

Sensible and crazy numbers



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Using a game-based context and concentrating explicitly on language, students in the early years are able to make sense about place value amid the vagaries of the English language in naming numbers. This conceptual approach to understanding place value allows students to further develop number strategies beyond counting by ones.

These two variants on the popular counting game ‘Buzz’ are designed to prompt young students to think more deeply about the number names, and to strengthen their understanding of place value.

It is widely known that the English language system for naming numbers is not particularly intuitive and lacks a clear, systematic structure (Morin & Franks, 2009). Research suggests that this hinders student understanding of place value and overall development of number sense, compared with students who learn the number system in a language which follows a clearer structure, such as Japanese, Korean or Chinese (Fuson & Li, 2009; Miura, Okamoto, Kim, Steere & Fayol, 1993). Recent longitudinal evidence has emerged outlining how introducing a program involving explicit number-naming at pre-school level improves children’s number sense and place value recognition into primary school (Magargee & Beuford, 2016). Moreover, it appears that the superior mathematical performance of those children who participated in the pre-school explicit number-naming program is sustained into the later years of primary school (Magargee & Beuford, 2016).

As an early years’ primary teacher, I have chosen to confront this issue head-on through endeavouring to introduce explicit number names alongside ‘ordinary’ number names. In my classroom, this has involved distinguishing between what we term ‘sensible’ and ‘crazy’ numbers, and exploring these ideas through playing a couple of variants on the popular counting game Buzz.

Introducing sensible and crazy numbers

The lack of a clear pattern in English number names can make grasping place value very difficult for students

(Morin & Franks, 2009). Early on in Grade 1, I introduce students to the concept of sensible and crazy numbers.

I begin with a think-pair-share activity where, as a whole class, we explore the suffix ‘ty’ by asking questions such as:

- “What do you think the ‘ty’ might stand for in sixty-seven?”
- “What do you think the ‘ty’ might stand for in seventy-three?”

Once students have come to the consensus that it likely means ten, I note how such numbers are very sensibly named, because they tell us exactly what ‘lives inside them’. For example, eighty-three tells us that it is made up of eight tens and three ones. To emphasise this point, I frequently write two digit numbers so they are separated by the suffix ‘ty’ (e.g., 8-ty-3 or 6-ty-7).

I then contrast this with examples of numbers that are not so sensibly named. Of course, the biggest culprit are the teen numbers, where the tens and ones are inverted. However, there are other numbers with a somewhat confusing structure. In particular, we discuss how the decades thirty and fifty are for some reason related to the ordinal terms third and fifth instead of the cardinal terms three and five. We then address how the prefix “twen” in twenty appears to be linked to two, given the similarities in spelling, and because other similar sounding words also mean two (e.g., twin).

However, as a class, we lament the fact that the ‘w’ in two is silent, because this would make the connection between two and twen far more obvious.

After this discussion, students generally accept that the names of these decades provide a hint about the

structure of the corresponding number. However, after we make these connections, I allow myself to become mock outraged in front of the class, and ask a string of rhetorical questions such as:

- “Why did those people who designed our language make learning the number names so confusing?”
- “Why isn’t fourteen one-ty-four? It sounds like it means four tens!”
- “Thirty-two almost sounds right, but why couldn’t it just be called three-ty-two?”

I encourage the class to come to the conclusion that some of the names for numbers are a “bit crazy”, which makes learning mathematics in English more difficult than in many other languages.

As a class, we then classify numbers into those which are sensible (numbers which follow the A-ty-B structure, grey in the figure below) and those which are crazy (numbers which do not follow the A-ty-B structure, purple in the figure below).

This activity provides students with the requisite background for engaging in our of whole-of-class games: Sensible Buzz and Crazy Buzz.

What is Buzz?

Buzz is a simple game to help build student familiarity with our base-ten place value system. The whole class stands in a circle, and the teacher chooses a student to begin the game. The student calls out “one”, and the student to his or her left calls out “two”, the next student “three” and so on, with the sequence continuing clockwise around the classroom. The student who calls out the number “ten” then says the word “buzz” and sits down. He or she is out of the game, and the count continues from eleven. Continuing this pattern, each time a multiple of ten is reached (i.e., twenty, thirty etc), the student whose turn it is calls out “buzz” after their number, and then sits down. Although there are many variants of this game, I generally continue counting until I reach 100 or 120 (by which time around half of the class has sat down). I make the student who calls out the number “100” or “120” the winner.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Figure 1: Sensible (grey) numbers and crazy (purple) numbers.

What is Sensible Buzz?

