11: can you tell me what the FASMED lessons have been like?

They have been really nice and I have enjoyed them.

Q12: how are they different to your normal maths lessons?

Because the normal maths lessons have just been in our books and doing loads of writing, but the FASMED ones been a lot better.

Q13: what is it that is better?

I do like working on my own, but working in groups is good too.

Q14: where would the teacher be in a normal lesson?

He would just be standing at the front and saying you need to do this, you need to do that.

Q15: what is the teacher like in a FASMED lesson then?

He just lets you get on with it.

Q16: what do you like about working in groups?

You get to compare the answers and hear it from a different person.

Q17: how have you been put into groups?

He has just been putting labels on the tables with our names on it.

Q18: have you ended up working with your friends or…?

Sometimes my friends yeah.

Q19: do you mind who you work with?

Sometimes I do.

Q20: how did you react to the first FASMED lesson you did?

I thought it was quite fun at first because I was with my friends and when we stopped being with our friends it became just 'ok'.

Q21: why do you like comparing your answers?

Because if you say it yourself you can't know that it is the right answer, but if you say to a friend, they might say 'yeah, that is a good answer'.

Q22: are you quite confident in maths lessons?

Sometimes I am.

Q23: do you mind putting forward your own ideas?

No, I don't like it because I don't think my ideas are good.

Q24: but if you had to you'd get on with it?

Yeah, but if I had a choice I wouldn't.

Q25: have you enjoyed the technology?

Yeah, I have enjoyed using the Ipad's.

Q26: why is that?

Because I am used to using it, because I have got one at home and I have got my phone as well and I know how to use them.

Q27: is that quite different to your normal lessons?

Yeah, because I am not the best at writing, so I don't really enjoy it, but I am quite good at typing, if that makes sense.

Q28: so it is faster when typing?

Yeah, because I am used to it.

Q29: what kind of things do you do on the Ipad's?

We go on an app, and this doogle thing.

Q30: do you use the Ipad's to work out the answers of things, on big and little questions?

I like doing the little questions, but not so much the big questions, the massive paragraphs.

Q31: do you give feedback, like peer-assessment on other people's work?

Yeah, sometimes.

Q32: does the teacher talk more to you in a FASMED lesson?

Sometimes he has to, like if someone asks him a question, but if people are just getting on with it, he'll just let us do it, unless we are stuck.

Q33: how do you ask for help in a FASMED lesson, do you just put your hand up?

Yeah, I'd just say sir I need help.

Q34: would you ask more friends for help in a FASMED lesson?

Yeah, I'd ask my friends first and then I'll ask the teacher if they don't know.

Q35: what have you not liked and found difficulty about the lessons?

Just because I get distracted with it. Sir will say just leave the Ipad and I will just be clicking the button on and off. Tats what I do at home, I'll just keep playing.

Q36: do you find it distracting working in a group with your friends?

Yeah, sometimes I get on with the work, but sometimes I just gossip.

Q37: from the teachers point of view do you think it would be better to put you in a group with friends or not?

He might put like one or two of my friends in a group with me but not the rest.

Q38: do you manage to get the work down by the end though?

Sometimes I do, but not always.

Q39: generally have you preferred these types of lessons?

Yes, because it is a bit more active.

Q40: has looking at other people's work has it made you able to find new ways of doing maths?

Yeah it has.

Q41: do you use timetables and stuff in the FASMED lessons?

Yeah, it depends.

Q42: has it made you more confident?

Yeah, it has.

Q43: did you like maths in primary school?

I was always in a little group, I was never in a big classroom.

Q44: do you think it was better then?

No, because I get the full impact of being in a bigger class.

Q45: so do you prefer being in a bigger class?

Yeah, I like being in a big class.

Q46: would you like to do more of these types of lessons and why?

Yes, and because they are really fun.

Q47: what are your favourite lessons?

My favourite is Art and maths is a bit far down there.

Q48: have you talked about FASMED with either other teachers or other students?

Well I'll tell my friends that in my class we used the Ipad's today, but I don't tell the teachers.

Q49: have you discussed it at home?

Yeah with my mum, because she used to be a maths teacher here, so she always asks about my maths.

Q50: has she been interested in the FASMED itself?

Yeah.

Student 6

Q1: looking at the strongly agree column, you prefer talking to a teacher then?

Yeah, because you can find out things and work it out as you do it.

Q2: so you are comfortable going up and asking your teacher for help?

