Case study 1: Jessica

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Case Study 1: Jessica

1. Context

The School

The case study school is an average-sized mixed comprehensive school for students aged 11-18 and is situated in a new town on the outskirts of a large city in the North East of England, UK. There are 1060 students in the school (50.8% male, 49.2% female). Students are mostly of White British heritage with very few students from minority ethnic groups or who speak English as an additional language. 13.4% of the students are eligible for free school meals (FSM) although this figure is rising year on year. The proportion of pupils supported by school action plus or with a statement of special educational needs is above average.[1]

The school has been graded as 'outstanding in all areas' by the Office for Standards in Education, Children's Services and Skills (Ofsted). As a result of its outstanding rating the school has achieved Teaching School status and is part of a Teaching Schools Alliance providing high-quality training and development to new and experienced school staff. The school has a reputation in the area as one that embraces innovation and is currently one of the two UK schools funded by Professor Sugata Mitra's TED prize money as a 'School in the cloud' and researching into Self Organised Learning Environments (SOLES).
The school has exam results in national tests at GSCE level that are in line with the average for England. (see Appendix A)

The Teacher

Jessica is a mathematics teacher who has been teaching for two years. She began working at the school as soon as she completed her Post Graduate Certificate in Education (PGCE). Since joining the school she has been involved in a range of high profile professional development activities including a European project trialling an app that encourages the sharing of good practice (VEO: video-enhanced observation); an exchange with mathematics teachers from Shanghai, China as well as the FP7 FaSMEd project.

Jessica has experience of using a range of formative assessment strategies including the use of traffic light cards (where students demonstrate the level of their understanding by showing the teacher an appropriate coloured card – red 'I do not understand', amber 'I need more help', green 'I understand') and the use of individual student whiteboards

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

where answers/workings can be quickly displayed to the class teacher. Jessica has less experience of using technology in her lessons. Prior to the start of FaSMEd, this was limited to the use of powerpoint presentations. She had not used i pads or interactive whiteboards (other than during her teacher training). As a consequence at the start of the FaSMEd project she was feeling 'quite scared' and out of her 'comfort zone'.

The Maths Department

There are 10 teachers in the maths department and 6 took part in the FaSMEd project. Usually the staff plan their lessons individually although there is a bank of resources that has been created by the department and which is accessible to all. The relationship between all of the teachers is very good and as an outside observer you sense a warm, friendly and supportive atmosphere (researcher observation). The teachers spend their break and lunchtimes together in the maths department staff room.

The Students

Jessica was working with a class of Year 7 students (11-12 years old) during the FaSMEd project. There were 23 in the class made up of 10 males and 13 females. The year group at this time was split into 5 sets for mathematics (1= high ability , 5=students with behavioural issues) and this class was set 3. Also in the class were one student with ADHD (attention deficit hyperactivity disorder) and one with literacy problems.

The class is well-behaved and the students are happy to work together. The teacher pre-plans the seating of her students and it is her policy to put a weaker student next to a stronger one so that there is the potential for peer support.

When arranging activities based on group work the teacher pulls out names that have been written onto lollipop sticks – this means that the students get used to working with a range of people and it is expected that they may not always end up working with their friends.

2. The tasks

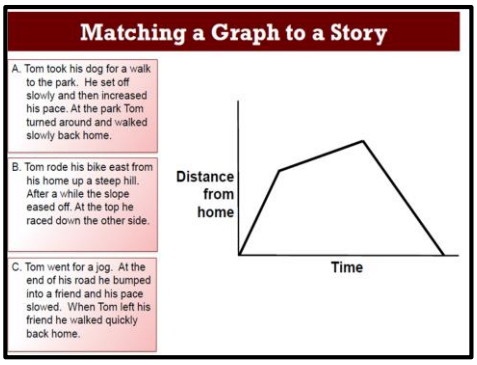
Outlined below is a brief synopsis of the tasks and resources used. It is based on the teacher reports, lesson observations and researcher notes. The full details of the lessons are discussed in the 'lessons' section.

Task 1: Interpreting Distance Time graphs

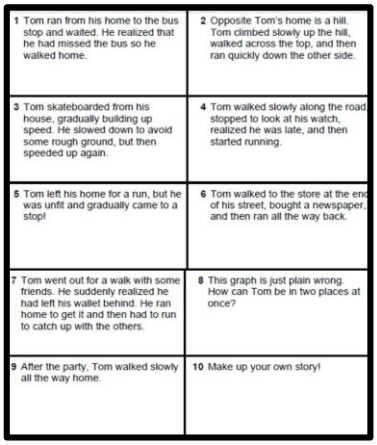
Year 7 students (aged 11/12 years) set 3 out of 5, 24 students 4x 50 minute lessons

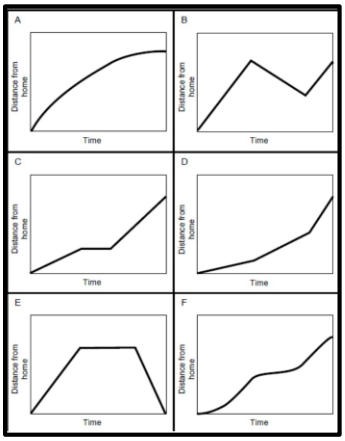
This task was based on the Mathematics Assessment project (MAP)[2] materials. It was discussed initially at one of the teachers' planning meetings and then Jessica made her own modifications based on the needs of her class.

The class were given the 'Journey to the bus stop pre-assessment task prior to the first 'task' lesson so that the teacher could identify any misconceptions. The objective of the first lesson was 'To begin to develop ideas on how to read distance-time graphs. Jessica began with the 'matching a graph to a story' slide and asked the students to vote which they thought was correct. This enabled her to assess who understood the concept.



The students then worked in groups on the matching task. The groups were mixed ability: high-middle-middle-low so that they could all support each other. Jessica then discussed the students' answers. She used Reflector software[3] and an ipad to enable the students to project their work on the interactive whiteboard.





In the second lesson the objectives were to 'produce a distance-time graph for a journey and to 'match a distance-time graph with given information'. Although in the original resources the students are asked to draw a graph of their journey from/to school, Jessica asked the students to 'sketch a graph of their journey form their last lesson and to consider if they had all travelled the same distance and had they all got there at the same time? The groups then shared ideas.

In the third lesson the objectives were to review thinking about distance –time graphs, read a distance-time graph and develop an idea of the distance travelled.

Task 2: Optimizing coverage: Security cameras

Year 7 students (aged 11/12 years) set 3 out of 5, 2x 50 minute lessons

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

[3] http://www.airsquirrels.com/reflector/

This task was based on the Mathematics Assessment project (MAP) materials[4]. It was discussed initially at one of the teachers' planning meetings and then Jessica made her own modifications based on the needs of her class.

In the first lesson Jessica introduced the idea of security cameras and asked the students which mathematical concepts they felt would be relevant to their use. The students write down their ideas and hold them up. Jessica discusses their ideas. She then asks why percentages might be relevant.

A mini lesson on percentages follows. She then gives out the pre-assessment task in order to gain an understanding of any misconceptions the students might have. The potential difficulties had been discussed at a teachers' planning meeting: difficulties with understanding the concept line of sight, percentages and plan view. As a consequence Jessica had built into her plans some 'mini lessons' e.g. a mini percentages lesson, a mini lesson on plan view.

Jessica then does the mini lesson on plan view. She asks the students to use multilink cubes to create shapes which she then takes photos of from above and projects onto the interactive projector. This enables them to see their shapes from ' a bird's eye view'. At the same time she asks a few percentages questions e.g. what percentage of your shape are red?

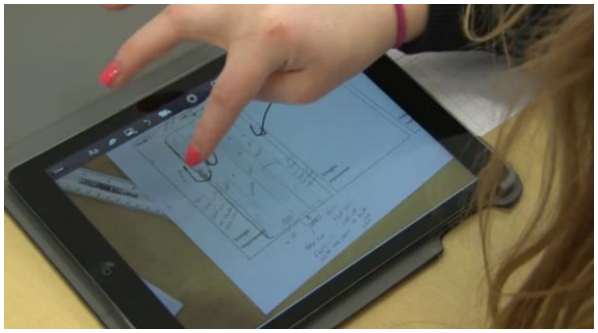
In the next lesson Jessica recaps on the previous lesson and then introduces the topic of line of sight. She then asks the students to look again at their pre-assessment task to see if they can improve their answer. The students work in pairs and are given a worksheet for the new shared answer

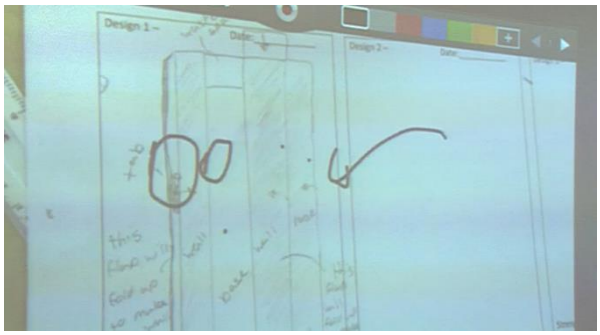
Over the next two lessons the students work through their answers. She then asks them to consider the extension questions a) is there is a 'better position for the camera?' b) What percentage of the room cannot be seen in this position? C) what is the smallest number of cameras that would be needed to see the whole shop? This is done by individual students who come out to the interactive whiteboard to explain their answers.

3. The Resources

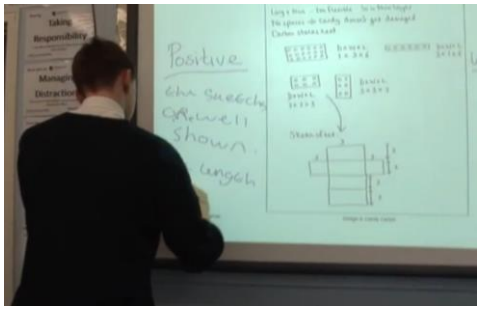
The FaSMEd teachers purchased interactive whiteboards and Reflector software plus a set of ipads as part of the project. They were keen to be able to share student work and have the facility for them to annotate it in real time.

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





The example above shows a student explaining how she designed her 'candy carton-annotating on the ipad, which was then projected onto the interactive whiteboard. Jessica felt this facility was particularly helpful for students who were too shy to get up and talk in front of the whole class. On the whole though, the majority of students were keen to annotate on the interactive whiteboard with cues often forming as they went up to the front of the class to contribute their ideas. The example here shows a student 'critiquing' another group's design.



4. Work with teachers

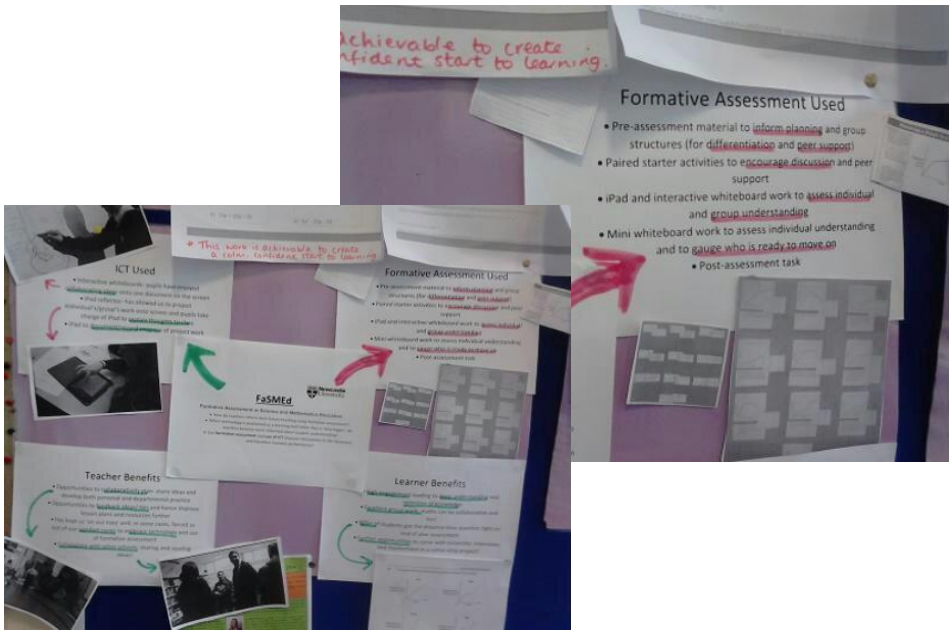
Work in school

The teachers at the case study school were given time by the senior leadership team to meet in order to plan and review the FaSMEd lessons. The fact that all 6 were in the same department also meant it was easy for them to 'catch each other' at lunch and break times (researcher notes). At the meetings the teachers discussed the tasks they would be teaching and explored the misconceptions that had arisen from the pre-assessment tasks and level ladders as well as any potential gaps of knowledge. Although they discussed ideas for the lessons, individual teachers were still encouraged to tailor their planning to their individual classes. The research team attended the formal planning and review meetings in order to observe but also support the teachers.

Jessica felt this method of joint planning and reviewing was 'quite different' (researcher notes) and thought it was good to be able to share practice and resources. In her final interview she commented that one of the best things about the project had been 'to sit down as a department and plan and see how other people plan' because usually 'you just plan on your own and 'you get stuck in a bit of a rut'. (Appendix B)

The teachers also shared their work with the wider school at a whole school CPD (continuous professional development) event organized by the senior leadership team. The focus of the event was: the use of ICT, formative assessment and/or differentiation.

The maths department felt that the FaSMEd project 'encompassed all three of these' and so showcased their work. (see photo below)



Work with the university/cluster meetings

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 from 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.

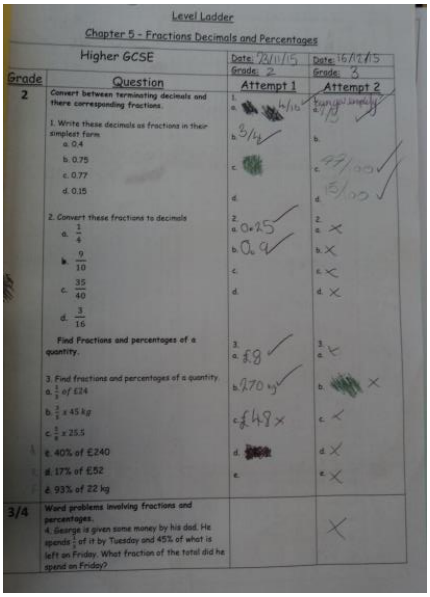
Jessica described these opportunities to meet teachers from other schools as 'nice' because she was able to 'see how other schools work together' (interview appendix B). She also valued hearing about how the tasks were taught in other schools and the resources that were used. She stated that:

Learning about 'Socrative, it made me feel like I could use it, especially hearing about their struggles with it, it made me feel like I could tackle it.

