

An Roinn Oideachais agus Scileanna

Department of Education and Skills

**Subject Inspection of Mathematics
REPORT**

**Loreto Secondary School, St. Michael's
Navan, County Meath,
Roll number: 64370T**

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**AN ROINN DEPARTMENT
OIDEACHAIS OF EDUCATION
AGUS SCILEANNA AND SKILLS**

REPORT
ON
THE QUALITY OF LEARNING AND TEACHING IN MATHEMATICS

SUBJECT INSPECTION REPORT

This report has been written following a subject inspection in Loreto Secondary School, Navan, conducted as part of a whole-school evaluation. It presents the findings of an evaluation of the quality of teaching and learning in Mathematics and makes recommendations for the further development of the teaching of this subject in the school. The evaluation was conducted over two days during which the inspector visited classrooms and observed teaching and learning. The inspector interacted with students and teachers, examined students' work, and had discussions with the teachers. The inspector reviewed school planning documentation and teachers' written preparation. Following the evaluation visit, the inspector provided oral feedback on the outcomes of the evaluation to the principal, deputy principal and subject teachers.

SUBJECT PROVISION AND WHOLE SCHOOL SUPPORT

Loreto Secondary School, Navan, has a current enrolment of 777 girls. Timetable provision and timetabling arrangements for level choice in Mathematics are very good. Concurrent timetabling of Mathematics lessons is provided for all year groups with the exception of Transition Year (TY); this provides students with the flexibility to change level as and when the need arises. TY is optional and there is one mixed-ability mathematics class group.

There is a variety of strategies employed in assigning students to levels throughout the six year groups. At the beginning of first year, students are assigned to higher and ordinary level classes. This is done on the basis of their performance in pre-entry assessment tests. While very good arrangements are made for students to change level if required, it is recommended that the mathematics department reviews their policy on assigning students to higher and ordinary levels in first year. Consideration should be given to deferring level decisions until the beginning of second year by creating mixed-ability mathematics classes for first year. There are benefits in taking this approach: it will provide students with time to settle into the school before level decisions are made and it will allow teachers to have a greater input into decisions regarding level choice. In undertaking this consideration, the school should review the research carried out in this area.

There are four higher-level classes in each of second and third year; students are assigned to these class groups on a mixed-ability basis for that level. There are two higher-level classes in each of fifth and sixth year and similarly these class groups contain students within a range of abilities for that level. This approach is in keeping with good practice. However, the third, fifth and sixth year students, studying ordinary-level mathematics, are assigned to class groups in order of ability. In order to raise expectation for ordinary-level class groups, it is recommended that consideration be given to assigning students to ordinary-level classes on a mixed-ability basis, where feasible.

There are thirteen teachers delivering the mathematics programme in the school. Teachers are assigned to class groups in accordance with their experience and expertise. There is good rotation of levels in both the junior and senior cycles.

The school supports teachers' continuing professional development (CPD). In addition to attendance at the workshops provided in preparation for *Project Maths*, whole-school events on topics such as mixed-ability teaching and on teaching students who have special educational needs have been organised. Teachers also attend CPD events in their own time. There is a well established culture of teachers mentoring colleagues who are new to the subject or to a particular level, within the mathematics department. Teachers also provide training for each other, particularly with regard to using information and communications technology (ICT) in mathematics lessons. This is evidence of teachers' commitment to the subject and to their own professional development.

The provision of ICT resources for Mathematics is very good. There are ceiling-mounted data projectors and audio facilities fitted in all classrooms. Some rooms also are equipped with personal computers and in others, teachers use laptop computers. Broadband internet access is available throughout the school. A number of teachers have purchased their own tablet personal computers and use them in lessons. There are two computer rooms available on a booking system and the computers in the Technical Graphics room are also used for mathematics lessons. Teachers are active in sourcing suitable material on the internet and a list is provided in the mathematics folder. Emails are sent to students' homes informing parents of valuable web-based resources. The high quality and quantity of the ICT resources used for teaching and learning in Mathematics is evidence of the department's commitment to making the subject relevant and vibrant for students.