The idea of Sensible Buzz involves renaming all numbers from eleven onwards according to the pattern that regulates all of our numbers from 40 to 49 and 60 to 99, where the number of tens and the number of ones in each number is clearly stated in the number name (with the suffix ‘ty’ taken to represent ‘ten’). So eleven becomes ‘one-ty-one’, twelve becomes ‘one-ty-two’, thirty-six becomes ‘three-ty-six’ and so on. We then play a game of Sensible Buzz where we use sensible number names instead of the regular English language number names. Once students grasp the pattern, I find the game flows as smoothly as a game of regular Buzz.

To support students to make connections with the corresponding place value concepts, I allow them to view a hundreds chart whilst playing the game. I also occasionally interrupt students during the game to ask a student who is sitting out of the game (because they have already been ‘buzzed’) the question “What lives inside that number?”, and give another ‘buzzed’ student the instruction “Show me what lives inside that number”. I expect the first student to tell me how many tens and how many ones make up that particular number, whilst the second nominated student rapidly constructs the number on our class bead-frame. If both students answer correctly, they are back in the game. This not only reinforces the place value concept, but encourages students who have been ‘buzzed’ to remain engaged in the game.

For example, after a student calls out “five-ty-nine”, I might quickly turn to two of the buzzed students and ask “What lives inside that number?” and “Show me what lives inside that number”. I would expect the first student to respond verbally “five tens and nine ones” and the second student to display five tens and nine ones on the bead-frame.

What is Crazy Buzz?

Once students are familiar with the concept of sensible numbers and the Sensible Buzz game, they are ready for Crazy Buzz. When playing Crazy Buzz, we use the regular number names, and all the regular rules of Buzz apply (e.g., students who call out a multiple of ten follow this with the word ‘buzz’ and then sit down). However, in every instance when we encounter a number that does not fit the ‘sensible’ pattern (i.e., A-ty-B), the student has to make a crazy face when they state the number. Students who forget to make

a crazy face, or who make a crazy face when stating a sensible number, are also out of the game.

For example, the student who states “eleven” needs to make a crazy face, as does the student who states “twenty-seven” (because if it was sensible it would be two-ty-seven). However, the student who states “forty-six” must keep a straight, sensible face (we can ignore the different spelling – the point is that it sounds like four-ty-six). During games of Crazy Buzz, I also ask the question “What lives inside that number?” as a way of allowing buzzed students back into the game. This provides another opportunity for reinforcing the idea that sensible numbers tell us what lives inside them (e.g., sixty-seven tells me it has six tens and seven ones), however crazy numbers do not (even though they do hint at it).

An alternative, somewhat simpler and less competitive version of Crazy Buzz does not require students to sit down on multiples of ten. The class objective in this game is to keep the count going around the circle until the number 100 is reached, making as few errors as a class as possible (recall that an ‘error’ in Crazy Buzz is made when a student makes a sensible face instead of a crazy face, or vice versa). The teacher can keep track of the number of errors the class makes and offer a whole-of-class reward (e.g., eating lunch outside) if the group can complete the game without making any errors, or manages to beat their previous record.

Supporting the development of mathematical proficiency

In addition to building fluency with counting I believe the current activities have implications for two of the other proficiency strands, reasoning and understanding, identified in the *Australian Curriculum: Mathematics* (ACARA, 2015). Specifically, the process of engaging students in the discussion about the structure of the English number names promotes mathematical reasoning, as students have to reflect on and consider the extent to which our number naming system is logically sound. It encourages students to engage in a meaningful discussion about an important concept (i.e., number names) that can on the surface seem arbitrary, and enables students to connect the known (i.e., the A-ty-B structure of ‘sensible’ numbers) to the unknown (e.g., other numbers that are less sensibly named, such as the teen numbers).

With regards to building understanding, playing these games regularly in the classroom can enhance student conceptual understanding of place value,

which can in turn improve fluency with mathematical processes and procedures beyond counting by ones. For instance, students may resort to their knowledge of the sensible number names when attempting to count by tens from a non-zero starting number (e.g., three, one-ty-three, two-ty-three, three-ty-three etc), because sensible number names make the link between counting on by ones and counting on by tens far more explicit. This deeper knowledge of the base-10 structure of our number system can then in turn support students to appropriately apply the ‘jump’ strategy when adding two-digit numbers (e.g., $37 + 32 = “37, 47, 57, 67, 68, 69”$).

I find students really engage with these two variants of Buzz, and that playing them has generated many stimulating discussions about place value. I hope you find the concept of Sensible and Crazy Numbers, and the associated buzz games, to be of some benefit in your own classrooms.

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Figure 2: A game of Crazy Buzz