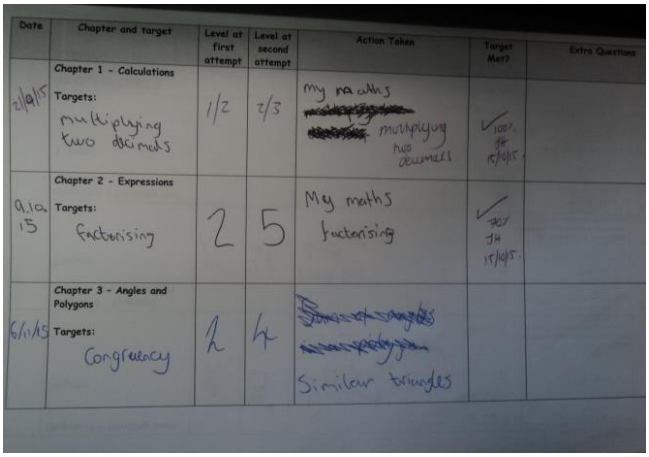
5. Classroom teaching

Jessica is an enthusiastic teacher who 'loves maths' (researcher notes). Her aim is to instill the same enthusiasm for the subject in her students. She achieves this through creating a friendly atmosphere and by giving as much praise as possible even when mistakes are being made. One of her responses for example, is to say "I can see where you're going with that, but …….". She doesn't want the students to be frightened to talk about their answers.

Jessica has always used a range of formative assessment strategies. She has adopted the maths department's level ladders which are given out to students one week prior to a new topic being started. The students make a first attempt which is taken in and marked and used by Jessica to assess the students' understanding and what they need to be taught. At the end of the topic the students do a second attempt in a green pen. This information is then fed by the student into a 'targets' sheet so that they have a record of what they have achieved and where they need to go next. (see photographs below)



A Level Ladder, showing a student's first and final attempt at fractions



The same student's targets sheet

Jessica also uses whiteboard voting in every lesson. Packs with pens are placed on each table and she asks a range of questions that the students have to write a response to on their whiteboards. These they then hold up in the air so that Jessica can instantly see who has the correct answer. Jessica expressed a desire to try 'Socrative' when she heard about its' use in case study school 2, because this would enable her to continue with the voting but the software would be able to record the results, thus 'bringing assessment and recording together' (researcher notes).

Jessica thought the pre-assessment tasks that were introduced in the FaSMEd lessons were very good. She particularly like the sample questions as these helped her to know how to support students who had specific misconceptions.

Jessica uses a range of questioning techniques in order to support students and help them progress. She usually starts with a main 'hinge' question which the students answer on their whiteboards. She then asks them who has understood and gets them to put their thumbs up (yes), down (no) or sideways (a little). Depending on this response she then gives them either extension work, consolidation work, or brings them to the front of the class for extra teaching.

She also asks the students to help each other and uses strategies like C3B4ME (see three before me) or as one student described:

> *Miss is really brilliant, she comes and helps you whenever you want, she is always there for help and if you get really stuck she will say 'Rosie has just asked this question, does anyone know the answer?', then we will analyse that answer and if I still don't get it then we can explain it on the whiteboard. (student 4)*

Group was something that Jessica did very rarely prior to the project. Her planning always centred on individual or paired work. However as a result of undertaking the FaSMEd tasks, she now uses group work on a regular basis- this is largely because the students reacted so well -they did not misbehave as she thought they might. she uses a range of techniques to select the groups - sometimes they chose their own groups, sometimes she selects them. Whatever the selection process though, she always gives each student a role so that they all contribute to the task.

When Jessica embarked on the faSMEd project, she felt distinctly 'out of her comfort zone' (researcher notes) as she did not like using technology in her lessons. Prior to the project she used powerpoint slides for presentations but no other forms of technology. However she was extremely pleased with the potential that the interactive whiteboard and ipads offered. The facility to project and annotate both her own and the students' work means that she and they are able to 'talk through certain aspects' of the maths that are important (teacher interview). Although at the end of the project Jessica has not

continued to use the ipads on a regular basis, she does use the interactive whiteboard in every lesson.

6. The lessons

The following discussion is based on evidence from the teacher reports (TR), researcher notes and the teacher's presentation slides.

Task 1: Interpreting distance-time graphs

Lesson 1

The objective of the first lesson was 'To begin to develop ideas on how to read distance-time graphs using FA strategy A. Jessica began with the 'matching a graph to a story' slide and asked the students to vote which they thought was correct. This enabled her to assess who understood the concept.

The students then worked in groups on the matching task. The groups were mixed ability: high-middle-middle-low so that they could all support each other. This is evidence of FA strategy D. Jessica then discussed the students' answers introducing questions like 'what is the difference between a diagonal straight line and a curve?' 'Does it matter which way the curve is bending?' these were questions that had been discussed in the teachers' planning meeting. This is evidence of FA strategy B. She used Reflector and an ipad to enable the students to project their work on the interactive whiteboard using technology for 'sending and sharing' and for FA strategy D.

Lesson 2

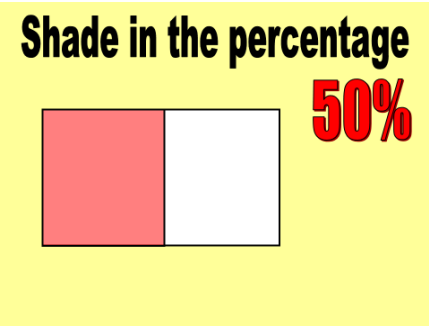
In the second lesson the objectives were to 'produce a distance-time graph for a journey and to 'match a distance-time graph with given information'. Although in the original resources the students are asked to draw a graph of their journey from/to school, Jessica asked the students to 'sketch a graph of their journey form their last lesson and to consider if they had all travelled the same distance and had they all got there at the same time?' She asked the groups to act out their stories in order to help them draw their graphs. The groups were then encouraged to share their ideas. Using FA strategies B, D and E, Jessica asked the students to go round and look at each other's graphs. One student from each group was to stay behind to 'explain to other groups what your logic is'. The students were asked to 'listen to each other's explanations and consider if each group has the same answer as you- if not who is right?' (teacher presentation) they were told to make notes. The students really 'enjoyed helping others understand' (TR).

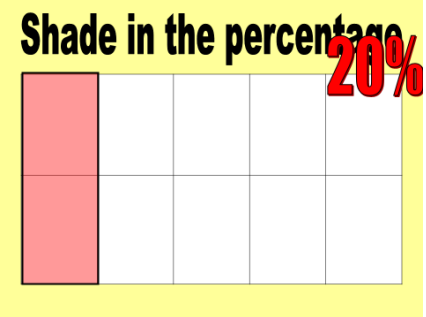
Optimizing coverage: Security cameras

Task 2

Jessica started by putting up the presentation with pictures of security cameras on the first slide. She asks the students why they might be looking at security cameras in maths? The students are asked to take a whiteboard and pen and write down their ideas. After a few minutes the teacher picks names at random using the named lollipop sticks and asks the students for their ideas. The students come up with: co-ordinates (to know where to look), binary coding (to tell the camera where to look), volume, time (to look at a certain time of day).

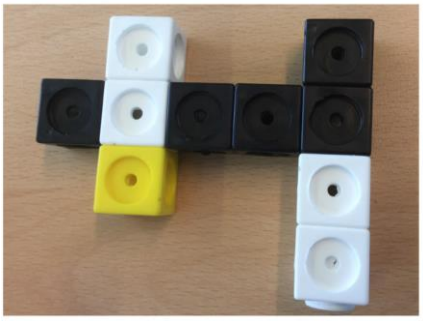
Jessica introduces the topic of percentages and asks the class why this might be linked to the security cameras question. They suggest: battery life, angles that the camera sees. She then begins a mini percentages lesson.





The students are asked to shade in 50%, then 25%, 75% etc . of the shapes on their whiteboards. She calls 3-2-1 and then the students hold up their answers. Jessica assesses who has understood/not understood and discusses why individuals have selected particular answers. Here she is using FA strategy B.

The students are then given the pre-assessment worksheet to complete individually. Jessica gives out 10 multi-link cubes to each student and asks them to make a shape- any shape. She uses the ipad and reflector to display the shapes on the interactive whiteboard. She then asks what is a plan view of a shape? Its's a bird's eye view, it looks flat. She also asks some percentages questions in order to keep this fresh in their minds. E.g. what percentage of your shape is black? Here the technology is being used for sending and sharing to support FA strategy B.



The teacher finishes the lesson by asking the students to write down two things they have learnt today. They respond with: plan view, to work out percentages. This could be said to encourage students to be owners of their own learning (FA strategy E),

Lesson 2

The teacher recaps on what was learnt in the earlier lesson? What maths is linked to security cameras? Answers come from the students: percentages, co-ordinates, angles, plan view. She then asks what do you understand about the term 'line of sight'? She demonstrates by saying 'if I stand here where is my line of sight?'

She asks the students to look again at their pre-assessment task to see if they can improve their answer. The students work in pairs and are given a worksheet for the new shared answer. The students are now using the terminology 'line of sight'. Once the task has been completed by most of the students, the teacher asks them to explain why 15% can't be seen. The students explain that 1 square out of 20 is 5% and by adding the three squares they get 15%. Here the teacher is using FA strategy B.

The teacher asks the students 'can you think of a better position for the camera?' What percentage cannot be seen in this position? The students work again in pairs. The teacher then chooses individuals to explain their answers. The first student comes up to the interactive whiteboard and shows the new positon of the camera and the lines of sight. What percentage now cannot be seen? 10%.

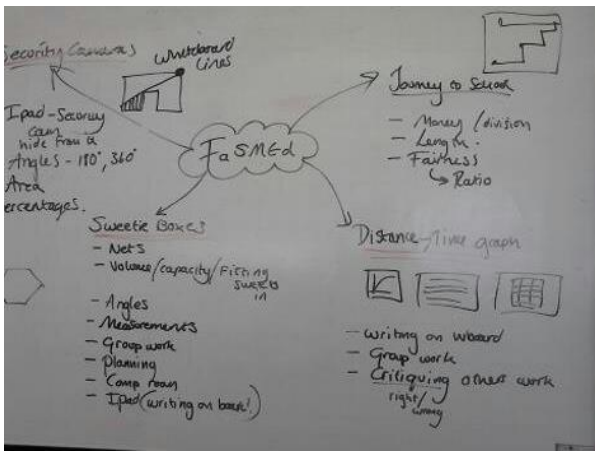
A second student comes up and shows an alternative position which also gives 10% that can't be seen. The teacher then asks where would you put the camera to see the least amount of the shop? The student displays the answer on the interactive whiteboard. What percentage can now be seen? Here the teacher is using FA strategy B.

The teacher then asks the student an extension question: what is the smallest number of cameras that would be needed to see the whole shop? The student shows an answer on the board and others give alternative suggestions with the same result.

Reflection

In these lessons we can see a teacher who skillfully elicits students' ideas and encourages them to problem solve through adapting the MAP resources to match the needs of her class and drawing on a range of FA strategies. Her use of key questions is particularly effective. Her use of technology is integrated into her teaching and provides a way of enhancing the students learning through sharing their work and obtaining feedback about their understanding so that she can provide feedback to move the students forward through efficient communication supported by the technology. Notice that the use of technology is limited to an iPad and a digital projector, but used in a thoughtful way, this can be highly effective.

7. Student perceptions



Brainstorming 'what we did in FaSMEd' with the class teacher

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 C) and the analysis of a student questionnaire (Appendix X). 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 D.

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

The evidence from the Q sort and interviews reveals a very positive attitude towards mathematics despite the fact that the students are in a low ability set. For example all of the students strongly agreed or agreed with the statements:

Mathematics is important
Mathematics makes sense in the real world
Mathematics is used in everyday life

In the interviews particularly the students showed a good understanding of the need for maths in day-to-day life:

If I had a kid in my future life then I would have to work out how I could pay for food and having a car, that's what I'm worried about for when I am older, credit cards because I'm not that good at that (student 1)

it is because you use it in everyday life, because you need to know how to tell the time. You need angles for example if you were making something you would need to know what shape you want it to be, how big and what the area you want it to be, (student 3)

Several jobs were also identified as requiring maths e.g. shopkeeper (student 5) a job where you need to count money (student 2) a physicist or pathologist (student 4).
The students also had a strong belief that anyone can do mathematics with ALL strongly agreeing with the statement:

Mathematics is something everybody can learn

As one student succinctly put it:

Because it doesn't matter if you can't do something because everyone can learn. You aren't born with the ability of maths, it's like English, and you learn it. (student 6)

In terms of technology all of the students expressed a positive attitude towards its use in maths lessons. All agreed/strongly agreed that using it was 'fun' and 'useful' and disagreed/strongly disagreed that it 'does not work or help'.
Interestingly in the interviews the students did not elaborate much on the use of technology in their FaSMEd lessons. Some talked about websites that were useful for practising and learning e.g. Mymaths (http://www.mymaths.co.uk/) or the education category on Youtube, but in terms of using the interactive whiteboards or ipads the discussion was limited to the usefulness of being able to see others' work without having to 'crowd round' (student 3), sharing ideas (student 2) and learning from others (student 2). In fact quite a lot of mistrust was articulated i.e. that with the technology 'you don't feel that you get the right answer' (student 3), ' it calculates it but it doesn't tell you how to do it' (student 5), and that actually the teacher and friends are very important:

Yeah, because if you type something into google then it is other people trying to explain the answer, you can't actually just type into the internet 'I need help with such and such', it doesn't really work like that, whereas a teacher it is face to face and she can write things down for you and show you on the internet. (student 4)

The idea of a balance in lessons was identified by student 4 as being important because people like to learn in different ways:

Yeah, it depends if you want to learn it or not; if you want to learn it then you have more enthusiasm but if you don't want to then you'll still learn it and remember it if its shown correctly, like if you prefer for it to be shown on technology or on a whiteboard, then you'll probably learn more if it is your decision.