Yeah, I am not frightened.

Q3: you have put that you are nervous when using technology, why is that?

It is just because the teacher puts it up on the board and then it is embarrassing if you get it wrong.

Q4: why do you think maths is important?

Because you need it in everyday life, like in English, geography you might need it to add up.

Q5: do you ever use maths while shopping?

Yeah, sometimes.

Q6: you're generally nervous in lessons?

Yeah.

Q7: but you think you are okay at it?

Sometimes, but if I don't know how to do it then I get scared, I give up, I just don't want to do it anymore.

Q8: do you ask your friends to help if you're stuck?

Yeah and if they don't know then I will ask the teacher.

Q9: you don't think the technology helps you at all?

Sometimes it doesn't, sometimes it does.

Q10: don't you like exams?

Because it is the same as doing work in our books, exams do help us, to see where we have gone right or wrong, when you get your mark so you know how to improve.

Q11: do you go through exams and have a look what you got wrong and why?

Yeah, we just look at them and see what we got wrong and what we got right.

Q12: do you enjoy exams?

Sometimes.

Q13: you don't think the technology helps the teachers see where you are and how you are doing?

No, I don't think so.

Q14: do you think the teacher is important in the lessons?

Yeah, sometimes.

Q15: you disagree that maths is exciting, why is that?

Yeah, I don't know.

Q16: is it because you are nervous you don't like it?

It might be because I am nervous or that I don't know much about maths.

Q17: what is your favourite lesson?

I don't really have one.

Q18: so everything is about the same?

Yeah.

Q19: how are the FASMED lessons different to your normal lessons?

Well you get to work in groups and that might help you. You get to go on the IPad's and work on them.

Q20: is there anything different the teacher does?

Yeah, the teacher helps us and he talks to us a different ways and walks around and goes around to different groups.

Q21: how is that different to a normal lesson?

Because he would just stand at the front, but sometimes he does come round and help if we are working in our books or doing class work together or he'll stand at the front and we would put our hands up.

Q22: do you not put your hands up in a FASMED lesson?

We do sometimes but much less.

Q23: have groups been useful? Do you work with your friends in the groups?

Yeah, but the teacher puts us in groups, so we might be in pairs, say a boy and a girl or a boy and boy, I don't know.

Q24: how was that?

It was okay, I don't like working with boys because I don't feel confident, but I'm working with my friends then I can do more stuff.

Q25: how often do you end up working with a friend rather than a boy?

I did last time, working with friends is better as it is more helpful and I feel more confident.

Q26: do you assess each other's work?

I don't think we do that, we did more in the normal lessons, self-assessment work.

Q27: is that looking at your own or other peoples?

Both.

Q28: are you sharing different ways of doing things?

Yeah, when we write up ideas, we bring ideas together and see what is good about it.

Q29: do you just use the IPad's in the FASMED lessons?

Yeah, we just use them in FASMED.

Q30: do you like that?

Yeah.

Q31: how would you use them?

We would go on this thing and we have to answer the questions about the thing we are working on, we go separately, but sometimes we go in partners and write the things together.

Q32: do you like being in partners more, is it less nerve wracking?

Yeah, because we share the ideas we get.

Q33: do the teachers talk more or less to you?

They talk more and help us.

Q34: are you more nervous in a FASMED or normal lesson?

It is about the same.

Q35: if you were stuck who would you turn to?

If we were both stuck I would put my hand up and ask, but if it was just me, I'd ask my partner.

Q36: what has been difficult and you haven't enjoyed about the FASMED lessons?

You can't work with your friends and people might like working with girls and not all boys. That you have to go to an IPad and write what you think, but it is better when you are sat with a partner and thinking what you both think about it.

Q37: do you think you could have done it without the technology?

I think it makes it better because you don't have to write it on a piece of paper. You can write it on an IPad and it would feel better for people.

Q38: have you learnt any maths from it?

I think it is helping, but we need to have more stuff that we do in normal lessons, things like times tables and things that we need help with.

Q39: when sharing ideas do you ever think I wish I had thought of that?

Yeah.

Q40: have you changed the way you do it?

When I do it I think of all my ideas and then when I give it to the teachers I think of more and say why didn't I put that.

Q41: has it made you more confident with your maths?

No, not really.

Q42: were you nervous in Primary School?

Yeah I was.

Q43: are you more nervous than then?

About the same.

Q44: do you know what would make you more confident?

I don't know.

Q45: has it helped you with your learning?

