

Making the most of games: Lesson learned from playing Numero

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Abstract: *Games have been advocated as a means of encouraging children to learn mathematics. Often it is simply assumed that by playing a game children will learn what the teacher intended them to learn. Clearly this is not the case. In this paper we outline the factors that help to maximise the learning opportunities. The game Numero® is used as an example.*

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Introduction

Several authors have focussed on the benefits of playing games in the mathematics classroom (Ainley, 1990; Ernest, 1988, Booker, 2000) but under what circumstances games contribute to learning is less clear. In many cases teachers refer to games being ‘fun’ or removing the drudgery from drill and practice sessions. Onslow (1990) referred to games as improving the learning environment and adding to the motivation for children to learn. Booker (2000) maintains that games be used for developing concepts and not just simply for reinforcing skills. This implies that when choosing a game the teacher should consider the underlying mathematics that the game aims to develop. Often teachers focus on the attractiveness of the game rather than the mathematics to be developed from the game.

For children the idea of game playing in mathematics differs from the notion of playing games in the playground where the rules are often made up on the spur of the moment or where rules have been passed down from generation to generation of school children. Likewise playing a game with the family at home can be quite a different experience to playing a game in the classroom. For example a child may play Monopoly at home with siblings and parents, where the game continues for a long period of time and where parents or older siblings intervene to settle disputes. Rules are more likely to be bent in these situations, for example, by every player being ‘given’ \$500 from the Bank when one player runs short of cash. In the classroom context generally the game will be of short duration and the children need to develop the social skills to play. There are some examples of cross over games such as Battleships that may be played at home or in class.

The authors have noted that it is often the case in school that fast finishers are given games as a reward. While this may encourage children to complete a set amount of work, the efficacy of such an approach must be questioned. If the game is deemed to be a valuable and worthwhile learning experience why not have the entire class play. Often it is the weaker or slower children who would gain the most benefit from mathematics being presented in a more interesting form. Booker (2000) argued that it is the discussion that takes place during the game between participants and after the game via whole class discussion that really focuses the children on what they should be learning. This is in line with social constructivist theory that highlights the value of student – student and student – teacher talk.

It should be noted that the social context of game playing may also help to reduce the stress so often associated with learning mathematics. For example Bight and Harvey (1982) suggested that children were more likely to risk making mathematic errors when playing a game without overly worrying about their peers (p. 205).

It has also been noted that children often do not translate what they learn in games into the more formal settings encountered in school (Rogers, 1989). This is possibly because it is assumed that by playing a game the children construct the desired knowledge, whereas they

may not. As noted earlier, without clear guidance and follow-up discussion children may not be attuned to what they should have learned. Children may also experience trouble in moving from the informal to the formal in mathematics. For example it is one thing to explain an idea in words but quite another to write it down paying attention to the conventions of mathematics.

Booker (2004) noted that listening to other players, talking about what is happening and even assisting others to understand and complete the tasks involved in the game come to be seen as critical playing behaviours. (p. 16)

Booker cautioned that a number of factors concerning instructional games, methods of play and the manner in which games need to be integrated into a mathematics program should be considered when choosing, developing or adapting a game to promote learning (Booker, 2000). Booker provides a list of factors to be considered when choosing a game. (2004, p. 17)

Número

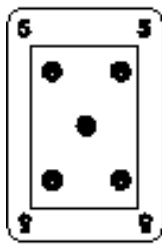
Número® is a card game that may be played at different levels depending on the choice of cards included in the pack. The pack is made up of four sets of cards numbered 1 – 15, each in a different colour (red, blue, green and yellow). The first level of the game uses only these cards and involves combining or adding cards. At higher levels wild cards ($-$, \times and \div) are added; and later still fraction, percentage and decimal wild cards, along with square, square roots, cube and cube roots may be added.

For a detailed explanation of the game see www.numero.org. An instructors guide may be found at <http://www.ricgroup.com.au/Prim-ed%20Aust/Mathematicsaus/2992aus.html>

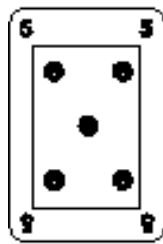
Essentially the game revolves around three rules.

1. Each turn, play one numbered card from your hand.
2. When you build you must have the answer in your hand in a single card
3. A wild card played from your hand gives an extra turn.

The aim of the game is to make the best 'take' that you can using the cards in your hand and those on the table. At the simplest level a take is made by matching a single card from the hand to a single card from the centre.



