Subject Inspection of Mathematics
REPORT

St Vincent’s Secondary School
Dundalk, County Louth
Roll number: 63900R

Date of inspection: 25 November 2009
SUBJECT INSPECTION REPORT

This report has been written following a subject inspection in St Vincent’s Secondary School, Dundalk, 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 and subject teachers.

SUBJECT PROVISION AND WHOLE SCHOOL SUPPORT

St Vincent’s Secondary School has a current enrolment of 853 girls. Timetable provision for Mathematics is very good. In the junior cycle, for each of first, second and third year, there are two bands. One comprises three higher-level classes for Mathematics and there is a combination of higher and ordinary level classes in the other. Students are assigned to class groups on the basis of achievement in pre-entry assessments. The abilities are mixed within the bands. In addition, students who have been identified as requiring learning support in Mathematics are assigned to a small ordinary level class. The mathematics lessons in the second band are concurrently timetabled to provide flexibility around level choice. Concurrent timetabling has been provided for all of the mathematics lessons in transition year, fifth year and sixth year. This is good.

The arrangements around students’ choice of levels in Mathematics are good. However, since the proportion of students achieving very high grades in Leaving Certificate ordinary level Mathematics is higher than the national figures, it is recommended that they be kept under review to ensure that the uptake levels of higher level Mathematics are appropriately high. In the future the possibility of assigning all first year students to mixed-ability class groups, for Mathematics, might be considered as a strategy for increasing the uptake of higher level.

The mathematics department comprises fourteen teachers. There is good rotation of levels in the junior cycle amongst members of the teaching team. Higher level Leaving Certificate Mathematics is currently alternated between two teachers. It is therefore recommended that a greater number of teachers become involved in teaching higher level Mathematics to Leaving Certificate level; this would help ensure the development and maintenance of capacity and expertise amongst the mathematics teachers.

Teachers’ continuing professional development (CPD) is well supported by school management. In addition to whole school courses, for instance, on school development planning, mathematics
Teachers have participated in a range of mathematics-related courses. This is evidence of the mathematics department’s commitment to the development of the subject within the school.

The mathematics department has access to information and communications technology (ICT). There are two classrooms which are fitted with ceiling mounted data projectors; in addition a mobile data projector is also available on request. Teachers have and use their own personal laptop computers for teaching and learning in Mathematics. A range of ICT resources including; PowerPoint presentations, ‘Omnigraph’, ‘Geogebra’, mathematical games, and animated proofs of the Junior Certificate geometry theorems are accessible through a shared folder on the school’s network. While ICT is currently being used for teaching and learning in Mathematics there is scope for a significant increase. It is recommended that the members of the mathematics department explore ways in which this increase can be achieved.

In addition to ICT equipment there is a wide range of resources and concrete materials available for teaching and learning in Mathematics. These include twenty-four hour clocks, 3-D shapes, trundle wheels, geo boards, a mathematical balance, probability kits, tangram worksheets, and a variety of mathematical games and puzzles. In addition, everyday objects are used to make mathematics lessons more interesting and relevant for students. These resources are kept in a central location and are shared amongst the members of the teaching team. There is good practice in relation to the collection, sharing and using of concrete materials and resources in teaching and learning in Mathematics.

Classrooms are student-based therefore lesson materials and resources have to be carried from the storage area to the classroom. The possibilities for incorporating active methodologies and ICT regularly and frequently in teaching and learning in Mathematics are consequently limited. If some classrooms were teacher-based it would be possible to have materials, resources and ICT facilities to hand so that they could be used to enhance and clarify mathematical explanations on a day-to-day basis when the need arises. Notwithstanding the limitations of the school’s accommodation, it is recommended that the possibility for reaching a compromise in this situation be explored. This is of particular importance in light of the upcoming changes to the mathematics syllabuses which will see a greater emphasis on active learning and experimentation in teaching and learning in Mathematics. A designated mathematics room which could be booked or rotated might be one way of improving access to resources.

There are effective procedures in place for identifying students who require support in Mathematics. Students who experience difficulty with Mathematics or have been identified as requiring support with Mathematics are very well supported. Support is provided through the provision of an additional class group in each year group. Individual and small group withdrawal is also provided where necessary. In keeping with very good practice support is provided during mathematics lessons through team teaching.