Yeah, a little bit, when we are doing it, it does help with our times tables and what we are learning about in the lesson?

Q46: do you do learning in normal lessons and then the same in the FASMED?

No there is one lesson, we did one where we had a girl that was at a school that had to pay more, there was a grid and there was a lady that had to pick up the children and then we all had to go in groups and say who we thought would have to pay more or less. And we had to go outside and we had to make a grid by standing as the people. Then we went back inside and thought about what we had learnt.

Q47: can you remember what kind of things it was people had learnt?

No, I can't remember.

Q48: would you like to do more of these lessons?

Yeah, I prefer it to the normal lessons?

Q49: why is that?

Because it is more fun and we can work in groups and help each other. But I don't like it how the teacher chooses the groups that we have to be in.

Q50: when being with your friends do you still get on with the work properly?

Yeah, we do talk, but we talk about the work and not just weird thing.

Q51: have you talked about the lessons with other teachers or students in the school?

No.

Q52: do you know of anyone else doing it?

On the other side of the year I think they are doing it, but I don't know.

Q53: have you talked about it with your parents?

No.

Q54: do you generally talk about what you have been doing?

Yeah, I tell my mum what I have been doing, what I need help with and other stuff.

Appendix G Themes from student interview analysis

Maths is used in everyday life

- Buying lunch
- Adding up change

Maths is needed in jobs

- Shop keepers
- Computers
- Good jobs

The use of technology in maths: positives

- Easy to find things out
- The teacher can keep a record of your work
- Presentation is neater
- You can annotate your work
- You can build on others' ideas
- You can learn from others
- You save paper

The use of technology in maths: negatives

- Arguments over who uses the technology
- It turns off, crashes
- Can be frustrating
- Slow to set up
- Distracting
- embarrassing

Group work

- you can learn from others
- you need to be with people you get along with/group make-up
- people chat

The role of the teacher

- easier to ask a teacher
- teacher always tells the truth
- importance of balance: teacher and technology

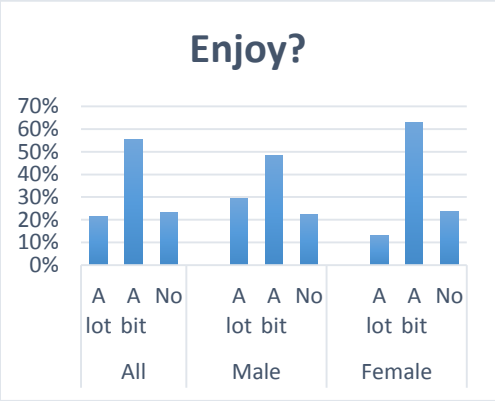
FaSMEd

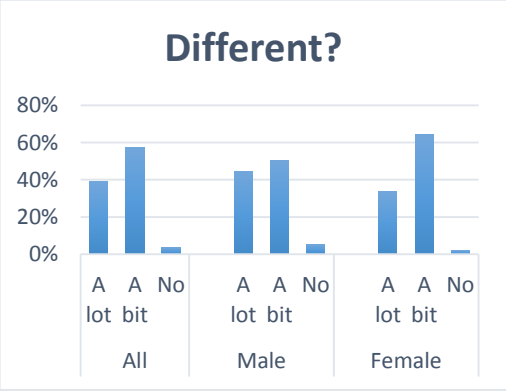
- experimental
- more group work/sharing ideas
- opportunity to make improvements
- involves different ways of working
- different teacher role
- turn to friends for help
- everyday problems/problem-solving
- more thought
- hands up less

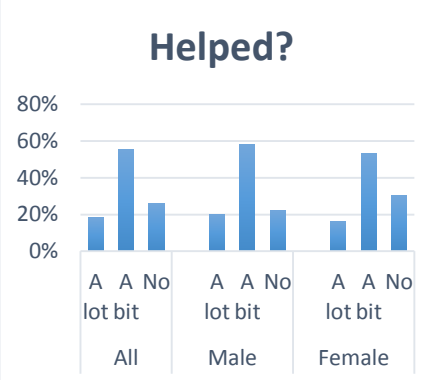
Appendix H: Student questionnaire data analysis

