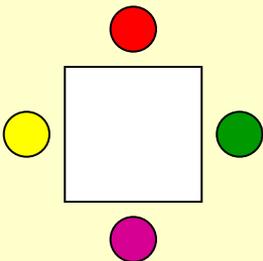


# Can Group-Work Work?

## Notes on Group-Work Tutorials in a Large Service-Teaching Module

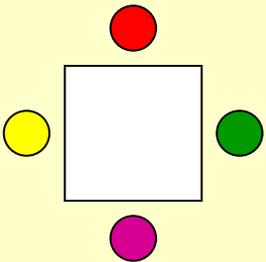
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School of Mathematical Sciences/CASTeL  
Dublin City University

IMLSN 8<sup>th</sup> Annual Workshop – 31<sup>st</sup> January 2014



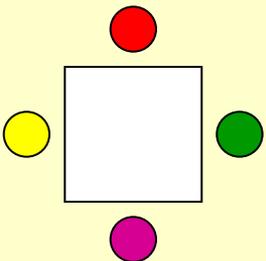
# Outline

- Background: problems with MS136 Business Maths
- Framework: complex instruction; tasks for mathematical thinking
- The teaching project
- Implementation, outcomes & reflections



# MS136

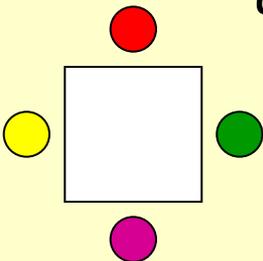
- MS136 Business Maths (introductory level calculus; closer to LC Ordinary level than Higher)
- Emphasis on applications (procedural skills) and mathematical thinking.
- Taught to > 400 students on 11 different programmes; no maths requirement (OD3).
- 2 lectures, 1 tutorial per week; multiple choice in-class tests [15%] and terminal written exam [85%].
- Persistent high failure rates (30-35%) and low levels of lecture and tutorial attendance.
- A typical (?) large service-teaching module.



# Framework: Complex Instruction 1

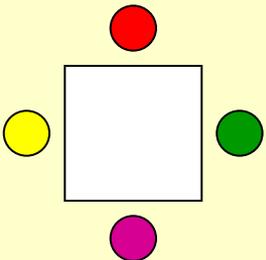
- Jo Boaler (MEI3 September 2009) – *Promoting Equity in Mathematics Classrooms; The Elephant in the Classroom* (2009).
- Problems and suggested solutions with classroom practice in mathematics.
- Solutions include emphasis on cooperative learning in the form of group-work:

*cooperative learning [is] defined as students working together in a group small enough that everyone can participate on a collective task that has been clearly assigned (Cohen, 1994)*



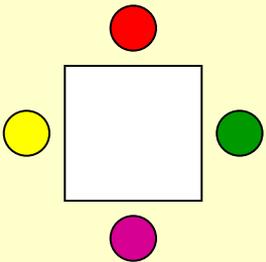
# Complex Instruction 2

- Cohen et al (2006, p. 199) list 19 advantages of using group-work in teaching.
- Noted as a characteristic of mathematics teaching in high-performing countries in TIMSS (Conway & Sloane, 2005)
- Group-work was not found to be a characteristic of Irish mathematics classrooms in a pre-Project Maths study (Inside Classrooms, 2003)
- Group-work is at the core of complex instruction:  
*a pedagogical approach that enables teachers to teach at a high intellectual level in academically, linguistically, racially, ethnically as well as socially heterogeneous classrooms. (Lotan, 1997, p. 15).*



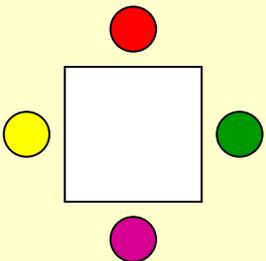
# Complex Instruction 3

- Complex instruction entails a combination of:
  - specialised curriculum based on open-ended tasks;
  - cooperative student groups;
  - a set of organisational arrangements that seek to maximize the benefits of cooperative learning for students.
- Two aspects of the teachers' role are key:
  - adoption of a multiple-ability orientation;
  - assigning competence to low-status students.