Students are encouraged to participate in a wide range of co-curricular and extracurricular mathematics-related activities. These include participation in the PRISM Maths Challenge, training for the International Mathematical Olympiad, and the Mathematical Modelling Summer School organised by University of Limerick. In addition, Maths Week is celebrated as a significant event in the life of the school. The mathematics department organise a bridge club for students; this takes place after school every Friday. In recent times students have represented the school at international level in bridge competitions and have achieved a very high level of success. Participation in extracurricular mathematics activities is very worthwhile as it provides students with opportunities to experience Mathematics for pleasure and it raises the profile of Mathematics within the school.
PLANNING AND PREPARATION

Meeting time is allocated to planning for Mathematics four times per year. In keeping with good practice, the minutes of these meetings are kept within the planning documentation. Mathematics teachers also meet frequently on an informal basis to engage in discussion about mathematics-related issues. The position of mathematics department co-ordinator is currently held by an experienced member of the teaching team and in keeping with good practice is rotated amongst all mathematics teachers. The members of the mathematics department work well together as a team and provide a high level of collegial support for each other.

It was evident from the review of planning documentation that the mathematics department has engaged well with the subject planning process and progress has been made on the plan for Mathematics. The plan opens with the aims and objectives of the mathematics department which focus on encouraging students to gain confidence with the subject and to develop an appreciation for Mathematics. The plan also contains the mathematics department policy on student access to levels and a list of resources used in mathematics lessons. It is recommended that work continues on the development of the subject plan so that it accurately reflects the valuable approaches and methodologies that characterise the day-to-day work of mathematics teachers.

The mathematics plan contains programmes of work for each year group and level. It is evident that much time and effort has been invested in their creation as they are set out in terms of learning objectives, resources necessary and methods of assessment. While this format is in keeping with very good planning practice it is recommended that a section for methodology should be added to these programmes. The programmes would also benefit from the addition of a section for reflection and review. Over time, with the collaboration of the entire teaching team, the development of the programmes of work should facilitate a very worthwhile sharing of experience and expertise.

The focus of the TY plan is on developing student confidence with Mathematics by using a hands-on approach to make the subject more relevant to students. The plan describes a good combination of Leaving Certificate course content and topics that are not on the Leaving Certificate course. Real life materials and active methodologies are used to help students to develop their understanding of mathematical concepts. TY students complete a project on, for example, the lives of famous mathematicians, Fibonacci sequences, and using ‘Omnigraph’. In TY students are given the opportunity to learn to play bridge; this is very valuable in helping them to develop their critical thinking, problem solving and mental arithmetic skills. TY students make models to use as concrete materials for the study of geometry and volume and area. A project to create clinometers and to use them to find the heights of structures around the school is suggested as an idea that would also fit well into this very good TY plan. Further information on this is available in the Mathematics Junior Certificate Guidelines for Teachers produced by the National Council for Curriculum and Assessment (NCCA).
High quality teaching was evident in all of the nine lessons observed during the evaluation. Teachers’ work on the board, explanations and instructions were very clear. All of the lessons observed had a clear focus, were well structured and progressed at a pace that was appropriate to the ability level of the students. In general, a good balance between teacher input and student activity was achieved as teachers were careful to vary the learning activity regularly throughout lessons. This very good practice should be extended to all lessons. Most teachers provided a comprehensive oral introduction to lessons. Some teachers wrote the learning objectives of the lesson on the board at the start and, in keeping with very good practice, checked that they had been achieved at the end of lessons. These good practices ensure that students know what to expect from each lesson and contribute to students’ appreciation of the progress that they are making in Mathematics.

Teachers made very good use of questioning to assess learning and to engage and involve students. In most cases higher-order questions, that required students to focus on the reasons for the steps in worked examples, were used to help students to explore ideas and concepts. In general teachers provided opportunities for students to develop creativity in the application of learning. This was achieved by teachers using open questioning strategies and allowing students plenty of time to formulate ideas, by expecting students to work on unfamiliar types of exercises without prior example and by encouraging students to work in pairs to provide assistance for each other. These excellent practices encouraged students to tackle the strategic elements of the questions for themselves. In some cases, however, students were provided with a strategic step-by-step breakdown of each problem and were expected to follow each step to answer questions. In order to allow students to develop their own problem-solving skills and to gain confidence in using them independently it is recommended that practices to encourage students to think for themselves be incorporated into to all mathematics lessons.

Most of the lessons observed during the evaluation comprised a very effective combination of teacher example followed by student exercise. In a lesson on algebra, this was complemented by an effective visual demonstration. The objective of this lesson was for students to understand that only like terms should be added in algebraic expressions. The teacher provided students with strips of paper on which the answers to each problem were to be written and then held up for the teacher to see. Later in the lesson, as the concept became more abstract, this demonstration was used as a concrete example to build understanding. Overall, this was an exemplary lesson.

