Refocusing Assessment

mathematics

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Refocusing Assessment – mathematics

Introduction

SSAT, ASCL and NFER have worked together to produce *Refocusing Assessment*, which is a resource to support schools in developing and reviewing their assessment practice. The resource identifies five key questions for all departments, which you will find below.

In the following pages you will also find some responses to each question. These are drawn from the expert panels that SSAT, ASCL and NFER convened, which were comprised of heads of department and representatives from subject associations. These are not intended to offer definitive answers to the key questions, but may help to support, challenge or structure your discussions.

For details about the references in this document, please refer to the *Refocusing Assessment* overview document.

How to use this resource

1. Spend time with your department discussing each of the five questions.
2. Record a summary of your discussion.
3. Look at the responses produced by the expert panels. How far do they reflect the thoughts of your team?
4. See if you can summarise the 'assessment requirements' for your subject on the template.
5. You may then be asked to share your responses with other departments to help identify the commonalities and differences between subjects in order to help establish a whole school approach. You may wish to consider the following questions:
   - How do the needs of different subject areas vary?
   - How can you apply best practice in different subject areas whilst also maintaining consistency across the whole school?
6. You may wish to produce an action plan to modify and shape your assessment policy and practice.
7. Set a time to review and evaluate the impact of the action plan on assessment.

Five key questions

1

What does it mean to be a successful student in mathematics?

What is the purpose of our subject?

What does it mean to be a good mathematician? Is this what we are preparing students for?

What are the core knowledge and skills required for success?

2

What is the purpose of assessment in mathematics?

Why do we assess?

Who is assessment for?

3

What does progress look like in mathematics?

How do we know when a student is making progress?

How might progress vary over time?

4

How can progress be assessed most effectively in mathematics?

Which assessment techniques work best in mathematics?

How successfully do we use formative assessment approaches?

How can formative and summative assessment work together to ensure effective assessment for learning?

How do we benchmark/ quality assure our assessment practices?

5

How do the assessment practices in our department contribute to/work with whole school policy?

Question 1: What does it mean to be a successful student in mathematics?

Some thoughts from the expert panel discussion

The broad aims of mathematics education are for students to understand how mathematics can be used to solve real-life problems and to develop an appreciation of mathematical ideas in their own right. This requires a firm grounding in key mathematical concepts, subject knowledge and skills; the 'big ideas' of mathematics. These 'big ideas' – for example, the application of multiplicative reasoning across a wide variety of mathematical ideas – underpin successful learning and are developed across all age ranges. *Key Ideas in Teaching Mathematics* (Watson, et al., 2015) highlights some of these 'big ideas'. The mathematics department should consider how these 'big ideas' can be developed in its own curriculum and how this might work alongside other planning tools e.g. national curriculum documents and published resources.

As with other subjects, success in mathematics in secondary school is intrinsically linked to the development of **higher order thinking skills**.

Students should be able to move freely between the **real world and the mathematical world**, understanding how mathematics can be used to find solutions to problems.

Conceptual understanding is an important feature of being successful in mathematics. This is especially important in secondary mathematics education in which mathematics moves from concrete to more abstract ideas. Understanding the structure of a mathematical idea can help develop a deeper understanding.

Secure subject knowledge and fluency with **procedural and algorithmic techniques** are important but are likely to contribute more strongly to success when combined with **conceptual understanding**.

As well as being fluent in **interpreting** information, they should be able to **communicate** their ideas clearly, using appropriate technical language and conventions where needed.

A successful student should be able to **connect together** different ideas in mathematics.

A successful student should be fluent in **applying ideas** in both familiar and unfamiliar situations, be able to identify how mathematics can be used to solve problems and develop creative thinking in developing their own ideas.

A successful student is one who can also understand why we do certain things in certain ways in mathematics and can consider the **most efficient** or **elegant method** to apply to a given problem.

Students can demonstrate **deeper understanding** when they can **explain how/why** a process works, not just replicate a method they have been shown.

Question 2: What is the purpose of assessment in mathematics?

Some thoughts from the expert panel discussion

The key purpose of assessment should be to help students understand where they are in their learning - supporting them to know what they are secure with in terms of their knowledge, understanding and skills and helping them identify areas to develop.

However, assessment can also:

- allow learners to reflect on learning over time
- be used to find out where students are before they start something new
- help teachers reflect on their pedagogy
- help teachers to develop a better understanding of the student as a learner
- help to identify learning issues to support the planning of strategic interventions
- provide a basis for a meaningful dialogue with students, parents/carers and other stakeholders, such as school leaders, governors and Ofsted, about students' progress.

Formative assessment can provide helpful insights into learning and take a range of forms, for example: from informal discussions, to the use of 'hinge questions' in lessons, to assessing extended tasks that can be used to tease out more complex and deeper levels of understanding. Formative assessment should address the totality of a student's performance, not just the easily measurable.

In developing formative assessment, it is vital to consider what information the assessment is aiming to collect. Effective formative assessment helps to identify strengths and areas for development and can also help to demonstrate progress over time.

Assessment information is needed for a variety of stakeholders and purposes but, fundamentally, assessment should be focused ***on*** the student and ***for*** the student.

Whilst each subject is unique in its own right, the purposes of assessing students are broadly the same in all subjects:

- to allow students to know where they are in their learning
- to help to inform future teaching and learning activities
- to help identify specific learning issues and to provide additional support/intervention where needed
- to track and monitor students' progress and to identify underachievement.

Formative assessment is integral to everyday teaching and is part of good pedagogy. It should be embedded into teaching activities, with regular opportunities for assessment and feedback within each lesson. There is already some excellent formative assessment practice occurring in schools. However, this is not necessarily consistently good across schools or between different subjects or between teachers within departments within the same school. This inconsistency can be due to a number of factors including varying levels of expertise, confidence and experience amongst teachers.

