Laurel Hill Secondary School

An Investigation into a Cross Curricular Teaching Strategy for Numeracy Awareness and Raising Students’ Numeracy Levels.
Section 1:
School Context:

School background:
Laurel Hill Secondary School FCJ is an all-Girls Voluntary Secondary Catholic School in the FCJ tradition. The school is run under the auspices of the FCJ Trustees. It follows the curricular programmes prescribed by the Department of Education and Science, which may be amended from time to time in accordance with sections 9 and 30 of the Education Act (1998). It operates within the regulations laid down by the DES, which may be amended from time to time. The school depends on the grants and resources provided by the DES, voluntary contributions and fund-raising and school policy in all areas has regard to the resources and funding made available to us by the DES.

The school’s Board of Management is appointed by the FCJ Trustees. The members come from the following constituencies: FCJ Trustees (4 Nominees); Parents (2 Elected Nominees); and Teachers (2 Elected Nominees). The Chairperson of the Board is appointed by the FCJ Trustees from among the eight nominees. The Principal is the Secretary of the Board of Management.

Philosophy of Education
Laurel Hill Secondary School’s philosophy Statement, ‘courage and confidence in the pursuit of excellence’ outlines the FCJ approach to education. We aspire to celebrate a joyful Christian faith that finds expression in daily life. We aim to offer our students a stimulating learning environment, in which each student has the opportunity to develop the fullness of her academic and personal potential. We work to promote a school culture which values diversity and nurtures an ethos of respect for self, others and the wider community.

The School Programme
Every effort is made at Laurel Hill Secondary School FCJ to offer students a broad and enriching educational experience. In addition to the (usual) Junior and Leaving Certificate, all students complete a Transition Year Programme. Other features of the school are the establishment of CSPE, SPHE and Microsoft Office Specialist Programme for Transition Year pupils. Fifth Year students are offered the
opportunity of the Leaving Certificate Vocational Programme, which is completed over two years and is taken in addition to the normal subjects. The management and staff keep themselves informed of current educational developments for the benefit of the students. The school offers a study skills programme through the Deans of Study and there is after-school supervised study available for Junior and Senior students. Physical Education is an integral part of each student’s development. Students are encouraged to become involved in a variety of activities outside the curriculum, such as sport, music, debating, drama, charitable fund raising, quizzes and foreign trips.

Staffing
In the academic year 2013/2014 the school has a Principal, Deputy Principal, and approximately 40 teachers. The staff includes 1 Guidance Counsellor, 3 Resources Teachers, 3 P.E. Teachers, 1 Transition Year Co-ordinator, 2 LCVP Co-ordinators, 2 Deans of Study and 6 Year Heads. The school has a Pastor assigned on part-time basis and a Priest from the Parish of St. Joseph’s works with the school. The school also comprises administrative, caretaking and cleaning staff.

Admissions and Special Educational Needs Policy
Laurel Hill Secondary School operates an open admission policy, promoting equality of access participation and benefit for all; in as far as the school can fulfil the needs of an individual student. The Board of Management is committed to ensuring full entitlement and access for pupils with special educational needs to high quality education with a broad, balanced and relevant curriculum, so that they can reach their full potential and enhance their self-esteem. This is consistent with the provisions of the Educations for Person with Special Educational Needs Act 2002. Finally, a current objective for the school and its Special Education Needs Department is to introduce a whole school numeracy promotion which will aim at increasing the numeracy levels throughout the school.
Section 2:
A) Rationale

Why did our school become involved?
This is Laurel Hill Secondary School’s second time partaking in The Learning School Project. The Dept. of Education’s current ‘Literacy Awareness’ initiative, ‘The National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020’,\(^1\) requests all schools to concentrate on raising the literacy and numeracy standards within their school. In recent years, Laurel Hill’s 1\(^{st}\) Year student intake have been presenting with wide ranging abilities and needs regarding their numeracy levels, and it has been impacting on the students, teachers and school’s learning as a whole.

Furthermore, there has been a rise in the number of 1\(^{st}\) year students presenting with Special Educational Needs or in need of Learning Support.