The evidence from the student questionnaire (Appendix E) shows that the students considered the FaSMEd lessons to be enjoyable (88%), different (96%) and helpful (77%). No significant differences according to gender were identified (Appendix E). In the interviews the 'different' nature of the lessons in comparison to 'normal' lessons was articulated clearly by Student 1:

> *They are different, because you could be in a lesson and she'll put the questions on the board and tell us to do them, but in the FASMED lessons you get the task and you are allowed to be really creative and make it your own.*

This statement encapsulates what were considered to be the main differences; notably the changed role of the teacher who 'moves around more to see what we are doing' (student 2); the creativity and practical nature of the tasks:

> *Well they are more creative, more teamwork and more practical hands on activities in real life situations. You can get a more sophisticated understanding by making it easier and fun (student 4)*

and the fact that the students had greater ownership of their learning and could 'actually be in control' (student4).
Some of the students felt that the tasks were too long and 'dragged out' (student 1 and 5) and others felt that the open nature of the tasks led to 'off-task' behavior:

> *well I think we went off task when we were just sitting there relaxing and colouring in, where we put the different colours wherever we wanted. (student 4)*

The attitude of the students to summative assessment was interesting and had a generally positive response. The students felt that exam results showed them 'what I need to do to improve things' (student 2) and 'how you have improved throughout the year' (student 3) and also that the 'teacher can see how you are doing and out you into sets and stuff' (student 6). However there was also an appreciation of the value of formative assessment and that though sharing and explaining work the teacher would 'know you haven't just copied, because if you had copied then you wouldn't have been able to explain the answer' (student 3). One student did explain that it was important not to be judged or humiliated or for people to make fun of you (student 4). The classroom culture created by the teacher would therefore appear to be crucial if 'in the moment' formative assessment strategies are adopted i.e. students need to feel it is o.k. to explain their ideas even if they might be wrong.

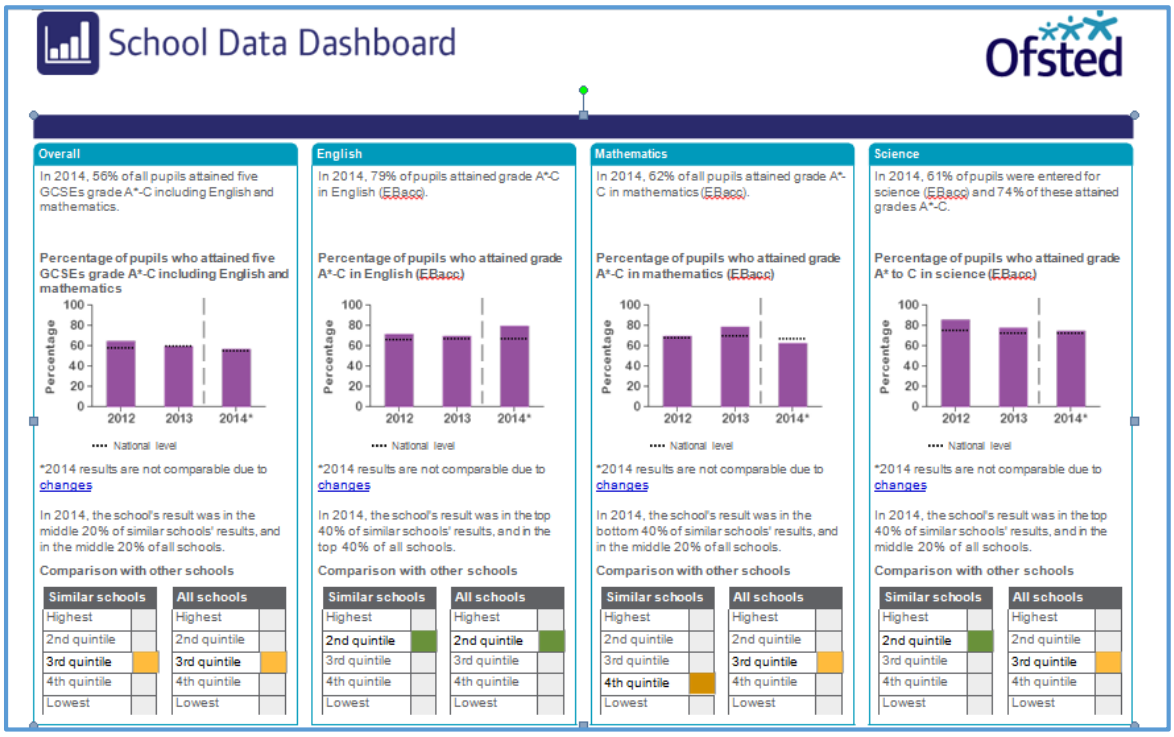
8. Key Findings

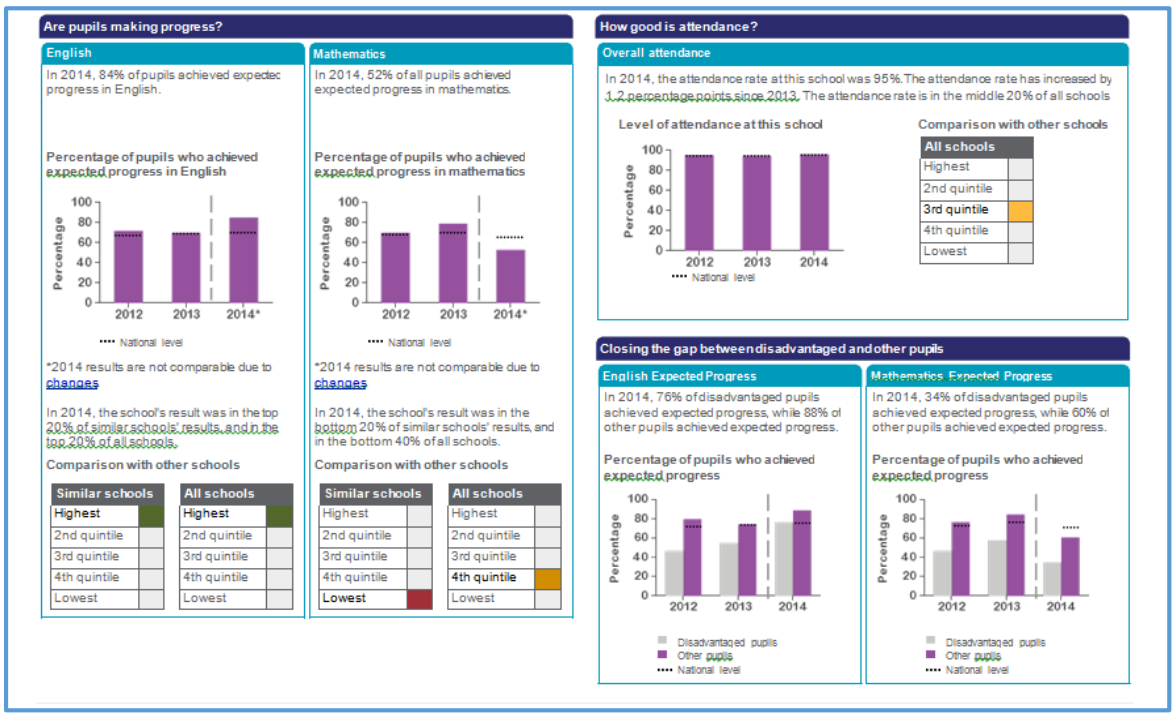
One of the most successful features of the FaSMEd project with respect to case study school 1, was how the teachers worked together. Jessica identified this as a highlight for her. She felt that she learnt a great deal from seeing how others plan and the strategies and resources they adopt. What was important in the context of this school was the support that the FaSMEd teachers received from the senior leadership team. They allowed dedicated time for the planning and reviewing. This is in stark contrast to case study school 2 who had to grab moments together and this ultimately affected their ability to meet and plan together.
Having the support of a group of teachers also meant that Jessica felt able to take risks and step out of her comfort zone. She was therefore able to trial a range of technologies and also group work, which was something she had been too worried to try in the past-fearing bad behaviour. If teachers are to be encouraged to be innovative and not to remain 'stuck in a rut' (teacher interview) then the importance of support mechanisms and networks needs to be taken into account.

With respect to formative assessment the maths department had already initiated a range of successful approaches, including the development of level ladders. Jessica was using these but also developing her own techniques e.g. using lollipop sticks to ensure that all students contribute; voting using whiteboards, the use of hinge questions that allow her to differentiate her feedback (see section on classroom teaching). The introduction of the technology (ipads, interactive whiteboard and Reflector) allowed her and the other teachers to share the students' work more effectively so that both the teachers and other students could comment. Jessica felt this was particularly helpful for students who are frightened to come up to the board in front of others.

Case study school 1 has a reputation for developing their students so that they are able to communicate their ideas effectively. The FaSMEd project tasks therefore fitted in well as an approach to encourage mathematical communication. What was different for the students was the very practical, realistic and open-ended nature of the tasks. Although some students found this disconcerting, the general response was very positive. All acknowledged that the tasks allowed them to be creative and gave them greater ownership of their learning.
Although the students enjoyed working with the new technology, there was still an appreciation of the need for balance within maths lessons and all valued the relationship with the teacher and what she could offer that technology couldn't.

Appendix A: school data dashboard





Appendix B: Teacher Interview

Q1: How have the students responded to the FASMED lessons?

They have been really engaged and you can see that they find it really fun and I think that the way they tackle group work now is far better than it was. This project that I am doing at the minute, planning a holiday, I haven't had to tell one group to get on with it, they took it upon themselves, knew exactly what they needed to do, talked to each other, delegated roles and just worked really hard. The distance time graph activity, which was the first one we did, they weren't as organised and involved; but as we have done more and more they have become really interested.

Q2: so that was the organisation in the groups, were there different roles?

Yeah, they are all engaged, there is not one person that sits there and thinks they can get away with doing nothing because it is group work. They all know that they are responsible, because in a lot of the activities I will come round and talk to them and ask questions. But, the person I ask must be able to answer, they can't rely on the rest of the group for an answer, so they knew they were responsible for what they were saying.

Q3: do you think it is different to how they were working beforehand?

I think certainly in my lessons, I am not sure about Primary School, I think it has been clear because of the way they have been trained during these lessons and they are suddenly much better at dealing with things like this. I think they obviously beforehand didn't do much like this kind of thing. Certainly in my lessons it would be pair work or individual work, I wouldn't have done much group work until Christmas when they started.

Q4: has it made you more confident about putting them into groups now?

Yeah, definitely, I have done a few things since we did the tests at the very start of this half term, so since then I have been doing fun things with them, I haven't drilled them with anymore topics. Every week we have done group work on different things, we have done a timer project, a Buildathon project and they have all been in different groups for that, sometimes chosen by them, sometimes chosen by me.

Q5: so you have obviously seen the benefits of them working in that way?

Yeah, definitely.

Q6: do you think the formative assessment practices have worked well, do you still get feedback on when they are and where they want to go?

Yeah, I like the set of questions that come with the lessons, the sample questions, I look at their work, especially the pre-assessment work and I write on questions based on what is right and wrong.

Q7: so the pre-assessment tasks, you have found them useful, useful for planning?

Yes, very useful for planning and then throughout having that list of questions, which are there for support, what went wrong and what I could ask to make it better.

Q8: in terms of the technology, what do you think has worked particularly well?

I have really liked having the white board, not just for this class but for all classes, the interactivity of it, they love coming up and putting their answers on there. We got it this year because of the project, I think we have all got good use out of it as well. I have used the Ipad's in conjunction with it, so they can project their answers up onto the board so it can be annotated. Or for people that don't have the confidence to go up to the board, they can sit with the IPad on the desk while it is being projected up there and talk through certain aspects of it that everyone can see. So that has been nice.

Q9: so there are opportunities for them to join in in discussions in ways that they may not have always done with the class?

We talked about the other day as technology not just being the stuff that we plug in, like whiteboards. I always used whiteboards a lot, but I think I am using them better than I used to. It means I can easily see who has done what, we don't do any of the quizzes that the other departments seem to do, and we don't use Socrative or anything like that.

Q10: but you use the whiteboards in a similar way, where you give them a question and they show you the answer?

Yeah.

Q11: in terms of technology and formative assessment, is there anything that you feel could do with improvement?

I think we should start to use Socrative, now I can immediately see who has got it right and who has got it wrong, and I will pick on the person who got it wrong, so they can try and explain their way of it. But if I could keep a result of that, so this person has got all of that wrong, so they need extra help and keep a record, I think that would be useful. So I suppose that is using technology and assessment together.

Q12: so in terms of your other teaching outside of FASMED, has the FASMED impacted on your other lessons?

Yeah, **I** think so, for a start using the whiteboards, it makes lessons a lot easier, so instead of using a PowerPoint, which really can't be touched or changed, using the interactive whiteboard the kids can write on it and I can write on it. So that is one thing, I have used the lessons as well with a lot of other classes. When that famous man came in to watch the distance time graph activites and he said it was the best use of an activity he had seen in a lesson, so that was down to the resources, which are fantastic.

- I'm sure your teaching as well

Well I just let them get on with it, so he was big fan of that distance time activity and I love it and would use it in all lessons, also the security camera one as well. The sweet box one they loved, but I wouldn't use it as a topic, I would use it as an end of term activity.

Q13: who is the famous man? (8:00- 9:25)

Kevin Collins, he is a CEO and he came in, we are doing another project with the Uni as well, the VO project and he is the one that they wanted funding off, so I was told that it pretty much depended on this lesson…

Q14: so in terms of FASMED overall, what would you say is the most beneficial aspect of the project?

I think the impact that it has had on the kids is the best thing that has come out of it because they are just far more equipped to deal with situations like that. So like open ended lessons, where they just have to get on with it themselves, it doesn't have to be structured, I don't have to say this is what you are doing now for ten minutes, they can get on with it for the whole lesson and their minds don't wander, they don't mess around. Also I think that the other thing the teachers have got out of it is the joint planning aspect. That has been the best thing for us, to sit down as a department and plan and see how other people plan, because sometimes you don't really get that, you just plan on your own, and you get stuck in a bit of a rut, so that has been really good. The reviewing sessions as well.