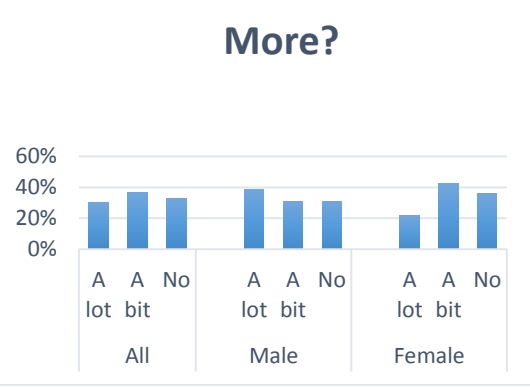
All Newcastle University FaSMEd schools

Male	92										
Female	95										
Enjoy?			Different?			Helped?			More?		
All	A lot	21%	All	A lot	39%	All	A lot	18%	All	A lot	30%
	A bit	56%		A bit	57%		A bit	56%		A bit	36%
	No	23%		No	4%		No	26%		No	33%
Male			Male			Male			Male		
	A lot	29%		A lot	44%		A lot	20%		A lot	39%
	A bit	48%		A bit	51%		A bit	58%		A bit	31%
	No	22%		No	5%		No	22%		No	31%
Female			Female			Female			Female		
	A lot	13%		A lot	34%		A lot	16%		A lot	22%
	A bit	63%		A bit	64%		A bit	53%		A bit	42%
	No	24%		No	2%		No	30%		No	36%

