



An Roinn Oideachais  
Department of Education

# Looking at Mathematics

## Draft Guide for Post-Primary Schools

Inspectorate

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## Introduction

*Looking at Mathematics* (2022) has been compiled by inspectors of Mathematics to make a positive contribution to the learning and teaching of the subject in post-primary schools. It seeks to enrich existing self-review practices, to share exemplars of highly effective practices gleaned from subject inspections, and to assist mathematics departments in interlinking subject processes of self-review with ongoing whole-school self-evaluation.

Materials are presented in the following order:

- A suggested list of evidence sources to support self-review by the mathematics department. In reflecting on your particular context you may identify additional in-house sources of evidence relevant to your needs
- An overview of how the learning and teaching domains of *Looking at Our School 2022: A Quality Framework for Post-Primary Schools* can be used as a tool to support mathematics department development. Prompt questions are also offered to activate discussions, but are not intended as an exhaustive checklist. Each of the four learning and teaching domains includes an exemplar of how this process might take place in departments.
- A practical example of how subject-specific School Self-Evaluation (SSE) can be interlinked with the whole-school SSE process
- Further resources to support self-evaluation of learning and teaching in Mathematics

## Possible evidence sources to consider during subject department self-review

- Feedback from students on their learning experiences, for example through surveys and focus groups
- Review of students' work to elicit trial and error practices, perseverance, misconceptions, common errors and problem-solving strategies
- Teacher notes on students' engagement in both individual and collaborative work
- Discussion points raised at departmental meetings, including key points for improvement following Subject Learning and Assessment Review (SLAR) meetings
- Discussion and sharing of practices around the use of digital technology to support teaching, learning and assessment
- Ongoing review and development of units of learning for each year group
- Inspection reports, especially for Mathematics

- Data relating to student outcomes

Further sources of evidence and tools can be found at <http://schoolself-evaluation.ie/post-primary/resources/gathering-evidence/>.

## Using *Looking at Our School 2022: A Quality Framework for Post-Primary Schools* to support subject department self-review

*Looking at Our School 2022: A Quality Framework for Post-Primary Schools* provides a set of standards that can help teachers and school leaders to assess how good their practice is and guide the way towards improvement. Within this framework, learning and teaching are viewed through the following four distinct, although interrelated and sometimes overlapping, domains:

<ul style="list-style-type: none"><li>• <b>Learner outcomes</b></li><li>• <b>Learner experiences</b></li></ul>	<ul style="list-style-type: none"><li>• <b>Teachers' individual practice</b></li><li>• <b>Teachers' collective/collaborative practice</b></li></ul>
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Having identified and agreed on the aspects of practice they need to evaluate, schools should look more closely at the relevant domains and standards for the areas of their practice that require more investigation. The statements of practice associated with each standard will serve as a useful and more detailed benchmark in assisting schools to decide on the effectiveness of their practice.

It is advisable to focus on one or two areas for improvement rather than taking on too many at one time. This will facilitate incremental, ongoing self-review and improvement planning that is manageable for teachers and meaningful for students.

### **Learner outcomes**

This domain and its related standards encompass students' attitude to learning; their understanding of themselves and others; their acquisition of curriculum knowledge and skills; and their levels of attainment.

When enquiring into learner outcomes, the mathematics department may use the related standards to establish whether:

- Students enjoy their learning, are motivated to learn and expect to achieve as learners.

- Students have the necessary knowledge, skills and attitudes required to understand themselves and their relationships.
- Students demonstrate the knowledge, skills and understanding required by the post-primary curriculum
- Students attain the stated learning outcomes for each subject, course and programme.

**For example, when the learner outcomes in *Probability* are good or very good for a group of first-year students:**

The students can describe how likely an event is to occur on a scale of 0–1 (their understanding); when given experimental data, the students can estimate the probability of an event occurring (their skills); students will persist with more difficult problems (their attitudes).

**Possible prompt questions to support departmental self-review**

- Having gathered evidence of students' attitudes toward Mathematics, what areas of teaching, learning or assessment need further development?
- Do students demonstrate the capacity to formulate and analyse a mathematical argument?
- Do students use subject-specific terminology appropriately and in context?
- Are students able to draw on and apply their knowledge and skills across the various mathematical strands, and to/from other subjects?
- Do students demonstrate creativity in Mathematics?
- Is there evidence that students are making progress?

