D1.3) FaSMEd Protocols: a set of research protocols to support the collection of the data at each stage

FaSMEd used a Design Research (Swan, 2014) methodology to work with teachers and students to test and modify formative assessment practices using technologies in classrooms. Case studies detailed practices across the partner countries. In particular the following questions were addressed:

- How do teachers process formative assessment data from students using a range of technologies?
- How do teachers inform their future teaching using such data?
- How is formative assessment data used by students to inform their learning trajectories?
- When technology is positioned as a learning tool rather than a data logger for the teacher, what issues does this pose for the teacher in terms of their being able become more informed about student understanding?

Structure for working with schools

Local clusters of three schools, with three (or more) teachers from the same subject area (mathematics or science) in each school, engaged in the design study of the toolkit. Where partners were working with mathematics and science teachers, two clusters were established or clusters were combined, depending on the applicability of the setting.

The technology used (ranging from low tech mini whiteboards to complex hardware and software) to support these activities were chosen by the school and Higher Education Institution (HEI). The research followed a plan-do-review format, with typically three weeks allocated for each activity:

- Week 1 – Plan activity
- Week 2 – Do activity in classroom
- Week 3 – Review activity.

The design study period took place between January 2015 and July 2015. HEI partners supported this process in schools, and through local cluster meetings of schools and HEI partners which took place monthly to share practice and progress (ideally these involved the three schools together but where this was not possible some meetings happened at school level). As a minimum, cluster meetings involving the three schools happened at least twice (once towards the beginning of the process and once towards the end).

Additionally preparation work took place with schools from September to December 2014 and consultation and reviewing between September and December 2015.

Data to be collected

HEI partners worked with school teachers to collect data on the design process of the activities. All partner countries collected basic data listed below and in addition worked with teachers in ways most appropriate to the setting

- Contextual information for each participating school:

School Context	
School Roll (number of pupils)	
Staff Roll (number of teaching staff)	
Geographical location (urban/rural, etc.)	
Relationship to other schools (e.g. cluster/Feeder/Part of a group of schools)	
Age range	
Single or mixed gender	
Ethnicity	
Mixed ability or selected (could include Special Educational Needs)	
Socio-economic intake (with local contextual indicators, e.g. UK Free School Meals)	
How the school is judged to be performing in local context	
Past experience of using formative assessment	
Past experience of using technologies/tools	
Previous experience of working within other research projects	

- Teacher demographic information

Teacher demographic	
Subject area (science or mathematics)	
Role (e.g. Head of Department/Teacher, etc.)	
Gender	
Age range (under 20; 21-30; 31-40; 41-50; 51-60; over 60)	
How long has he/she been teaching	
How long has/she been working at this school	
Past experience of using formative assessment within lessons	
Past experience of using technologies/tools within lessons	
Past experience of working in a research project	

- Student demographic information

Class demographic	
Age range	
Number of students in the class	
Gender split within class (male/female)	
Ethnicity	
Mixed ability or ability set	
Any relevant contextual information (do the class work well together or are there any particular difficulties/are they taught in this class for other subjects or only for this subject/do students have any additional needs (special educational need or are they being taught in an additional language/is there high mobility of students etc)	

- Teacher report of what happened in each lesson (e.g. length of lesson, day and time, attendance, objectives, any significant event, etc.)

Intervention Data	
Teacher report of what happened in each case study lesson (e.g. length of lesson, day and time, attendance, objectives, any significant event, etc.) (See Appendix 1)	
Teacher report of what happened pre and post each case study lesson (e.g. planning, reviewing, interaction with other school staff and professionals outside of school, etc.)	
Teacher reflective diaries or blogs (where possible)	
HEI partner observations	
Video of extracts of lessons (where permission is granted to be used for research purposes)	
Video of lessons and/or interviews to be used for dissemination and professional development. (where possible)	
Interviews with case study teachers (see Appendix 2 for interview schedule)	
Interviews with participant students – to include focus group interviews (based on Q sorting – see Appendix 3) on their perceptions of how FA and technology/tool helped them in their learning. (see Appendix 4 for interview schedule)	
Student questionnaire (see Appendix 5 for questionnaire)	
Students as researchers - At Newcastle, UK, a group of students reflected on the FaSMEd experience and expressed their ideas through the design, drawing and production of a FaSMEd Comic (put link).	
Parent forum (where possible)	
Attainment data was collected in line with individual schools usual attainment data collection (where available). Where possible, pre- and post- design study data was collected. For	

comparison, data from an equivalent class/year was also be collected.	

