

**An Roinn Oideachais agus Scileanna**

**Department of Education and Skills**

**Subject Inspection of Mathematics  
REPORT**

**Belvedere College S.J.  
Great Denmark Street, Dublin 1  
Roll number: 60520P**

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

**REPORT**  
**ON**  
**THE QUALITY OF LEARNING AND TEACHING IN MATHEMATICS**

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**SUBJECT INSPECTION REPORT**

This report has been written following a subject inspection in Belvedere College S.J. 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 headmaster and subject teachers. The board of management was given an opportunity to comment in writing on the findings and recommendations of the report; a response was not received from the board.

**SUBJECT PROVISION AND WHOLE SCHOOL SUPPORT**

Belvedere College has a current enrolment of 996 boys and there is very good whole-school support for Mathematics. Timetable provision for Mathematics and timetable arrangements for level choice are good. Concurrent timetabling is provided for mathematics lessons in all year groups except first and second year where other sound arrangements are in place. The use of concurrent timetabling is valuable in facilitating a change of level where necessary. Applied Mathematics is provided on the school's timetable and this was included in the evaluation.

Students are assigned to mixed-ability groups for Mathematics for first and second year. In third year there are five higher level class groups and one ordinary level class; students are assigned to one of these groups on the basis of achievement in end-of-year examinations in second year. In addition, teacher opinion, performance in class tests and student and parent preference play a strong role in level choice which is good. Students are encouraged to study Mathematics at the highest level possible for as long as possible and the arrangements made for level choice support this very well.

In transition year (TY) five higher level and one ordinary level class groups are formed; as many students as possible are encouraged to try higher level Leaving Certificate Mathematics which is very good practice. Senior cycle students are, however, assigned to class groups in order of ability. This means that from TY onwards each higher level class group, in particular, contains students within a narrow range of abilities for that level. It is recommended that the mathematics department consider placing students in class groups on a mixed-ability basis, where there is more than one class group for a particular level. This measure would consolidate the current good practice in the junior cycle and would contribute positively to Leaving Certificate uptake of higher level Mathematics.

The mathematics department comprises thirteen teachers. There is very good rotation of levels among the members in both the junior and senior cycles. School management strongly supports

teacher continuing professional development (CPD). Teachers have attended the *Project Maths* workshops, in addition to whole-school CPD on topics such as 'Key Skills', and 'Assessment for Learning'. There is a culture of teachers providing training for each other in areas such as information and communications technology (ICT) which is a very positive practice. Currently two members of the mathematics teaching team are participating in the Masters Degree in Education course in the area of Digital Learning Peer Tutoring at St Patrick's College, Drumcondra.

ICT provision for Mathematics is very good. All classrooms are fitted with a ceiling-mounted data projector, audio equipment and a personal computer. A number of classrooms also have 'Mimio' interactive whiteboards installed. There is broadband internet access throughout the school and there is a link on the school's website to the mathematics department information and resources page. In addition, some mathematics teachers use 'Moodle', a virtual learning environment, to enable students to access lesson material through the school's website. The school's two computer rooms can be accessed for mathematics lessons through a booking system. These very good resources, however, are underused across the mathematics department. There was some good use of ICT observed in the evaluation in the form of good *PowerPoint* presentations, use of the internet and 'Moodle'. However, there is significant scope for an increase in the integration of ICT as a teaching and learning tool to enhance learning for students. It is recommended that the mathematics teachers explore ways in which a more consistent approach to the use of ICT can be adopted across the department. This should include the regular use, where appropriate, of geometry software such as 'Geogebra'.

In addition to ICT resources there is a range of teaching aids available for the subject. These include playing cards and dice, measuring equipment, 3-D solids, geometry equipment and geo-boards. In some cases teachers get students to make and use clinometers in their study of trigonometry. This is very good practice and it is suggested that this be built upon by teachers using everyday objects such as household bills and payslips, containers of various shapes and sizes, and newspapers to contextualise syllabus material and to help students to identify with the Mathematics on their courses.

The school has recently changed from having student-based rooms to teacher-based rooms for all subjects. This provides many advantages for teaching and learning in Mathematics particularly with the introduction of *Project Maths*. It means, for example, that teachers can prepare ICT equipment and other resources in advance of lessons which would be necessary for the experiential learning activities required for the successful implementation of *Project Maths*. Some teachers have created stimulating mathematical environments by displaying posters on the walls of their classrooms. It is suggested that teachers consider ways of further enhancing students' physical learning environments, such as placing student work on the walls of classrooms and displaying and using number lines to assist learning.

