"I've got it!" – A Card Game for Developing Number Sense and Fluency

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INTRODUCTION

The Foundation Phase CAPS document indicates that learners exiting the Foundation Phase should do so with "a secure number sense and operational fluency" and that these learners should be "competent and confident with numbers and calculations" (Department of Basic Education, 2011a, p. 8). In the context of the Foundation Phase the development of number sense includes the meaning of different kinds of numbers, the relationship between different kinds of numbers, and the effect of operating with numbers. In the Intermediate Phase this development of number sense and operational fluency should continue, with the number range, kinds of numbers, and calculation techniques all being extended. However, from my experience in the South African context, many learners are still reliant on concrete one-to-one methods of calculation such as finger counting or tally marks throughout the primary grades. This unfortunately does not match the expected level of fluency as reflected in the official CAPS documents (Department of Basic Education, 2011a, 2011b).

DEVELOPING NUMBER SENSE THROUGH GAMES

Number sense is important because it is the foundation upon which all higher level mathematics is built. Having good number sense can be thought of as having a well structured conceptual framework of basic number facts such that allow one to work with numbers and number relationships in a flexible way. While the mathematics education literature is awash with ideas about ways to teach our learners their basic maths facts, what most maths educators agree on is that learners need to reason and work with numbers in different ways rather than only through drill and practice. An important aspect of developing number sense and computational fluency is to engage learners in activities that require flexible thinking and sense making.

Fosnot and Dolk (2001) advocate that playing card and dice games "provide rich contexts for mathematical learning" (p.37). In my work over the last 4 years with the South African Numeracy Chair project I have worked with Grade 3 and 4 learners in after-school maths clubs. In these clubs I use a wide variety of playing card and dice games to promote the development of both number sense and fluency in the club learners. I developed the game described in this article as an activity that could be used in these clubs to encourage learners to use numbers in different ways and to develop fluency with numbers and the four basic operations, particularly multiplication.

HOW TO PLAY THE "I'VE GOT IT!" CARD GAME

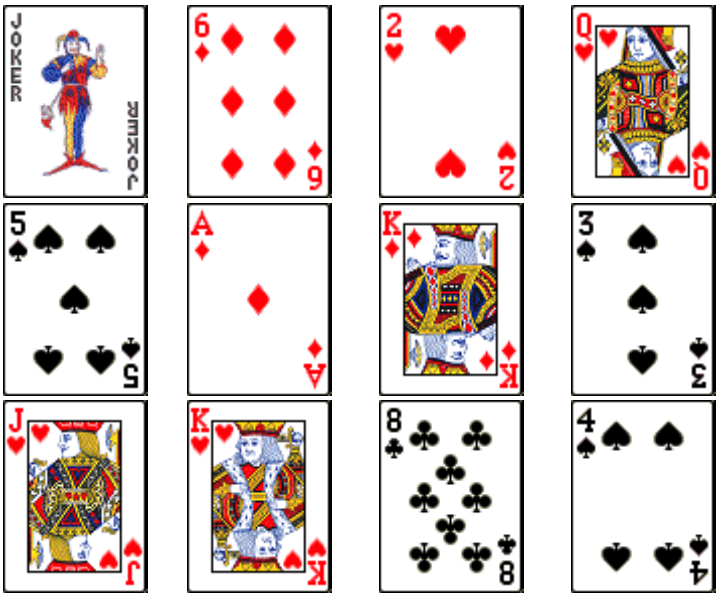
The game uses ordinary decks of 52 playing cards. Each card represents the numerical value displayed on the card. For cards without a numerical value, the following apply: Ace = 1, Jack = 11, Queen = 12 and King = 13. Jokers can also be included and should be valued at a specific number of your choosing, such as 15 or 20.

The instructions for the game are as follows:

1. Organise the learners into groups of two, three or four (depending on how many packs of cards you have available) and give each group a pack of cards, a piece of scrap paper and a pencil.

2. Explain which numerical value each card represents.

3. Each group shuffles their pack of cards and lays out twelve cards in a 4 by 3 array. An example of such an array is shown below:



4. A set of target numbers is then given to the learners. Each group initially works with the same set of target numbers. The purpose of the game is for each group to use the numerical values of the cards in the 4 by 3 array to arrive at any of the target numbers. Learners can use as many cards as they like to accomplish this, and they can use any combinations of the four operations – addition, subtraction, multiplication and division. The only requirement is that a multiplication operation MUST be used in each calculation of a target number. A good set of target numbers to begin with is 12, 18 and 24.

5. Each group plays the game independently, and the learners in each group take turns to calculate one of the target numbers from the array of cards.

6. When a learner has found a combination of cards that yields one of the target numbers they say *"I've got it!"* They then need to explain their calculation to the other members of the group. When the group agrees that the calculation is correct, it is recorded on the group's piece of paper, and the cards used in the calculation are removed from the array.

7. The gaps in the layout of cards are then filled with new cards from the remaining pack and the next member of the group has a turn to calculate one of the target numbers.

8. The game continues in this manner for an agreed upon duration of time or until all the cards in the pack have been used.

DISCUSSION

The *"I've got it!"* game has been specifically designed to have variable entry points. By this I mean that the same basic game can have different points of entry for different learners depending on their age or level of mathematical proficiency. Another important feature of the game is that it allows for different solution paths that can vary in complexity depending on the kinds of mathematical operations and multiplication knowledge being used.