Ethics

In addition to usual teaching practices, researchers observed a selection of lessons, and (where permission was granted) videod film extracts and interviewed teachers and students (group or one-to-one) about their experiences and opinions of these lessons. Interviews were audio-recorded, transcribed and analysed. Audio and text files were numbered and stored on the secure research data server at the University. Transcripts and files will be stored for five years in accordance with the British Educational Research Association guidelines and participants can have access to their data at any point during that time. Participants will not be identified or identifiable in any publication or report arising from the research. In doing so we are not interested in data concerning individual students but in the overall tendencies in an entire group of students. Participation in the research was completely voluntary. Any participant had the right to withdraw from the research project at any time without consequence. Data collected was reported anonymously and in an aggregated manner, meaning that neither names nor specific data, which would allow the identification of particular schools or participants are reported.

All participants received information and consent sheets, please see attached examples:

- Appendix 6: Participant Information Sheet
- Appendix 7: Headteacher Consent Form
- Appendix 8: Local government Consent Form (where applicable)
- Appendix 9: Adult participant Consent Form
- Appendix 10: Parental permission for student participant Consent Form

Reference

SWAN, M, 2014. Design Research in Mathematics Education. In: LERMAN, S, ed., Encyclopedia of Mathematics Education Springer.

Appendix 1 – Teacher report of case study lesson

FaSMEd Project – teachers' data collection

School name …… ……

Teacher name …… …….

Class ……Year 10……

Day, time and length of lesson …Fri 6 Feb and Tues 10 Feb '15 – each lesson 1 hour long (1120-1220)…

Attendance ……19 students, then 20 students**……**

Lesson (e.g. Interpreting distance time graphs or other)……Interpreting Distance – Time Grpahs**……**

What methods did you use to find out what your students know or understand? (Whole class or individual/small group?)

- **Questions (open/probing)?**
- **Strategies?**
- **Tools?**
- **Technologies?**

Did you use a way of recording this information?

- Use of the pre-task assessment – 3 students were able to show a "good" understanding, the remainder had little understanding of D-T graphs
- The three "able" students were split between groups – on reflection it may have been better to group them together and provide opportunities to explore D-T graphs even further as there is not much difference between their pre and post activity tasks.

How did your students react to your interventions/questions and strategies?

What issues arose from the information you elicited from your students? (Was there too much/too little detail or too diverse/too uniform responses?)

A group's decision making is too easily influenced by other groups. For example, a whole-class discussion on slide P-1 – Matching a Graph to a Story – showed that all groups except one had (incorrectly) chosen B as the story. The other group had correctly chosen C. I asked that group why they had chosen something different to the remainder of the class, and they justified it well. I asked some of the other groups for their reasoning. I then gave groups a chance to change their mind. Many did – from B to C – but when asked to explain their reasons they could not. I think groups "called my bluff" in pretending that the one group that chose C was "different" and perhaps wrong. In this task it would have been better for me to know how each group had voted then to lead the whole-class discussion without the groups knowing how many agreed or disagreed with them.

What most surprised you?

What do you think were the factors that contributed towards this (factors coming from pupils, teacher, tools/technologies used, department/school)?

How did you feel about this?

The level of engagement during the first lesson was a little lower from some students than I had expected. In the main this was because of the unfamiliarity with the structure. I was surprised that the second lesson – students visiting other groups and "improving" their own work – was fairly well received.

What decisions did you take in reaction to the feedback from students?

Are you going to change your planning for the next lesson because of the information you got?

Are there changes you might make in the way you use these tools/strategies in your future teaching?

I tried altering the structure so that the "tables of values" were matched to the graphs before they started to match the stories. The aim was to try to get the students familiar with the graphs using a more "usual" idea before moving on to the more demanding interpreting with stories. Overall, I found this had little affect in eliminating their difficulties; I felt that I was largely having the same conversations and dealing with the same problems as I had other classes doing this task.

