Take Time to Tap into Talent, and Clock into Students’ Needs

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It’s the start of the year. You are about to launch into the year’s mathematics curriculum (and everything else, of course). You are also getting to know a small sea of new, eager, and maybe not so eager, faces. But where should you start?

Of course, if this were “literacy” (English, language arts, or whatever you call it), this might be easy. You could give a quick screening test, such as the redoubtable Burt Word Test (Graded Vocabulary: eg. Pumfrey, 1970, pp. 77-78). (Incidentally the Burt test has been around in slightly different versions, and with different “norms” since the 1920s!) This can help you shuffle students into appropriate ability groups. Later, as you get to know the students better, you can move some of the students from one group to another.

The aim is to quickly match individuals, and small groups with reading material at an appropriate level of difficulty – hard enough to provide an acceptable challenge to learn, although not too easy to be a waste of time, and not too hard to be intimidating.

Is there anything comparable with regard to mathematics?

The KeyMath test (Connolly, Nachtman, and Pritchett, 1971, and revised versions) is very detailed. But it only works in one-to-one situations. It is not suitable for a whole class.

What we’re looking for is a short whole-class graded screening tool, with questions that range from easy Prep, up to, say, Year 8 or even 9 or 10.

Incidentally, do we really need to go that high? Consider the example of reading, again. Some children in Year 3 or 4 can read adult books, such as Jane Austen, or Lord of the Rings. Of course some are still struggling with very simple readers. It is important to find out what each can manage, and provide the optimum reading-practice challenge.

Similarly, with mathematics, some children in Year 3 or 4, or 5 can handle algebra and advanced mathematical reasoning. Others are still struggling to understand two-digit numbers and how to use them in calculations.

But if we never ask our students questions that are hard enough, we are unlikely to ever discover that— they can manage “advanced” mathematics. We can expect, roughly, that about one child in every three can handle the mathematics of the next year-level, and one child in every five can handle the mathematics of two years above. And so on.

If our goal is to make an optimum match between individual’s ability, and current level of achievement, and appropriate curriculum level, we have to try – carefully – to see just how far each of them can already go. Don’t make it a gruelling process for students. Encourage them to do their best, and not worry if they find the questions are getting hard. The “test” will be over fairly soon, and it will help you to help them to get the most out of their classroom mathematics experiences during all the rest of the year, because you will be able to match suitable experiences to individual needs.

As far as I am aware, there is no commercially available, normed screening instrument for school mathematics that can be used as easily as one of the classic “blunt-instrument” Sight Vocabulary tests. Perhaps the following short collection of Time questions can help.
I would be interested to hear from anyone who tries this.

Why Time? It's practical, and familiar, even for Preparatory level students on their first day of school. Certainly it is not a central strand or sub-strand in the mathematics curriculum, but it has the special advantage that, like money, it is learned and used outside of school; hence students answering these questions may reveal their overall ability, and their informally taught "street smarts", and not just the mathematics they have been drilled in.

**Making the Screening Profile:**

**Consider "Time" in the CSF.**

Drawing on the revised CSF II version published in 2000, I have selected a representative sample of Time-related learning outcomes. For each learning outcome I have, perhaps roughly, devised a Time-related question. It's as simple as that.

Assembling such curriculum focus and learning outcome statements for any particular topic or aspect of mathematics is a valuable preparatory planning exercise. Unless such an assembly task is carried out, the CSF leaves a fragmentary sense of how a topic develops from Level to Level across the cumulative years of schooling.

Incidentally, an extremely detailed Time "profile", and similar profiles, ranging from Prep to Year 6 are available for almost all Primary mathematics topics in *Diagnostic mathematical profiles* by John Gough (see Reference list). Some of the shorter profiles, possibly abridged, could also be used for this initial screening of current achievement and ability.

Just as "sight vocabulary" is, crucially, only a very narrow but potentially helpful window for looking at a student's whole collection of reading and comprehension skills, so a short one-topic profile can offer a narrow window for getting an initial sense of a student's whole mathematical achievement and ability. As with any "test", results should be interpreted sensitively, and cautiously. The alternative, namely not "testing", means you would start teaching blindly, or with no better basis for where and how to start than crude age-grade expectations. That may not be good enough.