There is a range of teaching aids available to the mathematics department. These include 3-D models, *Geostrips*, geometry equipment, laminate boards, and calculators. Bean bags in a variety of colours were used in one lesson to illustrate the idea of grouping like terms in algebra. This is very good practice and it is recommended that opportunities to further the use of everyday objects in teaching and learning in Mathematics be explored. The use of household bills, newspapers, containers of various shapes and sizes, playing cards and dice provide for rich mathematical learning experiences. Science equipment and sports equipment could also be used in lessons. In addition, it is suggested that students should be encouraged to make resources such as clinometers.

Students are encouraged to participate in a variety of extracurricular and co-curricular mathematics activities. These include taking part in preparation for the *Irish Mathematical Olympiad*, attendance at the *Mathematical Modelling* course organised by the University of Limerick and participation in the *PRISM Maths Challenge*. In addition *Maths Week* is celebrated in the school each year. TY students made presentations of their mathematics projects as part of this year's *Maths Week* celebrations. Providing opportunities, such as these, for students to experience Mathematics for fun is a very valuable way of encouraging an interest in the subject.

PLANNING AND PREPARATION

There is good provision of planning time for Mathematics with meetings organised once per term as part of the school's planning process. There are two co-ordinators of the mathematics department; one with responsibility for the junior cycle and the other looking after senior cycle.

These positions are filled on a rotational basis which is in line with good practice. Regular informal meetings of mathematics teachers take place in addition to those held in formal planning time. There is a very strong sense of team work amongst members of the department and it is common for teachers to seek and provide advice and support for each other. The achievement of best outcomes for learners is a central focus of the decisions made for the subject. In the past, teachers have shared expertise through observing each others lessons. It is suggested that this excellent practice be reintroduced.

The subject plan contains all of the relevant policies for Mathematics. These include the homework policy, the policy on teaching students with special educational needs and the assessment policy. While it is good that some progress has been made on planning, the subject plan does not reflect the very good decision-making and forward-planning processes that are active on the ground. It is therefore recommended that a section for action planning, that identifies actions to be carried out by a specified date, should be included in the mathematics plan. This would provide a formalised process for the action planning that is already taking place and provide a forum for addressing issues that are identified in a structured way. An action plan to review the current arrangements made for level choice for first years would be a good starting point, for example.

Programmes of work for each year group and level are included within the planning documentation. These are described in terms of chapters of the text book to be completed within an agreed timeframe. There is scope for some work to be carried out on the programmes of work in light of the introduction of *Project Maths*. It is recommended that the mathematics department take the new syllabus document, where each strand is set out in terms of learning outcomes, and that they interpret it in a way that exploits links across topics and strands. It is also recommended that teachers make themselves very familiar with the teaching and learning plans provided by the *Project Maths* team and those on the *Project Maths* website. These should be used to facilitate the use of appropriate methodologies to deliver the syllabus in a way which will best achieve the learning outcomes.

The TY plan for Mathematics is very good and is designed to encourage the development of an interest in the subject. Topics such as '*Green Maths*', the history of Mathematics, project work on careers in Mathematics, and problem solving are included to add variety of material. Students are also provided with the opportunity to learn to play chess and to decipher codes; this is a valuable way to teach problem solving and strategic thinking skills. A variety of suitable methodologies is used to ensure that student engagement is as active and, through using ICT, as interactive as possible. Overall, through this very good TY programme, students are exposed to the uses of Mathematics and are encouraged to see how the subject can be relevant in their own lives.

TEACHING AND LEARNING

High-quality teaching and learning was evident in all of the ten lessons observed. At the start of most lessons, the learning objectives were written on the board and shared with the students; in other cases lessons began with an oral sharing of the learning objectives. In keeping with very good practice, these focused on achieving solid student understanding of the main ideas outlined. This ensured that students knew they had to understand the subject material by the end of the lesson and encouraged an environment where students took appropriate responsibility for this through asking questions and engaging very well. There was a sense of achievement at the end of lessons as students attained the learning outcomes.