Any other comments

Now we have had a "proper" of technology to help me solve:

Can technology be used to help keep students on track/focussed/talking at a higher level (as in Bloom's taxonomy) etc?

Can technology make it easier for students to share and compare work?

FaSMEd

Appendix 2 – Interview schedule for case study teacher

Case study teacher interview 1 schedule:

Teacher biographic information:

- Subject area (science or mathematics)
- Role (e.g. Head of Department/Teacher, etc.)
- Gender
- Age range (under 20; 21-30; 31-40; 41-50; 51-60; over 60)
- Highest qualification (and teacher qualification where applicable)
- How long have you been teaching?
- How long have you been teaching at this school?

Teacher background information:

1. Before the FaSMEd project what was your experience and how comfortable were you:
   - Using technologies within lessons (in what ways)
   - Using formative assessment within lessons (in what ways)
2. What are your department's normal practices for planning and reviewing lessons? What is your role within this? To your knowledge, is this typical of whole school practice?
3. Have you any past experience of working in a research project or a professional learning community? If so what?
4. Can you tell me how you first became involved in the FaSMEd project? What attracted you or were you asked to become involved by your school?

Class background information:

- Student age range
- Number of students in the class
- Gender split within class (male/female)
- Ethnicity (EAL and where applicable nationality)
- Mixed ability or ability set (where ability set – which set)

Relevant contextual information:

- Do the class work well together or are there any particular difficulties?
- Are they taught in this class for other subjects or only for this subject?
- Do students have any additional needs (special educational need or are they being taught in an additional language/is there high mobility of students etc)

Attainment data:

We would like to collect attainment data in line with individual schools usual practices. Where possible, we would like pre- and post- design study data and for comparison, data from an equivalent class/year who have not participated in FaSMEd.

- Attainment data for each child in case study teacher's FaSMEd class for September 2014 and July 2015 (or as near as possible).
- Attainment data for each child in an equivalent class (parallel set or previous year group) for September and July (or as near as possible).
- Information regarding usual expected progress and any notable factors as recognised by class teacher.

FaSMEd Case Study teacher – Interview 2

Impact of FaSMEd lessons

- How have the students responded to the methods used? (Engagement; self-assessment; peer assessment; peer dialogue; teacher-student dialogue) How different have the FaSMEd lessons been from 'usual' lessons?
- Where (in your FaSMEd lessons) has formative assessment worked well?
- Where (in your FaSMEd lessons) has the technology worked well? Added value?
- How could the formative assessment processes and/or technology be improved?
- What impact, if any, has FaSMEd had on your other teaching? What will you take forward, if anything, next year?
- What has been the most beneficial aspect of the project?
- What has been difficult within the project? What would you do differently if you were to repeat the process?

Professional learning

- How effective/beneficial do you think the model of professional learning (professional learning communities within schools/plan-do-review cycle) within FaSMEd has been?
- Who else have you discussed the FaSMEd project with in your school? (Other teachers and/or senior leadership; within the FaSMEd group and beyond – Ofsted, parents?)
- How beneficial has the interaction with FaSMEd teachers outside of your school been? In what ways?
- How beneficial the support from the University been?
- Would any further support have been useful?
- Will you take any of the learning forward into next year? Or other classes?

