Algebra "from Whoa to Go" in 8 Weeks

New Zealand high schools are expected to take 12-13 year olds with little or no algebra, and often a fear of the subject, to a level where they can simplify, expand and factor expressions and also solve equations with x on either side of the equal sign in about 8 weeks of work. This is one teacher's method for cutting through the fear and getting students, even bottom band classes, to a reasonable level of work.

Text:

When introducing algebra, my first rule is never to mention the word "algebra" until the students have invented the concept for themselves. Instead, we have a story and a problem to solve.

"Spud is an airport manager for a courier company. Yes, he really exists and is a friend of my son. I've called him Spud since he was 8 years old." (They always ask.)

At this point, I dump a mixture of large brown envelopes, film canisters, and white business envelopes onto the desk or floor and invite the boys to come up with a way for Spud to keep track of these items without knowing what is in the packages. They can feel something inside, but don't know what it is. They end up with a list

such as 4 large brown envelopes, 6 small white

envelopes, and 8 canisters.

Almost immediately, often with no suggestion

from me, the boys ask to abbreviate to one letter e.g.

4b, 6w, and 8c. I answer that mathematicians are

lazy, they want to write things as short as possible,

so the boy's suggestion is a good idea.

Another load comes in, and now the boys have

to combine and get a total for each kind of item.

They automatically assume that you "only add like to

like" and cheerfully come up to the board and write
$4b + 6w + 8c + 7b + 2w + 9c = 11b + 8w + 17c$.

Sometimes we get to 3 or more loads, but the boys

think this is a sensible way to keep track of things.

Usually the same day, I invite a boy to open one

brown envelope and we take out the contents – two

big pretzels, or 3 lollies – and they have no problem

replacing the requisite letter with a number and

working out the total of pretzels or lollies in the load.

It is only at this stage that I tell them **they** have

invented the basic idea of algebra, and the relief on

their faces at finding "that scary stuff, algebra" is

just common sense and not so scary is

wonderful to see.

Then to re- inforce their positive reaction, each

boy who correctly totals up several more loads is

allowed to select and open one container and eat the

contents. (This is based on the tried and true

method with my students that the fastest way to a

teenage boy's brain is via his stomach. In fact, my

department is budgeting at least $20 per teacher

next year for rewards of some sort.)

This also leads to the idea of **substituting numbers into an expression**.

5p + 2 , when each 'package' contains 3 pretzelsa gives

5 x 3 + 2 = 17 pretzels

Some solid practice has most boys competent

and very relaxed about the subject in a few periods.

Because of the imposed time-frame, within two

weeks I must introduce the idea of solving a basic

equation and getting the boys to write out clear,

neat steps. This brings us to the next story time.

One of the boys is invited to come up and

wrap up a present for his girlfriend. Another student

writes out the clear steps to

Wrap the present	Find out what the present is
wrap present in tissue unwrap tissue	
put tissue in box	take out tissue
close box	open the box
wrap box in paper	unwrap the paper
tie bow around box.	untie the bow

These are algorithms in a simple sense,

but are also the exact reverse of each other in the order of steps carried out and in the procedure at each step. This leads to two basic rules for finding out what is in a box represented by the letters the boys have been happily using.

Students here are taught the mnemonic "BEDMAS" for the order of calculation – brackets, exponents, division, multiplication, addition then subtraction. The reverse is obviously how you "unwrap" a letter and leads to just **two simple rules** for basic solving based on the boys' concrete concept of the package –

1. **SAMDEB is the order to use to unwrap a letter**

2. **undo something by doing the exact opposite.**

Whether you teach them to move a number across the equal sign and do the reverse operation, or use the balance method of doing the same to both sides doesn't matter.

I **never, ever** start with simple problems that the boys can guess, or they will think writing out steps is too much trouble. Typically, I start with something like $3x + 2 = 15$ and make sure that the answers do not come out to guessable whole numbers until they have been able to write out nice solutions in clear steps.

The first worksheet has an example:

7x – 5 = 29   cover the –5 with the end of your

pencil to see how to start the

next line, then move the -5

7x   = 29 **+ 5**

7x   = 34   now cover the 7 to see how to

start the next line and move 7

x $= \dfrac{34}{7}$.

The sheet then walks the students through several

problems.   By the 12th problem, some boys were

happily getting $5 - 2x = 14$ and $\dfrac{3x}{2} + 5 = 16$ correct even though this class is considered one of

the least

able at mathematics.

The biggest hindrance to students is the fear of

algebra. By letting them invent the basic idea,

and showing them how to use concepts they already

have for unwrapping things, this fear can be

removed and within the 8 week timeframe, all had

lost their fear of the word algebra, and could do the

basic equations such as $3x + 2 = 15$, while the best

were able to cope with equations such as

$5(2x + 2) - (2x - 3) = 5(x + 1)$.