Q15: so I guess that joint planning has given you a focus as well?

It has yeah.

Q16: what have you found difficult about the project or what would you have done differently?

I think the main difficulty is that we haven't had much time for anything else in CPD time because most departmental time has been taken up by that, which we have all enjoyed. So it hasn't been too bad, but I think it has effected the two people in the department that didn't do the project, maybe if they had been involved as well, it wouldn't have had so much of an impact. In terms of the lessons I can't think of any difficulties, it has been fine yeah. What we were worried about is that they were going to eat into time that they needed to be learning topics, but I haven't found that. So that hasn't been an issue that I originally thought would be.

Q17: within the schools you have done the Plan Do Review cycle, how beneficial has that been?

It has been great to plan together, I have enjoyed doing the lessons and then the reviewing part has been really good. Because we haven't all been doing the lessons at the same time, we have staggered them a little bit so for example I did the distance time one first and the first one was awful, so then I could go and tell the rest of the department, make sure you do this, and look out for this, so we all review at different times.

Q18: has it worked well working in a group within your own school, has that been a useful model do you think?

Yeah, I think because in this school we are expected to do a lot of research on lessons anyway, so it has been good practice for that and in particular you need to work within the department. It is easy because we see each other all the time and we can sit at lunchtime and breakdown and chat about it. It's not like you are trying to catch someone in Geography.

Q19: have you discussed the FASMED project with anyone else other than the project team?

Yeah we have talked about it with SLT and I have just in passing mentioned it to people. We did a CPD session last week, where it was like a market place type thing an you had to showcase something that you had done over the year and that is what me and Kirsten did, we did about FASMED project, it either had to be the use of ICT, the formative assessment or differentiation and I think we kind of encompassed all three of those.

Q20: so the other two people in the department, you have talked to them?

Yeah, we have talked to them about it and I think they have used the distance time resources.

Q21: how beneficial has it been to meet the teachers outside of the school?

It has been really nice to see how other schools work together and which things that they use. So learning about Socrative, it made me feel like I could use it, especially hearing about their struggles with it, it made me feel like I could tackle it, I could try it, I'll probably struggle more. There was one meeting where we all sat and had to talk about the lessons that we had done, we differed from the other schools, we said we had done and what we would do differently, so that was really useful because then we good put that into place for the next task.

Q22: in terms of the support from the University, has that been useful?

Yeah, we have known you have always been there, if we have needed to email you and you have certainly made an effort to come here a lot and sit in on the sessions and be there to answer questions if you needed to. So yeah, couldn't fault it.

Q23: is there any other kind of support that you would have found useful in the project?

No

Q24: was there a good balance between the cluster meetings and the meetings at your school?

I think it was a good balance yeah because I think that anymore twilight sessions might have been difficult for people to make, but obviously the ones where we have had CPD time, where you have come here, that hasn't been a problem for us at all.

Appendix C : student interviews

Student 1

Q1: why is it you think exams help you?
I like to know what the level is that I am at, so I can work on what I have done wrong and you comment on what you have done and how you can work on it better.
Q2: do you think most people like exams?
No, I am just a bit weird like that.
Q3: why do you think maths is learned best when doing practical things?
For example the sweet activity, we had to make something, I like doing creative things, so making shapes into boxes. We made it into a hexagon so I can fit all the sweets in.
Q4: why do you find maths fun?
Because Miss doesn't just say that you have to write these sums down, she does something called magical box which is where she puts a box the board and asks us to put even numbers in it, but it would be like hundreds and thousands and it was even millions once.
Q5: was it different to how you learnt in Primary School?
In primary school it was just sitting on the floor and holding a board up.
Q6: why are you nervous in a maths lesson?
People comment too much, they are quite harsh if you get something wrong, and they'll go on and on about it and they'll want to know your scores.
Q7: you prefer working on your own rather than group work?
Yeah, because in group work people are more dominant than others, I can be dominant, but in a group I have to show dominancy. Most people in my lessons are afraid of me. I can get along with people but if I am with them for too long then it'll play on my mind, what have I got to say to them, what have I got to do to them?
Q8: tell me about technology.
If we use it too much then it gets a bit hard, it isn't an ICT lesson, it is a maths lesson.
Q9: Do you like using it a little bit?
Once a week we go to the computer rooms, so when we are in there we go on the computers once a week. We would go to the soul room and go on the computers in groups and there would be a police man/woman that would go around and check on what we were doing. We use IPad's sometimes, but we couldn't do all that in the same week because it would be really hard.
Q10: when you use the soul room is that just for maths?
No it is for everything.
Q11: do you find maths frustrating?
It is alright but it can be really annoying because you know you have got something right but when the test comes and you get a blank and you just sit there like what am I doing.
Q12: why is it you prefer a teacher to learning through technology?
Because Miss knows where you are going wrong, she has seen our tests and marked it, and she knows where you can go wrong. But the computers are just a block of metal.
Q13: are certain teachers different from each other?
Some are intimidating, not maths teachers, but others can be really intimidating. Some of them say go and work on your own and with some when you have been working on the activity and they try to explain it in a way that you'll understand it. If I was doing symmetry then I could get my phone out and get a ruler and put it in the middle to see if

it is symmetrical and wouldn't be good because I could have my phone on and they will send me to the back without letting me try to explain it.
Q14: is maths relevant for your future life?
Yeah because if I had a kid in my future life then I would have to work out how I could pay for food and having a car, that's what I am worried about for when I am older, credit cards, because I am not that good at that.
Q15: it is good to know how to use credit cards is it not?
Yeah, well we were getting our kitchen done and they messed it up so they had to bring everything back in. they measured it but the guy that came out to do it wanted it for himself, he spent the full time trying to convince us.
Q16: how are the lessons like the security cameras different to your normal lessons?
They are different, because you could be in a lesson and she'll put the questions on the board and tell us to do them, but in the FASMED lessons you get the task and you are allowed to be really creative and make it your own.
Q17: if she gives you a question what do you have to do next with it?
Working out and trying to convert fractions, you can do more if you want to get grammar points or you can make it like even better.
Q18: how do you work in that: on your own? In groups?
You sit on a table, and obviously some people try and look at your work and then it gets a bit frustrating, but you don't want to say anything. She says you can either work by yourself or work in partners or in threes with the people you sit next to. So with your partner he thinks he will get the marked right by working with me. It is really annoying because I don't want to work with him. The partner I have got now isn't that bad.
Q19: so it depends on your partner does it?
Yeah.
Q20: are you always sat boy, girl, boy, girl?
No, but I am mostly sat at the front.
Q21: in the FASMED ones do you ever have to get together in a group and share your ideas?
No, but it is like, we get to change our groups and I think that is a lot better when you get to choose them. But then the frustrating bit is that I got to choose my group and my friend is deciding to be my friend over and over again and she keeps asking if I want to go to the guidance manager about it. She keeps asking and asking, we were doing one of the FASMED lessons and she said she didn't want to be my friend half way through it.
Q22: so it is good to work in friendship groups but not all the time?
Yeah, I am friends with most of the people in my class, even the boys, most of the boys there are approachable. They are not stereotypical because I am one of those girls that can have a laugh with them, I am not that bothered by them.
Q23: so you not that nervous about sharing your ideas with boys?
No, I am not that bothered. Other girls like go in a huff about it, but there are other girls who are like me that aren't bothered about it, which kind of frustrates me.
Q24: what are your normal maths lessons like then?
I can't really remember, because I had the test ages ago.
Q25: what does the teacher do in a FASMED lesson?
They just tell you how to do it.
Q26: do they walk round then?
She just sits back and lets us get on with it, but obviously she watches the behaviour.
Q27: how do you find out at the end if you have done the right thing?

Well we did this farm thing with FASMED and we had to design a farm, but what we had to use them isometric paper cubes and we had to make the farm with the amount of money we had which was the cubes, it could be a fiver. But it depends on what building you are putting on there, so I put a farm house that is free, I could even put a normal farmhouse. She got us all at the front and got us to be all to press as much space as we could in as possible and I think it was Sir that judged it. Sir came in because Miss couldn't choose, mine was really colourful and it worked so he chose mine. That was the one where the girl fell out with us and I had to do it on my own, so I think I got an extra prize because I was doing that.
Q28: does she do a similar thing in the FASMED ones?
Yeah, in the sweet box one she judged the winner.
Q29: do you do much peer or self-assessment in the FASMED lessons?
No, I don't think she does that very much, I think it's a bit frustrating peer assessment because you could be put with someone that doesn't like you and they'll do it on purpose. If you are put with someone that likes you then they'll wait till you have marked there's then they will look at theirs and put the same mark. They don't want you to put a 5B on there's and they put a 6C on yours. They don't want it to look like you are smarter than them.
Q30: so it's a bit competitive then, you want to get the same as your friend?
Yeah, sometimes it is like being put in a booth and they have put my mam next to me.
Q31: is there anyone you wouldn't do that with, where you are more honest?
I don't do that, it is just them that do it, but most of the boys don't because they are really competitive, they don't look at the mark they just put one down. Sometimes they even lie, and as the term is going on like check it more.
Q32: in a FASMED lesson do you talk more to the other students?
The teacher talks less.
Q33: what are the teachers like in a normal lesson?
In a normal lesson, our teacher's desk is behind us so it is kind of bad.
Q34: what else don't you like about the FASMED lessons?
Well, with the graphs she dragged it out quite a bit, it went on too long.
Q35: what technology do you use in them?
We used the IPad's, the computers and the SOL, SOL is basically self-organised learning. We do that sometimes in the FASMED.
Q36: what kind of things do you do on the IPad's?
Just researching, we did a timer project, we had to make a 2 inch timer and we searched about timers, how they worked and what they were about.
Q37: did you like doing that on an IPad?
Yeah, it is easy to use because I have got one at home, but some of the computers we have got are like… I have a Mac so, so the computers they have got are really frustrating because they are not as new. I am used to Apple and I don't know what they are, Microsoft or something.
Q38: so the computers don't always work out as well?
Yeah, because I am used a certain type.
Q39: so you don't quite know how to use it?
Yeah, because you get different computers in Primary School.
Q40: anything else difficult in the FASMED lessons that you don't particularly like?
Sometimes it depends on how much you stop, because sometimes you will be stopped half way through a lesson. And if people don't work the teachers will threaten them, they'll say you'll be sent to time out or on report, but they never actually do it.

Q41: have the FASMED lessons helped you learn maths?
I don't like the other people because I just work by myself in my mind, and they copy, but copying should really be an honour.

Q42: so some people copy?
Yeah, and if you are working in groups some people pass work off as their own, because I have been with people that have just sat there and done nothing. But when it comes to the talking and explaining they want to do it. That has happened before and I have just let them and when they have tried to explain it, Miss said do you want to wait until the end and we can go outside and talk about it, and she was like 'what do I need to say, what do I need to say?', she hadn't listened, she was on her phone under the table.
Q43: are you allowed your phones in school?
Sometimes, it depends on what we are doing.
Q44: have you been able to use what you knew already from maths in your FASMED lessons?
Oh yeah, because you have to add when you are doing graphs.
Q45: you know when you were making the sweet box, was that maths you had already learnt, how did you know how to make a cube?
We did that in Primary School and I always did that sort of thing. At home I have got this giant box full of art stuff, so I make cubes, houses and miniature people and that.
Q46: do you feel more confident in maths now?
Sort of, it is not really a change for me, it has just got more competitive.
Q47: is that because there are more tests?
Yeah, I was told that as we went in to High School that I would get homework every day, so I was getting really worried and it is not as bad as I thought, it is not as hard as Primary School. I used to get homework every day at Primary School.
Q48: all the time, or just in year 6?
All the time.
Q49: so you don't get as much here?
You don't get as much, but you get big projects.
Q50: which do you prefer?
Big projects.
Q51: do you think with FASMED you have learnt general stuff, like group work?
Yeah, like how to cooperate with people, and how to get along with them, I haven't cracked it with Rosie yet though.
Q52: does it help you to learn in other lessons, like ilin?
Ilin is completely different, it depends where you are sitting in ilin bcause I was sitting with the girl that decides if she is my friend or not and the other girl that keeps deciding to be my friend. Then I moved away to sit with this other girl and the second I moved away there was this girl that sat with them, she moved to the end of the first desk, the other girl was sitting at the other end of the desk and the worst girl, the one in maths, got moved to the other side of the class to be sat next to the window. There was a girl that side, one in the middle and one over there and I was just sat at the back laughing my head off
Q53: would you like to do more of these types of FASMED lessons in the future?
Yeah.
Q54: why is that?
Because it is easier and it helps you're learning a bit more.
Q55: is that because it is practical?

Yeah.
Q56: have you discussed the lessons with other teachers or students in the school?
No, because we don't really talk about that kind of stuff, if you talk about lessons you sort of get the mick taken out of you.
Q57: have you talked about it with your family?
I have told my mam about the boxes.
Q58: what did you tell her about that then?
That I enjoyed it and it was creative.
Q59: what kind of subjects do you like in school generally?
Science, Art, ilin is alright, and I love PE and Science, and design.
Q60: do you have any idea what you want to be when you are older?
I want to be a wrestler.

Student 2

Q1: can you explain why you like to use technology a lot in maths?
I like using it because it means you can understand it a bit more and say if you didn't understand a word or something then you could research it.
Q2: do you enjoy maths?
Yeah.
Q3: it is sometimes not always easy to do?
No.
Q4: how does maths help you understand the real world?
Seeing how maths is used in everyday life and things like that.
Q5: is there any jobs you can think of that you will need maths for?
If you work in a shop or something for counting money.
Q6: do you use money quite a bit?
Yeah.
Q7: so you use maths a bit to work out how much something is going to cost and if you have enough money?
Yeah.
Q8: what do you like about doing exams?
I like doing the exams because I know I have got to do them, so I work a bit harder towards them and learn a bit more about things.
Q9: do the results you get from that help you?
Yeah because then I get to know where I am and what I need to do to improve and things.
Q10: you like working with groups more than on your own?
Yeah, I like working with my friends and things.
Q11: when you are in group do you prefer to be with your friends?
Yeah, with my friends.
Q12: why is that?
Because they understand a bit more what all of us want to do, whether it is to be bossy or quiet and stuff like that.
Q13: how old are you?
11.
Q14: how were the FASMED lessons different to your normal lessons?