FaSMEd

Appendix 3 – Student Q Sort statements

Expressions for Q-sorting cards

Mathematics is difficult.
Using technology in maths is difficult.
Mathematics is fun.
Using technology in maths is fun.
Mathematics is important.
Mathematics is exciting.
Using technology in maths is exciting.
Mathematics is something everybody can learn.
Mathematics is used in everyday life.
You are born with mathematical understanding or not.
Mathematics is a tool for doing something else.
I like mathematics.
I like using technology in maths.
Mathematics is frustrating.
Using technology in maths is frustrating.
Mathematics is either right or wrong
I do not like mathematics.
I do not like using technology in maths.
Mathematics is not relevant for my future (life).
Mathematics means exploring and experimenting
To do mathematics means to solve many of the same tasks/exercises.
I learn things quickly in mathematics.
Mathematics helps us to think systematically and logically.
Mathematics means seeing connections.
Mathematics helps us to see/understand the world.
I can do without mathematics.
I learn/understand mathematics best when I work on my own.
Maths is best learnt with the help of a textbook.
Mathematics is best learnt by doing practical activities.
Mathematics requires a lot of repetition.
Mathematics makes sense in the real world.
Mathematics is only for the maths classroom, not for real life outside.
In maths (lessons) there is no time for reflection.
Only gifted people understand mathematics.
If I do not understand something, I work with it until I get it right.
I am nervous in mathematics lessons.
I am nervous when using technology in maths lessons.
I feel that I can do/understand mathematics.
To learn/understand maths depends on the teacher.
In maths (lessons) there is no room for expressing your own ideas.
Maths is best learnt (in collaboration) with others.

I understand better if I work with friends in maths.
Exams are boring.
I like exams because I can see how I am doing.
Exams help me to work more.
Working with technology in maths is useful.
We use a lot of technology in our maths lessons.
Our teacher in maths always uses some kind of technology during the lessons.
I can understand better when I use technology in our maths lessons.
When we use technology during the maths lesson, I quickly understand if and why I am wrong.
When we use technology during the maths lesson, I understand better what I have to do to improve my understanding.
Using technology during the maths lesson helps me to better understand the objectives of the activities.
It takes me twice as long, if I have to work with technology, and cannot ask the teacher directly.
I prefer to talk to the teacher, rather than find out myself with the technology.
For me, the technology does not work, or help.
I feel that the teacher knows much better where we are, when s/he uses technology.
When we work together, it makes sense to use technology.
Our teacher uses the technology to find out where we are in our learning.
With the technology I can find out myself whether I can do the tasks in maths.
I never know what to do with the technology.
I prefer to talk to the teacher, rather than find out myself with the technology.
For me, the technology does not work, or help.

FaSMEd

Appendix 4 – Student Interview schedule

- Gender

- Age

- Can you tell me about what the FaSMEd lessons have been like?
  - Are these lessons different to the type of maths lesson you might normally have? If so, how?
  - What has been useful about the lessons? In what ways? (Prompt: engagement; group work; self-assessment; peer assessment; peer dialogue; teacher-student dialogue; use of technologies/tools)
  - What has been difficult about the lessons? In what ways? (Prompt: engagement; group work; self-assessment; peer assessment; peer dialogue; teacher-student dialogue; use of technologies/tools)

- Do you feel that these lessons have helped your learning of maths? In what ways? (Prompt: topic; formative assessment; subject generally; learning generally; confidence in maths)

- Would you like to do more of these type of lessons in maths in the future?

- Have you discussed the FaSMEd lessons with other teachers or students in school? If so, in what ways?

- Have you discussed the FaSMEd lessons with your parents or family members? If so, in what ways?

FaSMEd

Appendix 5 – Student Questionnaire

Newcastle University

FaSMEd

FaSMEd Project Student Questionnaire

As part of your maths lessons this year you have been taking part in activities from the FaSMEd project. Your teachers have been working with researchers from Newcastle University to explore how these activities can be used with different technology in schools. We would like to hear what you think of the activities and if they have helped your learning in maths.

1. Are you: Male ☐
   Female ☐

2. Have you enjoyed the FaSMEd activities this year? Yes, a lot ☐
   Yes, a bit ☐
   No ☐

3. Do you think that the FaSMEd lessons have been different to your usual maths lessons?
   Yes, a lot ☐
   Yes, a bit ☐
   No ☐
   If so how? (Eg. Use of technology, more paired or group work, problem solving, feedback on how to improve work)

Do you think that the FaSMEd lessons have helped your understanding of maths? Yes, a lot ☐
Yes, a bit ☐
No ☐

4. Would you like to do more of these type of lessons in maths in the future? Yes, a lot ☐
   Yes, a bit ☐
   No ☐

Thank you for your views.

Appendix 6 – Participant Information Sheet

Improving Progress through Formative Assessment in Science and Mathematics Education (FaSMEd)

This three year research project led by Newcastle University involves researchers in Europe (UK, France, Ireland, Germany, Italy, Netherlands, Norway) and South Africa working with science and maths teachers. We will work with a cluster of schools in each country to look at how technology can be used in formative assessment to help raise student achievement.