The variety of methodologies used included group and pair work, active learning, investigation, and ICT. These were all very well prepared and were successful in ensuring students fulfilled the learning objectives of the lessons. Where it was used, ICT was integrated into classroom activities and supported learning very well. Video clips were used in two lessons to consolidate understanding; this proved very successful. Teacher example followed by student exercise was a feature of lessons, and where this was the case clear examples and a good balance between student and teacher input made it an effective strategy. The approaches observed were used in a variety of combinations by all teachers and it is recommended that teachers explore different ways of sharing their own very good practice.

Questioning was used very effectively to support learning in the lessons observed. Teachers and students collaborated through asking and answering questions and through engaging in discussion in exploring the concepts of the lessons. This ensured that there was a high level of student involvement in the work at hand. Higher-order questioning approaches that encouraged students to uncover underlying ideas were used frequently. In some of the lessons observed, teachers chose exercises for students to complete that naturally exposed the underlying concept and the students demonstrated a very good ability to make logical connections and to find short cuts. This very good practice will contribute positively to students' ability to answer *Project Maths* examination questions which will require students to demonstrate a solid understanding of the learning outcomes on the syllabus.

In some cases, the work of lessons was related across different areas of the syllabus. In one lesson, for example, algebraic word problems resulting in simultaneous equations were very well related to linear programming and to linear graphs. This excellent practice provided students with very full explanations and allowed them to explore the concepts in a complete way. In some cases, however, there was scope for the creation of this type of connection. It is recommended, in interpreting the syllabus, that teachers remain conscious of the need to identify links between topics and to take advantage of these in lesson planning.

Very well thought out concrete examples were chosen to help students to identify with the material presented. A very good example of this occurred in a lesson on finding the median and the inter-quartile range, where the service times in two restaurants were compared and the resulting analysis was thoroughly discussed. Similarly, teachers used everyday scenarios and ideas to explain mathematical concepts, where this strategy was appropriate. This was achieved through, for example, substituting prices from a menu into a variety of algebraic expressions. This was very effective in contextualising the topics covered and in making the concepts less abstract and therefore easier to understand. It was evident from student contributions in such lessons that deep learning was taking place.

Very good practices in relation to differentiation of learning were observed. Students worked in pairs or groups and discussed the work of lessons with each other. Teachers provided individual attention to any student experiencing difficulty while the remainder of the class group worked ahead. In addition, teachers presented material in a variety of ways to facilitate repetition where necessary. In all cases, teachers were very careful to anticipate potential areas of student difficulty through high-quality observation and to modify lesson activities to address any problems that arose. In one case, in a lesson on problem solving, the provision of information was carefully staggered to ensure that each student was sufficiently challenged. In this case, the initial problem was put on the board with the minimum amount of information needed to solve it, as soon as the teacher noted that certain students had begun to solve the problem some more information was provided to those students who were having difficulty. This very effective approach continued

throughout the lesson and ensured that the students were given the opportunity to experience the delight of solving the problem for themselves.

Students, through their enthusiasm in engaging in lessons, demonstrated that very good learning was taking place. They made very high-quality contributions to lessons in the form of deriving formulae, establishing general rules and in making logical connections. Students worked these out for themselves, with the support of their teachers in the form of general encouragement but without specific mathematical advice. There was much excitement and a sense of fun when students engaged in problem solving activities, particularly where they worked in groups, this is very appropriate. Providing opportunities like these for students can encourage them to experience the intrinsic attraction of Mathematics and is very worthwhile.

The relationship between students and their teachers was observed to be very good. Students responded very well to the encouragement and support that they received from their teachers. In one case, while there was much encouragement provided to students, there was scope for the inclusion of more direct affirmation. A warm and caring learning environment existed in all of the classrooms visited. Every effort was made to ensure that students' experience of Mathematics was positive and that they could develop confidence with the subject. Students contributed fully and freely to lessons and it was evident that they were enjoying Mathematics.

