# GROUPING AND STRATEGIES FOR DIFFERENTIATION OF THE MATHEMATICS CURRICULUM

**Sue Ditchfield**

*Monbulk College*

*It is well documented that teachers should differentiate the curriculum to cater for a wide range of student abilities. Having taught in Secondary schools for many years I have worked upon a model of grouping within the classroom in various formats. Here I outline the methodology that I currently use and find very effective. This includes the use of online programs such as Mathletics and open ended tasks such as those obtained from Maths300. Prior learning is used to assist with groupings which change for each topic. Students are encouraged to be responsible for their own learning and hence create their own individual learning plan. All students are encouraged to extend their learning. Withdrawal enrichment is a feature which also enables targeted support for students who struggle with their Mathematical learning.*

## Requirements

There are several requirements of this methodology.

- Classes are grouped (two or more homegroups) at least once a week for withdrawal enrichment and support. (Recommended but not essential.)
- A textbook is used.
- The online program Mathletics is used and hence about 8 to 10 laptops are required per class.
- Activities from Maths300 or similar are utilised.

## Recognition of students' prior learning

Firstly students must be assessed in the topic about to be undertaken for their prior learning. My experience shows that by calling any task a "Pre-test" this can be a negative experience for students and whilst the lower achievers would gain a very low score as expected this is difficult for students to understand and can sometimes lead to negative thoughts about Mathematics. Hence I call these tasks "Prior Learning Assessment" of simply just an "Assessment Task". I have used a couple of simple homework sheets in the weeks prior to the topic to gather this assessment of prior learning. Graphic organisers can also be used such as a Concept or Mind Map. The assessment of prior learning may be undertaken for a single topic or could be a task for several topics.

The assessment of prior learning enables me to break my students into three groups for this particular topic. This must be considered for all topics and some students will be in different groups depending upon the topic. The prior learning assessment enables the groupings to be established. The students are informed of which group they are in and I give each group a name based upon a Mathematician. Hence I have the Archimedes (generally achieve above the expected level), the Hypatians (generally achieve at the expected level) and the Newtons (generally achieve below the expected level).

## Rotations

Over a period of three lessons these groups rotate through three tasks namely text work based tasks, an online program called Mathletics and activities such as Maths 300. On the fourth lesson an activity is undertaken by the whole class. An example of this rotation is shown in table 1 below.

| **Lesson** | **Text based – Teacher focus group** | **Mathletics** | **Activities such as Maths 300** |
|---|---|---|---|
| 1 | Archimedes | Hypatians | Newtons |
| 2 | Hypatians | Newtons | Archimedes |
| 3 | Newtons | Archimedes | Hypatians |
| 4 | Whole class activity | | |

*Table 1. Example of Rotations of groups.*

## Student Task Outline

Students are provided with a Student Task Outline to paste in their Mathematics workbooks. This details the work to be undertaken from the text book, the curriculum tasks from Mathletics and activities from Maths300.

The first section of the Student Task Outline is the tasks from the text book. This is a grid with three columns as shown below in Table 2. Note: C = Chance & Data hence C4.0 is Chance & Data level 4.0 so below the expected level for students in year 7. This is a unit of work for students in Semester One Year 7.

| | **Task** | | | **Stud Tick** | **Tch Sign** |
|---|---|---|---|---|---|
| | **Newtons** | **Hypatians** | **Archimedes** | | |
| 1 | (C4.0)<br>Ex 10.1 p 452<br>Q 1,2,3,9 | (C4.25)<br>Ex 10.1 p 452<br>Q 1,3,5,9,12 | (C4.5)<br>Ex 10.1 p 452<br>Q 3,5,9,12, 14 | | |
| 2 | (C4.0)<br>Ex. 10.2 p 458<br>Q1abcdefg, 2ab, 3 verbal with tchr, | (C4.25)<br>Ex. 10.2 p 458<br>Q1aceg, 2ac, 3&4 verbal with tchr, | (C4.5)<br>Ex. 10.2 p 458<br>Q1aeh, 2ae, 4 verbal with tchr, 6 | | |
| | Worksheet | Worksheet | Worksheet | | |
| 3 | (WM4.0)<br>Ex 10.2 p 462<br>Q 6 | (WM4.25)<br>Ex 10.2 p 462<br>Q 8 | (WM4.5)<br>Ex 10.2 p 462<br>Q 11 | | |
| etc | | | | | |