You do more practical work and you would get up and learn a bit more about area and things like that.
Q15: what did the teacher do differently in these lessons?
Using IPad's which were connected to the whiteboard, so we could see what everyone had made by using the camera.
Q16: so that was kind of sharing ideas?
Yeah.
Q17: did you work by yourself and then in a group or just in a group?
Sometimes we were in a group but working on our own for a part of it.
Q18: how were the groups made?
They were mixed sometimes, but sometimes we got to choose.
Q19: which groups worked best?
When you were with your friends.
Q20: what does the teacher do in your normal lessons then?
Normally it would just be copying out of books and things like that.
Q21: does the teacher move around a bit more in a FASMED lesson?
Yeah, she moves round to see what we are doing.
Q22: did she talk a bit more in…?
Yeah asking what we were doing and how we were doing it.
Q23: did you just much self or peer assessment in the FASMED lessons?
We did a bit of self-assessment.
Q24: were you looking at other people's work and comparing it to your own?
Yeah.
Q25: did that help with your learning?
Yeah because you could see what they did and how you can improve your own work.
Q26: did you learn from the other groups or did you tend to get it right?
Yeah, sometimes I thought things in other groups were better but sometimes I preferred the stuff we had done.
Q27: do you talk to other students more in the FASMED lessons?
Yeah, we could normally work with as many people you want as long as it is under a certain number, you could be on your own or in pairs.
Q28: did most people work in groups?
Some people worked on their own and some people worked in pairs or in groups of three.
Q29: what did you normally do?
Pairs.
Q30: would that be with a friend?
Yeah.
Q31: were the IPad's to share ideas?
Yeah and research about certain things.
Q32: how did you share your ideas?
The teacher had an IPad and she would connect it to the whiteboard and she came round because you could see without videoing it and as she was walking around it would show it.
Q33: do you mind sharing your ideas?
I don't really mind sharing ideas sometimes.
Q34: what was difficult in the lessons?
Sometimes working out the maths behind it and things like that.
Q35: did you always know how to start when given a task?

I would ask the teacher how to start it.
Q36: anything difficult about using the technology?
Sometimes the Wi-Fi would stop working or something like that, so they would just not work.
Q37: the tasks that lasted longer than one lesson, did you like them?
Yeah, I like doing the ones that took longer than one lesson.
Q38: was it always learning new things or using things you already knew to put them into a practical activity?
I like doing stuff that we already know.
Q39: so you had to find the right maths to use?
Yeah.
Q40: did you learn any new maths from looking at other people's answers?
Yeah, I learnt stuff about certain topics that I didn't know about.
Q41: what kind of stuff?
I learnt a bit more about angles and things.
Q42: did you learn about stuff generally, how to work in groups and stuff like that?
No, not really.
Q43: has it made you more confident with maths?
Yeah, made me more confident about sharing ideas.
Q44: was it a bit scary at first sharing ideas?
No, not really.
Q45: do your friends like it?
Yeah.
Q46: would you like to do more of these lessons?
Yeah, because it is more fun and interesting and it helps your learning.
Q47: have you talked about the lessons with any other friends or teachers?
No, because we didn't actually know that they were called FASMED, we just thought they were like different lessons.
Q48: have you said to your friends that you are doing the sweet box thing today?
Yeah, I talk to my friends about it that aren't in my class.
Q49: what kind of things have you told them?
That we were making sweet boxes.
Q50: are they interested that you are doing something different?
Yeah.
Q51: have you talked about it with your family or anyone at home?
Yeah, I just told them what I was doing.
Q52: do you normally talk about you maths lessons?
Yeah, if it is something interesting, if it was just writing on paper then I wouldn't mention it.
Q53: what kind of subjects do you like?
Maths mostly and I like science and art.
Q54: what do you want to do when you are older?
Maybe a teacher.

Student 3

Q1: why did you put some of the statements in the strongly agree column?
For the first one it is because you use it in everyday life, because you need to know how to tell the time. You need angles for example if you were making something you would

need to know what shape you want it to be, how big and what the area you want it to be, and that is it for that one.
Q2: you think it is quite easy to learn things in maths?
Yes.
Q3: do you think maths helps you to make sense of the world?
Yeah.
Q4: does it help you to understand different things?
Yeah, how to tell the time and stuff.
Q5: you like using technology in maths?
Yeah, it helps me to understand better.
Q6: do you like using technology for learning?
Yeah.
Q7: do you use a lot of technology at home?
Yeah.
Q8: is maths one of your favourite subjects?
Yeah, one of my favourites.
Q9: have you always liked maths, in primary school?
I didn't like it that much in primary but I did like it.
Q10: you liked it more since starting secondary?
Yeah.
Q11: you think maths will help you in the future?
Yeah, it'll help you work out sums, if you needed to know, if someone was coming to your party how many party bags or something you might need.
Q12: you think everyone can learn maths?
Yeah, everyone can learn it.
Q13: you prefer to the teacher than use technology?
Yeah, because say for example you might look at the technology, but you don't feel that that is the right answer, you want to double-check with your teacher.
Q14: do you like to find stuff out by yourself and ask the teacher?
Yeah. Because sometimes there is things you look at and no straight away that it is the right answer.
Q15: do you like exams?
Yeah, because you can see how you have improved throughout the year and what you need to work on.
Q16: does the technology helps your teacher know where you are in your learning?
Yeah.
Q17: you think maths can be right or wrong?
Yeah, but obviously not every question, some questions have a right answer.
Q18: how does the technology help you to learn?
It helps me understand it better.
Q19: you like doing group work?
Yeah, because you can find out other people's opinions and what they think.
Q20: you are happy to keep working at something till you get it right?
Yeah.
Q21: you don't think that there is time in your lessons to reflect?
Yeah.
Q22: would you like more time to reflect?

We do go back over some topics that the class struggles on a bit. If it was easy then we were less likely to forget it, so we didn't go back over it. But at the end of the year we will start revising everything we have done.
Q23: you think maths is best learnt doing practical activities?
Yeah, because it gets it in your head better and you can remember it more.
Q24: you learn better maths when you are on your own?
Yeah, because if it is group work and you copy someone, then when it comes to working on your own you will have no clue because you have copied off someone and you haven't found the answer yourself.
Q25: you like to learn maths in lots of different ways: groups, independently?
Yeah, some tasks like technology you want to work on your own.
Q26: what is good about using the technology on your own?
There isn't much fuss on your own because normally if you are working in a pair then you have to decide who is going to write and who is going to use the technology. But if you are on your own then you will have to do both.
Q27: does your teacher always use some type of technology?
Yeah, she use the IPad's to show the class what she is doing, so instead of all crowding round, she can click the camera thing and it will go up on the board for everyone to see.
Q28: do you like that?
Yeah.
Q29: do you think exams make you work more?
Well, if you didn't know that exams were happening then you might not want to remember it that much more. So it might get out of your head a bit quicker, but if you know that there is an exam then it will help you to remember.
Q30: you are quite comfortable using technology in maths?
Yeah.
Q31: are you happy to do exams?
Yeah, you know after you have done the exam you know that something fun is coming up and how to improve. The actual exam might be boring but after you have done it you might think that it wasn't actually that bad.
Q32: you think anyone can learn maths?
Yeah.
Q33: you get to talk about what you are thinking?
Yeah, most of the time. But, if she knows you know how to do it, then she will go and help other people. If I knew just subtraction and someone else just knew division and it was a subtraction question, then she will ask the people who aren't that comfortable.
Q34: is using the textbook is one of your least favourite ways of learning?
Yeah, because you don't remember it as well because you are just reading through a textbook and it is quite boring.
Q35: you don't agree that maths is something you are born with?
No, it is learnt, I mean when you are born you might know some maths, but you won't know everything.
Q36: are you comfortable using technology?
Yeah.
Q37: you disagree that maths is difficult?
Yeah, because if you ask the teacher than it becomes not that difficult anymore.
Q38: you think maths is relevant in your future life?
Yeah, I could be using it.
Q39: do you think you will use in maths in a job?

Yeah, you might use it in a job, as I said like with making party bags.
Q40: were your FASMED lesson different to your normal lessons?
Well, obviously when I was doing the activities I didn't know that they were FASMED activities, so it didn't feel that much different, because I didn't know we were doing a different thing.
Q41: now can you think how they were different?
We worked in groups most of the time.
Q42: what do think of group work?
It is good, but as well as doing group work it is good to do some individual work.
Q43: do you think you used more technology?
Yeah we did.
Q44: what was that like?
It was quite fun using the technology.
Q45: do you think there has been anything useful about the lessons?
Yeah, angles, area, perimeter and stuff.
Q46: so you feel you have learnt different things?
Yeah, because we used to just do like area as a topic, but this time we have done a topic that includes area and perimeter and everything.
Q47: how was that?
Quite good, because it helps to understand it a bit quicker.
Q48: what did you think of the practical lessons: sweet box and security cameras?
That was good because instead of just sitting down, reading a textbook or writing in your book, you are doing something interesting.
Q49: do you think that helps you to learn?
Yeah.
Q50: has anything been difficult about the lessons?
No, it has been like, well somethings have been rather challenging, like most of things, but usually we have been taught them in the past.
Q51: so some things were challenging, but you were able to work at it and get there in the end?
Yeah.
Q52: you had lessons where you were going over things to improve the, what was that like?
Good because say for example if you had 1 + 1, the answer is 2, but the teacher would ask why, how did you get that.
Q53: what was it like having to explain your answers?
Yeah good.
Q54: is that different from what you would normally do?
No, because the teacher usually asks can you explain it, so she knows you haven't just copied. Because if you have copied then you wouldn't know how you got the answer.
Q55: so that is how the teacher knows you have learnt it?
Yeah.
Q56: do you think the lessons have helped your understanding of maths?
Yeah.
Q57: would you like to do more of these types of lessons in the future?
Yeah, because they are fun and they help me learn quicker.
Q58: have you talked about the lessons with anyone else in school, other than your class?
Yeah.

Q59: who to?
My friends, just like what I had been doing in maths and stuff.
Q60: have you told anyone at home about them?
Yeah.
Q61: who?
My mam, dad and grandma.
Q62: and what do they think?
That it is good.
Q63: do you normally tell them what you have been doing?
Yeah, I normally tell them.
Q64: is there anything else you want to say?
That I would like to do more in the future.

Student 4

Q1: is maths one of your favourite subjects?
I wouldn't say favourite, but second.
Q2: why do you like maths?
Firstly the teacher is brilliant and second because maths is more practical and hands on and you are free to express your ideas. We write on the whiteboard and you can tell other people your ideas and they won't make fun of you, they adapt your ideas and make them better. I also like maths because in some things I'm good at there is a definite right answer and the things I'm not so good at I can kind of analyse my answer and make it better and actually get the answer right to a question.
Q3: so you can improve it?
Yeah.
Q4: you like exams because you can see how you're doing?
Yeah, you can see how you are doing independently without any help. So in the future when you are working independently in University and working at home, it means you can see how you are going to do for future reference.
Q5: you say maths depends on the teacher, so you have had a good teacher this year?
Yeah, Miss is really brilliant, she comes and helps you whenever you want, she is always there for help and if you get really stuck she will say 'Rosie has just asked this question, does anyone know the answer?', then we will analyse that answer and if I still don't get it then we can explain it on the whiteboard.
Q6: so you have class discussions and you can use the whiteboards?
Yeah.
Q7: do you like to do practical activities in maths?
Yeah, I just can't think of stuff in my head, I like to write it down and check and check, whereas it is hard to keep your answer in your head and improve it when it is not even wrote down.
Q8: do you like to get up and do things, just thinking of the security camera activity?
That was a really good activity.
Q9: distance-time graphs, where you acted out stuff?
Yeah, that was really good, I really like the farm and the fair because it actually taught us how to have a business and how to be responsible to run that business and to not get overwhelmed and say I'm going to buy this and that when we actually need proper facilities such as toilets, food, drinks, etc. It was really good.
Q10: so you like having a real life situation that you can use your maths in?

Yeah.
Q11: so you like using textbooks as well?
Yeah, because they are written by professionals so it will give you a right answer and if you don't really get that answer then you can flick to another page and it might explain that answer even more and you can always go back to the textbook to learn anything you want.
Q12: does the technology help you to learn?
Yeah, I think we use this thing, they're called Alfie Tests, and we do them on the computer, it is a test to see how well we are doing. Or we can use MyMaths, which is technology based on online homework, so you can do it at home in your own comfort and see how you're doing at home.
Q13: do you think maths is used everywhere?
Yes, especially when you get a job and a house and a baby and family because you have bills and the responsibility of a child – there is the baby bottles, so you need to measure. If you work in a shop you need money and if you work in a bakery you need ounces. Everything revolves around maths.
Q14: sometimes you like to work on your own in maths?
Yeah, I feel like I get more done when I'm working on my own than I do with a friend, because a friend will often go off task and ask what I'm up to at the weekend or something. Whereas I am like I want to get the work done, but it depends on what we are doing.
Q15: you think maths is something you can learn and everyone can have a go at it?
Yeah, it depends if you want to learn it or not; if you want to learn it then you have more enthusiasm but if you don't want to then you'll still learn it and remember it if its shown correctly, like if you prefer for it to be shown on technology or on a whiteboard, then you'll probably learn more if it is your decision.
Q16: so you think exams help you work more, do they motivate you?
Yeah, it is because you only have a certain amount of time to complete it and try to do it at your best ability and if you know your results will impact whether you move up or not then you'll obviously work really hard at it and remember most things.
Q17: you prefer to get the answer off a teacher rather than googling it?
Yeah, because if you type something into google then it is other people trying to explain the answer, you can't actually just type into the internet 'I need help with such and such', it doesn't really work like that, whereas a teacher it is face to face and she can write things down for you and show you on the internet.
Q18: so sometimes the internet is too general is it?
Yeah.
Q19: so the teacher gives specific help?
Yeah.
Q20: but you do think technology helps you to understand what you need to do?
Yeah.
Q21: and it works when you are working in a group together?
Yeah because if you have an idea and another person has an idea, but then your idea is wrong then you can search up on the idea and we can see how we can combine the two ideas together.
Q22: you are happy using technology and if you need it you can search on it?
Yeah.
Q23: is technology something you use a lot of at home?