Appropriate procedures are in place for identifying students who have learning support needs in Mathematics. Support is provided through one-to-one and small group withdrawal. Teachers provide individual attention to any student experiencing difficulties on an ongoing basis throughout lessons. Overall, good arrangements are made for students experiencing difficulty with Mathematics.

Very good opportunities are provided for students to engage in extracurricular and co-curricular mathematical activities. Students participate in a wide variety of mathematical quizzes and competitions including the Irish Junior Mathematics Competition, the Irish Applied Maths Teachers' Association Quiz, the *PRISM* Maths Challenge, the Irish Mathematics Teachers'

Association table quiz, the Gauss competitions and the Cayley competitions. In addition, *Maths Week* is celebrated as a significant event each year. This is evidence that the mathematics department members are committed to ensuring that students experience Mathematics for pleasure and are challenged and stimulated by the subject.

## **PLANNING AND PREPARATION**

School management strongly supports subject department planning with the provision of meeting time at least once per term. There are also plans to allow the mathematics department planning time for arrangements to be made for *Project Maths*. Much informal discussion about mathematics also takes place amongst members of the subject department. There are two department co-ordinators who have responsibility for convening meetings, communicating with school management and maintaining the mathematics plan. These positions are currently filled on a voluntary basis and it is recommended that they rotate periodically. This measure is recommended to ensure that the workload is shared amongst the team and to extend this experience to the other members in order to build capacity within the department.

It is evident from the minutes of meetings that, in addition to dealing with organisational issues, good discussion takes place around teaching and learning strategies. It is recommended that this good practice be built upon in order to ensure that every mathematics teachers is thoroughly familiar with the teaching and learning plans provided in preparation for *Project Maths* and those on the *Project Maths* website. A suggested format might be that each teacher would teach one of the lessons outlined in the teaching and leaning plans and then provide feedback to the team as a whole. The intention of this would be to assist the mathematics department with the integration of the range of methodologies and approaches that will be necessary for the successful delivery of the new syllabuses.

A very good subject department plan has been developed and in keeping with good practice it is updated regularly. It is very good to note that subject inspection reports for Mathematics in other schools are included in the planning documentation; this is evidence of the school's capacity to self-evaluate. The plan contains all of the relevant policy documents for Mathematics as well as common programmes of work for each year group and level. These are set out in terms of topics to be covered within timeframes. The content of the new syllabus documents, however, is described in terms of learning outcomes. It is therefore recommended that the syllabus documents now become the focus for planning the programmes of work and that this work centre on interpreting the syllabuses. This should be done in a way that exploits cross-topic links and ensures a solid understanding of the learning outcomes for students is achieved.

To support the mathematics department in ongoing planning for the subject the members should engage in action planning where each task to be undertaken is given a manageable timeframe for achievement and should be carried out by a specified date.

The TY plan contains a good combination of syllabus and non-syllabus material. Among the topics included are casino games, horse racing and card games in the study of probability and surveys, census and ballots for statistics. It is very good that the new Junior Certificate syllabus topics are provided in TY for those students who studied the old Junior Certificate course but will go on to do *Project Maths* in fifth year. There is a strong tradition of Applied Mathematics in the school and the uptake for this subject is currently high. At present there is a small module of Applied Mathematics covered in TY which is good. It is suggested however that consideration be given to the extension of this module to include more topics in Applied Mathematics. This is to

make the best use of the high level of expertise available in the school in this area and to encourage Applied Mathematics as an alternative tool for the development of students' problem-solving and critical-thinking skills.

## **TEACHING AND LEARNING**

Nine lessons were observed in the evaluation including one Applied Mathematics lesson. The quality of teaching and learning across these nine lessons varied. Best practice was observed in lessons where there was a strong focus on students' achievement of learning outcomes that were clearly defined in terms of deep understanding of the core concepts of the lessons. Where this was the case appropriate strategies were devised by teachers to facilitate students in achieving the learning outcomes. In some cases, lesson planning focused on the completion of a quantity of material, the learning of mathematical vocabulary or on the application of rules and procedures, rather than on students achieving genuine understanding of mathematical concepts. It is strongly recommended that the very good practice that was observed in the majority of lessons in relation to focusing on exploring the underlying concepts presented become the practice in all lessons.