ASSESSMENT

First, second, transition and fifth year students are formally assessed at the end of the Christmas term and in May. Students preparing for the certificate examinations are continually assessed throughout the year and sit 'Mock' examinations in spring. Reports are sent home on foot of all formal assessments and parent-teacher meetings are held annually. There is widespread use of the student journal as a valuable means of communicating with parents. Teachers are using them as a way of motivating students by sending home positive and encouraging notes. Where there is cause for it, advisory notes are also included. Test results are also written in student journals for parents to see. Parents and class tutors sign the journal each week.

There is very good practice in relation to assessment. Homework is given regularly and is usually corrected as part of the following lesson which is good practice. It is mathematics department policy to give class tests at the end of each topic studied. There was much evidence that teachers use assessment for learning (AfL) principles in the correction of student work by providing advice and encouragement through the comments made on written work which is good. The quality of the presentation of student work was very high in the copybooks reviewed.

Student progress is closely monitored on an ongoing basis through oral questioning and observation. Laminate boards were used very effectively in two of the lessons observed to provide teachers with a quick and comprehensive assessment of student progress. This involved students writing their answers on the laminate boards and holding them up for the teacher to see. The use of this approach was particularly successful in a lesson on fractions where students had to identify equivalent fractions. In this case, the first exercise completed by students yielded correct answers from about half of the class group and a further teacher example meant that most of the remainder understood the idea. However, it was very effective in identifying those students who needed a more concrete form of instruction to achieve the learning outcome. This was a clear illustration of how the use of laminate boards in this way can provide a very rich form of

information to teachers. There is scope for the extension of the use this very good type of assessment.

A comprehensive analysis of the school's performance in the certificate examinations compared to national norms is carried out each year. This information is used to inform planning for Mathematics. It is evident from this analysis that the school is performing very well and in particular that it is very successful in retaining higher-level students from junior cycle to senior cycle.

SUMMARY OF MAIN FINDINGS AND RECOMMENDATIONS

The following are the main strengths identified in the evaluation:

- Timetable provision and timetabling arrangements for level choice are very good.
- The provision of resources for Mathematics is very good.
- There is a strong sense of team work amongst members of the mathematics department and this has contributed to the very good decision-making and forward-planning processes that have been established.
- The TY plan is very good and is designed to encourage the development of an interest in the subject.
- High-quality teaching and learning was evident in all of the ten lessons observed. There was a sense of achievement at the end of lessons as students fulfilled the learning objectives.
- The variety of methodologies used included group and pair work, active learning, investigation, and ICT.
- Questioning was used very effectively to support learning in the lessons observed. Teachers and students collaborated through asking and answering questions and through engaging in discussion in exploring the concepts of the lessons.
- Students, through their enthusiasm in engaging in lessons and by making very high quality contributions to lessons, demonstrated that very good learning was taking place.
- The relationship between students and their teachers was observed to be very good. Students responded very well to the encouragement and support that they received from their teachers.
- There is very good practice in relation to assessment.

As a means of building on these strengths and to address areas for development, the following key recommendations are made:

- The mathematics department should review their policy on assigning students to higher and ordinary levels in first year. Consideration should be given to deferring level decisions until the beginning of second year by creating mixed-ability mathematics classes for first year.
- A section for action planning, that identifies actions to be carried out by a specified date, should be included in the mathematics plan.
- The mathematics department should take the new syllabus document, where each strand is set out in terms of learning outcomes, and interpret it in a way that exploits links across

topics and strands. The *Project Maths* teaching and learning plans should be consulted for appropriate methodologies to deliver the syllabus.

- Teachers should explore different ways of sharing their own very good practice.

A post-evaluation meeting was held with the teachers of Mathematics, with the principal and deputy principal at the conclusion of the evaluation when the draft findings and recommendations of the evaluation were presented and discussed.