The challenge is in developing staff expertise in formative assessment practices and in assessment literacy more generally. This is a challenge that is relevant to all (Carter, 2015) not just to trainee teachers and newly qualified teachers (NQTs). To make formative assessment even more successful:

- teachers must understand formative assessment and be confident in integrating it fully into their teaching
- there needs to be a supportive and collaborative climate in which staff are encouraged to share good practice and try out new assessment approaches
- there needs to be strategic, long term planning in order to ensure that sufficient time is factored into teaching a topic to allow for feedback to students and for students to review and respond to the feedback given
- the leadership team need to promote a culture of Assessment for Learning (AfL) both within departments and across departments in a school and encourage moderation of assessment practices within and across departments.

Question 3: What does progress look like in mathematics?

Some thoughts from the expert panel discussion

Progress in mathematics may look very different from one student to the next, from one class to the next and from one school to the next. Learning in mathematics is not necessarily linear, and is intrinsically linked to curriculum design and the interplay between knowledge acquisition, conceptual understanding and the development of skills.

Assessment opportunities need to be **fit for purpose**. A context that is overly complex and unfamiliar, or mathematical content that is too demanding, is unlikely to provide useful assessment information.

A **supported progress model** can be helpful in considering progress.

- Who can remember what to do unaided?
- Who needs a gentle pointer (e.g. reminder of a key formula/result, or prompting for the first step)?
- Who needs a bit more support?
- Who needs a fully worked example before they can then do something on their own?

Carefully consider monitoring and assessing **progress over time**. Although short-term assessments may provide evidence that students are secure with recent learning, this is only part of the bigger picture. A collection of short-term assessments is unlikely to give an accurate picture of progress; it may mask issues linked to relative strengths within different topic areas or skills. The use of **strategic longer-term assessments** will contribute to a clearer picture of progress but need to be timed appropriately and reflect the key learning to be assessed. Opportunities to reflect on learning from a range of topics and to assimilate the connections between the underlying concepts are important.

Changing the **level of abstraction** may alter what you find out about your students and the progress they are making. For example, with simultaneous equations, students may demonstrate an intuitive understanding of problems based in real-life settings (e.g. costs of cups of tea / coffee), but struggle with similar thinking when presented in an abstract algebraic form.

Mathematical knowledge frequently builds on prior learning and understanding as in a **hierarchical system**. However, we must not forget the underlying **conceptual understanding** that students are developing. Beginning to be able to do something or to understand an idea is an important part of the learning process.

Progress is not just about being able to ‘do more’ or ‘do harder’. It includes students showing understanding of concepts, **explaining how and why methods work**, and how they might use the new knowledge and skills they are developing.

Formative assessment can help to identify where learning is more secure or less secure. Progress can be shown by a student’s ability to **articulate what they have done and why they have done it**, even if it is ‘wrong’. If a student is struggling with their learning, asking them to frame a question that shows where their understanding is breaking down can provide valuable diagnostic feedback.

Question 4: How can progress be assessed most effectively in mathematics?

Some thoughts from the expert panel discussion

A great deal of insight into students' progress can be obtained from observing and listening to students as they engage with tasks. Teaching and learning can be designed to guide students to take responsibility for their own learning, recognising their successes and articulating areas for development. This provides valuable information for the teacher to structure the next steps in learning.

Assessing progress needs to be linked to curriculum design with assessments timed carefully to allow students the opportunity to develop sufficient knowledge, understanding and skills to fully engage with the task. There needs to be a clear, shared understanding of progression through the curriculum with a set of standards against which outcomes can be compared. Despite the greater emphasis in the curriculum on reasoning and problem-solving skills, secondary mathematics remains 'content heavy', perhaps more so than many other subjects. It is important to be able to monitor progress through the content as well as through the 'bigger picture' of mathematics. For example, this might include developing understanding of broader concepts and recognition of their interconnectedness.

Talking and listening to students enables teachers to fully grasp the students' thought processes while the students are actively engaged in that thinking.

Quick tests can be used regularly to assess recall of knowledge and procedures, but aggregating scores over a period of time may not accurately reflect progress.

'Hinge questions' can bring out any specific student misconceptions to be addressed or areas that require further teaching. These can range from simple multiple choice to more detailed probing discussions during a lesson.

Rich learning activities that demonstrate securities and expose insecurities can allow for robust formative assessment. Rich tasks can provide useful insights into current understanding to better support future planning or can be equally useful after the teaching of a range of inter-related topics, as a means to assess the connections that learners have made.

Feedback lessons should be built into curriculum plans. These allow opportunities for self and peer reflection. Members of the expert panel considered that 'you can see more progress being made in that feedback lesson' because it encourages an explicit formative dialogue between the teacher and students about progress: what students can do, where they need to go and the strategies to get there.

Shared tasks/assessments and moderation can help a department develop a more consistent approach to embedding formative assessment. Teachers should be encouraged to talk about students' learning and progress outside of the pressures of accountability.

A lot of formative assessment **may not need recording**. The learners themselves may find it helpful to record their own progress, but an onerous system of centralised recording may be counter-productive to good formative assessment.

Immediate feedback can accelerate progress at the point of learning and develop students' thought processes. **Prompt feedback** (even if brief) often has more impact on students than detailed feedback delivered after the student has 'moved on' from a topic.

Peer and self-marking is a (teaching and learning) tool in itself. Critiquing other students' work or model answers allows learners to see different ways of thinking around the same topic and progress to be evidenced.

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