This project aims to:

- promote high quality interactions in classrooms that are instrumental in raising achievement;
- expand our knowledge of technologically enhanced teaching and assessment methods in mathematics and science

Major objectives for the project are to:

- produce a toolkit for teachers to support the development of practice.
- produce a professional development resource that exemplifies use of the toolkit.
- offer approaches for the use of new technologies to support formative assessment
- develop sustainable assessment and feedback practices that improve achievement
- challenge stereotyped attitudes and practices.

What will the research involve?

The researchers will work with teachers for one academic year from September 2014, and will use a design-based methodology to test and modify formative assessment practices using technologies in classrooms. In addition to usual teaching practices, researchers will observe a selection of lessons, and (where permission is granted) video film extracts and interview

Photographs by Keith Pattison

students (group or one-to-one) about their experiences and opinions of these lessons. Interviews will be audio-recorded, transcribed and analysed.

How will the data be used?

Audio and text files will be numbered and stored on the secure research data server at the University. Transcripts and files will be stored for five years in accordance with the British Educational Research Association guidelines and participants can have access to their data at any point during that time. Participants will not be identified or identifiable in any publication or report arising from the research. In doing so we are not interested in data concerning individual pupils but in the overall tendencies in an entire group of pupils and their teachers interviewed and/or observed.

Ethical Issues, Data protection, anonymity and privacy issues

Participation in the research is completely voluntary. Any participant has the right to withdraw from the research project at any time without consequence. Data collected are reported anonymously and in an aggregated manner, meaning that neither names nor specific data, which would allow the identification of particular schools or participants are reported.

Throughout the research project we value the participation and input from teachers, students, and parents, who will play an important role in developing science and mathematics teaching and learning.

For more information please contact: Fasmed@ncl.ac.uk

For more information on the project see our website at: http://research.ncl.ac.uk/fasmed/

Photographs by Keith Pattison

Appendix 7: Headteacher Consent Form

Improving Progress through Formative Assessment in Science and Mathematics Education (FaSMEd)

School consent form

I confirm that I have read the information sheet and I give consent for

…… (name of school)

to take part in the research activities.

Signed: _____

Please print your name _____

Position within school: _____

Thank you

Appendix 8: Local government Consent Form

Improving Progress through Formative Assessment in Science and Mathematics Education (FaSMEd)

School consent form

I confirm that I have read the information sheet and I give consent for

…… (name of school)

to take part in the research activities.

Signed: _____

Please print your name _____

Position within local government: _____

Thank you

Appendix 9: Adult participant Consent Form

Improving Progress through Formative Assessment in Science and Mathematics Education (FaSMEd)

Adult consent form

I confirm that I have read the information sheet and I give my consent to take part in the research activities.

I agree that: (please tick ✓as appropriate)

☐ Interviews may be audio-recorded and transcribed. Anonymised quotations (where individuals will not be named or identifiable) can be used in FaSMEd reports, publications and at events.

☐ I may be video recorded as part of a mathematics lesson and/or in interview and that this video may be used by the research team and school for research purposes. It will not be made publically available.

☐ I may be video recorded as part of a mathematics lesson and/or in interview and that this video may be used publically for dissemination about the research and/or for professional development.

Signed: _____

Please print your name _____

Role within school: _____

Thank you

Appendix 10: Parental permission for student participant Consent Form

Improving Progress through Formative Assessment in Science and Mathematics Education (FaSMEd)

Parent/carer consent form

I confirm that I have read the information sheet and I give my consent for my child to take part in the research activities.

Name of child: _____

I agree that: (please tick ✓as appropriate)

☐ My child can take part in the interviews which will be audio-recorded and transcribed. Anonymised quotations (where individuals will not be named or identifiable) can be used in FaSMEd reports, publications and at events.

☐ My child may be videoed as part of his/her mathematics lesson. This video may be used by the research team and school for research purposes. It will not be made publically available.

Signed: _____

Please print your name _____

Relationship to child: _____

Please return this form to Mr/Mrs …

Thank you