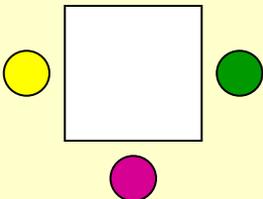
# Complex Instruction 4

- Cohen et al posit three organisational principals that lead to effective teaching:
  - The frequency of talk and work among students (lateral relations) depends on organisational structure;
  - The rate of lateral relations is lowered by the teachers' use of *direct supervision*: the teacher should *delegate authority*;
  - The greater the number of different tasks, ,the greater the opportunity to delegate authority.
- Note also the importance of ground rules (or cooperative norms) for group-work and of assigning roles within groups



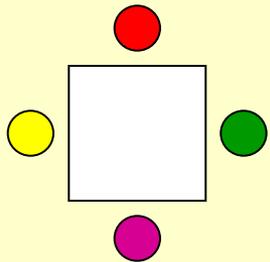
# Mathematical Tasks for Mathematical Thinking

- **Direct supervision:** informing, instructing or defining; disciplining; asking a factual question.
- **Delegating authority:** stimulating higher-order thinking, making connections, talking about multiple abilities and assigning competence.
- Links well with Watson and Mason's *Questions and Prompts for Mathematical Thinking*.
- Lists mathematical thinking capacities and proposes a teaching approach – based on questions and prompts – that seeks to engender these.
- Capacity of *Exemplifying/Specialising*:  
*Give me one or more examples of .. / Is .. an example of ..?*  
*/ Find a counterexample of ...*



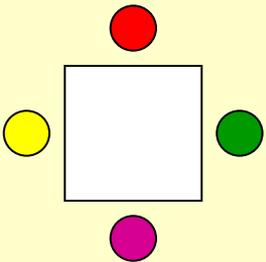
# Peer-supported group-work tutorials for MS136

- Introduced in Semester One 2010-11
- Attendance compulsory (5% of module mark)
- Advantages of peer tutoring well-established



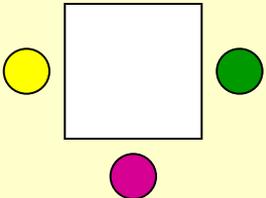
# Planning

- Development & delivery of tutor training workshop for group-work tutorials.
- Recruitment of peer tutors.
- Development of group-work tutorial structures and worksheets.



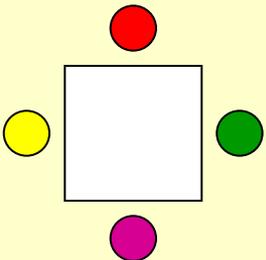
# Training workshop development

- Recruited 3 experienced post-grad tutors
- Brainstorm session July 2010: SWOT analysis & outline structure of training workshop:
  1. Introduction to Group-Work Tutorials
  2. The First Tutorial
  3. Case Study of Group Work
  4. Ground Rules and Conflict Resolution
  5. Questioning Skills for Group Work [school tutor training programme]
- August 2010: development and testing of the four new elements.



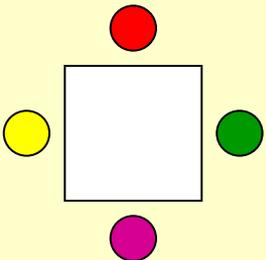
# 1. Introduction to Group-Work Tutorials

- Basic principles of group work.
- Why group work?
- How does group work benefit students?
- The tutor's role...
- ...and what it *does not* involve.



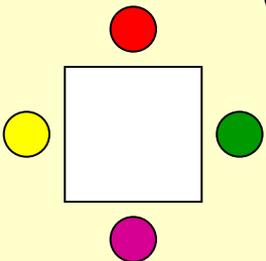
## 2. The First Tutorial

- Designed to ‘sell’ some of the ideas of group work to students.
- Tutorial worksheet/training element in one.
- Icebreaker (two truths, one lie).
- Communication task (broken plates).
- Personalities task (lifeboat).



