



# Action Research

ACTION RESEARCH: REFLECTIVE PRACTICE AND PROFESSIONAL DEVELOPMENT'

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2008

**Do groupings for group work matter?:  
Does the way in which I put students in small groups for  
group work help their learning and attainment?**

**Jane Catherall**

## INTRODUCTION

### Context (setting the scene)

When I have used group work with my classes, I have never had a pre thought-out way of allocating students to groups. They have ended up working either with the people they sit with or with some random allocation of fellow classmates. I would hand out cards at random and they would find their partners or group members through matching the cards. I would hide their names underneath smart board shapes and they would pick which number they would work with and so form the groups this way. Or I would count round the class or even use a variable such as the student's heights to group them.

It occurred to me that it could be frustrating to be expected to work with people with whom you didn't necessarily have a shared link and I wondered whether in fact the students may benefit more by working with students with who they had a common link, whether it is shared preferred learning style, ability, personality or some other shared factor.

### Aims

1. To see if students perceive that they learn more when working in groups where there is a common link.
2. To see what students think of group work as a learning tool in general.
3. To see whether the behaviour of some students is affected (either positively or negatively) by being allocated to group-work according to a common factor
4. For me to improve the way in which I use group work within the classroom.

### Theoretical Background

Much of the research into group work is not specifically focused on Maths teaching. However there are a number of authors who comment on good principles of group work which can be applied well to this context.

Hugh Coolican defines **learning** as 'a change (of behaviour or thinking) in an individual which is the result of experience' A definition of **group work** is 'students working together in a group small enough so that everyone can participate on a task that has been clearly assigned' (Cohen – 1994)

Jean Piaget (1954; 1963) states that the important thing in learning is **how** a child arrived at a conclusion rather than **what** they know. One of the educational implications of this is that in order to recognise the individual differences going on in the stages of development, there is a need to teach individuals in small groups rather than the whole class. Overwhelmingly, the research into group work says that it is of great benefit to the students.

Deutsch (1949) states that students working cooperatively in groups who were then all awarded the same grade for their assignments were more productive.

Weldall et all (1981) looked at how the physical arrangement of the class room affected behaviour. He tried students working as groups of 4 seated round the table and then in rows. He found that in more able students, the seating arrangements made little difference to behaviour whereas the less able students behaved better when seated in rows.

Goleman (1996) has a theory that whenever people work together, there is a 'group IQ'. The single most important element in group IQ is not the IQ of the group's individual members, but social harmony. This means that it is not always going to be the strongest academic group that will be the most successful, rather the group that gets on with one another best.

There is no doubt that group work itself, when handled properly is a good idea.

The problem then becomes **how** to use group work.

One of the greatest problems with group-work, as stated by Topping (1992), is that 'children often work **in** groups rather than **as** groups.'

The most invaluable book I have read is 'Designing Group work; Strategies for the Heterogeneous classroom'. (Cohen. 1994) Below are the findings most relevant to this project.

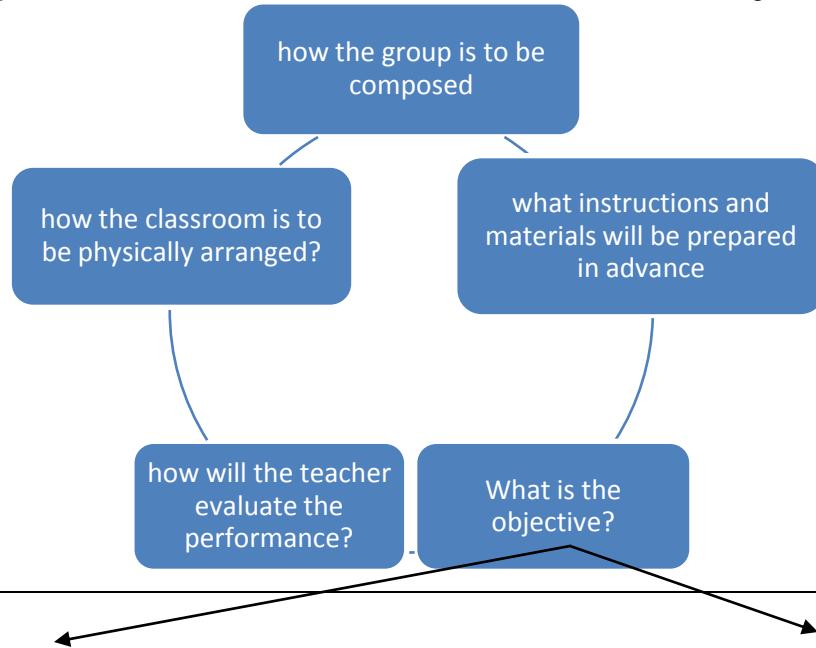
People learn more about concepts and ideas when they talk, explain and argue about them with others rather than listening to a lecture or reading a book

Although the teacher is in charge while group work is taking place, they should move away from the groups otherwise any questions will be directed towards the teacher rather than other group members.

A successful group work task means that students need each other to some degree in order to complete the task

When assessing the success of a task, include non-verbal communication such as frowning, smiling, nodding etc.

Before starting a group work lesson, the teacher needs to have thought of the following



#### **Relatively routine learning** – solving problems where there is a clear right answer.

- Here you should hear the stronger students helping the weaker ones.
- Students are given an assignment they would often do as an individual task, but told to work together and help each other. This will only work if students are motivated to help each other.