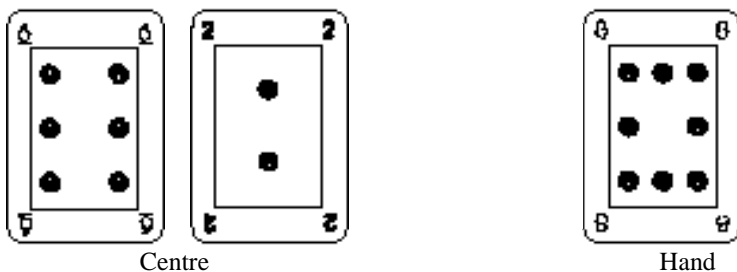
Centre



Hand

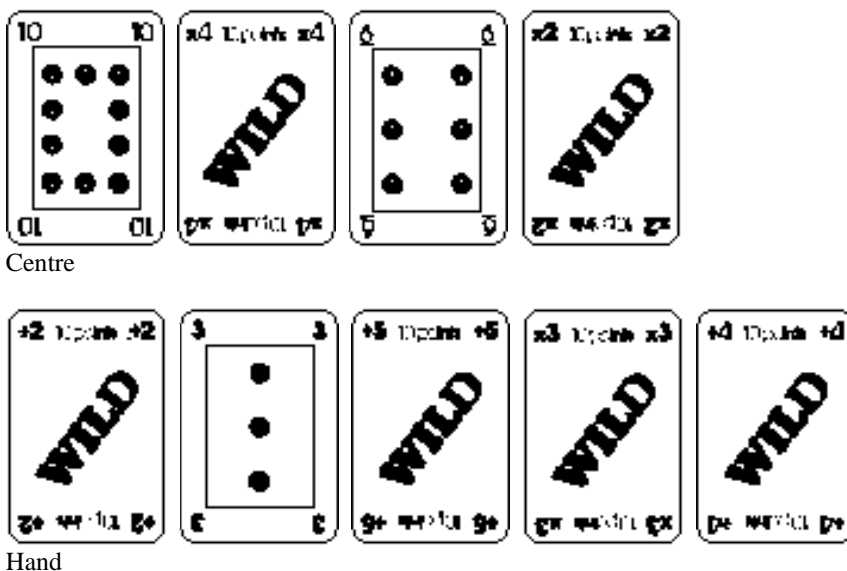
In this case the 5 from the hand is played onto the 5 in the centre. Both cards are placed face down on the table next to the player. These cards are now out of play and the player must pick up from the deck to maintain five cards in his/her hand.

Combining cards allows for other ‘takes’. In particular, when teaching the game, participants are encouraged to verbalise their moves. In this case children would be encouraged to state “six and two is 8”. This verbalisation not only reinforces an individuals’ thinking but also allows others to follow the reasoning used to arrive at the solution.



The 8 from the hand is used to win the 6 + 2 from the centre.

At first the game may appear fairly simple but moves such as the ones illustrated below indicate how complex the game playing can become.



The six Wild Cards available means that a wide variety of different moves are now possible.

Consider the following move that involves the use of zero using the above cards.

- (i) $10 \div 5 = 2$
- (ii) $2 - 2 = 0$
- (iii) $0 \times 4 = 0$
- (iv) $0 \div 4 = 0$
- (v) $0 \times 3 = 0$
- (vi) $0 + 6 = 6$
- (vii) $6 \div 2 = 3$

TAKE with your 3, to win **all** cards.

(Drysdale, 1995, p. 22)

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The authors noted when teaching the game, while it may be played in the usual card-playing fashion with children holding the cards to their chest, it is better to play with cards face up on the table to start with. This has several advantages. It removes some of the competitive element of the game. It allows children to work cooperatively to assist each other to find the best move. It also means children complete more mental calculations as they consider moves for other students and then anticipate possible moves for their upcoming turn.

Asplin (2003) completed a study where she examined the role of games and in particular Numero® in the development of mental computation. She found that children enjoyed playing Numero and helped to foster positive attitudes toward mathematics. She also found that by verbalising moves, children shared their mental strategies. Clearly this verbalising or sharing of strategies for producing 'builds' is a key element of the game. Playing with cards face up in the early stages of learning the game appears to encourage the verbalising of moves.

Asplin (2003) also noted that regularity of use and involvement of the teacher were key factors in children developing improved understandings. Sometimes teachers use games as time fillers. Using games in this way devalues the game and can be counterproductive. This is certainly the case with Numero®.

The results of Asplin's study indicate that used in the right conditions Numero® is a very useful game for developing number sense. The conditions that she mentions concur with authors quoted earlier.

The problem solving aspect of Numero® is often forgotten. In Western Australia a weekly Numero challenge appears in the West Australian Newspaper. An example is shown below. Students are encouraged to send in their solutions, with prizes offered for the best ones. The written solutions to such problems provide an interesting window to children's thinking about calculation. In addition an interschool challenge is run once a year where a group of four children from one school play another. The competition includes playing the standard game of Numero® as well as the solving of Numero® challenges.

Conclusion

The playing of games in mathematics has been advocated as a means of improving attitudes toward mathematics. In particular, games have been used as a means of providing skills practice. Some authors such as Booker advocate the use of games to develop concepts. Regardless of how games are used the authors argue that the teacher plays a pivotal role as to whether the game will be effective. Games in and of themselves do not necessarily teach. Teachers, however, may create an environment, via the use of games and discussion that help children learn. In the case of the game Numero® a simple instruction to 'verbalise the moves that were made' appears to have enhanced the learning that took place.

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