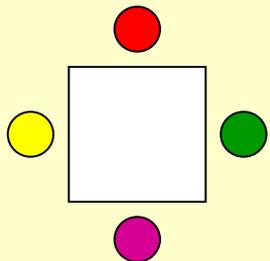
# 3. Case Study of Group Work

- A (very) short story featuring a mildly dysfunctional group.
- Tutor Grace attempts to deal with problems within the group relating to non-adherence to ground rules (*Grace Under Fire*).
- Teaching guide
  - Synopsis
  - Issues
  - Discussion task and questions
  - Wrap-up activity



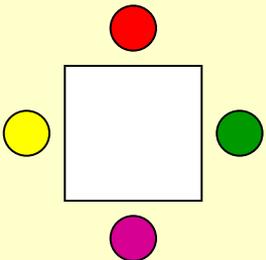
# 4. Ground Rules and Conflict Resolution

- Presenting the ground rules [part of Tutorial 1]
- The Ground Rules - why these rules?
- Sources of conflict/Avoiding conflict/Resolving conflict
- Grading



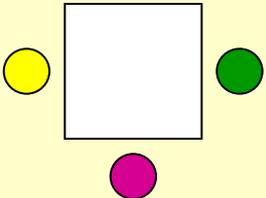
# The Ground Rules

1. All members must actively participate.
2. *Show respect* to all group members and to the tutors
3. All group members *talk and listen equally*
4. *No one is finished until everyone is finished*
5. Giving answers is not helping. Students must give *explanations* when helping others.
6. Call the tutor for *group questions* only.
7. Group members must *arrive on time* for the tutorials.
8. Group members must *prepare the tutorial assignment* prior to the tutorial and must have their work with them at the tutorial.
9. Group members must adhere to their *assigned roles*.



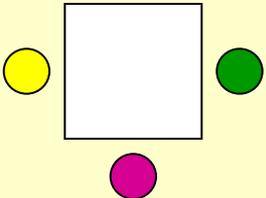
# Recruitment of Peer Tutors

- E-mail to 1<sup>st</sup> year class April 2010 inviting those who had passed MS136 to participate (hence peer tutors are 2<sup>nd</sup> year students).
- Information session in April; collected contact details.
- Invitation (whole class) to training workshop late August.
- Training Week 0 of semester one; positive feedback on workshop from peer tutors.



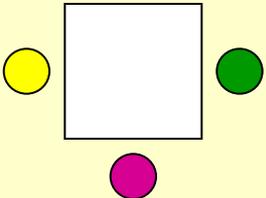
# Recruitment of Peer Tutors

- One-off fee of €100 for one tutorial for each week of semester one.
- 18 positive responses in April
- 12 attended training
- 11 participated
- 32 tutor hours per week required; uptake by some of two hours per week yielded 23.
- Contracts issued using hourly undergraduate tutor assistant rate.



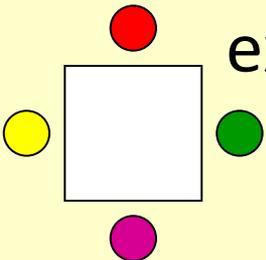
# Group-Work Tutorial Structure

- Students assigned to a tutorial; randomly assigned to group of 4 within their tutorial; 6-7 groups in each tutorial.
- One post-grad tutor, 1-2 peer tutors in each tutorial.
- Each student assigned a colour code: red, yellow, purple, green.
- Roles: chair, recorder, ordinary members, rotating weekly.



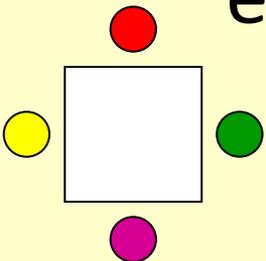
# Group-Work Roles

- Chair - ensures that the group sticks to the Ground Rules and keeps to the time-keeping guidelines given by the tutor.
- Recorder - records a clean, legible version of the group's work on each question on the tutorial sheet. They must provide the other members of the group with a copy of these solutions within one day of the tutorial.
- Ordinary members must co-operate with the recorder in providing solutions to their assigned exercises.



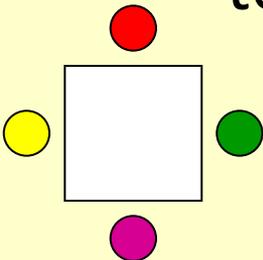
# Compulsory Attendance!