The problems with this type of task is that some students may become a 'free-rider'. If you try and solve this by giving everyone an individual task, the group work will break down into individual tasks. The solution to this is to have some kind of individual and group final product.

**Learning of concepts** – this does not rely on the stronger students helping the weaker ones and is an equal exchange model. This would require a group task where no one person could easily do the task alone

- The instructions for the task should be written down as well as given verbally. Don't make the set of instructions too detailed and don't supply one copy per person (otherwise they will all read individually)
- The size of groups. A group of three has special problems as 2 people will form a coalition. Larger than five and there become problems for participation.
- Composing groups. Groups should be mixed as to academic achievement, sex, race etc. Allowing friends to choose each other to work with is not a good idea as group work should be work and not play.

There is very little research that helped with **how** groups should be chosen and who should work together.

This is why I felt that I could learn from trying out different ways of grouping in my classroom. In particular, since we know that there is overwhelming research into multiple intelligences and learning styles, I could try grouping according to learning styles.

Howard Gardiner (1983) developed the Multiple Intelligence Theory. He states that 'by introducing a broader range of learning methods, educators can hone in on an individual's strengths and weaknesses by determining their preferred learning style. This would consequently give them the opportunity to learn in ways more productively to their unique minds.' The multiple intelligences or learning styles are:

- **Kinaesthetic** learner. - They benefit from physical experiences such as touching, feeling, holding, doing, and getting practical hands-on experiences
- **Visual-Spatial** learner- Their learning involves the use of visual or observed things. These include pictures, diagrams, demonstrations, displays, handouts, films, flash cards and flip-charts etc.
- **Musical** learner – Their learning involves the transfer of information through sound, song, music and listening to jingles, rhythms and rhymes. They remember well by repeating things back in a rhythm.

- **Linguistic (or verbal)** learner – They prefer the transfer of information through writing, reading and listening to the spoken word, such as conversation, discussions or debates.
- **Logical** learners - ask lots of questions and are good puzzle solvers. They also like to experiment and see logical and numerical patterns in their work by making connections between pieces of information.
- **Interpersonal** learners - benefit from being able to see things from others point of view. i.e. to re-enact the movement of an animal or consider how an individual may have been feeling at the time and place of an historic event. They enjoy working, learning, helping and being around other people
- **Intrapersonal** learners - are particularly determined and can work well with personal deadlines and goals. They may sometime shy away from others and find it easier to work alone and quietly, but it is likely that they will be strong in one or two more intelligences.

(Information taken from <http://www.multipleintelligencetheory.co.uk>)

## **METHODS USED.**

### **The target population**

Class	Size	Gender breakdown	Achievement data	Notes on students
AS Statistics 1 class	21	Females: 12 Males: 9	GCSE Average: Females: 6.6 range-2.5 Males: 6.7 range-1.6 Core 1(January module) average UMS Females: 76.6 range-74 Males: 63.9 range-54	This is a very mixed ability class who have been one of the harder classes I have had to teach both in terms of ability and behaviour. Their Maths GCSE grades range from A* at higher tier to B at intermediate. There are some very bright students in the class – 3 (2 girls and 1 boy) who stand out – but also some weak and unmotivated students. 1 girl in particular who gained a U on her first module and three boys who severely underperformed. This girl and some of the boys have loud personalities who at times end to overwhelm and dominate the rest of the class.

I haven't used a specific control class, but instead can compare this class's group work with themselves when they have been allocated to group in a different way especially where I have used random grouping and also with my previous experience of group work with my other classes.

### **Methods of grouping the students**

(see appendix 1 for groupings and appendix 2 for ways of allocating students to groups) Originally I put the students in groups of 4 using different criteria. I chose 4 as a group number after reading the research and also after asking the students what they felt a good group size would be. These grouping criteria were

- **Learning styles.** The students fill in a questionnaire at the beginning of their time of Farnborough Sixth form college which give them an idea into how much they prefer working according to a multiple intelligence of Visual, Verbal, Physical, Musical and Logical (virtually all AS and A2 Maths students have logical as their preferred learning style, therefore I chose their second preferred style and in some cases their second and third in order to place them in groups). Thus the groups became Visual and logical, Physical and Musical, 2 x Logical and Verbal, Musical.
- **General attainment level** – using their average GCSE point score
- **Maths attainment level** – using their Maths GCSE grade and their October test score
- **Personality type** – putting the louder students together, the naughtier, the conscientious and the quieter ones in the same groups etc.
- **Friendship groups.** Putting groups of friends and natural working partners together.
- **Random grouping.** Using a systematic way of ordering students in particular groups.

N.B THE STUDENTS WERE NOT TOLD HOW I HAD ARRANGED THEIR GROUPS OR WHAT THE GROUPS MEANT.

## Data collection

I explained to my class what I intended to do with them and gave them an initial questionnaire to fill in (appendix 3) getting their views on group work. Then at the end of each lesson where I used group work I asked them to fill in a questionnaire

During the January course forum, I didn't ask for them to make comments about group work but it did come up.