Yeah definitely, I thin YouTube helps a lot, there is a category on YouTube called education and within that there is other categories of subjects: maths, English and science, etc. and it will actually explain what maths is and how we can improve on that and how you can be better in class and more confident by giving you tips.
Q24: the teacher uses the technology to find out where you are?
Yeah.
Q25: you think maths requires a lot of repetition sometimes?
Yeah, especially when we did the farm and the funfair, there was a lot of adding up and calculating profits because you actually had to see how to get more people to come to your farm or the fun fair. If the number of people coming to your farm is decreasing then you know there is a problem and you would need to find out what that problem is. Then you have to add up again and subtract, it is like a sequence.
Q26: so you are quite happy to learn maths in lots of different ways?
Yeah.
Q27: does it help to learn it in different ways rather than the same way all the time?
Yeah, because you can actually find out yourself which way is the best way, for example if you use technology and you use a real life person like a friend, then you can see which gives the best answers and then you can choose which you will use to get the answer.
Q28: you can compare the answers you get?
Yeah.
Q29: so working groups is not your favourite way of learning?
No, I think it is best to learn independently but it isn't strongly disagree, because you can work with friends, but it depends on if you're stuck the you're going to ask a friend but if you're not then you can get more work done.
Q30: so you're happy to work on your own and in groups if you have to?
Yeah, I'm not choosy.
Q31: do you agree that maths is either right or wrong?
Well, it depends on what you are doing because if you were doing the distance or the two-minute timer. The two-minute timer would say you're not right or wrong because you can have tonnes of different ideas because your answer cannot be wrong, and no one can judge you on that. Whereas the distance one can explain their answer better than use, not by judging or humiliating you but it tries to help you on your answer because it might be wrong because distance is kind of either a right or wrong answer.
Q32: you disagree that you are nervous in maths and it is frustrating?
Yeah, because if your teacher is really friendly then she will give you guidance because she will tell you anything and help you with anything you want.
Q33: so you feel quite happy to talk to your teacher if you don't understand something?
Yeah, so do you want to do that on the interactive whiteboard or do you want to do it on here and explain your answer on the whiteboard.
Q34: so you have lots of options to do different things?
Yeah, but I prefer on the whiteboards because if you do something wrong then you can just erase it and forget about it and try and do it again.
Q35: you think maths is relevant in later life, you think you'll use it a lot?
Yeah, definitely, I don't know what I want to be, either a physicist or a pathologist.
Q36: but something you think you will be using maths for?
Yeah.
Q37: do you think maths is something you learn and develop?
Well, when you are born you just don't know anything about maths, it depends on what you actually go onto learn or what you go on to try and learn. So for example if you're

not really good at maths you can always improve, but if you are good at maths you can always improve further and help the person that isn't good at maths.
Q38: so everyone can have go on and improve?
Yeah, everyone can have a go at maths.
Q39: so everyone can?
Yeah, because that is like judging people, say you see someone that doesn't really look popular or not, they could be really good at maths, better than someone who is popular. Most people that are popular don't like learning, but could be really good at maths. You don't really know because it depends on their personality, and whether they want to learn it or not.
Q40: you get that opportunity in maths to express and discuss your ideas?
Definitely, because miss is always sitting at her desk over there, I don't know what she does on her computer, I think it is trying to find out ways to help us. But always if you need her she'll come over in the space of two minutes and she'll help you and then you can get onto another task. And if someone puts their hand up and says 'I am stuck on the same question as her', then she'll say why don't you two talk together about it and if you still don't get it the you can go to the teacher. There is a C3B4ME (see three before me), that means you see three people and if they can't help then you can and ask the teacher and you can choose if you want to work with your friends or if you want to go with the teacher.
Q41: how have the FASMED lessons been different to your normal lessons?
Well they are more creative, more teamwork and more practical hands on activities in real life situations. You can get a more sophisticated understanding by making it easier and fun.
Q42: you enjoyed them?
Yeah.
Q43: so they are more practical, so did that help you to understand all the different maths involved?
Yes because you don't realise you're learning something when you're colouring in, but you are.
Q44: did you use more technology than you would normally use, or about the same?
I think really you could always do it on the interactive whiteboard and that but I think in these FASMED lessons that you can have that idea of using your own technology and brain or you can actually go for help on the technology or see the teacher.
Q45: so there is lots of different options?
Yeah, you can think of what you want to do and choose your own way of doing it.
Q46: what has been useful about the lessons?
Well, I am talking about the fair again, it is business so if you want to go off and do business work then you know you can't spend everything on rides, you have to get really needy facilities and you have to have responsibility on getting them little details that actually make the whole thing come together. I think it was very useful to say that if you get a job it isn't going to be really boring. Some things might be boring, but you need those borings things to lead up to actually getting you to do the fun things. If you don't do the and actually learn in grid methods or for example learning sequences then you are not going to be able to do the fun things.
Q47: having that practical application that you would use in a job?
Yeah.
Q48: has anything been difficult in the lessons?

Em, well I think we went off task when we were just sitting there relaxing and colouring in, where we put the different colours wherever we wanted. I though what was difficult was trying to list all of the different possibilities and trying to figure out which one is right and which one is wrong. But with having that friend, or teacher or technology, then you can always find out which one is the best one and which one can help you, if you are an independent worker.
Q49: do you think the lessons have helped your understanding of maths?
Yeah, because you don't really understand if you are doing colour methods and when you are making a fun fair or planning a holiday. Because when you are planning a holiday, well we have got this imagined family that we can actually be in control of and we can send them to wherever we want them to go and we have to use their information to justify our answer and try and get them to where they want to go.
Q50: so you have use lots of different things you have learnt in maths and applied it to the situation?
Yeah, definitely.
Q51: would you like to do more of these types of lessons in the future?
It depends on what you're in, if you want to be serious about this then you can use textbooks and search up on the internet. But if you want to have a chilled, more relaxing thing then you can actually learn more and do fun things. But it depends on what the teacher wants to do or not.
Q52: so you like using a mixture, sometimes textbook, sometimes more practical?
Yeah, I think we should definitely use more textbooks, but actually I think we should do more fun things than textbooks because textbooks are time-consuming whereas fun things go by really quick.
Q53: but you also think you learn a lot?
Yeah, well with boring lessons you can always make them more fun by actually getting on with your work and you can talk to your friend.
Q54: have you talked about the FASMED lesson with anyone else in school – teachers or friends?
We have talked about it in class, Miss explained it on the whiteboard. But my friends don't really talk about it outside of school.
Q55: have you talked about the lessons at home at all?
Yeah, I have told my dad and my grandma and they said you are going to learn more when you are having fun than if you find it boring because you are not going to put any effort into it.
Q56: anything else you would like to add?
Well I just think that it is a very good idea, I don't know whether we are continuing with it in the future, but in my opinion it would be definitely advisable to do that in the future, especially with year sixes to show them that high school isn't boring, it just sounds boring. But when you put your mind to it, it can be fun.

Student 5

Q1: why do you think maths is important?
You need it for general stuff, like if you were going to the shop, like Asda or something. You can use it in jobs.
Q2: can you think of any jobs where maths is important?
Shopkeeper.
Q3: why is it you find maths fun and exciting? Is it your favourite lesson?

Yeah, I think it is because like the more you know it, the more you like it.
Q4: is it satisfying you think?
Yeah.
Q5: did you like maths in Primary school?
I didn't like it as much, but once I came into High school I have learnt more and I enjoy it more.
Q6: why do you think exams are boring?
Because you have to prep and do stuff before them and it makes you get nervous. If you don't understand the question then you become frustrated.
Q7: when you get your results, do you think that it is useful?
It tells the teacher what you have learnt and if lots of students don't understand one thing then we'll go back over it.
Q8: so they just use them to assess how you are getting on?
Yeah.
Q9: what kind of connections is it?
It associates with angles, measurements and shapes.
Q10: you don't like using the technology, you would prefer to talk to the teacher?
Because with technology it calculates it, but it doesn't tell you how you do it.
Q11: so it is like a tool, but it doesn't help to teach you things?
Yeah.
Q12: what is fun about using technology?
Well, in the last lessons we have done stuff like building things and measuring how much things you'll need.
Q13: do you use the IPad's?
We used the IPad's in one lesson and we used calculators in others.

Q14: would you like to use IPad's more?
No, because it is sort of cheating.
Q15: do you like being able to do it in your head?
Yeah.
Q16: you are quite keen to keep working at something till you have got it right?
Yeah.
Q17: why is using technology in maths frustrating?
Because if you put a divide then it comes up with a decimal and you have to click this button that I never knew of, then it comes up with the answer in fractions, or whatever you need it in.
Q18: sometimes it isn't helpful in the answers it is giving you?
Yeah.
Q19: you don't find maths particularly difficult?
No.
Q20: sometimes?
I didn't understand the bus method for division that Miss taught us, I had to do it on the board to learn it.
Q21: so you are keen to learn, you don't just sit if you don't understand it?
Yeah.
Q22: do you think we can all learn maths?
Yeah, you won't know it when you are born, through the years it will develop as we are all taught it the same way.
Q23: you think only gifted people can understand maths?

Everyone can understand maths, you can be gifted at a sport but don't understand mathematics.
Q24: so you think everyone needs to learn maths?
Yeah.
Q25: do you think everyone can be really good at it, or just be average?
I think it depends on your listening skills as well, Miss might explain something, and you might not here it, so everyone else has got it apart from you.
Q26: you think maths is best learnt in collaboration with others?
Yeah, you could work better with your friends, if you don't understand it, then your friend might and you can ask them for help.
Q27: do you think you need maths?
Yeah, on a daily basis.
Q28: what kind of things do you use maths for?
For lunch.
Q29: do you have to pay with money then?
Yeah.
Q30: you have to work out if you have enough money?
Yeah.
Q31: How are the FASMED lessons different to your normal lessons?
In normal maths lessons, on the board we would be doing division and adding numbers. But in these ones they were almost all together. You would have to measure how heavy the sweet box would be and you would have to decide which angle you would have to put the sweets in, to fit them all in and that.
Q32: so it was more group work?
Yeah, we were put in groups.
Q33: could you choose your groups?
It depends, because some groups would be silly, but Miss would normally let us choose.
Q34: was the teacher any different in the FASMED lessons?
It was the same teacher but she would teach us in a different way. Because with the sweet box it would be making the lessons more fun, but you would learn at the same time.
Q35: how was the teaching different?
She would tell us all together, what equipment we would need, how to build it and where to get the paper from.
Q36: did you share your ideas of how to solve a problem within your group?
Yeah, we had a piece of paper and it had three drawings on what you had to do.
Q37: did you share across groups?
Yeah, some groups worked together.
Q38: did you always know what maths to use, to solve the problem?
Miss would as us what maths we should use, and if people didn't know then the other people would answer it and they would learn from them.
Q39: so you learn off others?
Yeah.
Q40: did you enjoy the group work, was it a good way to work?
Yeah, because you are having fun and learning a bit more.

Q41: do you not have much fun in normal lessons then?
You have a bit of fun, there's the odd person that makes a joke and stuff, but then it goes quiet because everyone is concentrating.

Q42: did you do self and peer assessment on the work?
Yeah, because we were working in groups, we would self-assess and look back on it.
Q43: did you talk more, to the teacher and your friends?
Yeah, the teacher talked a bit less, and it was more like help your friend and they will help you.
Q44: is that we she said was it?
No, when you are working in a group, especially if it is your friend you get along with them more.
Q45: you think groups work better when…?
When you are with friends and not with random students.
Q46: do you still concentrate as well, when you are with a friend?
Yeah, there will be the odd time when we are a bit silly, but most of the time we are okay.
Q47: did you enjoy using the technology in the FASMED lessons, the IPad's?
Yeah, we used them more than the computers.
Q48: did you like doing that?
Yeah.
Q49: why?
Because it would be a bit easier, but at the same time, if I was on the computer less, then it would a bit boring.
Q50: you used IPad's and computers?
Yeah.
Q51: what kind of things did you do on the IPad?
We would search up stuff like measurements and the best shape that could hold sweets. For the security cameras, Miss would get her IPad and we would have to go to the corners and pick somewhere that the camera couldn't see us.
Q52: which was your favourite of the activities?
Probably that one, it was the shortest, but it was the most fun.
Q53: Did you like the longer activities?
Yeah, I wouldn't like a topic that went on for ages, I prefer little short ones, short fun ones.
Q54: how long was the longest?
I think the longest was about 6 lessons.
Q55: and how was that?
That was fun, because we were like had to plan our own holiday and spend the least to save the most money.
Q56: so you like the practical bit?
Yeah.
Q57: what did you find difficult in the lessons, the bits you didn't like?
It was just the odd child that was silly and that out everyone off, that's the one I didn't like, but that was it.
Q58: do you think people were being sillier in the FASMED lessons because you were getting to choose?
Yeah, because you were getting to choose what to do.
Q59: do you think the lessons have helped your maths?
Yeah, it is like with science when you are doing the practical, you have to be aware of safety, it is better than just reading stuff. You get to see yourself how it works and you get to do it rather than watching a video on someone making a sweet box, instead of just drawing it out in a normal lesson, you get to make it.
Q60: did it help your team working skills?