*Table 1 Sample of section of Student Task Outline.*

This relies upon a reasonable text book which allows for some questions in each exercise to be at the expected level, some above and some below. This may need to be supported with some scaffolding easier questions for the Newtons and some more difficult

questions to extend the Archimedes. Students are encouraged to be responsible for their own learning by deciding if the current given questions for their grouping are too easy or too challenging and to inform me when this occurs. Hence they create their own individual learning plan. All students are encouraged to extend their learning.

Note the inclusion of the "Worksheet" with no further information. This allows me to select a worksheet that is suitable for each group of students. This could be a problem solving task, an investigation or could be a homework sheet. I have about three "Worksheets" included for each topic which is expected to take about four weeks

The second part of the Student Task Outline lists the Curriculum Activities to be completed from the online program called Mathletics. We have found this program to be engaging and effective for teaching the "skills" and to provide "skills practice" for our students. Students are able to work independently and are encouraged and stimulated by a points system and an avatar to achieve higher scores. Table 3 is a sample of this list.

| **Curriculum Activity** | **Student Check** | **Highest Score** |
|---|---|---|
| Are you ready | | |
| Reading from a column graph | | |
| Mean | | |
| Median | | |
| Mode | | |
| etc | | |

*Table 3: Sample of Student Task Outline: Mathletics Section*

We look at our current topic and the Curriculum Activities listed in Mathletics and select those required to make a course called "Year 7 Monbulk" so it is tailored to suit our needs.

The third section of the Student Task Outline is for Maths300 tasks and other activities, called the Activity Menu. A part of this is shown below in Table 4.

**Activity Menu**

| **Activity Name** | **Tchr sign & date** | | |
|---|---|---|---|
| Problem Dice | | Temperature Graphs | |
| Dice Footy | | Game | |

*Table 4: Sample of the Student Task Outline for Activities, the Activity Menu.*

Note that this is called an Activity Menu, the format as recommended by Charles Lovitt, the guru of Maths300 tasks. There is no set order for these tasks to be done and I always leave some blanks that can be filled in. There is no expectation that all activities will be undertaken and it depends on the time requirement for each activity as to how many you can fit into a four week unit. In this example Temperature graphs is a one lesson activity and you would expect to cover about 3 or 4 one lesson activities.

The whole group may do one task, or students can be provided with 4 to 5 of these tasks and choose one each rotation. Ideally it involves a game which rotates through pairs of students (hence you only require one copy of the game) within this group while the others choose a task. Tasks are chosen which are self explanatory. Students answer the questions from the task in their mathematics workbooks.

It is important that these are listed separately. The students then see that the text book tasks are separate and different from the other tasks. It is encouraging to see that most text books do include problem solving tasks however I find that when students do these tasks from the texts they perceive these as more book work and is not seen as different to doing several questions from an actual exercise.

## Application of grouping: How does it all work?

The classroom is physically separated into three sections by grouping tables as much as possible. This way each group is sitting together to enable the teacher to work with a group together or to call the group to the board for an explanation.

It is also vital that regular teaching of the whole class occurs either through an activity or traditional chalk and talk prior to some text work. This is the fourth lesson in the cycle. I recall the occasion when the prior learning assessment informed me that no student knew how to do a grouped frequency table. In this case I did some whole class instruction with an example and some questions.

The approach is clearly going to depend upon how well you know the students.

Over a period of three lessons all groups have completed tasks in Mathletics and worked upon a Maths300 activity or completed text book tasks. As mentioned previously, sometimes a game is played. One such game that I have used successfully is "Factor Grab" from the Mathematics Continuum. These games or activities are chosen as they are quick to explain or students may work independently on them. At the completion of the task, the Student Task Outline is signed to indicate the task is completed.

When I know the next rotation involves the Archimedes working independently on text book work next lesson I will have a brief conversation with this group in the lesson

prior. I will check their understanding of the concepts and run through an example of two as required. This enables this group to come into class the next lesson and begin with only a quick reminder of the days task being needed.