My views on how the students worked during group work lessons

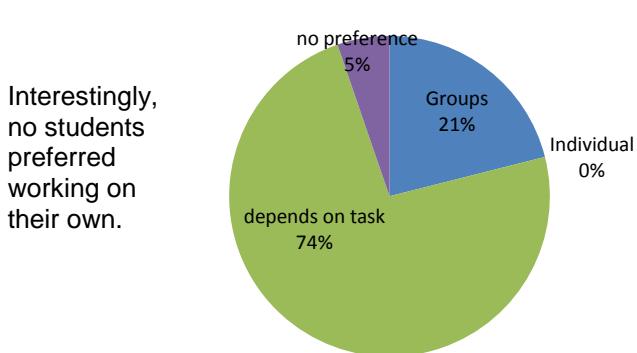
Comments and the attitude of students during the group work lessons.

## FINDINGS

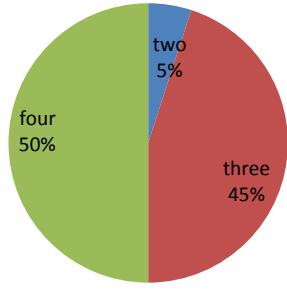
### **Initial questionnaire.**

Before starting any of my groupings, I asked the classes their views on group work so that I could compare them to their views at the end of my project.

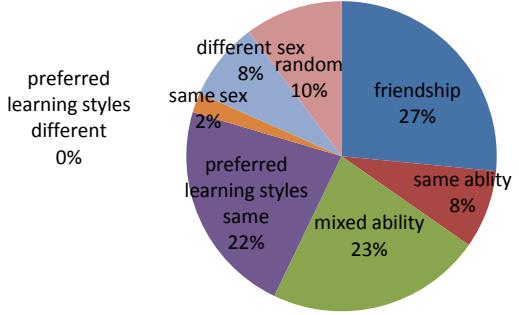
**Do you prefer working in groups or on your own?**



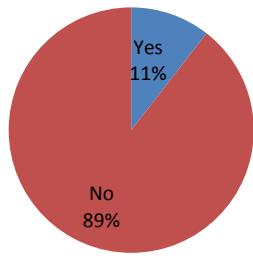
**What is your preferred group size?**



**How would you like me to arrange the groups?**



**Do you think that you will be anxious about working in groups?**



There was no surprise that arrangements by friendship were the most popular (although not unanimous). I personally was surprised that the class would prefer to work in mixed ability groups than groups of the same ability. They were already 1 stage ahead of me when it came to learning styles.

## **Group work lessons**

I only did about 1 group work lesson per half term, starting after October half term so that I got to know the class and their natural friendships first. I also made sure that before telling the class I was starting the project I did some work where I allocated them in groups by one of my previous random ways so that they had done some ‘un thought-out’ group work.

### **Lesson 1 – Multiple intelligence groups.**

For the first group work lesson (see appendix 4 for full plan) I decided to group the students by their multiple intelligences (putting students with the same learning styles on the same groups). They did not know that they were grouped in this way. I tried to use some open ended activities. I also tried to limit the resources and tried to make them work in pairs within a group and gave them only 1 piece of sugar paper for the whole group to work on. Unfortunately, the main task of the lesson involved cutting up and sticking things to paper. Only afterwards I realised that this was a largely kinaesthetic or visual task which was hard to adapt for verbal learners. The feedback from this lesson by means of a questionnaire (appendix 5) is as follows

#### **Questionnaire and feedback on grouping by MI criteria. Lesson involved poster making, matching**

Nepal =	Visual and logical
Britain =	Physical and Musical
Australia =	Logical and Verbal
China =	Musical
Germany =	Logical and verbal

My views: If I ranked how well the groups worked together and how many of the outcomes they achieved, in descending order

1 = China (group of 3)

2 = Nepal

3 = Britain

4 = Australia, Germany

This was before seeing which Multiple Intelligence I had used to make the groups. I suppose that it shouldn't have been a surprise that the groups who worked the least well together were verbal learners and I was asking them to do a predominately visual task. Australia and Germany couldn't settle to the task and couldn't work well together. They did each have a loud personality in them too. Australia had probably the brightest students in the group.

## **Group feedback**

Do you think that your group worked well together?

Yes = 15                  No = 4 (3 Australia, 1 German)

Do you feel that you benefited from being in your group?

Yes = 13                  No = 6 (2 Aus, 4 German)

Do you think that the group size was correct? (4)

Yes = 18                  No difference = 1

Would you have preferred to work on your own?

For some = 1    No = 18

Would you be happy to work in this group again?

Yes = 16                  No = 2 (Germany)

More than anything, the students seemed to enjoy working with different people than usual. Nepal happened to have been made up of the weakest students and yet worked really well together and achieved everything they should have done. I suppose that if I am going to arrange students by Multiple Intelligence data, I should make the task fit their preferred learning style. Also I should make some allowances for where the disruptive students are. This feedback is positive.

### **Lesson 2 – ability groupings.**

Rather than introducing an ‘artificial’ lesson to involve group work, I decided that I would try a different tack and when teaching the hardest topic on Core 1, I asked students to sit in ability groups.

We didn’t do any specific group work, I wanted them to work with people at a standard similar to theirs, but also for it to act as a trigger in the exam ‘I remember learning this, I sat with ....’