Finally, the overall aim of our participation is to test and assess numeracy methods that we as a school could use as a self-evaluation tool, as per the current inspection guidelines of the Dept. of Education.\(^2\)

Why did we become involved?
Our project aimed to assess and raise general numeracy awareness and skills across all subject areas and provide students with the ability to link their numeracy understanding across the curriculum. Maths teachers in Laurel Hill Secondary School have noticed a marked decrease in numeracy skills of incoming first years over a number of years and this needed to be addressed. Taking 1\(^{st}\) year students entrance exams as a starting point for our investigation together with further diagnostic testing it was decided to focus on the idea of number, its magnitude and its place on the number line in relation to other numbers as this was an area that seemed to cause difficult for students. The maths teachers of Laurel Hill Secondary School have observed over time that all year groups had problems with graphs; when not given specific instructions they were not confident in their ability to apply an appropriate scales to the axes. This supported our decision to focus on number lines. The primary aim was to build confidence in this area. A baseline test was


carried on magnitude of number and number lines only. The intervention was to supply all 1st year maths students with a number line without a scale each week for 5 weeks, this was affixed in their journal, in math class everyday they were asked to add a certain number to their number line, the scale of numbers varied per week, week 1 number line had a scale 0 - 1, week 2 number line had a scale 0 - 100 etc. Students were coerced to finding the appropriate scale for themselves. At the end of the intervention the students were again tested to see if their accuracy at placing numbers on a number line and ordering numbers had improved.

The idea of number line was then extended to a whole school timeline project. On the Châteaux Roux corridor of Laurel Hill Secondary School we created a timeline from the formation of the school in 1844 to present day. First year students along with their history, CSPE and religion teachers were asked to add important events to this timeline, this formed an important link from number lines to real life applications.

Transition Year students were also involved in a school numeracy task. Measuring distances from reception to different areas of the school in metres. Following this they were given the task of converting these measurements to centimetres and feet. They then made sign posts of these measurements (in m, cm and feet) which were displayed in reception for the whole school. The aim of this task was to draw attention to approximating heights, widths and distances of objects as well as thinking about conversion factors. Transition Year students also made metre sticks for each classroom placing it on the inside of the classroom doors so that students could see their height in relation to a metre. All this work was driven by the fact that an exam paper in Leaving Certificacte recently asked students what was the average height of a male in metres and we discovered our students approximations were not very accurate, hence the need for conversion to and from feet as the norm in Ireland is to talk about height in feet and inches.

The aspirations for the project as a whole were that first year students would have a better understanding of number, its place on a number line, its relationship to other numbers. That they would be able to apply their knowledge of number lines from maths to other subject areas. We also hoped that they enjoyed the timeline project and that the timeline gave them a visual representation of events that have
happened in their lifetime and before by putting everything in the context of time. With the measurement exercise we hoped to improve approximation and concepts regarding conversion between units. Overall it was hoped that maths and numeracy could be seen as a fun activity.

**Who did we hope to involve in this project?**

For this project, maths teachers were the primary focus working on number lines in maths class each week, it was then extended to other subject areas where magnitude of number and number lines were appropriate, number lines could be applied quite easily in science (experiment results), geography (populations), history (timelines), to name a few subjects. Teacher involvement depended on flexibility and availability.

The team consisted of all 1st Year Maths teachers; Ms. Rachel Butler, Ms. Andrea Enright, Ms. Mary Trainor, Ms. Noreen Mckeogh and Ms. Margaret Punch. This was then extended to subject specific teachers Ms. Elaine Carroll (1st Year History Teacher), Ms. Ciara Ronan (1st Year Geography Teacher), Ms. Eukaria O’Grady (1st Year History Teacher) and Ms Rita O’Farrell (1st Year Religion Teacher) supported by senior management Mr. Michael Cregan (Principal) and Ms. Susan Garrahy (Deputy Principal).

The students involved were primarily 1st Year students taught by the aforementioned teachers. They participated in the testing, the numeracy strategy exercises and gave written feedback in the form of questionnaires. Transition year students were also involved in tasks and all years were encouraged to offer ideas on how to extend the timeline project.