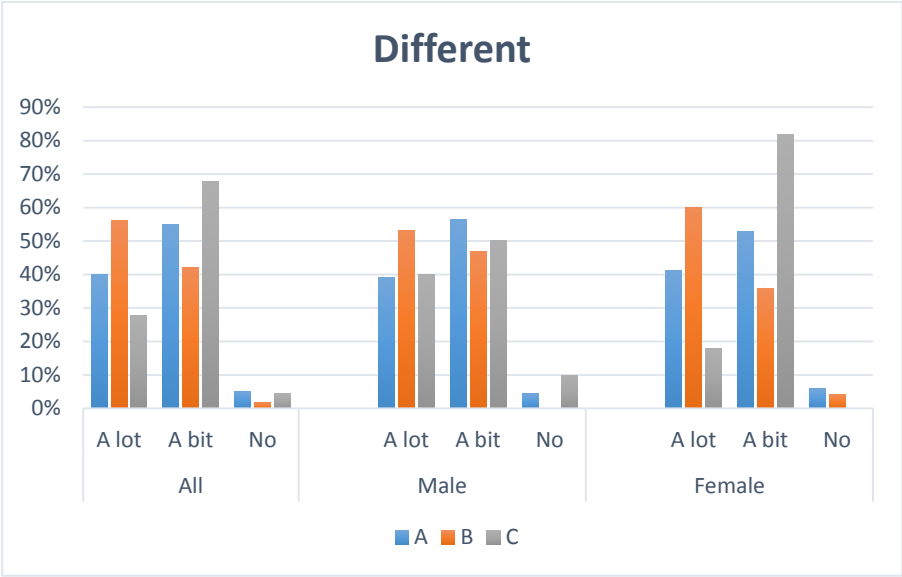


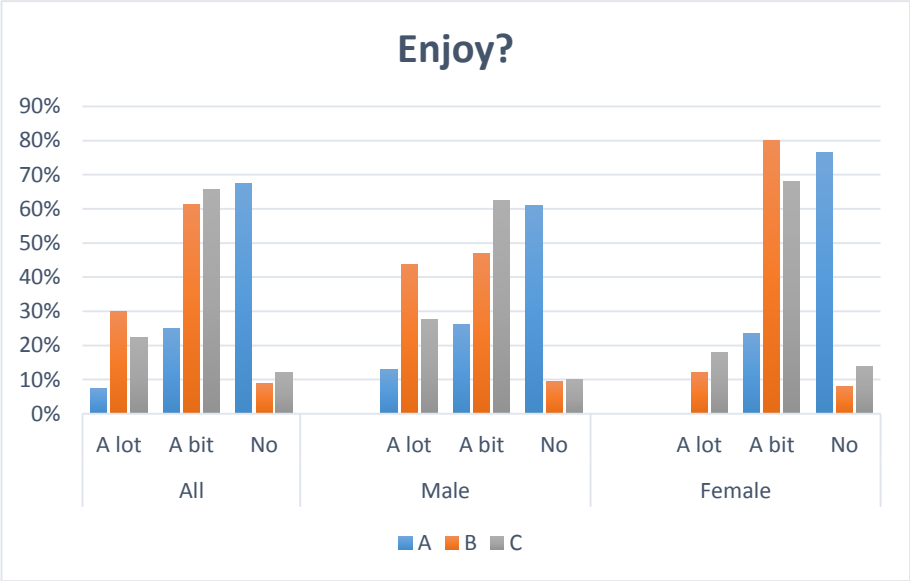


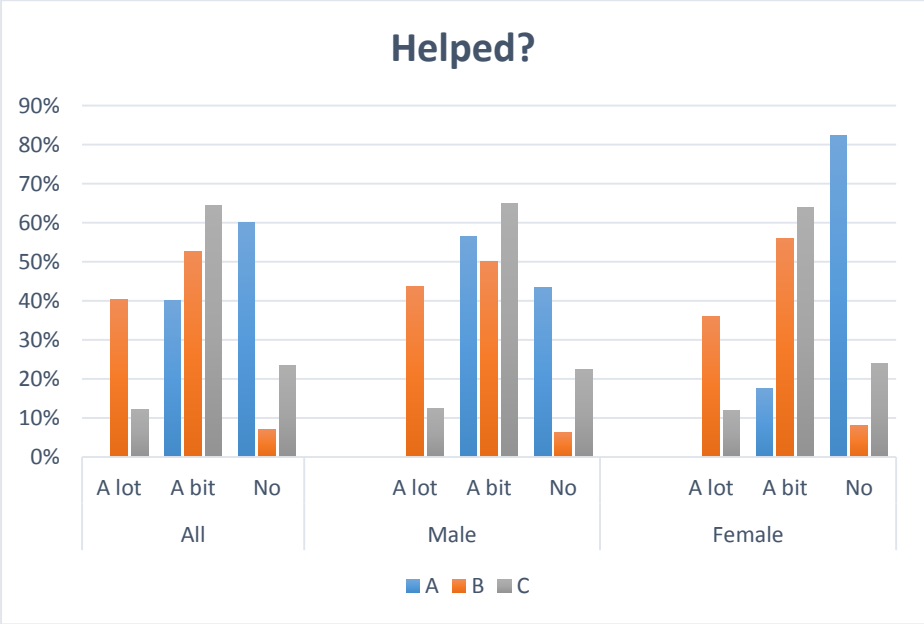


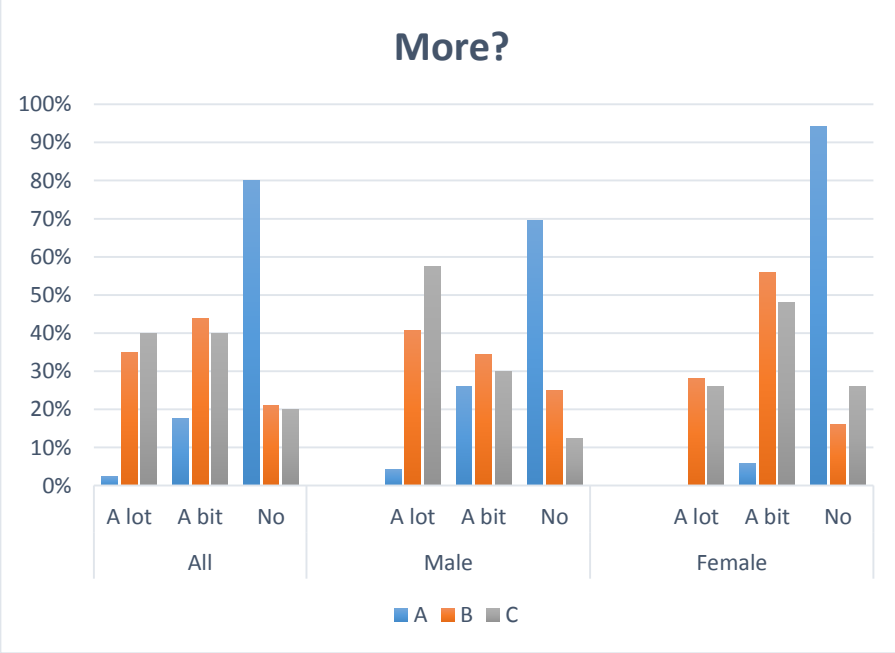


Comparing Schools



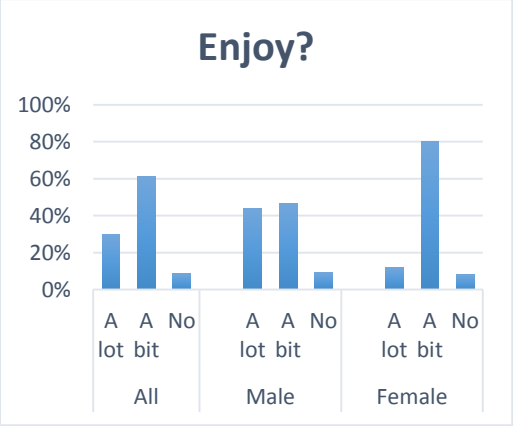


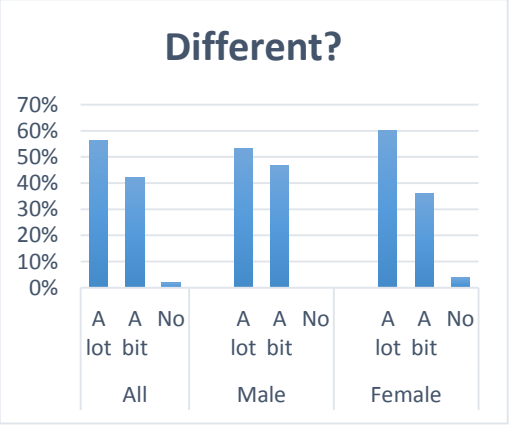


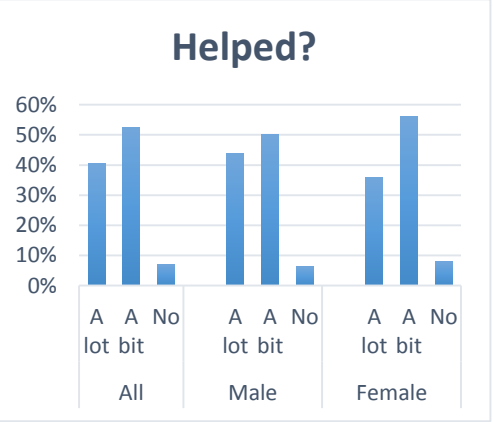


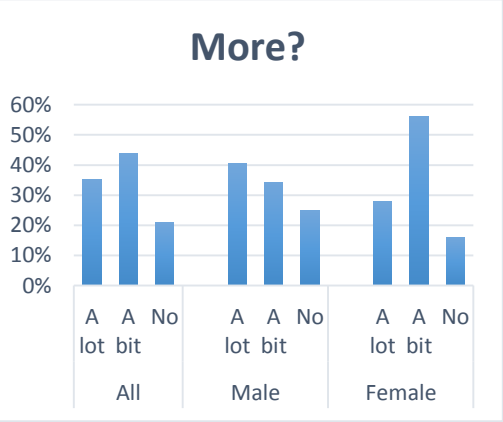
School 2

Male	32										
Female	25										
Enjoy?			Different?			Helped?			More?		
All	A lot	30%	All	A lot	56%	All	A lot	40%	All	A lot	35%