**How a mathematics department improved the quality of learner outcomes**

As part of the whole-school SSE process, the mathematics department sought to establish the degree to which students enjoy their learning, are motivated to learn and expect to achieve as learners. They focused, in particular, on students' motivation to learn.

To gather data, teachers surveyed students and gathered samples of students' work to look for evidence of perseverance and of disengagement. Students reported that activity-based lessons increased their levels of motivation and that a mixture of individual and group tasks was particularly effective in engaging them in their learning. Students reported that they were less motivated when the teacher spent a large proportion of the lesson talking about

concepts. Samples of students' work showed evidence of persistence among a minority of students, for example, multiple attempts to solve a problem. Evidence of disengagement was found in a large proportion of work samples, for example, drawings that were unrelated to the concept and questions where no attempt was evident. Teachers of Mathematics adopted a two-pronged strategy to increase levels of motivation among students. A folder on the school server was set up as a central repository for individual and group tasks, and each teacher agreed to contribute a minimum of five resources per term to the folder. Teachers also agreed that at least 50% of each lesson would be dedicated to student activity.

Following an agreed period of time, teachers evaluated the effectiveness of this strategy through re-issuing the student survey and re-evaluating a sample of students' work. A high positive response led to teachers engaging in further work related to the planning of effective group tasks. Also, teachers agreed to create a bank of three-minute explanatory videos related to key concepts. Students were encouraged to access this content in advance of engaging with a new concept. This allowed more in-class time to engage actively with the talk.

## Learner experiences

This domain and its related standards encompass students' learning experiences as demonstrated in levels of engagement as learners; growth as learners; self-reflection and ownership as learners; and development as lifelong learners.

When enquiring into learner experiences, the mathematics department may use the related standards to establish whether:

- Students engage purposefully in meaningful learning activities
- Students grow as learners through respectful interactions and experiences that are challenging and supportive
- Students reflect on their progress as learners and develop a sense of ownership of and responsibility for their learning
- Students experience opportunities to develop the skills and attitudes necessary for lifelong learning

### **When learner experiences in Mathematics are good or very good:**

Students engage in purposeful tasks that link to their real-world experiences; students participate in classroom discussions and place value on listening and contributing. Success criteria support the conduct and completion of tasks and students both reflect on and act on feedback.

### Possible prompt questions to support departmental self-review

- Do students engage actively with rich and appropriately challenging tasks that develop solution curiosity?
- Are students able to identify Mathematics in their personal life and in their environment?
- Do students ask questions of one another, as well as the teacher, and suggest possible solutions confidently?
- Do students engage in problem-solving and have they developed a range of problem-solving strategies?
- How do we know that students understand, and apply teacher feedback and peer feedback on their learning?
- Can students demonstrate the ability to reflect meaningfully on their work? Do they use these reflections to strengthen further decision making, investigation and refinement to progress their work?

### **How one subject department improved the quality of learner experiences in Mathematics**

As part of the whole-school SSE process, the mathematics department sought to establish the degree to which students experience opportunities to develop the skills and attitudes for lifelong learning. In particular, they considered whether students were enabled to make meaningful and authentic connections between learning in different subjects, areas of the curriculum and real-life contexts.

Teachers gathered evidence from a student focus group and from samples of students' project work, including classroom based assessments. They identified students' ability to connect their learning to other subjects and to real-world contexts as an area for improvement and agreed a departmental strategy to address it. They then established an open-ended improvement target, with a view to re-evaluating through further focus groups and reviewing work samples at the end of the school year.

Teachers changed their practices by commencing each new concept with a discussion around real-world applications. It was also decided that at least 75% of classroom activities would be based on real-world examples or examples that related to at least one other curricular subject. This required teachers to work together to build a bank of resources. At each team meeting, one member of the team was scheduled to provide an input on the application of

mathematics curriculum content to one other subject. At the end of each lesson, students were encouraged to reflect on the content of the lesson and to discuss further applications. At the end of the year, teachers held a further focus group meeting with students and reviewed more samples of students' project work. This allowed them to evaluate the effectiveness of the interventions.

### Teachers' individual practice

This domain and its related standards encompass teachers' knowledge and skills; their use of practices that progress students' learning; their use of appropriate teaching approaches; and their responsiveness to individual learning needs.