- PG Tutor awards mark of 0, 1 or 2 each week based on
  - preparation of assigned work;
  - arriving on time;
  - participation in the tutorial.
- 5% of module mark for tutorial element.
- 6% was given for 100% mark for tutorial element.



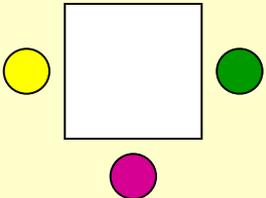
# Tutorial Worksheets

- Available on Moodle at least one week before tutorials.
- Each question indicated two of R/Y/P/G to be attempted by those students in advance of the tutorial.
- Tutorial: discuss questions, work together and with tutors to develop complete solutions.
- Notes and answers available in advance of in-class tests.

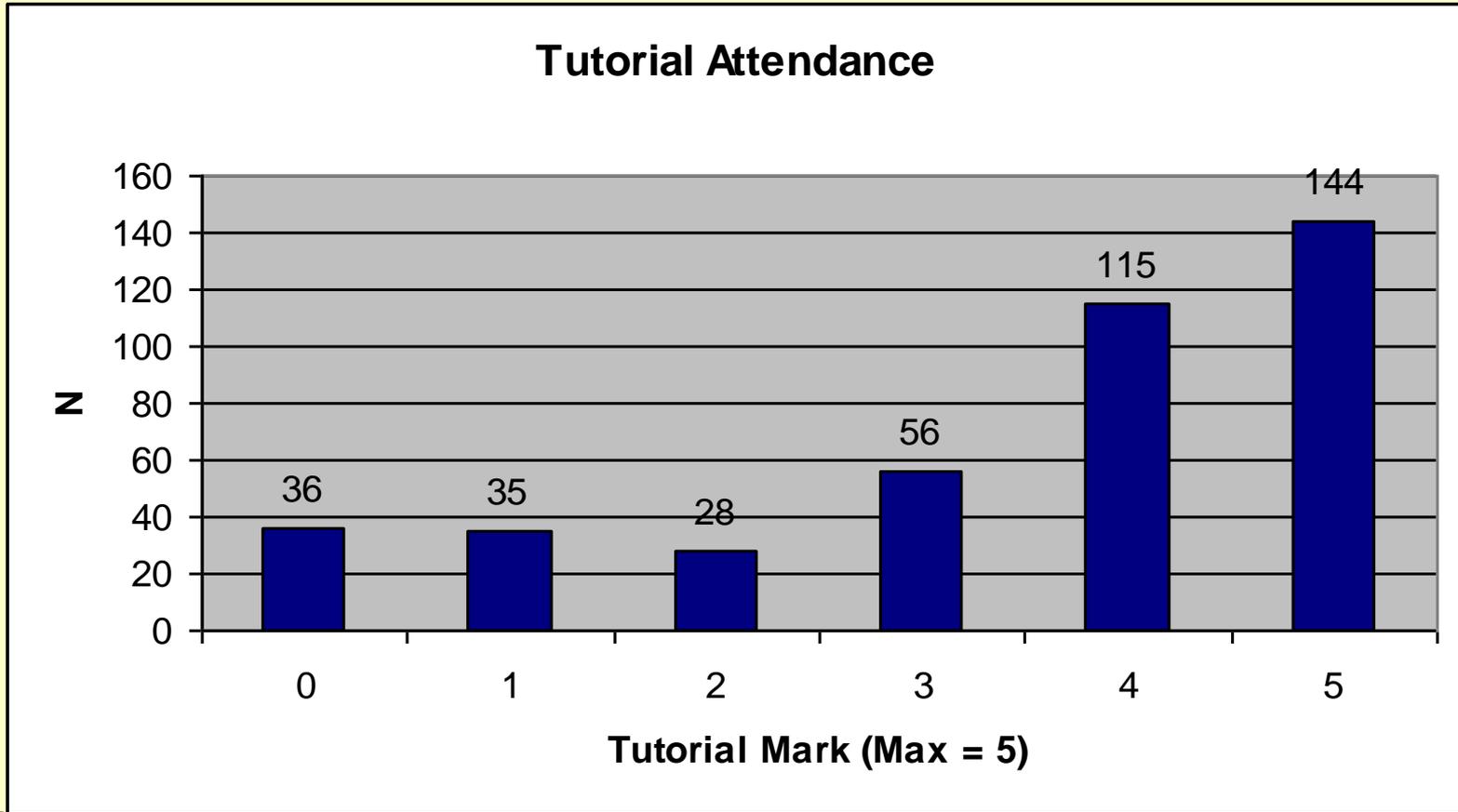


# Worksheet Questions

1. Definitions (i.e. take out your textbook/notes and look something up).
  2. Example generation (cf. John Mason).
  3. True or false.
  4. Calculations, formulas, graphs, algorithms, interpretations,...
- NB! Question types 2 and 3 have not been encountered previously by most students.
  - Transition to advanced mathematical thinking (Tall).

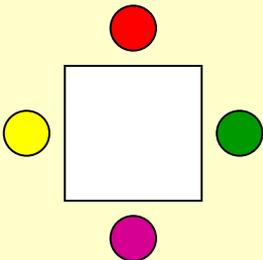


# Some Stats



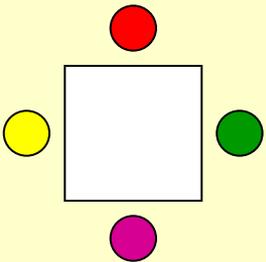
# Some correlation coefficients

- Tutorial mark versus total mark: 0.516668
- Tutorial mark versus exam mark: 0.390514
- Tutorial mark versus CA mark: 0.773238



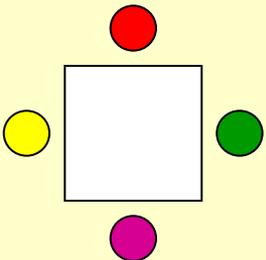
# Questions

- Students were surveyed in semester 2.
  - Did the group-work tutorials help you learn the course material?
  - Did they help you in exam preparation?
  - Changes to attitude/approach/engagement with maths



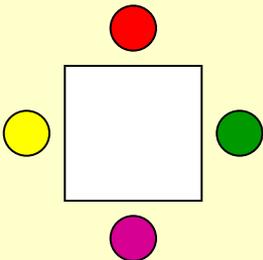
# Survey Results

- Very low participation rate (10%) and some disappointing results:
