This article discusses strategies that were developed by teachers in response to ideas about formative assessment. The teachers were part of the KMOFAP project that has been underway for about two years now. Here I am reporting the teachers’ ideas, that is their ways to implement or improve formative assessment in their classrooms.

The KMOFAP project came into being as a result of a literature search [1] of a large number of research projects that resulted in the booklet *Inside the black box* [2]. It was set up as a research project to investigate what happened when the messages on assessment gleaned in the search were developed by the teachers in their classrooms. This became the KMOFAP project.

*Inside the black box* said clearly that there was evidence that improving formative assessment raises standards, that there is evidence that there is room for improvement in British schools and that there are clear guidelines for how we can improve formative assessment. These messages were communicated to a group of twenty-four maths and science teachers from six schools and the KMOFAP research followed how they worked with and developed these ideas over a period of eighteen months. Over time we saw these teachers change the way they thought about and planned their lessons, incorporating different tactics into their repertoire in order to enable formative assessment to happen in their lessons. They began to think about ways to access the pupil’s understanding of a topic, to enable the pupils to articulate what they know and do not know and thereby allow the teacher to move their learning forward. Many of the tactics described came as a result of this way of thinking, although sometimes it was in using the tactics that the teachers began to understand the importance of thinking this way.

In this project we defined formative assessment as all the activities that are undertaken by teachers and their students, perhaps by assessing themselves, which provide information that are used as feedback to modify the teaching and learning activities in which they are engaged. Assessment happens in many ways and forms in the classroom but we would argue that it is only formative when the information gained is used to adapt the teaching to meet the pupils’ learning needs.

The project deliberately focused on mathematics classrooms, because we knew that the assessment practices in them seemed particularly problematic and this was where the team had expertise. From our previous work with teachers and from our reading of research studies the following points seemed important:

- Marking is usually conscientious but often fails to offer guidance on how work can be improved or is unfocused.
- The giving of marks and the grading function are over emphasised while the giving of useful advice and the learning function are under-emphasised.
- Competition is encouraged, feedback teaches pupils with low attainment that they lack ability and are not able to learn and offers little challenge to those with high attainment.
- Questions and other methods used are not discussed or shared between teachers and there is no critical review of what they assess.
- There is a tendency to emphasise quantity and presentation of work and neglect its quality in relation to learning.
- Marks are collected to fill up mark books, there is no attempt to analyse the pupils’ learning needs and the assessment records of previous teachers are rarely used.

These are the problems but what are the solutions? If the learning that goes on in the mathe-
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Asking a question worth thinking about

One of the things that was emphasised by the KMOAP team to the teachers in the project was ‘think-time’. That is the time that they waited after they had asked a question before they jumped in and rephrased it or answered it themselves. This quickly became known to the teachers as ‘think

time’ as it is the time that the teachers left to encourage their pupils to think. There are other ‘wait-times’ that seemed important to the teachers, time left so that a pupil can complete an answer after starting it and time between the pupil making their response and the teacher offering feedback. All these ‘wait-times’ are important in a classroom where everyone thinking is a priority. It seems self-evident now, but not then, that if you want a pupil to spend some time thinking you must ask a question worth thinking about. These questions are not easy to devise, as the important thing is to uncover misconceptions and to give the class something to discuss. This way of thinking resulted in our teachers devising questions that took a different slant on teaching common topics. For example one of our teachers thought out the following question as an introduction to the teaching of approximating:

Which of them are less than 1600 and which are more than 1600?

- 42 × 41
- 44 × 43.2
- 38.2 × 39.7
- 38 × 44
- 37 × 40.3
- 420 × 3.7

- Justify your answers
- Invent 5 more products that are approximately equal to 1600
- What about 44 × 36? Why is this difficult to tell?

When you have asked a question worth thinking about then the discussion needs to continue. The project teachers used a selection of tactics here, they might

- Collect answers in from the whole class without commenting on the response or rephrasing it. If there is a ‘wrong’ explanation as opposed to an incomplete or not very clear one then the class would often be asked if they could see where these

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ideas had come from. This meant that ‘wrong’ answers were interesting and challenging for the class and often opened up ideas and misconceptions that others shared. ‘Wrong’ ideas were viewed as valuable and nothing to be ashamed of.

**Questions that last a lesson (or two)**

The project teachers often used the tactic of asking a complicated question and then spending a lesson or two working on the answer. The pupil’s interest is engaged and the teaching is then a process of introducing them to the skills they know they need to be able to solve such questions. First of all the pupils would be asked to decide what they knew that will help them solve the question, then they would decide what they needed to know to solve the question. Teaching the skills they need to know was then a matter of helping the pupils fill in the gaps they identified in their knowledge. The pupils then checked that they understood these new skills by solving the question. The motivation for learning was turned around, the pupils found out for themselves what they needed to know and used the teacher as a resource to help their learning. The teacher used their teaching skills and their content knowledge and of course they had to find a good question that helped the pupils identify their learning needs in the first place.

**Students writing their own questions**

Many of the project teachers used this tactic. This is the way one of them did it. At the end of teaching a topic, as a way to assess what the pupils have understood, the pupils were asked to write their own questions on the topic. This took some time, but with practice the teacher felt she could pick out what the pupils found straightforward and what they found difficult by the questions they wrote. The time was needed to ensure the pupils had an idea of what constitutes a good question, as this could be where the misconceptions were rather than in the content knowledge. The teacher thought it best to ask the pupils to write the questions at home, perhaps five questions each. The lesson was then spent looking at the questions and working out which seemed to be good questions and why. The pupils said that a good question was one that was challenging, (they did not like easy ones), fair and based on their own experience where possible. Questions written in this way were the result of pupils thinking hard about what they knew about a topic and therefore the range of questions was a good indicator of what the pupils understood and picked up misconceptions. The questions picked out as particularly good were collected together and used as a summative test, the teacher said that the pupils liked to do this. However, it is true to say that, if the pupils can write a complex question covering all aspects of a topic you can be sure they understand that topic. They don’t need to take a test!