#### **Maths Ranking**

Hippo	A* GCSE / A Oct test
Kangaroo	A/A* GCSE , A/B on Oct test
Panda	A GCSE / C/D Oct test
Killer Whale	B GCSE / E Oct test
Chimp	B GCSE / U Oct test

This didn't work particularly well. If anything this maybe had a detrimental effect as the students weren't as confident asking their group for help as they would have been if they sat with their usual partner. I suppose that the weaker students couldn't help each other as readily and the stronger maybe didn't need the help. Probably a better grouping would be to have had one of each animal at a table to make sure that the groups were mixed ability (which is what the students told me in the initial questionnaire that they would prefer)

### **Feedback**

Do you think that you benefited from sitting in this group?

Yes – 11      No – 8

Do you think that you got more, less or the same amount of work done as usual

More – 6,      Less – 2,      Same -10

Would you have preferred to sit when you usually do?

Yes – 6      No – 5      Don't mind - 9

Would you be happy to work in this group again?

Yes – 18      No – 0      Don't mind - 2

### **Lesson 3 - S1 Project – writing up a coursework like task in MI groups.**

Aim: Students to complete analysis on various statistics from over 200 countries (e.g. population, Infant Mortality etc). At the end of 2 lessons plus homework, they had to complete a report in their groups showing and explaining the statistics from some countries.

They had to first decide on what to investigate and how to split up the task within their group. They split into pairs to complete the main body of the task and then met again as a group again at the end to compare their findings. I gave them the choice of how they wanted to submit their report. They could handwrite, use computers, use a poster etc. I also gave them a lot of choice in what they did and how to arrange themselves.

Nepal =	Visual and logical
Britain =	Physical and Musical
Australia =	Logical and Verbal
China =	Musical
Germany =	Logical and verbal

### **Feedback**

The most surprising thing was that all groups worked really well together and although the students weren't working with their usual choice of partner, they worked really well as a team – much better than on either of the other 2 tasks so far. Even the lazier students in the class made sure that they contributed. Giving a choice of how to submit their report meant that some groups seemed to choose to work together in the class room and produce a handwritten report while others preferred to work in the computer room.

If I ranked the groups in how well they worked together, the ranking would be      (not the same order as group work lesson 1)

Britain  
China  
Australia  
Nepal  
Germany

All did work well as a group.

I found this set of lessons a great success. The students enjoyed being put into these groups and the groups alone seemed to produce a sense of competition (we started with a competitive activity between groups). This is the first time that my project felt that it was working as I don't think the students would have worked as well if I had left them in their usual seating to do this. Because there wasn't so much structure in how the task was given to them, they could use their own learning styles in deciding how to approach the task. I think that I have learned a big lesson through doing this task. If I am going to make them

work with students of the same Multiple Intelligence, I need to make sure that the task can be adapted to suit this. I then feel that it is of benefit for them to be in a group with students who work in the same way.

(Independently to this, at the same time, my double Mathematicians were working on a Mechanics project. I grouped them according to ability and only the strongest 2 groups are managed to make good progress. This statistics group worked much better in groups. (Whether this is a function of the grouping, of the class or because I have actively done more group work with my Statistics group I don't know)

The week prior to this, I overheard some students complaining that they hadn't done any work in their groups recently. They seemed to resent that I hadn't given them a group work lesson.

#### **Lesson 4 – Discovering the binomial expansion (core Maths) – multiple intelligence groups**

I gave open ended questions to the groups. E.g. – we started with expanding  $(a + b)^2$ ,  $(a + b)^3$ ,  $(a + b)^4$ , then they had to spot the pattern to expand  $(a + b)^5$  etc. They had a piece of sugar paper in their groups which was the only place share they were allowed to write (and incidentally it was the group with the mathematically weakest students in who were the first to find this) They then practiced and exercise then had to deal with the challenge of finding  $(a + b)^{20}$  and  $(a + b)^n$  (this is quite hard) I adapted the questionnaires for this response so be a sliding scale so I got a range of answers rather than just yes or no (appendix 6)