I often use a quick question on the board to begin the class which all students attempt, as a warm-up. This gives me time to get the laptops, mark the roll or collect homework. Sometimes two groups will do a warm-up whilst I explain an activity or a game to the third group.

## Withdrawal enrichment and support

One of the requirements listed was that the classes to be grouped with another class or two at least once a week. At our College we run a withdrawal enrichment program during this time - a selection of students from the two or more classes (students who are above the expected level overall) meet with another teacher to undertake enrichment activities such as the Mathematics Olympiad and other problem solving tasks of an extended nature. This does involve undertaking further depth in some topics with students working well beyond the expected level.

Back in the usual classroom this leaves a smaller group of students who are at the expected level or below the expected level. This generally means that I will have all of the Newtons, Hypatians and perhaps a few of the Archimedes. It all depends on numbers and how many classes are blocked together and the ability of the students. Generally I plan for the Hypatians and Archimedes to use the laptops on these days. The Newtons are my teacher focus and often I split this group into two with a set task for some and a teacher focus for the few who really struggle mathematically. Frequently concrete aides are used to assist students with their understanding of either the current topic or numeracy in general. A focus in term 1 for this group in year 7 was the times table. Students made flash cards for the times tables to use in class and at home. They worked in pairs to support each other with this task. These tasks are signed off on the Student Task Outline as a "Worksheet" or "Activity" from the activity menu.

## Evaluation

This program was evaluated in a couple of ways. First a POLT type survey was undertaken with some questions directly about this program. Small groups of students were also gathered in a conference situation and verbally asked about their learning and some directed questions were about this grouping in Mathematics.

Students were videoed during this discussion. Positive feedback from the students included comments such as:

- They liked being with students in groups of a similar ability and hence were able to undertake more challenging work. This was especially noted by the Archimedes who felt on other occasions they were compelled to spend some part of their mathematics time assisting others who struggled.
- Students liked the structure of the program "We know exactly what we have to do."
- Students in the Newtons group, whilst not all were enthusiastic to be in this group, did like the support time and felt this extra attention was good. We often used the phrase "Nice Newtons". We did not hear the students calling themselves a part of the "vege maths group" which often occurs when streaming of groups happens. This was a huge positive.

Teacher feedback was also undertaken and comments were included such as:

- It was noted that there were less students with hands up to answer questions at the same time.
- The language used when talking to each group naturally changed on most occasions; also the pace of instruction was different when taking each group for the "teacher focus".
- When the teacher was absent, students knew what to do. An observation was made from a technology teacher taking a mathematics class for an absent mathematics teacher that the program was excellent. "The kids knew what they were doing; they helped each other in their groups and students worked independently."
- Teachers who preferred a traditional style of teaching were comfortable as this grouping was based partly upon the text. The inclusion of activities which could be undertaken with one group at a time was very focused and structured. This did encourage use of activities for these teachers.

## Conclusion

The range of abilities in the classroom means as educators we cannot provide a course where one size fits all. Continual application of the same methodology is not stimulating mathematically. Daily text book tasks do not promote students to think like a mathematician and if the student is one of the lucky ones to be able to understand the given question, then they can at their very best apply an algorithm and computate the

answer. I have attended many Professional Development Events which promote an all activities approach. Whilst we do these activities as a group of mathematics teachers who are engaged, listen and willing to experiment and work like a Mathematician to seek a full solution, I find that their application in some classrooms very difficult. Students do look out the window, do push and shove, are not interested in some puzzle which will lead to some possible glorious quadratic formula for instance.

Here I have suggested a methodology which mixes all of these in a very structured framework. We work with a small group of students with somewhat similar abilities (within two VELS levels rather than five) for our teacher focus group. We support students who struggle and try to extend those who are above the expected level both vertically and horizontally. I use activities as open ended investigations either within a small group or the whole class for *some* of the time. Finally it is vital that the whole class undertake some tasks (textbook, activities, game, etc) as a whole group not as three separate groups. It is also vital that students are encouraged to move from one group to the other and to try questions outside of those given. In this way I work towards a differentiated classroom in a structured and manageable method.

## References

*Websites*

HREF1: **http://www1.curriculum.edu.au/maths300/**

HREF2: **http://www.mathletics.com.au/**