Whole school participation was encouraged by updating all teachers at staff meetings and asking them to get involved in their subject area where appropriate. All 1st Years subject teacher were also encouraged to involve themselves with the timeline project where appropriate.
B) Specific indicators for the school:

What were the objectives?
The Learning School Project is about being a learning school by continuing reflection and inquiry with commitment to the process of review and self-evaluation for a team of teachers to pre-test, implement and evaluate a project relating to how we as a school learn, and to enhance the capacity of teachers in contributing to a learning school. The aforementioned formed the basis for our project’s objectives and aims.

Objectives:
Project Organising Group:

- To conduct and produce a Learning School Project within the school with a aim of raising numeracy awareness and students’ numeracy levels.
- To research via literature, websites, Learning School Project hub meetings and through staff consultations a relevant and feasible numeracy project.
- To ensure our Learning School Project is an agenda item within the school plan, staff meetings and on staff notice boards.
- To schedule and manage the record keeping (reflections and evaluations via the ‘Project Record’ book) of all hub and Project Team meetings.
- To create opportunities such as project meetings, feedback sheets and reflective diary forms for the project team and staff (teachers), enabling them to reflect and evaluate the effectiveness of the project and its numeracy awareness strategy.
- To design, compile and mark the hand-outs for the pre-assessments, in class exercises and after-assessments.
- To design feedback questionnaires for the project team and staff and information sheets for staff and parents, including parental consent forms for their daughter’s participation.
- To be available to staff for information advice and suggestions regarding the project.

http://thelearningschoolproject.com/
Project Team

- The team’s main objective is to meet, collaborate, reflect and evaluate on the numeracy project, via oral discussion at meetings and completion of reflective diaries and the project’s reflective/evaluation record form.
- The team is also responsible for conducting the project in their lessons, tailoring it to their lessons and students’ needs within their time constraints and curriculum demands.
- To assist with analysing the project and making future recommendations based on our experiences of the project.
- To be available to staff for information, advice and suggestions regarding the project.

Students:

- The project aims to raise students’ numeracy levels regarding number, making them aware of magnitude, placing numbers on number lines and increasing student confidence in their ability to complete the above tasks individually.
- The students will via assessment demonstrate their current ability to plot and order numbers. Moreover by re-assessing after conducting the in-class strategy students will hopefully show a significant rise in their numeracy levels.
- Students will also via feedback sheets reflect upon the numeracy exercises in terms of value and experience. Their suggestions will inform the impact and assessment of the project’s value.

School (Senior Management and Staff):

- Senior management will provide advice and support by attending meetings, discussing the project, completing reflective feedback questionnaires and providing any necessary resources (including test results, finance etc.) to conduct the project.
- Senior management will ensure opportunities to promote the work of the team within the school via staff meetings, school notice boards and its insertion within the school plan.
- Staff will provide feedback/suggestions via questionnaires and have the option to trial the strategies in their classes.
- Staff will hopefully become more aware of the numeracy moments within their subjects and draw attention to them and the links between subjects and therefore increasing numeracy awareness and improving our students’ numeracy levels.
C) Methodology

What specific actions did we take?
Firstly the project organising group, Ms. Rachel Butler, Ms. Andrea Enright and Ms. Noreen McKeogh, collaborated and discussed with all maths teachers in our school to identify areas which could need focus. Following this meeting we met with other school teachers at a Learning School Project hub meeting and this reinforced the idea of magnitude of number and use of number lines as well as attitude to numeracy as these seemed the common areas for all.

Quantitative data was collected via pre and after-assessments and questionnaires (Appendix A). Line charts were produced to show whether numeracy levels had been raised after the intervention (Appendix D).

The numeracy strategy and its relevant options executed by the Project Team in their classes were made available in a teacher hand-out that informed the teacher on how to conduct the project in class and record feedback (Appendix B).

Finally, qualitative data was collated via the ‘Project Record Book’, the ‘Reflective Diary’ and feedback questionnaires (Appendix D).