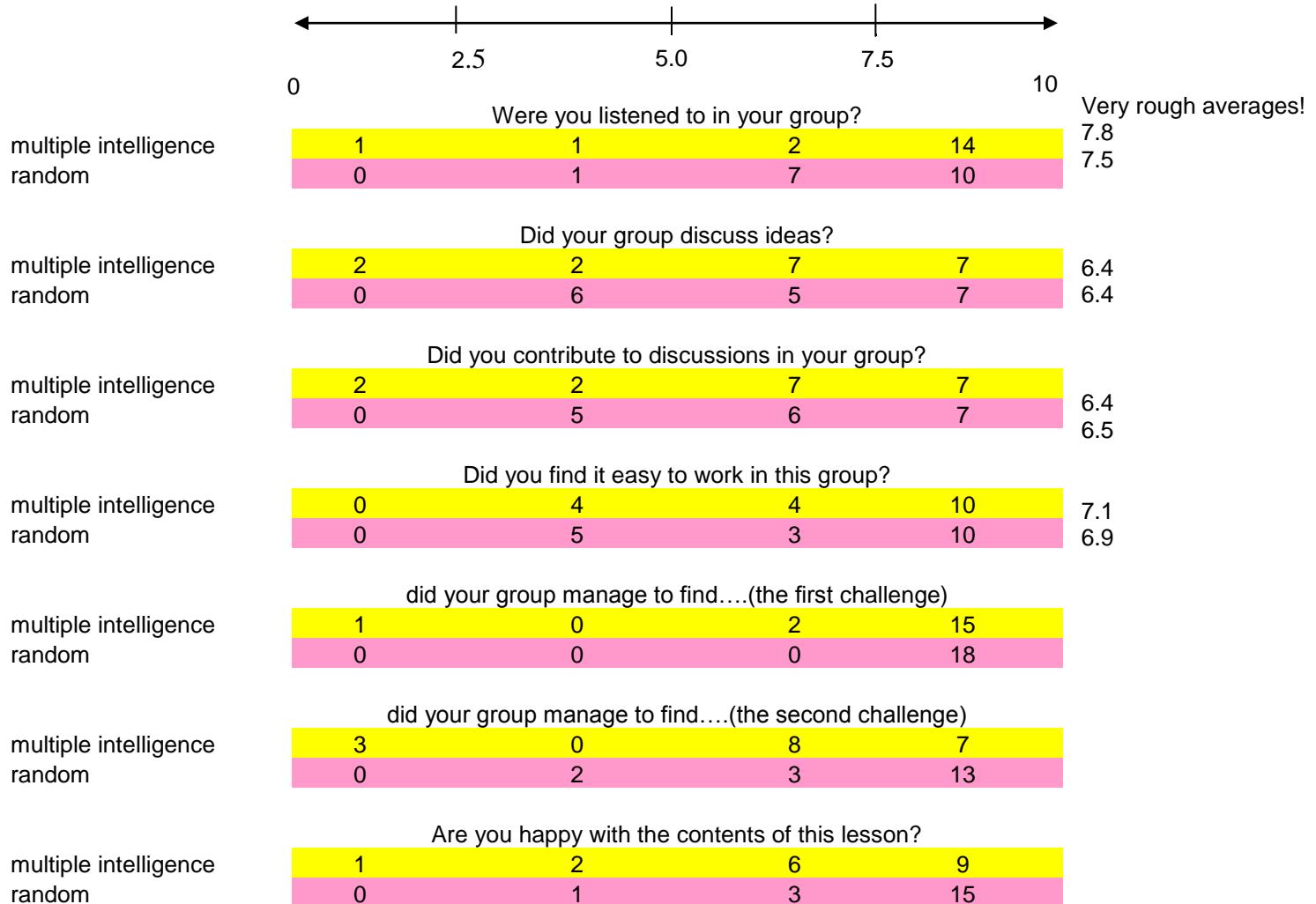
Feedback will follow with lesson 5

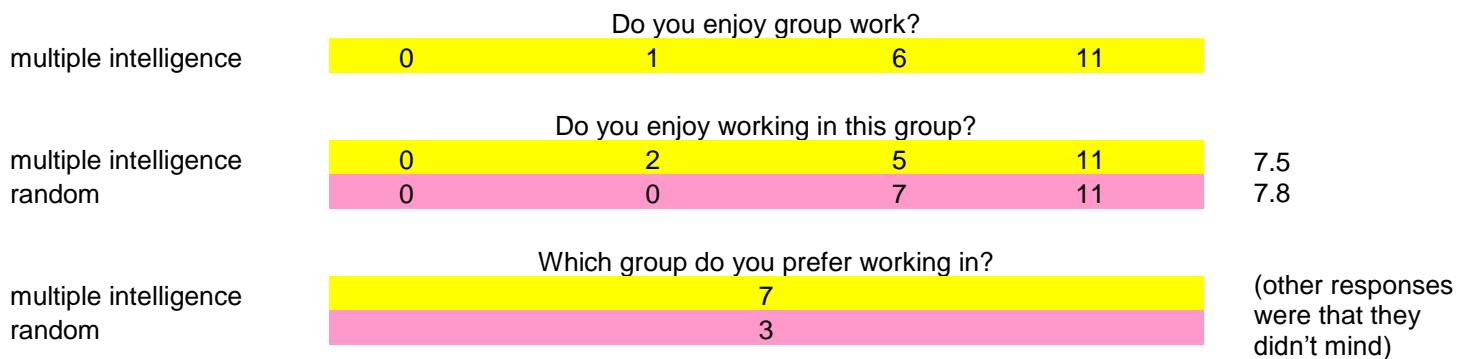
#### **Lesson 5 – Discovering the binomial distribution (statistics) – random groups**

The format was similar to lesson 4, but with the students in random groups. There is a link between the content of lesson 4 and what we needed for the Statistics module so the main part of the lesson was the groups finding out the link for themselves and working out how to apply it. Again they only had one piece of sugar paper together to write on and again there was a final questionnaire (appendix 7)

The hope here is that since the tasks were similar, I could directly compare the results of putting the students in Multiple Intelligence groups with the results when they were put in Random groups

Displaying the results on a sliding scale of 1 to 10 with 10 being positive.....