	A bit	61%		A bit	42%		A bit	53%		A bit	44%
	No	9%		No	2%		No	7%		No	21%
Male			Male			Male			Male		
	A lot	44%		A lot	53%		A lot	44%		A lot	41%
	A bit	47%		A bit	47%		A bit	50%		A bit	34%
	No	9%		No	0%		No	6%		No	25%
Female			Female			Female			Female		
	A lot	12%		A lot	60%		A lot	36%		A lot	28%
	A bit	80%		A bit	36%		A bit	56%		A bit	56%
	No	8%		No	4%		No	8%		No	16%





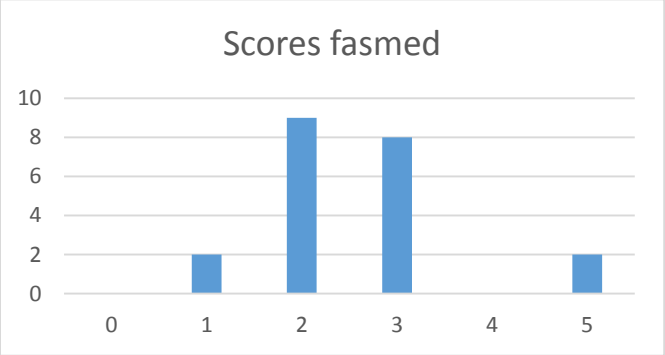


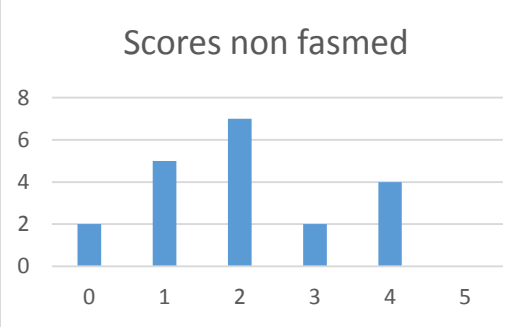


Appendix I: Attainment data for Newcastle schools.