When enquiring into teacher individual practice, the mathematics department may use the related standards to establish whether:

- The teacher has the requisite subject knowledge, pedagogical knowledge and classroom management skills
- The teacher selects and uses planning, preparation and assessment practices that progress students' learning
- The teacher selects and uses teaching approaches appropriate to the learning intention and to students' learning needs
- The teacher responds to individual learning needs and differentiates learning and teaching activities as necessary

#### **Where a teacher's individual practice in Mathematics is good or very good:**

They have modified their practice based on the learning intention of the lesson. Students are purposefully engaged. Students are facilitated to engage in conversations about Mathematics. Teachers recognise when things are not going to plan and adapt their approach accordingly.

Possible prompt questions to support departmental self-review

- Do we demonstrate the necessary rigour in the quality of Mathematics we present to students?
- To what extent do we differentiate tasks and resources to meet the diverse needs of students in our classes?
- Do we provide opportunity for more able students to accelerate their learning?
- Do we plan for the use of a range of oral and written questioning strategies?

- Do we use and encourage the use of digital technology as a learning and teaching tool?
- Do we create units of learning that exploit linkages across the curriculum strands?

### **How one teacher reviewed teaching approaches to further progress students' learning**

Having reviewed the progress of students through a series of in-class assessments, one teacher noted that, while most students were progressing, the performance of the more able cohort of students had stagnated.

In order to identify where the issue may lie, the teacher observed students over the course of five lessons, paying particular attention to how the more able students interacted with the lesson. While these students contributed well to classroom discussions, the teacher noted that they completed classroom activities much faster than the other students. In such cases, the more able students were largely idle until the remaining students completed the activity. After consulting with colleagues and engaging in some internet-based research on how to engage all students effectively, the teacher decided to trial some new approaches. In preparing for each lesson, the teacher drafted some differentiated learning intentions and these were discussed with students at the start of the lesson. As part of the discussion, students were given an opportunity to suggest amendments to the learning intentions.

The teacher also decided to incorporate at least one group activity into each lesson. These activities included more challenging tasks that students could choose to do or could progress to.

After an initial period, the teacher observed that the more able students were much more engaged in lessons. When in mixed ability groups, their contribution to the group discussion meant that they were less likely to disengage. When working together on a more advanced task, it was clear that the additional challenge was a source of considerable motivation for the students.

Data gathered from a series of subsequent in-class assessments showed a marked improvement in the performance of the more able cohort of students. Interestingly, it was noted that the performance of other students in the class had also improved.



## Teachers' collective/collaborative practice

This domain and its related standards encompass teachers' professional development and collaboration; their co-operation to extend students' learning opportunities; their collective use of dependable assessment practices; and their sharing of expertise to build capacity.

When enquiring into teachers' collective/collaborative practice, the mathematics department may use the related standards to establish whether:

- Teachers value and engage in professional learning and professional collaboration
- Teachers work together to devise learning opportunities for students across and beyond the curriculum
- Teachers collectively develop and implement consistent and dependable formative and summative assessment practices
- Teachers contribute to building whole-staff capacity by sharing their expertise

### **When teachers' collaborative practice in Mathematics is good or very good:**

Teachers talk regularly about students' learning outcomes. Teachers plan together for teaching, learning and assessment in Mathematics and modify practices to address any recurring difficulties identified as part of their discussion. Teachers share expertise in Mathematics within the mathematics department and with other subject departments in their school and in other schools.

Possible prompt questions to support departmental self-review

- Have we identified and documented agreed teaching approaches for the related learning outcomes across the strands?
- Does the subject plan document teachers' engagement with relevant continuing professional development (CPD), contain an analysis of the outcomes of this CPD, detail how the CPD is linked to whole-school policies and contain evidence of sharing of the associated learning?
- Have we identified Science, Technology, Engineering and Mathematics (STEM)-based partnerships between the school and the business, industry and research communities?
- Does the subject plan document our reflections on students' work, including reference to available data, identification of trends and agreement on common strategies for ongoing development of learning and teaching?

### **How one mathematics subject department improved teachers' collaborative practice by sharing their expertise in a more structured way**

At the start of the school year, a number of new teachers had joined the mathematics department. During their first meeting, it was decided to capitalise on the blend of experience and new ideas that now existed in the department. The group decided to focus on professional collaborative review. As a target, each teacher undertook to observe at least two lessons conducted by colleagues and to try at least two new teaching methodologies over the course of the term. An observation template was devised in order to support the review process. At the end of the term, the outcomes of the period of professional collaborative review were discussed.