Yeah, you could work together and help friends, get the IPad's.
Q61: how many IPad's were there?
There was at least one between two or one between each group, so we all get a bit.
Q62: do you think it has helped your confidence in maths, or were you already confident.
Yeah definitely, because usually in normal lessons we would have to put our hands up, but in FASMED we were allowed to shout out.
Q63: did it matter if you were wrong?
No, because you found out the answer afterwards and you would learn from your mistakes.
Q64: do you get embarrassed if you shout something out that is wrong?
Yeah, I do get a tiny bit embarrassed, but I learn from it, I am not the only one that gets questions wrong, everyone makes mistakes and you learn from them.
Q65: would you like to do more of these types of lessons in the future?
Yeah, because they're fun but we still learned, but I think we would learn a bit more to be honest because instead of just getting a piece of paper and drawing and doing your measurements you had to do it, so you learn how to do it.
Q66: so instead of just writing in books you actually get to do it?
Yeah.
Q67: have you discussed the FASMED lessons with other teachers or other students in school?
It is mainly just our class, other classes do it, but we don't really talk about it.
Q68: you don't compare and say 'oh we did this camera thing'?
They would tell that to me and my friends.
Q69: so you did mention it to your other friends?
Yeah, the ones outside my class.
Q70: what kind of things would you say to your mates then?
Like we did this in the lesson and it was a good lesson.
Q71: do you do that a lot with your friends?
Well, the people I walk to school with are in my class because we all live near each other.
Q72: do you talk about school work a lot, or not really?
No, not really, but maybe on the weekend we would say we have homework or something.
Q73: have you discussed these lessons with your parents or anyone in your family?
Yeah, I have told my sister and my mam because when I go home she is always like: 'what have you been doing today?'
Q74: what would you say to your mum about a FASMED lesson?
Like 'today we did about security cameras'; we had to hide from a camera.
Q75: does you think the lessons sound more exciting?
My sister, because she is out of school now, said that my lessons were much better than hers.
Q76: what are your favourite subjects at school?
I enjoy maths, science, ilin, DT and Art.
Q77: which of the ilin ones did you do?
We made a movie.
Q78: you know for the museum, which was your board for that?
It was the big yellow one, the George Stephenson one.
Q79: so you like maths and science, do you enjoy the more creative ones, like Art and Drama?

Yeah, and DT as well.
Q80: have you got any ideas on what you want to do when you're older?
I like more practical things, because in all of them, you don't just write or do sums.
Q81: do you mind writing?
I would prefer to write like speed questions, like if we had whiteboards, like 5, 10, 5 and we would have to write it down and whoever got it wrong would have to learn?
Q82: but you don't like having to write tonnes down?
On paper no.

Student 6

Q1: you have put that maths is something everyone can learn in the strongly agree section, why?
Because it doesn't matter if you can't do something because everyone can learn. You aren't born with the ability of maths, it's like English, and you learn it.
Q2: so it is just practicing and trying?
Yeah.
Q3: so you like using technology in Maths?
Yeah.
Q4: are you comfortable with technology, do you use a lot at home?
Yeah a lot.
Q5: you say technology helps you to understand the objectives of what you need to do?
Yeah.
Q6: was that to do with having things on the interactive whiteboard?
Yeah.
Q7: is there any other ways?
Well, the computers and the whiteboards and stuff, it helps us to understand the objective, so yeah.
Q8: is it kind of a reminder when it is there?
Well yeah kind of, yeah it is actually. The interactive white boards help us more.
Q9: do you discuss things as a class together, with the technology?
Yeah, but when we come into the class and sit down and talk about what we are doing, then we do the work and talk about them with the class.
Q10: so you think exams are boring?
Yeah, all exams are boring, unless it is a subject that you really like, then it is obviously not completely boring.
Q11: so even though you think exams are boring you do see that they show how well you are doing?
Yeah, you can see how you're doing. Because if your teacher sees how you are doing they can put you into sets and stuff.
Q12: you understand how you are getting on?
Yeah.
Q13: you think maths is frustrating at times?
Yeah, because algebra frustrating and I don't really get it. It makes no sense, some things are easy. It is frustrating because of algebra but not all the time.

Q14: you like working with others and in groups?
Yeah because if you don't know what one thing is then others might now, so you can ask them. It kind of helps to understand things.

Q15: the technology helps you?
Yeah, because if you use MyMaths then you learn but it is more fun on the computers. And then we can go on games once all the maths is done.
Q16: so when you use computers you think it is more fun and more enjoyable?
Yeah.
Q17: so does that help you to learn if you find it fun?
Yeah because if it is boring then you won't want to do it. If it is fun you like it.
Q18: if it is fun do you remember it more?
Yeah if it is but if it is boring then I don't.
Q19: so your teacher uses the interactive white board most lessons but use different technology in other lessons yes?
Yeah, because sometimes we use it when doing different things. Like the Ipad's and stuff, so yeah.
Q20: so there is lots of different types?
Yeah.
Q21: you understand better when in groups?
Yeah because it is more fun, it helps more than being by yourself because that's boring.
Q22: so when you're with friends that's more fun?
Yeah.
Q23: is it bad to be with friends sometimes?
Sometimes yeah, but if it is an exam then no because it is not going to help is it.
Q24: but you can concentrate well enough when you are with your friends?
Yeah.
Q25: you say maths is exciting, you like it then?
Yeah I do.
Q26: is it your favourite subject or in the middle?
Probably in the middle, it isn't my favourite but it is fun.
Q27: do you think maths is important and can be used in everyday life.
Yeah, you might not notice but you will use it in everyday life. Like now we use it a lot every day.

Q28: do you think you might use it in your job?
Yeah, I think I might but I'm not really sure what I want to be so…
Q29: you're quite happy to persevere with work until you get it right?
Yeah, I don't give up I will keep trying.
Q30: you are quite happy using technology?
Yeah.
Q31: so you don't find maths difficult?
Yeah.
Q32: do you like finding stuff out yourself?
Yeah, but sometimes a bit of help.
Q33: you don't use technology a lot?
No, not all the time.
Q34: you're quite happy doing maths?
Yeah.
Q35: why aren't you so keen on the textbook?
Because it is has a lot of information and I don't like reading it all. I'd sooner have the teacher tell us the stuff and not use the textbook.
Q36: you think maths is something you learn?

Yeah.
Q37: you don't think maths helps you understand the world?
No, maths is just maths, it just helps with maths, not the rest of the world like geography.
Q38: you disagree that it is easy to do stuff in maths, you have to keep trying?
Yeah.
Q39: you do see that you can use maths elsewhere?
Yeah.
Q40: do you think you do lots of different things in maths?
Yeah.
Q41: you disagree that you can't express your ideas?
Yeah, there is room to ask questions.
Q42: you're happy to use technology?
Yeah, it is easy.
Q43: so it is not difficult and you do like it?
It is easy and I like it.
Q44: you enjoy technology and you're happy using it?
Yeah.
Q45: you remember the FASMED lessons you have been doing?
Yeah.
Q46: how have these lessons been different to your normal maths lessons?
They are more fun and you get to do different things, it isn't just maths work.
Q47: so it is a bit more practical?
Yeah.
Q48: is there other ways it has been different?
No.
Q49: have you used anymore technology that you might have normally used?
Yeah more technology.
Q50: different work that you normally do?
Yeah.
Q51: how have you felt about doing group and practical work?
I don't really know to be honest, group work has been more fun.
Q52: has there been anything useful about the lessons?
Yeah I work better in groups now, team work.
Q53: have you learnt how to use different technology or did you already know?
Yeah, I learnt more.
Q54: did it improve your learning?
Yeah it did.
Q55: in what ways did it improve your learning?
I don't know it just did.
Q56: have you found anything difficult about the lessons?
No it was quite easy.
Q57: and you're happy working in groups and with technology?
Yeah.
Q58: do you think they have helped your learning of maths?
Yeah, but it was stuff we already know how to do.
Q59: has it helped to show how to improve your work?
Yeah.
Q60: has that been a new experience having to re-do work?
Yeah, we would usually only do it once.

Q61: so you would only look at it once, but now you go back and try to improve it?
Yeah.
Q62: would you like to do more of these kinds of lessons in the future?
Yeah I would.
Q63: have you discussed the lessons with any other students or teachers that aren't in the class?
No.
Q64: have you talked about it at home?
No.
Q65: is there anything else?
No.

Appendix D : interview themes

Exams: positives

- Desire to know level
- Shows you were you need to improve
- Shows what you can do without help
- Tells teacher what you have learnt

Exams: negatives

- Boring
- Nervous

Group work: positives

- Find out other's opinions and ideas
- Friends can help you understand
- Peer support

Group work: negatives

- Dominance of some individuals
- Group might know but not all individuals
- Off task

Anyone can learn maths

- Need to be motivated
- Need to be given different ways to learn
- Anyone can improve
- Satisfying

Importance of maths in later life

- Every day – shopping, credit cards, bills, looking after children
- Jobs

FaSMEd vs normal lessons

- Creativity
- Greater ownership of the learning
- Length of lessons: too long
- Tasks that put maths in a real life context
- More practical
- Greater use of technology
- Role of teacher – walking round more
- Fun and interesting
- Real life
- More group work
- More sophisticated

- Off task (p.20, p.26

Peer assessment:

- Problems of being marked by friend/not friend (

Technology: Value of

- Ability to do research
- Teacher shows individual's or group's students work to whole class so that others can learn from it and improve their work
- Improves confidence
- Practicality of seeing work
- Software packages that help you learn
- Youtube

Technology: negatives

- Doesn't work/slow
- Arguments (
- Can be embarrassing showing work

Technology vs teacher

- Teacher more likely to provide correct answer
- Teacher can support your needs, hard to find on internet
- Can't teach

Formative assessment

- Teacher asks students to explain their working, ideas
- Teacher shows individual's or group's students work to whole class so that others can learn from it and improve their work
- Sharing ideas
- Teacher can see who understands
- Importance of culture especially towards making mistakes

Strategies of teachers to support learning

- Teacher shows individual's or group's students work to whole class so that others can learn from it and improve their work
- Teachers ask other students to explain if someone is stuck i.e. teacher doesn't just give answer e.g. C3B4ME

Textbooks:

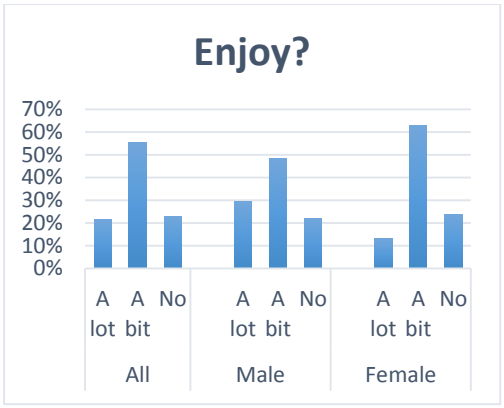
- Boring
- Written by professionals

Appendix E: Case study school 1 questionnaire analysis

All 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%


Enjoy?
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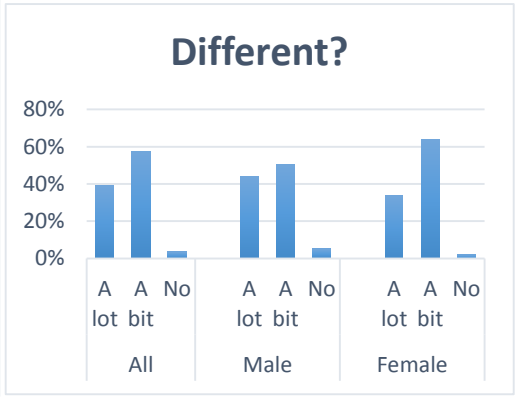
Different?
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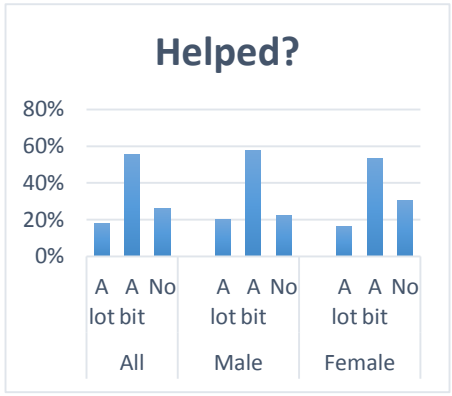
Helped?
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Male
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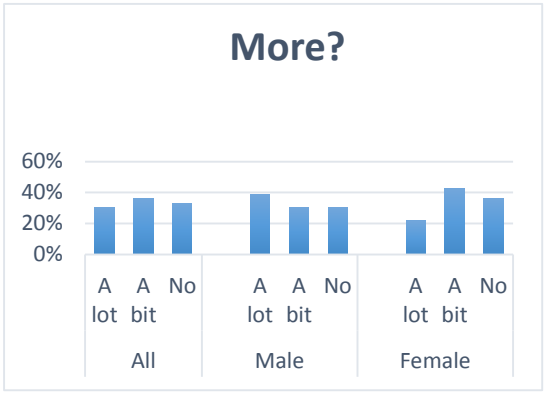
More?
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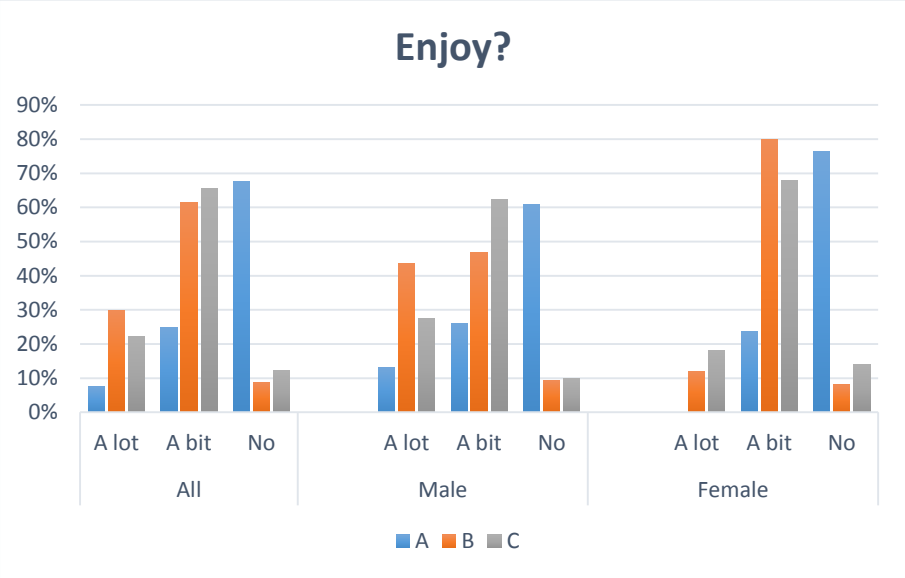
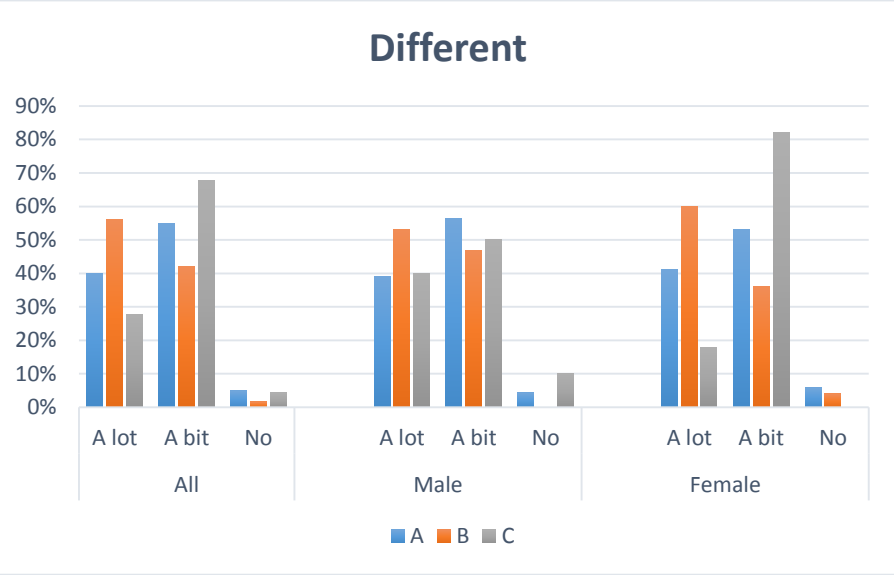
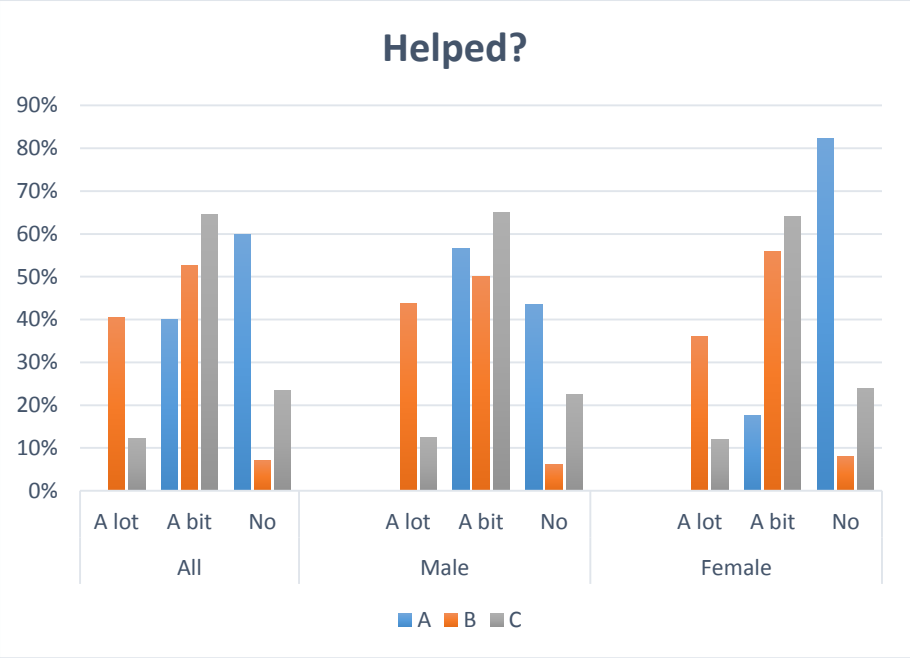
Male
Female