Change in levels

School A



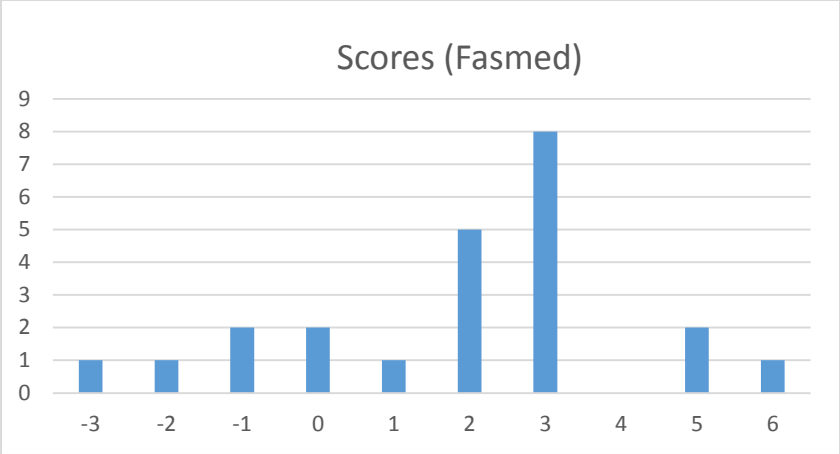


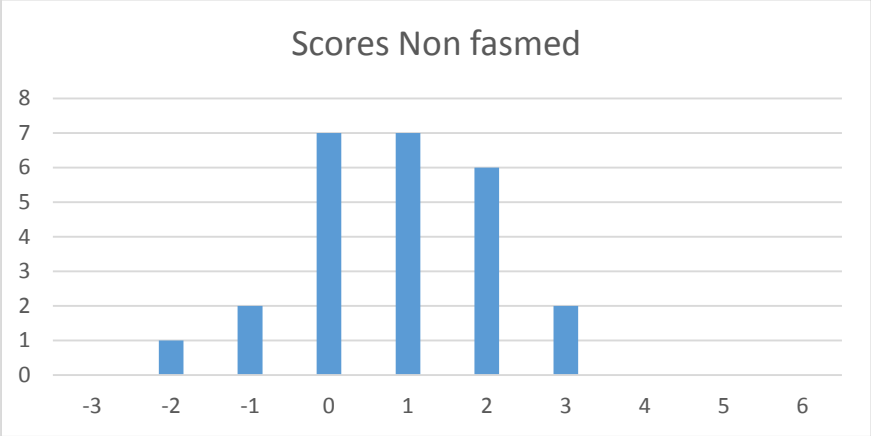
t-Test: Two-Sample Assuming Unequal Variances

	Variable 1	*Variable 2*
Mean	2.571429	2.05
Variance	1.057143	1.628947
Observations	21	20
Hypothesized Mean Difference	0	
df	36	
t Stat	1.436341	
P(T<=t) one-tail	0.07977	
t Critical one-tail	1.688298	
P(T<=t) two-tail	0.159539	
t Critical two-tail	2.028094	

The null hypothesis is that there is no difference between the two groups.
Since the t stat is less than the critical value we cannot reject the null hypothesis i.e. there is no statistically significant difference between the two groups.

School B





t-Test: Two-Sample Assuming Unequal Variances

	Variable 1	*Variable 2*
Mean	1.913043	0.84
Variance	4.992095	1.556667
Observations	23	25
Hypothesized Mean Difference	0	
df	34	
t Stat	2.030349	
P(T<=t) one-tail	0.025101	
t Critical one-tail	1.690924	
P(T<=t) two-tail	0.050202	
t Critical two-tail	2.032245	

The null hypothesis is that there is no difference between the two groups. Since the t stat is less than the critical value we cannot reject the null hypothesis i.e. there is no statistically significant difference between the two groups. (Although it is very close to the 5% level)