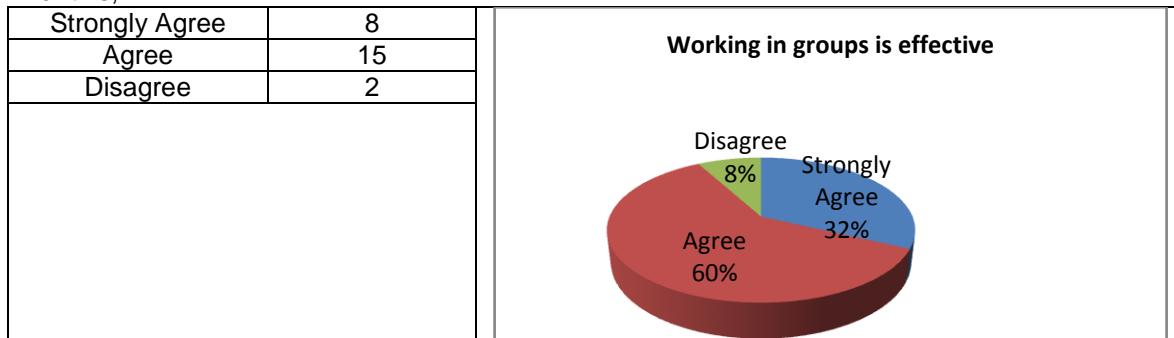
I feel that (of the half class who had a preference) the fact that 70% of them preferred working in a group arranged by learning styles was significant, especially as they were asked at the end of the lesson where they were grouped randomly, in which they had given positive feedback about the group work aspects in their questionnaire (if anything more positive than they did at the end of the lesson where they were in MI grouping)

### Course forum

I didn't want to guide their course forum in any way so I didn't ask them to comment on their group work lessons. It did come up though and was phrased as

**'Working in groups is effective; everyone in the class talks to each other'**

For this,



I have written about the lessons in which I asked the students for feedback. Sometimes, if I wanted to group the students for a 10 or 20 minutes task rather than a whole lesson, I would just quickly put up my smart board groupings and say 'get into fruit etc'

### DISCUSSION

I realised early into the project that I was trying to deal with too many variables and so needed to narrow it down. After the third lesson where they were in MI grouping to carry out a coursework like task and I really felt that it had been a really successful lesson, I decided that I would concentrate more on how MI groups worked compared to a grouping another way. I am quite aware that my methods of validating the results are far from scientific, however my views and the views of my class matter a lot. My own view of observing the class working is that (as long as I chose a task which didn't lean towards one way of learning and so allowed them to adapt to their preferred learning style.) the students worked better as a group and produced better work when they were grouped with students who had similar learning styles.

### **What worked well?**

- The students did seem to enjoy lessons in which we did group work.
- I have improved my skill as a teacher managing group work lessons.
- Having them in groups made them more competitive which I couldn't work out whether was a good thing or a bad thing, but did make them work harder.
- I thought more about my lesson and planned details better
- The class seemed to appreciate the fact that I had thought about how to group them and thought about the content of the lessons.

### **What would I change next time?**

- It made no sense having so many different groupings as part of what I felt was beneficial in working in groups is that the students got familiar with the other students in their groups. Next time I will stick to multiple intelligence grouping and to ability grouping which I can then either use to have same ability or have one of each object to have mixed ability.

### **How I would like to extend my project (given time)**

- I would like to compare working with all multiple intelligences the same (e.g. all Germany together, all Nepal together etc) with groups where there was one of each learning style (e.g., 1 Germany, 1 Nepal, 1 Australia etc in a group).
- Given time, I would have liked to try out my different ways of grouping – e.g. personality types
- I would have liked to put the disruptive students together in one group then the rest of the class in MI groups so that their opinions weren't swayed by the one student in their group.
- I would like to have tried this against a control group where I did the same lessons but not the same groupings
- I would have liked a third person to observe part of a lesson where they were in MI groups and part where they were in random groups to have an outsiders view.

Grouping students according to their learning styles is something that I would try again and will hopefully use next year when I do some group work with my classes.

### **Tips and recommendations**

- Limit resources when working in groups. E.g. 1 copy of instructions per pair rather than one each to force them to work together. E.g. One pair of scissors and one glue per group to force some collaboration.
- Think carefully about room arrangement. Can all students see board? Can they all hear each other?
- Try and keep away from the groups so that they ask each other questions rather than you.
- When using a questionnaire to get the class' opinion, use a sliding scale (see appendix 6) rather than a linear one (see appendix 3). This means that you don't simply get 'don't mind' answers and the results are more useful than just 'Yes' and 'No'. Also the students have to think more about the question in order to put the mark in a place rather than just ticking a 'yes' or 'no' box.

### **CONCLUSIONS**

- I think that students get more out of group work when they are arranged in a group by a pre-thought-out criteria rather than some random way. Grouping by multiple intelligence styles was more effective than random grouping.
- It is very hard to successfully plan group work which encourages students to work as a group rather than simply in a group
- Group work lessons take a lot more planning than other lessons in terms of content, resources and practical arrangement of room
- It didn't work when I put students into groups according to their learning styles but then gave them a task that they could not adapt to their preferred style.
- My teaching has improved this year simply by thinking about how to use group work and in particular the students preferred learning styles in how to teach topics or concepts.
- Both my own views and that fed back by the students during their questionnaires and the course forum told me that the students did enjoy group work. They liked coming in, seeing the smart board and going to sit with whichever group I asked them to.
- The simple process of putting them in group made them more competitive between other groups (particularly when I used countries as the way of representing the groups!).
- The final questionnaire which directly compared which group they preferred working in showed that they favoured the grouping of learning styles to the random grouping.
- In future, I will think more carefully about the way in which I group my students. I think that there is some anecdotal evidence that grouping according to learning styles worked.

