Are We Still Investigating Mathematics?

Mark R O'Brien

My background

- Secondary Maths teacher for over 20 years
- Author/Developer of Living Maths Series and Integrated Maths Modules and other materials
- Previously teaching at Eastern Hills SHS, in Maths and Middle School
- Currently doing PD/Consultancy, writing learning resources for the new WACE courses for WestOne, and running OTRNet
- Interested in 'the transformation of education'

What Is A Maths Investigation?

An investigation may be defined as *"a situation originating in mathematics or the real world which lends itself to inquiry"*.

A mathematics investigation allows students to examine this situation using various techniques and in the process of their exploration develop skills that can be applied to other problems. The type of skills normally associated with investigations are generally **higher order skills or processes**.

These processes fall under the broad heading of *Working Mathematically* in the *Curriculum Framework.*

Investigate this …

Dots and Lines

Task 1:

- **Mark three dots on a page as shown in the diagram here:**
- **How many lines are needed to join each dot to every other dot?**

Task 2:

- **Mark four dots on a page.**
- **How many lines are needed to join each dot to every other dot?**
- **Can you draw the dots in another pattern so that more lines are needed? In this investigation you need to make sure you always draw the dots so that you get the maximum number of lines possible.**

What types of processes and skills are involved?"

No. of dots	1	2	3	4	5
No. of lines	0	1	3	6	10

Processes and skills developed

- Data collection, tabulating, symbolizing, classifying, simplifying, abstracting, following and extending patterns, conjecturing, communicating, generalising, justifying, proving, hypothesising and predicting.
- Having developed these thinking skills through various investigations students become more able to apply and transfer this knowledge to new, non-routine situations as they arise.

Selection of Investigations

- The selection of what type is appropriate for a given class depends on what the aim of the work is, what time constraints are applied, whether it is being used for an assessment item, what experience the students have and a number of other factors. It is possible to select particular investigations with the aim of developing (or assessing) certain processes.
- An important part of the selection process should be completing the investigation yourself before deciding on its use. In doing this you can accurately assess its suitability and begin to build up an understanding of what is involved. This also help to decide on what is expected from students and how the item will be assessed (if this is required).

Implementation - Course

- If you intend to use investigations as part of the learning experiences of students then they will need to be written into your programme of work.
- Other planning that can take place at the programming stage is; planning the number of investigations, pre-selecting investigations to suit your objectives and deciding on the part they play in your assessment.

Implementation – Class

- Investigations should be presented in an interesting and suitable format. When students have had time to read through an investigation it may be necessary to go over it and clarify any restrictions etc. Make available any types of resource materials required such as graph paper, dotty paper, cubes, matchsticks or whatever will help their exploration.
- It may be necessary after the students have had some time to look at the investigation to discuss their progress and ensure that they are following any assumptions or restrictions that it involves.
- Helping students probably should be limited to encouragement and stimulation rather than hints. It is the 'mental leaps' that we are often trying to get kids to take, giving them these leaps removes this benefit. It may be necessary to go over any content that is hindering their progress or to remind them of suitable investigative techniques such as simplifying the problem, being systematic, tabulating results etc.

Implementation – Class

- You will need to monitor or set the level of cooperation occurring between students. I would strongly suggest that students are not allowed to share the 'hackwork' as it is during this hackwork that students often gain the insight into the investigation.
- In the end the level of help given to students depends on what you deem appropriate for their experience. In early investigations a lot of help might be useful but ultimately we want students to be able to 'conduct' the investigation on their own with only encouragement and stimulation from us.
- Once students have some experience with investigations my usual procedure is;
  - give out the investigation and allow students an introductory look at what it involves
  - a few days later briefly discuss progress, assumptions etc
  - after one week of students exploring have them submit their work and validate their personal understanding using an assessment task designed for that investigation

Higher level investigating

Population Control

- **Various methods of controlling the earth's population have been suggested over the years.**
- **One possible method might be:**

  " Families may not produce any more children once they have a boy".

- **This means that we could have families like;**
- **Girl, girl, boy or Girl, girl, girl, girl, boy or maybe just Boy**
- **What is the probability of each of these three families occurring?**

Resources

MAWA 40 Mathematical Investigations

MAWA Another 20 Mathematical Investigations

Points of Departure - 1, 2, 3, 4

Investigations 1

OTRNet Online Subscriptions Service

Conclusion

- Comments
- Questions
- Discussion

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You can find out more about this topic at my website: www.otrnet.com.au by reading

"Implementing Mathematical Investigations in the Classroom"
http://www.otrnet.com.au/subsfolder/math_investigations.html

You can also download this presentation and other presentations and papers.

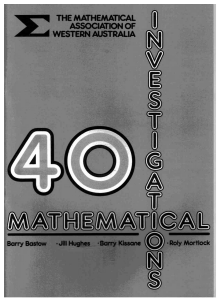
Mark R O'Brien

Resources 1/4

40 Mathematical Investigations

Bastow, Hughes, Kissane, Mortlock
MAWA

ISBN: 0 949278 05 X

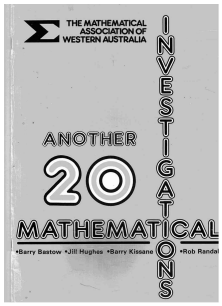


Resources 2/4

Another 20
Mathematical Investigations

Bastow, Hughes, Kissane, Randall
MAWA

ISBN: 0 949278 11 4

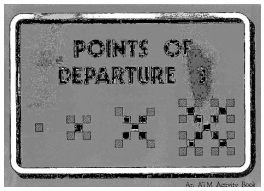


Resources 3/4

Points of Departure 1, 2, 3 & 4

Association of Teachers of Mathematics (UK)

ISBNS:
#1 - 0 900095 30 X
#2 - 0 900095 37 7
#3 - 0 900095 80 6
#3 - 0 900095 81 4



Resources 4/4

Investigations 1

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OTRNet Publications
www.otrnet.com.au

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