**At the stated Level, students will:**

**Level 1: end of Prep year**

1.3 relate time to, and describe time in terms of, familiar recurring phenomena within own life: order own daily activities in a simple sequence (eg. woke up - got dressed - had breakfast).

**Level 2: end of Year 2**

2.1 Order times of day or of year by natural or cultural events (eg. sunrise, sunset, New Year, Easter).

**Year 3 benchmark:** sequence regular activities during a day, say the days of the week, and months of the year in order, and find dates on a calendar.

2.2 Use standard units of time (minutes and hours) to describe the time elapsed (duration) (eg. "It only takes a few minutes to brush my teeth, but I sleep for hours every night").

2.3 Tell the time using analogue and digital clocks: Year 3 benchmark: tell digital time in hours and minutes, and analog time in hours and half-hours.

**Level 3: end of Year 4**

3.1 Locate dates on a calendar, calculating days elapsed between two dates within the same year.

Classify events into those taking less than, more than, or about an hour, half an hour, or five minutes.

3.2 Tell analogue time to within 5 minutes (including quarter past, quarter to).
Year 5 benchmark: tell the time in hours and minutes on analogue and digital clocks.

Show digital time on an analogue clock, and vice versa.

Calculate minutes or hours before or after the current time or specified time (eg. to set an alarm clock).

- Level 4: end of Year 6
  (MAMET401)

4.1 Read local timetables correctly to plan a simple journey.
  (MAMET402)

4.2 Estimate the time taken to complete a task.

Calculate starting time and finishing time from elapsed time, and vice versa (eg. the person who got up latest did not necessarily sleep longest).

(MAMET403)

4.3 Use 12-hour and 24-hour time (eg. convert TV program to 24-hour time for VCR recording).

- Level 5: end of Year 8 (MAMET501)

5.1 Use clocks, calendars, timetables, including seconds and 24-hour time.

Produce a timeline (eg. significant dates in the history of the Australian continent).

- Level 6: end of Year 10 and extension
  (MAMET601)

6.1 Calculate time intervals when working with daylight saving, Australian and world time zones (eg. flight times from an international timetable).

Plan daily and travel schedules required to meet a deadline.

Scoring and Interpreting the Screening Results

After allowing enough time so that all the students have completed as much as possible of the Time Screening Profile, end the test. Move on to something different and more relaxing. Later, in your own time, correct their worksheets. Carefully interpret unclear diagrams or written answers. In some cases it may be helpful to re-test on a one-to-one basis, or interview some individuals to check any surprising gaps or slips. (This is a mathematics counterpart to a Process Writing “conference”. It can provide invaluable information as students explain aloud what they were thinking, and also get a second chance to tackle a tricky question.)

Where appropriate, give reasonable credit for close answers or acceptable alternative answers, or partial answers, or right-on-a-second-chance answers.

With the questions about non-o’clock times shown on analog clock diagrams (clocks with hands) carefully note any students whose hour-hands wrongly point to an exact hour.

Use a table or spreadsheet, with a column for each question, and a row for each student. Place a tick or cross, for each question, as appropriate, and a question-mark or similar helpful code for partial answers. Leave a blank for questions not attempted.

Calculate each student’s total of correct answers. Enter this at the end of each row.

Similarly, calculate the total of correct responses for each question.

Draw a green vertical line for the appropriate grade level placement of these students. (Eg. the line would be between 2b and 3a for students starting Grade 3.)

If you would find it helpful, calculate a percentage total, based on 100% if a student gets all answers correct for those questions that are below the student’s current grade level.

By this stage the implications about where each student is along the mathematics curriculum should be staring you in the face.

After this, what you do will be up to you, and your colleagues. But you will have established an excellent starting point.
Teacher Instructions

The Year levels are indicative, not prescriptive. This profile does not cover all of
Time as a topic in the curriculum. Of course young students should have the
questions read and explained to them. Treat this as a worksheet, not a test.
Encourage students to attempt all questions, to see how far they can go. If
students are not familiar with the idea of a particular question, explain it briefly,
using a similar example. Students can learn immediately from a one-shot one-off
lesson. Only when we ask students to attempt a sequence of graded questions can
we find out what they can already manage, possibly with a little explanation and
encouragement. Once we identify what they already know or can do, we simply
teach what comes next, building on students’ interests, starting from where they
currently are. Naturally students should work on their own, without talking.