- *I found the maths tutorials helpful in terms of learning the course material: 50% in 'disagree' categories.*
- *I found the maths tutorials helpful in terms of passing the exam: 55% in 'disagree' categories.*
- *The tutors in my tutorial were helpful: 40% - 17% - 43%*
- *Apart from learning maths, there are advantages to having group-work tutorials: 78% in agree categories*
- *Overall, the group-work tutorials for maths are a good idea and should be continued. 48% - 2% - 50%*



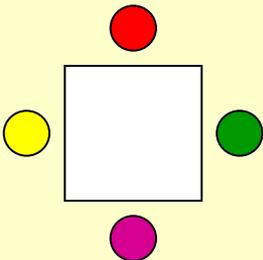
# Survey Comments

- Problems with tutors (weren't helpful, didn't know or understand the material, couldn't explain)
- Problems with group work (attendance, different levels of ability and participation)
- Not sufficiently focussed on exam preparation
- Useless/very helpful (c. 5:1)
- Good socially



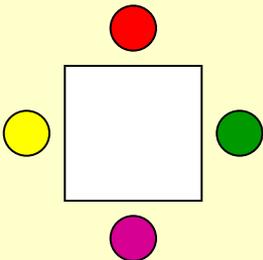
# Observations

- MS136 results were significantly worse in the relevant year...
- Significant admin burden (tutorial timetables, tutorial allocation, group allocation, peer tutor timetabling, contracts, certified absences, tutorial changes, record keeping).
- Attendance and participation levels were very good.
- Group work occurred...as did the predicted difficulties:
  - withdrawal from the group;
  - domination by one member.



# More Observations and Some Speculation

- Keeping to group-work principles is extremely difficult (complex instruction...); requires a lot of input from tutors.
- Students spent a disproportionate amount of time on *example generation* and *true or false* question.
- Did thinking about maths distract from more pragmatic, strategic exam preparation?
- 12 weeks versus 12 years?



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