The initial set of suggested target numbers is 12, 18 and 24. These numbers have been specifically chosen because they have a number of relatively small factors (e.g. 2, 3, 4, 6 and 8) and thus allow learners with different levels of multiplication knowledge and ability to find combinations of cards that give one of the target numbers. Given the 4 by 3 array of cards on the previous page, learners could for example arrive at the target number of 12 by multiplying 3 and 6. Alternatively one could get the target number of 24 by multiplying 8 and 3 or 6 and 4. More advanced learners might explore more complex routes to one of the target numbers. The target number of 18 for example can be arrived at by adding 5 and 4 and then multiplying the result by 2, i.e. $(5+4)\times 2$. More complex still, the target number of 24 could be arrived at as follows: $(13-11)\times(8\div 2)\times 3$. As learners progress, one can move on to larger target numbers – the set of 24, 42 and 100 works well. Alternatively make up your own set of target numbers. For older learners, the number targets can be changed to include not only larger numbers, but numbers that have different multiplication factors such as 7 and 9.

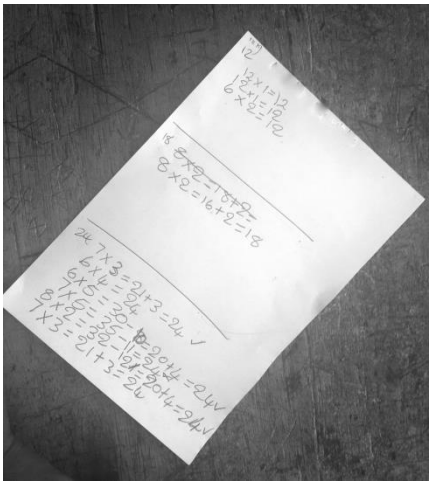
The rationale behind getting each group to record their various calculations is for learners to capture a variety of calculations that all yield the given target numbers. A structured way of doing this is to divide the sheet of paper into three sections, one for each of the three target numbers, and for learners to record their various sums under each of these target numbers. At the conclusion of the game one can then explore the different routes to each target number, and even compare and discuss calculations from different groups. As a teacher you may find it necessary to move around between groups to show learners how to use brackets when writing down their sums, or to show them how to lay out their sums in stages (step notation). The following table shows examples of operations generated by learners for the array of cards shown on the previous page. The Joker was set at a value of 20. Both bracket notation and step notation equivalents are shown where applicable.

Target number: 12		**Target number: 18**		**Target number: 24**	
Bracket notation	*Step notation*	*Bracket notation*	*Step notation*	*Bracket notation*	*Step notation*
3 x 4 = 12		3 x 6 = 18		6 x 4 = 24	
2 x 6 = 12		(8 + 1) x 2 = 18	8 + 1 = 9 9 x 2 = **18**	(5 + 1) x 4 = 24	5 + 1 = 6 6 x 4 = **24**
(5 x 3) – (2 + 1) = 12	5 x 3 = 15 2 + 1 = 3 15 – 3 = **12**	((5 + 6) x 2) – 4 = 18	5 + 6 = 11 11 x 2 = 22 22 – 4 = **18**	(13 + 13) – (2 x 1) = 24	13 + 13 = 26 2 x 1 = 2 26 – 2 = **24**
(5+1) x 2 = 12	5 + 1 = 6 6 x 2 = **12**	(5 + 4) x 2 = 18	5 + 4 = 9 9 x 2 = **18**	(3 + 1) x 6 = 24	3 + 1 = 4 4 x 6 = **24**
(13+12) – (13 x 1) = 12	13 + 12 = 25 13 x 1 = 13 25 – 13 = **12**	(5 + 4) x (3 – 1) = 18	5 + 4 = 9 3 – 1 = 2 9 x 2 = **18**	(20 x 2) – (11 + 5) = 24	20 x 2 = 40 11 + 5 = 16 40 – 16 = **24**

The basic *"I've got it!"* game can be adjusted to suit the ability of the learners. For example, if you want to make the multiplication aspect more accessible for younger learners then remove the face cards and Jokers from the pack before you start. If learners are unable to make a target number with the cards in the layout, they could add another layer of cards on top of the original cards and work with those instead.

To encourage learners to think more creatively, once a calculation for one of the target numbers has been determined and the corresponding cards have been removed from the 4 by 3 array, challenge learners to find a further target number *before* filling the empty gaps in the array with new cards.

As the game progresses, it's important to move around between the groups and provide appropriate assistance where necessary. For example, if learners are unable to arrive at a target number directly using a product then suggest alternative strategies such as finding a product giving an answer *bigger* than one of the target numbers and then finding ways of subtracting an appropriate amount to get to one of the target numbers. For example, to find the target number of 24 one could encourage learners to multiply 7 by 5 to get 35 (if these cards are in the layout) and then ask what needs to be subtracted from 35 to get 24. An easy card to choose would be the Jack (value of 11) if it is in the layout, but learners could also add or subtract two or more cards to make 11, for example 6 + 5, 13 (King) – 2 and so on.



PLAYING THE GAME BEYOND THE CLASSROOM

Not only can this game be played in the classroom, but games like these make perfect holiday activities – either played alone or with family members of different ages. This is an excellent way of keeping one's number sense and numeric skills sharp over the long holidays.

For more playing card and dice games, download a free booklet from our website:
http://www.ru.ac.za/sanc/resources/numeracyproducts/

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