Teacher example followed by student exercise was a feature of all of the lessons observed. This was complemented by the use of ICT in the form of well designed *PowerPoint* presentations in five of the nine classrooms visited which is good. In general teacher instructions and explanations were clear and in the majority of instances conceptual. Lessons were delivered at a pace appropriate to students' ability. Some good examples of the use of an investigative approach were also observed. In one lesson on statistics, a humorous example was used to make an explanation of the mean, mode and median more interesting to students and to add an element of fun to the lesson. These are some examples of the good practices in relation to variety of methodology observed. There is, however, significant scope for the inclusion of active methodologies and greater diversity in the use of ICT. It is recommended that teachers collaborate on increasing the range of strategies used in teaching and learning in Mathematics and on developing a consistent approach in this regard.

One Applied Mathematics lesson was observed in the evaluation and the quality of teaching and learning in this case was very high. The material covered in this lesson consisted of solving one problem on relative acceleration. The complexity of the problem lay in the number of key concepts that needed exploration. These were dealt with in a very clear way and involved much collaboration between teacher and students. To make the task easier for students a very well designed handout, in which the problem was broken down into clear, simple, logical steps, was provided. In working through the problem on the board the main concepts were outlined in red so that they remained the focus of classroom discussion. In keeping with excellent practice very little time was spent on actually solving the resulting simultaneous equations but there was much discussion on how to approach solving them; this task was left for the students to complete for homework. Every aspect of the work of this lesson focused on genuine understanding of the key ideas presented and this contributed significantly to its success.

Most teachers made very good use of class time and had enough material prepared to engage students for the full duration of the lesson. In a minority of cases, however, students were allowed to start homework or were provided with a large number of practice questions to complete over a considerable amount of time before the end of the lesson. This meant that students were practising techniques for a significant proportion of class time rather than engaging in activities to help them to understand the mathematical ideas in the lesson. It is therefore recommended that all

teachers prepare adequate amounts of appropriate material to ensure that the value of class time is optimised.

Various questioning strategies were used in lessons. These included quick questions to assess understanding and to involve students and open questions to engage students in exploring the underlying ideas in the lessons. In many cases students were expected to explain their reasoning; in one case students were asked to convince themselves and then convince their classmates of the mathematical ideas under discussion. This good practice encouraged students to take responsibility for their own learning. In most cases teachers were very careful in providing meaningful and accurate answers to student questions and to making sure that students fully understood what was being taught. This was not the universal practice; in one case the teacher's answers to questions lacked the appropriate level of depth to enable students to reach full understanding. It is recommended that ways to further the very good uses of questioning that were observed in most lessons be addressed in the mathematics department's planning for greater consistency of approach in teaching and learning.

Most teachers related the work of lessons to students' prior knowledge or to everyday life; this provided a valuable context for learning. In one algebra lesson, for example, euros and pounds were used to explain grouping like terms. The solutions to solving a quadratic equation were illustrated on a graph in another case and examples exploiting familiar contexts were used in two lessons on statistics. This was not the practice in all cases however and was of particular note in one lesson where learning definitions of mathematical terms, out of context, dominated classroom activity. It is therefore recommended that learning should be contextualised wherever possible and, in particular, that the teaching of vocabulary should be integrated into the work of exploring mathematical concepts.

Some good practices were observed in relation to differentiation of learning. These included providing individual attention to any student experiencing difficulty, allowing students to work ahead in the textbook and encouraging students to work in pairs to assist each other. It was evident in certain instances, however, that some students had finished the assigned tasks and needed to be provided with additional work. Teachers should create a bank of challenging and interesting material that would provide additional stimulation for those students who would benefit from it. Furthermore consideration should be given to allowing such students to work on previously unseen course content without teacher assistance; in addition to providing stimulation for students this measure would contribute to their independence as learners.

In all cases the standard of student behaviour was high. Classroom atmosphere was conducive to developing student confidence with the subject and in all cases the quality of relationships between the students and the teachers was good. There was a sense of warmth and care in the classrooms visited. Students responded well to the affirmation and praise frequently provided by their teachers.