Teachers use a range of resources and concrete materials in teaching and learning in Mathematics and create opportunities for students to participate in practical activities and mathematics related projects. There is scope, however, to increase the use of active methodologies, research, discovery and investigation, and ICT and to make them routine and regular features of mathematics lessons. It is therefore recommended that mathematics teachers seek ways in which this increase can be achieved.

Two separate lessons on the unit circle were observed as part of the evaluation. Both of these lessons provided excellent examples of teaching for deep understanding through maintaining a clear strategic focus in explanations, examples, questioning and discussion. The hierarchical approach that was taken in both of these lessons served to build on students’ understanding by exploring the core concept in its simplest form and working towards the development of more complex ideas. The students of these class groups were facilitated in thinking for themselves by their teachers expecting them to establish the veracity of the new concepts presented by
investigating, proving, and finally accepting the ideas. The spirit of teamwork that characterised the interactions between the students and the teachers in both of these lessons provided evidence that by the end of the lessons high quality learning had taken place.

Most teachers had prepared handouts or worksheets to complement the text book; in all cases these were well designed to support learning. This was of particular note in the LCA lesson observed. The teacher of this class group provided students with a copy of the day’s television guide and a work sheet with questions, on time, that gradually increased in difficulty. The questions were open-ended and required students to make personal choices and then use these to complete calculations; the quality of this supplementary material had a very positive effect on student learning outcomes.

Team teaching was a feature of two lessons observed in the evaluation. In both cases this arrangement worked very well with the main teacher and the support teacher providing high quality individual assistance by giving general advice that encouraged students to think for themselves. It was clear from visiting these classes that a very high level of genuine care is provided for students who experience difficulty with the subject.

The relationship between students and their teachers was observed to be very good. Students responded very well to the encouragement and affirmation that they received from their teachers. A 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

All year groups with the exception of TY are formally assessed at Christmas. Examinations are held in May for first, second and fifth-year students. TY students are continuously assessed throughout the year. Students preparing for the certificate examinations sit ‘mock’ examinations in spring. Reports are sent home in October, at Christmas, in May and at Easter. Parent-teacher meetings are held annually.

In keeping with good assessment practice it is mathematics department policy to set common examination papers within levels. There is very good practice in relation to differentiation on some examination papers where the questions set take account of the variety in ability levels in the class group; it is recommended that this practice be extended to all examinations.

Students’ progress is closely monitored by teacher observation and oral questioning in class. It is mathematics department policy to set class tests at the end of each topic or chapter studied.

Homework is set regularly and is usually corrected as part of the following lesson. It was evident from the review of students’ copybooks that the standard of presentation of students’ work is very high. Teachers routinely monitor students’ work and this contributes to these high standards. Most teachers provide students with valuable feedback by including comments in the correction of tests and homework. The standard of presentation of the LCA student folders and the quality of their key assignments are very high. These folders are kept within the school and they are evidence of the value placed on the mathematical applications component of the LCA programme in the school.
The school carries out an analysis of students’ performance in the certificate examinations compared to the national norms. This is used to inform planning for Mathematics. The school is justifiably proud of its students’ achievements in the certificate examinations.

SUMMARY OF MAIN FINDINGS AND RECOMMENDATIONS

The following are the main strengths identified in the evaluation:

- Whole school support, for Mathematics, in terms of timetabling and provision of resources is very good.
- The members of the mathematics department work well together as a team and provide a high level of collegial support for each other.
- High quality teaching was evident in all of the nine lessons observed during the evaluation. Teachers’ work on the board, explanations and instructions were very clear.
- Teachers made very good use of questioning to assess learning and to engage and involve students. In most cases, higher-order questions which required students to focus on the reasons for the steps in worked examples were used to help students to explore ideas and concepts.
- A very high level of support is provided for students who experience difficulty with the subject.
- The mathematics department’s practices in relation to assessment are very good.
- A caring learning environment existed in all of the classrooms visited. Every effort was made to ensure that students’ experience of Mathematics was positive.

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

- The arrangements for level choice should be kept under review to ensure that the uptake levels of higher level Mathematics in the certificate examinations are appropriately high.
- A greater number of teachers should become involved in teaching higher level Mathematics to Leaving Certificate level.
- The subject department should explore how the use of active methodologies, concrete materials and ICT in mathematics lessons can be increased.
- Work should continue on the development of the subject plan and on the programmes of work for each year group and level.
- In order to allow students to develop their own problem-solving skills and to gain confidence in using them independently approaches that encourage students to think for themselves should be incorporated into all teaching and learning strategies.

Post-evaluation meetings were held with the teachers of Mathematics and with the principal at the conclusion of the evaluation when the draft findings and recommendations of the evaluation were presented and discussed.

Published November 2010