The following outcomes emerged:

- The newer teachers reported that their ability to manage a lesson effectively had improved markedly through adopting some of the classroom management strategies of the more experienced teachers.
- Some of the teachers had begun to engage with digital technology in a more interactive way in lessons.
- Having struggled with using learning intentions and success criteria in the past, one teacher now had a much clearer sense of how to use these strategies effectively in lessons.

As a follow-up action, the department decided to engage with a focus group of students in order to establish whether or not their experience of learning had improved as a result of the more varied methodologies in use in lessons. It was also decided that teachers would extend their professional collaborative review by planning lessons in pairs and observing each other delivering the collaboratively planned lesson.

## Using this document to support your whole-school SSE strategy – a practical example

	Whole-School	Mathematics Department
Identify focus	<p>Example:</p> <p>Improve the learner experience with a view to enhancing student wellbeing and supporting higher outcomes</p>	<p>Ask questions of ourselves as teachers, e.g.</p> <ul style="list-style-type: none"> <li>• What does a good learner experience look like in Mathematics?</li> <li>• What does the mathematics specification /syllabus say about learner experience?</li> </ul>
Gather evidence	<ul style="list-style-type: none"> <li>• Focus group of students</li> <li>• Questionnaire for all/sample of students</li> <li>• Survey of parents</li> </ul>	<p>With a focus on assessment:</p> <ul style="list-style-type: none"> <li>• Listen to the students in our mathematics classes</li> <li>• Examine students' work for evidence of disengagement</li> <li>• Use parent-teacher meeting to talk to parents about their child's experience of the subject</li> </ul>
Analyse and make judgements	<p>Evidence gathered indicates positive practices in some subjects and classes:</p> <ul style="list-style-type: none"> <li>• Students are interested in learning and participate well in lessons</li> <li>• Students would welcome additional opportunities to work collaboratively on tasks</li> </ul>	<p>Evidence indicates:</p> <ul style="list-style-type: none"> <li>• Students engage regularly in investigative activities</li> <li>• More activities could stem from students' own interests and questions</li> <li>• Students enjoy working collaboratively</li> </ul>

<p>Write and share report and improvement plan</p>	<p>Improvement plan commits us to developing and implementing more frequent and enhanced opportunities for students to work collaboratively on tasks.</p>	<p>At subject level, the school improvement plan commits us to implementing more frequent and enhanced opportunities for students to engage in collaborative tasks that stem from their own interests and questions.</p>
<p>Put improvement plan into action</p>	<ul style="list-style-type: none"> <li>• Amend assessment policy to support plan</li> <li>• Implement at subject department level</li> <li>• Set up cross-department structures to enable consistent implementation</li> </ul>	<p>Agree on a list of collaborative tasks, including success criteria, which can be used for each year group and for each level of study. The tasks should have sufficiently broad parameters to facilitate adaptation to students' own interests.</p>
<p>Monitor actions and evaluate impact</p>	<ul style="list-style-type: none"> <li>• Is there consistent implementation?</li> <li>• Are adjustments needed?</li> <li>• Was the process manageable?</li> <li>• Was the process meaningful?</li> <li>• How did the plan support improvements in wellbeing and outcomes?</li> </ul>	<ul style="list-style-type: none"> <li>• What is the feedback that we have gotten from students?</li> <li>• Do we need to make changes? Why?</li> <li>• Was the process manageable and meaningful in Mathematics?</li> <li>• How can we continue to support and develop the process?</li> <li>• Is a link between students' sense of wellbeing and their progress in Mathematics evident?</li> </ul>

## Further reference sources to support subject departments in self-evaluating the learning and teaching of mathematics subjects

- A survey of inspection reports on the learning and teaching of Mathematics collated from the DE website. (See <https://www.gov.ie/en/school-reports/> for copies of subject inspection reports and also follow-through inspection reports on subject inspections of Mathematics)
- [Focus on Learning Toolkit, NCCA](#)
- Notes and/or online resources from the mathematics advisory team in [JCT](#) and [PDST](#)
- [State Examination Commission \(SEC\)](#) examination instruments such as past examination papers, marking schemes, and Chief Examiner's reports.
- The [Junior Cycle subject specification and associated Assessment Guidelines](#)
- The [LC Mathematics syllabus](#)
- The [School Self-Evaluation Process](#).
- The [Digital Learning Framework](#)
- [STEM Education Policy](#)