Comparing Schools



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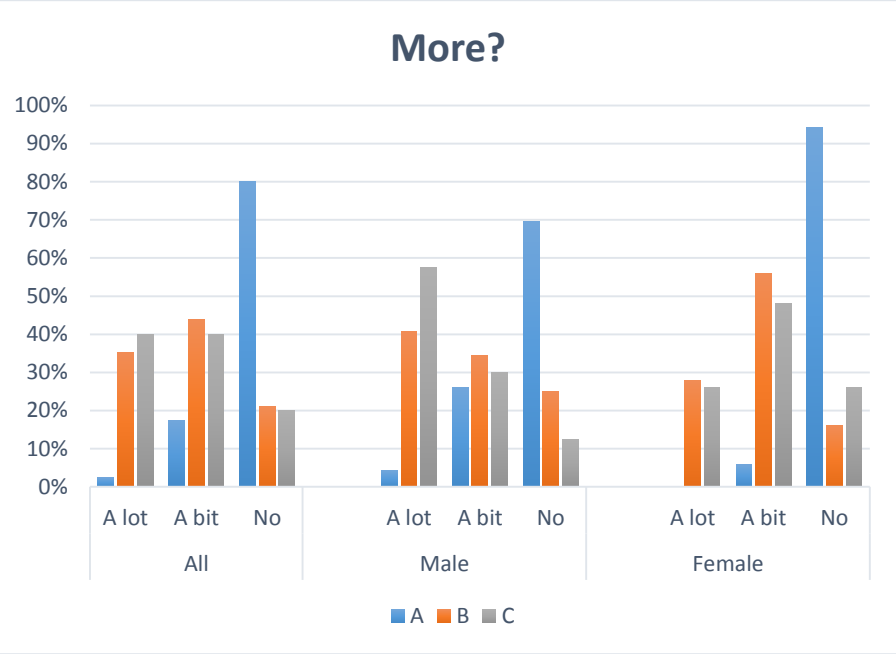
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Male
Female
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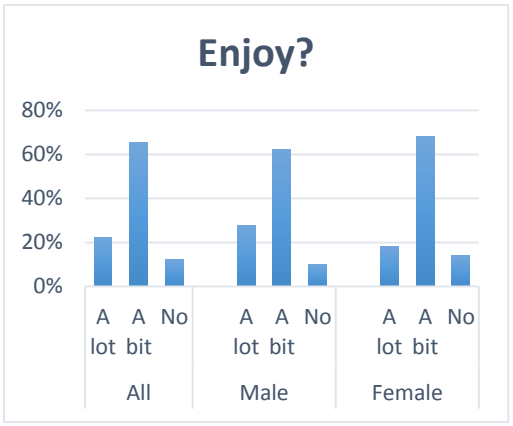
C

School 1

Male	40										
Female	50										
Enjoy?			Different?			Helped?			More?		
All	A lot	22%	All	A lot	28%	All	A lot	12%	All	A lot	40%
	A bit	66%		A bit	68%		A bit	64%		A bit	40%
	No	12%		No	4%		No	23%		No	20%
Male			Male			Male			Male		
	A lot	28%		A lot	40%		A lot	13%		A lot	58%
	A bit	63%		A bit	50%		A bit	65%		A bit	30%
	No	10%		No	10%		No	23%		No	13%
Female			Female			Female			Female		
	A lot	18%		A lot	18%		A lot	12%		A lot	26%
	A bit	68%		A bit	82%		A bit	64%		A bit	48%
	No	14%		No	0%		No	24%		No	26%


Enjoy?
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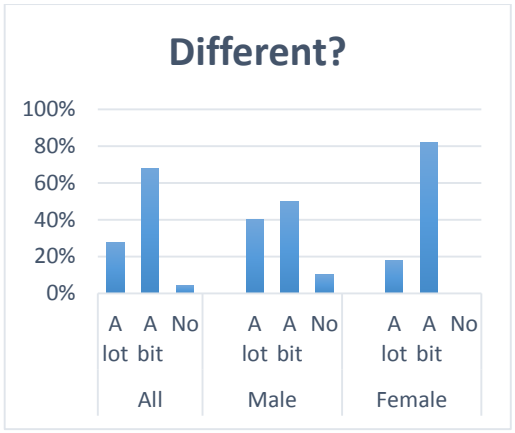
Different?
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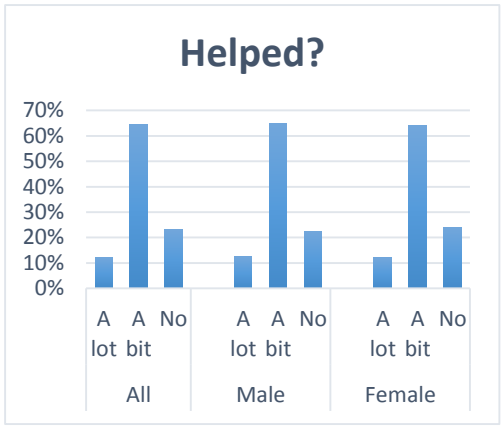
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More?
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Male
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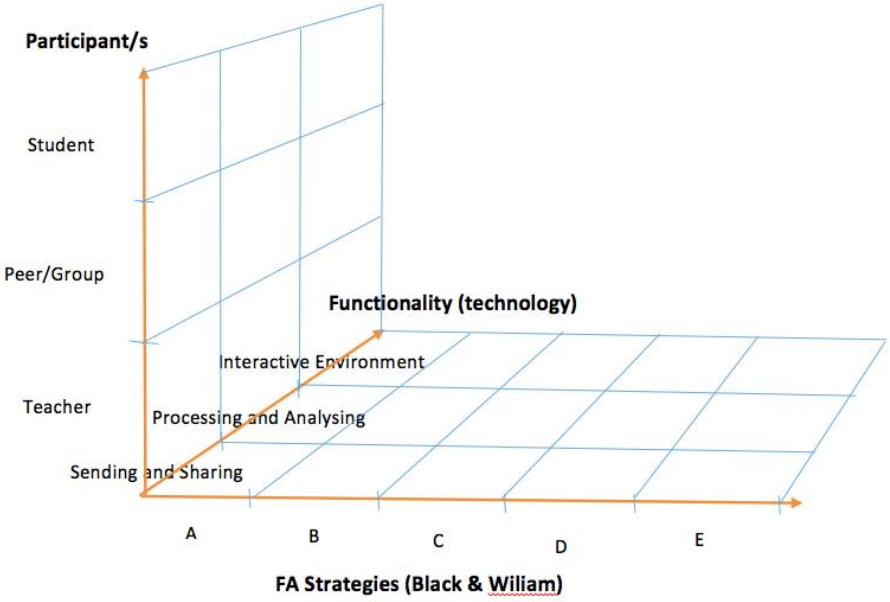
Appendix F: Frameworks

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.

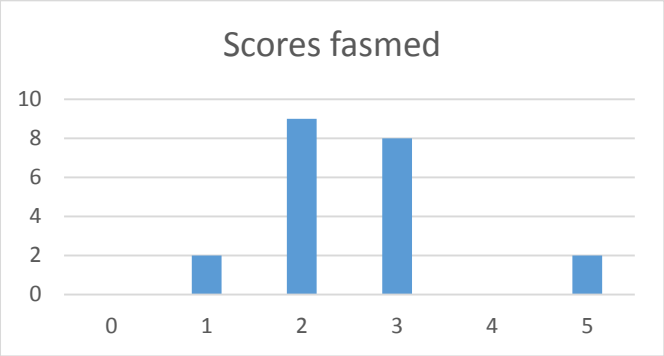
Thompson and Wiliam framework (2007)

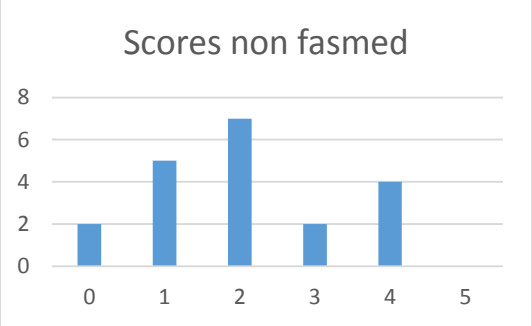
	Where the learner is going	**Where the learner is right now**	**How to get there**
Teacher	A. Clarifying learning intentions and criteria for success	B. Engineering effective class-room discussions and other learning tasks that elicit evidence of student understanding	C. Providing feedback that moves 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 G:Attainment data for Newcastle schools.

Change in levels

School A



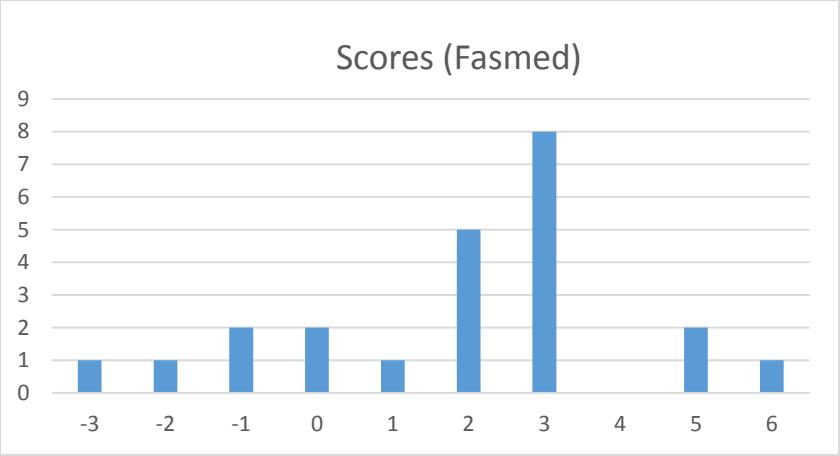


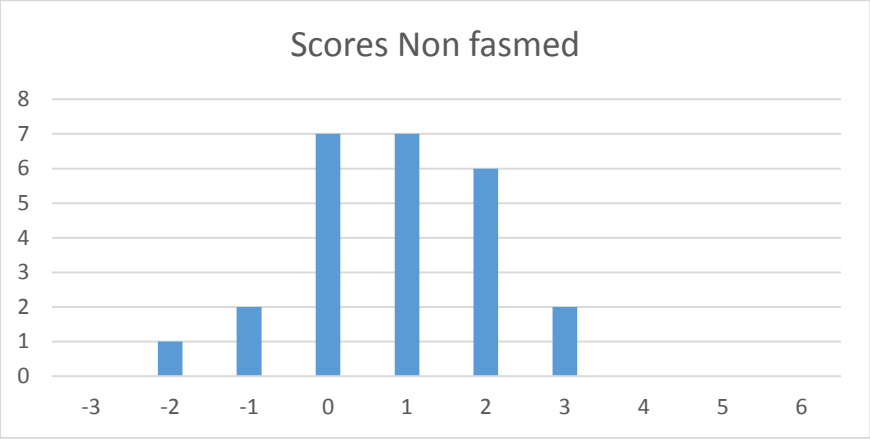
t-Test: Two-Sample Assuming Unequal Variances

	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)