Notes for Workshops on  
Getting the Most from Mathematical Exercises

John Mason 2013

## Background

Let us assume that work has been done on a topic, which means both that the teacher has reminded themself of the *structure of the topic* (see for example Mason 2004 or 2006), and that learners have encountered some or all of the elements of that topic. This will mean that attention has been paid to all four aspects of the human psyche as it is traditionally viewed: enaction (behaviour), cognition (intellect, awareness), affect (disposition and purpose-utility) and attention.

Exercises are one of six possible modes of interaction between a learner, a teacher, and mathematics (Mason 2004). For exercises to be successful it is not sufficient that tasks be assigned by the teacher. Rather, exercising is a response by a learner to a desire to consolidate, review, gain facility and-or internalise appropriate actions (behaviours), and this is mediated or arranged by the teacher suggesting or assigning particular tasks.

## Preparing to Use A Set of Exercises

Before setting learners exercises, it is important to have a sense of how working on those exercises might enrich their conceptual appreciation and develop facility with techniques. This means asking a number of questions:

|  |  |
| --- | --- |
| Cognition (Intellect/Awareness) What images, associations, alternative presentations might be brought to mind?  What is available to be learned (what is being varied, what is invariant)? | Affect (disposition & purpose-utility) What are origins of topic?  Where are the techniques useful?  How are exercises seen by learners (epistemic stances)? |
| Enaction (Behaviour) What technical terms used or useful  What inner incantations helpful?  What specific techniques called upon and developed? | Attention–Will What was worth stressing and what ignoring?  What properties are called upon?  What relationships recognised? |

|  |  |
| --- | --- |
| Strategies for Exploiting Exercises | Reflection Strategies |
| Sort collection of different contexts, different variants, different parameters;  Characterise odd one out form three instances;  Put in order of anticipated challenge;  Do as many of these as you need to in order to be able to do any question of this type;  Construct (and do) an Easy, Hard, Peculiar and where possible a General task of this type;  Decide between appropriate and flawed solutions;  Describe how to recognise a task ‘of this type’; Tell someone ‘how to do a task of this type’ | What are tasks like these accomplishing (narrative about place in mathematics)  What technical terms involved?  What concepts called upon?  What mathematical themes encountered?  What mathematical powers used (and developed)?  What links or associations with other mathematical topics or techniques? |

Mason, J. & Johnston-Wilder, S. (2006 2nd edition). *Designing and Using Mathematical Tasks*. St. Albans: Tarquin.

Mason, J. & Johnston-Wilder, S. (2004). *Fundamental Constructs in Mathematics Education*, London: RoutledgeFalmer.