### **References**

#### **Books**

- 1) Goleman, D. (1996), Emotional Intelligence, Bloomsbury
  - 2) Coolican, H. (1996), Applied Psychology, Hodder and Stoughton.
  - 3) Spurgeon, Davies, Chapman (1994), Elements of applied psychology, Harvard academic publishers
  - 4) Cohen, EG (1994), Designing group work – strategies for the Heterogeneous classroom, Teachers college press,
- Web sites
- 1) [www.multipleintelligencetheory.co.uk/](http://www.multipleintelligencetheory.co.uk/)

Appendix 1 - Grouping pictures

	Maths ranking Animal	Min grade ranking Toy	MI Flag	Friendships Instrument	Personality	Random
Jade						
Genny						
Sarah						
Mike						
Matt D						
Louise						
Vicky G						
Roshani						
Chris						
Craig						
Steph						
Kuru						
Mia						
Ryan						
Matt P						
Luke						
Ellie						
Richard						
Kerry						
Vicky S						
Pramin						

## Appendix 2

### Methods of sorting the students

Name	Avg GCSE	Min Grade	Maths	Oct test
Jade	6.7	C	A	54
Genevieve	6.9	C	A*	46
Sarah	6.5	C	A	36
Michael	7.2	B	A	50
Matthew	5.9	D	B	20
Louise	8.0	B	A*	54
Victoria	7.0	B	A	36
Roshani	5.7	D	B	27
Christopher	7.5	B	A*	41
Craig	6.0	D	B	31
Stephanie	5.5	E	A	21
Kuruphungma	7.4	B	A*	55
Amelia	6.8	C	A	44
Ryan	6.5	C	A	33
Matthew	7.0	B	A*	52
Luke	6.7	C	A	18
Ellena	6.9	C	A	51
Richard	6.3	C	B	22
Kerry	5.9	D	A	29
Victoria	6.0	C	A	45

Multiple intelligence grouping

Forename	Visual	Verbal	Physical	Musical	Logical	Inter Personal	Intra Personal
Jade	14	24	21	22	29	27	24
Genevieve	23	22	20	23	13	24	19
Sarah	15	23	15	21	16	28	18
Michael	17	29	27	26	27	27	17
Matthew	27	24	22	22	28	21	18
Louise	15	18	20	20	18	26	22
Victoria	26	28	21	27	29	30	20
Roshani	24	19	12	21	23	25	23
Christopher	25	31	32	35	34	33	20
Craig	18	26	23	20	29	30	24
Stephanie	24	22	20	22	27	22	18
Kuruphungma	29	34	31	22	38	40	28
Amelia	19	21	23	24	22	26	19
Ryan	12	32	26	20	36	25	33
Matthew	22	26	23	23	29	28	27
Luke	19	23	20	23	22	24	22
Ellena	22	16	25	26	27	30	22
Richard	16	17	22	22	17	23	19
Kerry	14	8	13	11	17	22	10
Victoria	21	20	19	18	24	18	23

## personalities

Jade
Genevieve
Sarah
Michael
Matthew
Louise
Victoria
Roshani
Christopher
Craig
Stephanie
Kuruphungma
Amelia
Ryan
Matthew
Luke
Ellena
Richard
Kerry
Victoria

## Friendships

Jade
Genevieve
Sarah
Michael
Matthew
Louise
Victoria
Roshani
Christopher
Craig
Stephanie
Kuruphungma
Amelia
Ryan
Matthew
Luke
Ellena
Richard
Kerry
Victoria

# CONGRATULATIONS

*I have chosen you*



*Specially to take part in my exciting research experiment.*

*I want to know whether the way in which I put you in groups affects your learning and indeed whether group work itself can help your understanding of certain topics. Approximately once every two weeks, I will ask you to sit in groups which I have predetermined through a range of criteria, including your preferred learning style, friendships and other groupings in which I think may influence the way you work. We will change these groups to different arrangements frequently so that you can feedback on which you find the most useful.*

*We will continue this until you leave in the summer term on exam leave. Then you can let me know on how useful you have found this.*

*Thank you for volunteering. Please could you now complete a short questionnaire for me....*

**Initial questionnaire about group work.** (Please circle your appropriate answer)

1. Do you prefer working in groups or on your own?

Groups                  individual                  depends on task                  no preference

2. What would be your preferred group size

2

3

4

4+

3. Why this size?

---

---

4. How would you prefer me to arrange the groups (ring more than one if appropriate)

Friendship                  same ability

mixed ability

Preferred learning styles the same

preferred learning styles different

Same sex

different sex

random

Other (please state) \_\_\_\_\_

5. Do you think that you will be anxious about working in groups?

Yes

No

Depends on grouping (if so - which groupings would make you anxious?)

6. Do you want me to consider anything else about any aspects of this group work?  
- If so, what? \_\_\_\_\_

---

7. Do you have any (sensible) suggestions which you feel may improve this research project?

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Thank you very much for taking part.

## Appendix 4

### Group work lesson

#### Quadratic functions and differentiation

Tuesday 6<sup>th</sup> Nov

#### Group according to flags

Mini whiteboard each. Sketching quadratics

#### Closed questions:

Sketch  $y = (x-3)(x+2)$  marking on x and y intercepts  
 $y = (x-2)^2 + 1$  y intercept and vertex  
 $y = (x+1)(x-1)$   
 $y = (x+1)^2$   
 $y = (x+3)^2 - 2$

(plot on Autograph to show answer)

#### Open questions:

[U:\Core 1\Quadratics\open questionning.notebook](#)

On mini whiteboards. Can't have the same equation as anyone else on your table. Check with others first.