All resources, were displayed in the staff room and available on the staff’s computer hard drive for staff to peruse and photocopy.
D) Resources:

- Hand-outs and proformas from the Learning School Project personnel, including the ‘Project Record Book’ and Reflection Diary.
- Advice from senior management, project team, staff, principal and Learning Support Project Co-ordinators, Dr. Joe O’Connell.
- In-school resource service on numeracy, encompassing a folder with hand-outs and strategies.
- In-school policies i.e. Literacy and Special Educational Needs Policy.
- The Junior Cert Schools Programme Support Service\(^4\) and English Language Support Programme’s\(^5\) website, literature and downloadable resources.
- Literacy and Numeracy for Learning and Life, ‘The National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020’.
- For designing and collating data the following ICT devices were used: Laptops, Computers, Memory Sticks, Microsoft Word, Excel, PowerPoint and Microsoft Dictionary for Word.
- For supplying and creating the materials we used photocopiers and printers.
- Whiteboard, markers, student text books and student school journals and class copies were used to in the execution of the numeracy strategy.

\(^4\) [http://www.jcspliteracy.ie/fckfiles/Between%20the%20Lines.pdf](http://www.jcspliteracy.ie/fckfiles/Between%20the%20Lines.pdf)

\(^5\) [http://www.elsp.ie/shortActivities.shtml](http://www.elsp.ie/shortActivities.shtml)
Section 3: Outcomes

A) Data Collection:

- Information regarding teacher literacy strategies for raising numeracy levels within the class were sourced via the Junior Certificate Social Programme accessed on [http://www.jcspliteracy.ie/](http://www.jcspliteracy.ie/).
- Results of the Drumcondra Reasoning Test, Laurel Hill Entrance Exam and Sten Scores from Primary School were collected for all first year students.
- All first year students completed 5 10-minute diagnostic tests in the areas of tables, integers, fractions, decimals and percentages.
- After discussion at project meetings it was decided that students would complete a pre-intervention test on number lines. It was decided the intervention would be done over a 5-week period. Each student in first year would be issued with a number line that they would stick into their journals at the start of the week. The Maths teacher for each class group would give students a number to plot each day. Week 1 would consist of numbers from 0-1, week 2 would be numbers from 0-2, week 3 would be numbers from 0-10, week 4 would be numbers from 0-100 and week 5 would be numbers from 0-10 million.
- At some stage during the 5-week intervention, a giant number line would be erected on a corridor which would represent a timeline from 1840 – 2020. 1840 was chosen as the school was opened in 1844. Teachers from the History, CSPE and Religion departments would be asked to add events to this timeline with their first year classes.
- Teachers from the Geography department were asked to construct a number line within their subject area with their first years during the same period.
- To help students understand the magnitude of numbers, it was decided to put a poster depicting the length of a metre and a foot into all classrooms and to add signs about the school giving various distances in metres and feet to particular points.
- At the end of the 5-week intervention, students would be asked to complete a post-intervention test which would be similar to the pre-test.
- Students would also be asked for some qualitative feedback by completing a questionnaire.
• Comments and feedback from staff members would be welcomed and recorded throughout the intervention.

How we conducted the pre-tests and after tests:

• In September 2013, from the results of the Drumcondra Reasoning Test, Laurel Hill Entrance Exam and Sten Scores from Primary School, it was apparent that a number of the current first years exhibited problems in the area of numeracy and that an intervention could prove beneficial.

• In October 2013, before the topic for the project was chosen, all first years were issued with 5 ten minute tests in the areas of tables, integers, decimals, fractions and percentages.

• No particular topic was especially poor but it was noted that the questions which involved graphing numbers on the number line within 4 of these tests were particularly poorly answered.

• The topic for the project was decided on – numberlines.

• In November 2013, the pre-assessment was issued to all first years. This comprised of a 10 minute test on graphing natural numbers, fractions, and decimals on a number line. (Appendix A). This was the baseline data.

• The intervention was staged in the first five weeks of the Christmas – Easter term.

• The after–assessment, which was conducted in February 2014, was the same as the pre-assessment.

• The results of both the pre and after-assessments were recorded in Microsoft Excel spread sheets. Line charts were then produced to show the students before and after scores on these tests. (charts are provided in Appendix A). Student who missed a pre-assessment or after assessments were not included in the results.

• Students were asked to complete a questionnaire, comprising open and closed questions, on the intervention (Appendix C)

• The Staff were informed about the project in February 2014 when a member of the Learning School Project team gave a staff talk on the Learning School Project and its then current outcomes. The staff were again updated at a staff meeting in March 2014 and again in April 2014.
Data results and findings:
Appendix D, provides the quantitative results, such as line charts, tabular information, percentages and statistics. Qualitative data, and feedback from the questionnaires are also provided in Appendix D. Some samples of the student’s work is provided in Appendix F.