**Last five minutes – pupils telling what they know now but didn’t before**

One of our teachers came up with this idea and several of them used it subsequently, changing it to fit in with what they needed. This is how it started.

The last five minutes of a lesson were used to allow the pupils to tell the class what they had learned during the lesson. The teacher said that this encouraged the pupils to reflect on their learning and assess what they have learned. One person was appointed as spokesperson each lesson, the teacher used his register to make sure that everybody was given a turn. The teacher went to the back of the class and the appointed person came to the front and told the class what they had learned that lesson often using the objectives that the teacher had written on the board at the start as prompts. The job of the rest of the class was to listen and say if anything was left out and ask questions of the person at the front about the topic. The teacher told us that these questions were often so revealing that they helped to plan the next lesson. The necessity to explain to the class helped some of them grasp the ideas more fully and the reflection that was prompted by the need to ask questions helped the rest of them become sure of the work of the lesson.

**Give yourself a mark out of 5, we’ll only go over the ones that you need to**

The teacher that used this devised some sets of five short questions, designed to reveal misunderstandings in a topic. The pupils were asked to work on the first five questions and were then asked to reflect on how well they had done the questions and, without seeing the answers, give themselves a mark out of five. If they had seen the answers first, they would not have been forced to reflect on how well they did, that is, on the state of their learning. The teacher then asked several pupils what mark they got and which questions they needed to go over. The class quickly reached a consensus on their most pressing needs and the teacher responded to this by helping them resolve their problems. This response took the form of a discussion with pupils contributing their carefully thought out ideas. Then they tried the next set and so on. The sets of questions were there to help the pupils learn for themselves what they know and what they don’t know, not to label them with a mark. They told the
teacher what mark they thought they had, as a way into the discussion about their learning needs, not as a labelling exercise. The answers were then put up on the board, without fuss, as a final check for those who wanted it.

**Peer homework marking, using prepared detailed solutions**

For this exercise our teacher put his class into groups of four. He chose the groups so that they were composed of people who were usually fairly comparable in attainment, so that they had plenty to talk about. They each had a set of complex questions to complete for homework and now they were going to go through their answers and see how they could improve them and iron out any difficulties they had found. The teacher provided them with detailed solutions to these questions, not just answers but a full way of working out these problems. He made clear that they did not have to conform exactly to these solutions but should be able to convince the rest of their group that the way they had worked was as good as the printed solutions. The discussion was heated as they worked in their groups with their own answers and the solutions justifying their thoughts and making sure they understood where any errors lay and how to remedy them.

**What questions do you have about how to complete this task?**

This idea came from a teacher who was starting off her pupils on a coursework task for their GCSE but it could be used as part of any study of a topic that takes longer than a lesson or two. The teacher introduced them to the task and then instead of setting the usual homework she would usually, i.e. ‘carry on with the task,’ she asked them to think hard about what they had been doing and what they were going to do and write up to five questions about the task. These should be their ‘burning questions’ the ones that they felt they needed to have answered before they could proceed further with the task. They had all done similar tasks in the past so the teacher was asking them to reflect on what they knew and see what questions were still troubling them. At the start of the next lesson the pupils were asked to decide which of their five questions they considered the most important and write it on a piece of paper. These written questions were collected in and while the pupils were engaged on another activity the teacher quickly sorted through them. There were many about similar things and some that were individual. Some were quickly answered ‘what is the timescale for getting this task done?’ for instance. Others needed more time and discussion ‘How many repetitions is the right number?’ The questions were all treated carefully and thoughtfully, the answers were developed in whole class discussion with opinions sought and commented on. The exercise proved fruitful in uncovering what the class really wanted to know, rather than going through what the teacher thought they needed to know. After going through all the questions that had been given in, the teacher made sure that all the questions that had been devised for homework had been dealt with during the discussions. The teacher was exceptionally pleased with the atmosphere as the pupils subsequently engaged with the task and the quality of the written outcomes. She made sure that they continued to start each session with the question ‘Have you got any burning questions about your work?’

All these tactics have a common theme, they are designed to make the students reflect, think and make their thinking public. They put the onus back on the pupil, they ask what have you learned and what do you still need to know? It is true that the learning has to be done by the pupil, it cannot be done for the pupil and these tactics illustrate ways this can be stressed to the pupils. The teacher is the expert in mathematics, the teacher should know their way around the syllabus, they should have ideas about how to help overcome misconceptions and about what to think about next when one idea is well understood. What they do not know, and need to know, is what the individual pupil has taken from what they have experienced so far. Using ways that allow the pupil to express the state of their current understanding, puts the teacher in a position to do something about it, that is to use their own professional knowledge effectively. These tactics give the pupils a voice. This would be no use unless the teacher listens to it and responds. If questions are asked and other tactics employed then the teacher must listen and respond in a way that makes the response clear to the pupil. This way the pupils learning is moved forward as well as their ability to think hard about and enquire into mathematics. This seems to our teachers a much better way to improve standards in mathematics than just concentrating on the tests and we agree with them.

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**References**

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