---

#### Matching exercise - quadratic graphs

Match a factorised form, a completed square form, a y-intercept, x-intercepts, a stationary point and a graph to each equation. [U:\Core 1\Quadratics\Quadratics poster.docx](#)

Cut up and stick onto poster paper. Any working out has to be done on the paper.

Set timer for 30 mins.

---

#### Stationary points.

Mini whiteboards.

$y = 2x^2 + 4x - 5$ . Find and classify the stationary point. (-1,-7) local min

(Discuss second derivative)

Take 2 equations each in the group. [U:\Core 1\Calculus\differentiation - second derivative.docx](#). Find and classify stationary points.

Write on the graph sheet and swap round to different group to compare.

For the graphs already stuck on the poster. Take at least one each and justify the stationary point (min or max) using the second derivative.

---

#### Open questioning.

Give me an example of a graph which has... (Answer in pairs. Can't give the same answer as the other pair in the group)

A stationary point on the x axis

A function with minimum point (4,0)

A function with maximum point (3,0)

A stationary point at (1,2)

12 function cards. [U:\Core 1\Calculus\differentiation - max and min show me.docx](#)

In groups. Use with 'Who am I' First group to show me correct answer scores +2 and incorrect -1. If get picture +3

Which graph crosses the x axis at 3 and -2?

$x^2 - x - 6$

Which graph has a local min of (3, -12)

$x^2 - 6x - 3$

Which graph crosses the y axis at 7

$7 - x^2 + 2x$

Any graph with a local max

(any  $-x^2$  graph)

Any graph whose second derivative is >0

(any  $x^2$  graph)

Any 2 graphs with the same y intercepts

$4x^2 - 12x + 3$ ,  $x^2 - 7x + 3$

A graph which wouldn't cross the x axis

$3x^2 + 2x + 8$ ,  $x^2 + 3x + 6$

$f(x) = 10x - 2$

$5x^2 - 2x - 1$

Local max when  $x = 1$

$7 - x^2 + 2x$

**Questionnaire. Feedback on group work lesson - Tues 6<sup>th</sup> Nov - Quadratics & differentiation.**

Group \_\_\_\_\_

1. Do you think that your group worked well together? \_\_\_\_\_

(any comments?) \_\_\_\_\_  
\_\_\_\_\_

2. Do you feel that you benefited from being in your group? \_\_\_\_\_

(any comments?) \_\_\_\_\_  
\_\_\_\_\_

3. Did any of the tasks that I asked you to do work particularly well in your group?

Did any of the tasks not work well in your group?  
\_\_\_\_\_

4. Do you think that the group size was correct? \_\_\_\_\_

(any comments?) \_\_\_\_\_  
\_\_\_\_\_

5. Would you have preferred to have worked on your own? \_\_\_\_\_

6. Would you have preferred to work with different people? Why?  
\_\_\_\_\_

7. Would you be happy to work in this group again? \_\_\_\_\_

8. Any other comments? \_\_\_\_\_  
\_\_\_\_\_

Thank you very much.

## **QUESTIONNAIRE ABOUT TUES 26/3 GROUP WORK LESSON - THE BINOMIAL EXPANSION**

Please mark your responses using an arrow on a scale of 0 to 10. (0 being very negative and 10 being perfect)

1. Were you listened to in your group?

0 \_\_\_\_\_ 10

2. Did your group discuss ideas

0 \_\_\_\_\_ 10

3. Did you contribute to discussions in your group?

0 \_\_\_\_\_ 10

4. Did you find it easy to work in this group?

0 \_\_\_\_\_ 10

5. Did your group manage to find the pattern for  $(a+b)^5$

0 \_\_\_\_\_ 10

6. Did your group manage to find the pattern for  $(a+b)^{20}$

0 \_\_\_\_\_ 10

7. Are you happy with the content of this lesson?

0 \_\_\_\_\_ 10

8. Do you enjoy group work

0 \_\_\_\_\_ 10

9. Do you enjoy working as part of this group?

0 \_\_\_\_\_ 10

10. How useful have you found working in a group this lesson

0 \_\_\_\_\_ 10

Appendix 7

**QUESTIONNAIRE ABOUT THURS 28/3 GROUP WORK LESSON - THE BINOMIAL DISTRIBUTION**

Please mark your responses using an arrow on a scale of 0 to 10. (0 being very negative and 10 being perfect)

1. Were you listened to in your group?

0

10

2. Did your group discuss ideas

0

10

3. Did you contribute to discussions in your group?

0

10

4. Did you find it easy to work in this group?

0

10

5. Did your group manage to find the probability of a coin ending up in row 4, slot 2?

0

10

6. Did your group manage to find the probability that when a die is rolled 7 times, it lands on a 6 twice?

0

10

7. Are you happy with the content of this lesson?

0

10

8. Do you enjoy working as part of this group?

0

10

9. How useful have you found working in a group this lesson

0

10

10. Did you prefer working in this group or working in the group you did in the Core 2 binomial lesson?

Why? \_\_\_\_\_