B) Data Analysis and Recommendations:

To what extent have our goals been realised?
The goal of conducting the project within the school was achieved. The expected findings of an improvement in the ability of students to plot as well as an improvement in the students understanding of magnitude were realised. Students improved by an average of 11% from the pre-test to the post-test. 82% of students either improved or remained the same from pre to post intervention.

Numberlines are clearly visible about the school. Signs indicating distances between points are dotted about the school and a metre chart and foot chart are visible in all classrooms.

The feedback form the staff directly involved was positive but it was reflected upon that we needed to be more proactive regarding involving other staff in the project.

Impact of the Project for the Project Team:

In general, the Project Team found this to be an enlightening and educational experience. This project raised awareness among the team as to the importance of numeracy and helped us make connections across other subject areas, which was of particular importance as the project team comprised all Maths teachers. The Project Team were well supported by senior management with advice and their time attending meeting. The principal was happy to oblige with providing data on the students.
However, we did note regularly the issue of ‘time’ in regard to various agenda items such as time to meet, design the project, to inform the staff, was a concern. However, overall the necessity for teamwork, discussions and collaboration when implementing a strategy was realised. Especially, at meetings where it was important to let people voice their concerns or opinions as they aided the project’s formation

**Impact of the Project on Students’ Learning:**

The quantitative information from the pre- and after tests shows that 54% of students improved from the pre-test to the after-test, improving their score by an average of 11%.

The qualitative information from the student questionnaire shows that the majority of students see numeracy as being cross-curricular and have made connections between the work in Maths on number lines and the work they did in other subjects. Because the timeline along the corridor had such a visual impact, students were able to get a sense of magnitude of the numbers and the distances between different numbers. The visual impact of the project raised awareness in the students and surprisingly, students from other year groups were, first of all curious to know what was happening as the number line was constructed and after the first years had added certain events, other years wanted to know when they were going to be able to add dates. In fact one sixth year student added their own yellow sticky note to the timeline. This indicates that students were excited, interested and motivated by the project.

The visibility of “signposts” with distances in metres and feet has contributed significantly to students ability to “guesstimate” values and has helped students realise the magnitude of certain numbers.

**Impact of the Project on the Wider Staff:**

This project has helped other staff members recognise the numeracy moments within their own subject and understand that numeracy is a whole staff issue and not just one for the Maths department.
The teachers involved directly with the project reported that students had a better understanding of the magnitude of numbers after plotting them. They also reported enthusiasm and motivation among their students with regard to the project.

“This was a fun and motivating task for my class, one which they thoroughly enjoyed, as did I” (First Year History teacher)

Teachers not directly involved with the project found themselves examining their own subjects for numeracy moments and trying to find an opportunity within their own subject to construct a number line.
Recommendations

- **Integration into the school culture:** Number lines are clearly visible about the school. Going forward, this project could be redone with first years every year, as the resources are already in place. An extension activity could be done with second years next year where they reproduce the timeline on a smaller scale in their copies. Number lines should become an integral part of the culture of Laurel Hill.

- **Frequency of numeracy strategy:** As the majority of student’s felt the numeracy strategy was useful but there was concern of it becoming less interesting by being repetitive, it is recommended that the strategy be used less frequently, possibly once a week or fortnight, and that it be spread over a longer period than 5 weeks.

- **Adapting to students’ needs:** Student of various learning styles and abilities were not specifically accounted for. Students with higher academic ability were also not catered for, an area that can be improved in the future. Perhaps students with higher academic ability could be asked to reproduce the timeline on a smaller scale or maybe the introduction of negative integers could be a possibility.

- **Class time and the curriculum:** Teachers were limited by how much time they had with the students and the content they need to cover. Often classes can be affected by extra-curricular activities; hence, employing the strategy on a less frequent basis would be more efficient.

Conclusion:

In conclusion, the qualitative and quantitative findings have highlighted significant achievements and concrete evidence of the Project Team exceeding its key objective of raising our 1st Year students’ numeracy levels, by implementing a cross curriculum numeracy policy, which can also be applied as a whole school numeracy promotion.