## **ASSESSMENT**

Overall, there is good practice in relation to assessment. Formal examinations, with reports sent home, are held at Christmas and in May. Students preparing for the certificate examinations sit 'mock' examinations early in the second term. Parents have the opportunity of giving feedback to the school on their sons' performance through completing a form that is sent out with the reports for this purpose. This provides the school with a very valuable form of information that is used to assist the school in improving the quality of provision for students and is very good practice.

Parent-teacher meetings are held annually. Common examination papers are set for each year group and level which is a good arrangement.

Class tests are set at the end of each topic studied. In order to complement the good practice in relation to provision of feedback that is currently in place for formal examinations it is suggested that teachers consider a similar arrangement for class tests. Students could be asked to fill out a feedback form on their performance in each test and to include suggestions on any measures they need to take to improve.

In some cases teachers are using Assessment for Learning (AfL) principles in the correction of written work by including constructive and encouraging comments. It was also noted that some teachers use class tests as a means of motivating and encouraging students. These are very valuable practices. It is recommended that teachers explore ways in which additional AfL principles could be used to optimise the educational value of assessment. Further information on AfL is available on the National Council for Curriculum and Assessment website ([www.ncca.ie](http://www.ncca.ie)).

Teachers effectively assess learning on an ongoing basis through observation and oral questioning. In one case the students of the class group were divided into teams with one student from each team chosen to solve problems on the board. In order to ensure that his team won, each other student carefully assessed the work at the board to make sure that the answers were correct. This proved to be a very successful way of using peer assessment to engage all students for the full duration of the lesson. It is suggested that consideration be given to the use of laminate boards and white board markers as a means of providing teachers with a quick and comprehensive form of assessment. This would require expecting students to write answers on the laminate boards and hold them up for the teacher to see.

The school's practice with regard to monitoring students is very good. Each student's progress is tracked through his results in class tests, formal examinations and the certificate examinations. This information is provided on an ongoing basis for teachers and is of particular value when students change teacher. In addition, an analysis of the school's performance in the certificate examinations compared to national norms is carried out annually and is used to inform planning for Mathematics which is also good practice.

## **SUMMARY OF MAIN FINDINGS AND RECOMMENDATIONS**

The following are the main strengths identified in the evaluation:

- There is very good whole-school support for Mathematics both in terms of timetable and resource provision.
- Students are encouraged to study Mathematics at the highest level possible for as long as possible and the arrangements made for level choice support this very well.
- Very good opportunities are provided for students to engage in extracurricular and co-curricular mathematical activities.
- School management strongly supports subject department planning with the provision of meeting time at least once per term and a very good subject department plan has been developed.
- The TY plan contains a good combination of syllabus and non-syllabus material.
- Best practice in teaching and learning was observed in lessons where there was a strong focus on students' achievement of learning outcomes that were clearly defined in terms of

- deep understanding of the core concepts of the lessons. This was evident in the majority of lessons observed.
- In all cases the standard of student behaviour was high. Classroom atmosphere was conducive to developing student confidence with the subject and in all cases the quality of relationships between the students and the teachers was good.
  - The school's practice with regard to monitoring students' progress is very good.

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

- The mathematics department should consider placing students in senior cycle class groups within levels, on a mixed-ability basis, where there is more than one class group for a particular level.
- The mathematics teachers should explore ways in which a more consistent approach to the use of ICT can be adopted across the department.
- The positions of mathematics department co-ordinators are currently filled on a voluntary basis and it is recommended that they rotate periodically.
- The mathematics teachers should work together on becoming thoroughly familiar with the teaching and learning plans provided by the Project Maths development team.
- The syllabus documents should now become the focus for planning the programmes of work and this work should centre on interpreting the syllabuses. This should be done in a way that exploits cross-topic links and ensures a solid understanding of the learning outcomes for students is achieved.
- To support the mathematics department in ongoing planning for the subject the members should engage in action planning where each task to be undertaken is given a manageable timeframe for achievement and should be carried out by a specified date.
- The very good practice that was observed in the majority of lessons in relation to focusing on exploring the underlying concepts presented should be the practice in all lessons.
- Teachers should collaborate on increasing the range of strategies used in teaching and learning in Mathematics and on developing a consistent approach in this regard.
- Teachers should explore ways in which additional Assessment for Learning principles could be used to optimise the educational value of assessment.

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

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