M & M & Ms: An Alternative Context for Teaching Mean, Median and Mode

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Too much mathematics instruction occurs by means of traditional modes of direct instruction. That is, as teachers we regularly expect our students to sit quietly and absorb our explanations of mathematical procedures and algorithms, and then apply and practise their new learnings by solving word problems. Several items are missing from this scenario: student discussion and talk, involvement and reflection, and (most important) motivation and enjoyment. Cognitive psychology tells us that language and learning are integrally linked. If this is so, then we all need an opportunity to talk about our ideas and to share our generalizations. We also need an opportunity to evaluate our learning and reconsider what we have believed to be true: reflection is an essential element in the revision, sorting and linking of new concepts. We also know that where students are not interested in instruction and not involved in the activities prepared for them, they will not learn. We cannot force students to talk about mathematics, to involve themselves in our lessons or to reflect, and we cannot force them to like our classes. We can, however, provide the most enjoyable and stimulating context that will encourage them to talk, reflect and participate, and thus to learn.

Games provide one possible context in which students may encounter mathematics in a more dynamic manner. Games provide drill and practice around specific objectives. They are fun and exciting. They give students a chance to talk, share and generalize about new ideas while using key mathematical terms. Games seem to be widely adopted in the lower elementary classroom but disappear rapidly from instruction in the upper grade levels. Why are they not more commonly used? One reason may be that teachers believe students no longer enjoy games once they have left elementary school: students feel too grown up. Yet, we adults enjoy games —why wouldn't our students? A second reason for this phenomenon may be that games are more difficult to devise for the upper grade levels. This article presents an example of a suitable game.

M & M & Ms is used to help teach the concepts of mean, median and mode. It provides students with an opportunity to practise calculating each measure of central tendency with simple, small sets of values. The game also provides students with an opportunity to generalize about how large and small numbers in a set affect the resulting central tendency of the entire set. Finally, the game provides a context for the process of comparing mean, median and mode.

To implement the game effectively, the teacher will need to discuss the algorithms for the computation of each measure. The concept of mean will undoubtedly be familiar to the students, so little time need be spent there. After reviewing the concept of mean, the class should be divided into groups of three or four, given a deck of cards and allowed to play one round of the game in their groups (game instructions and card decks are included in the following pages). The teacher should provide a description and demonstration of a median and repeat the game allowing the students (in their groups) to play for the highest median. Again, the teacher should be sure to discuss the strategy involved by providing and discussing

some examples. Repeat the process a second time when dealing with the concept of mode.

At first the students will probably believe that the only strategy necessary is always to replace a low card with a high card; however, this is true only with mean. Let's take an example. Assume you have the following cards in your hand: 2, 9, 10. The next card is face up on the discard pile: 5. Your current mean is 7, and your current median is 9. If you are playing for the highest mean, replacing the 2 card in your hand with the 5 card will improve your mean; that is, simply to trade the lowest card in your hand for a higher card is a productive move. If you are playing for the highest median, then trading the 2 card for the 5 card will not improve your score. Therefore, a different strategy may be necessary for the median game than for the mean game.

It should be obvious from the above that discussion is an important dimension of this activity. During the discussion the teacher should try to maximize the number of generalizations derived by the students rather than provide generalizations to the class. Students may need to play the game more than once to make the relevant observations. Some possible questions to help focus the discussion are:

- Is it always true that you should exchange a low card for a high card? When would you want to do so?
- How would you make a decision between drawing a card or taking a card from the discard pile when you are playing for the highest mean? highest median? highest mode?
- What is the effect of a high card (50 card) on the mean of a set of numbers? the median of the set? the mode of the set?
- What is the effect of a low card (0 card) on the mean of a set of numbers? the median of the set? the mode of the set?
- If all three of your cards are different, what is your mode? How many like cards are necessary to create a mode?
- How does the mode of the set of numbers change if you have three like cards rather than two like cards?
- Which is easiest to get: a high mean, median or mode? Why?
- If you had a 7 and two 10s in your hand and you drew the 50 card, which would change the most, the mean, the median, or the mode?

Games represent one method by which teachers can give students a chance to talk, compare and generalize from their experiences. As we continue to look for new contexts in which students can encounter and verbalize mathematical concepts we increase their opportunity to learn effectively. The measures of central tendency can be taught through a direct do-as-I-say approach; the important question is whether they can best be learned that way.

M & M & Ms

Objectives

(a) To calculate the mean or median or mode of a set of numbers

(b) To compare the relative impact of a small or large number on the mean, median and mode of a set of numbers
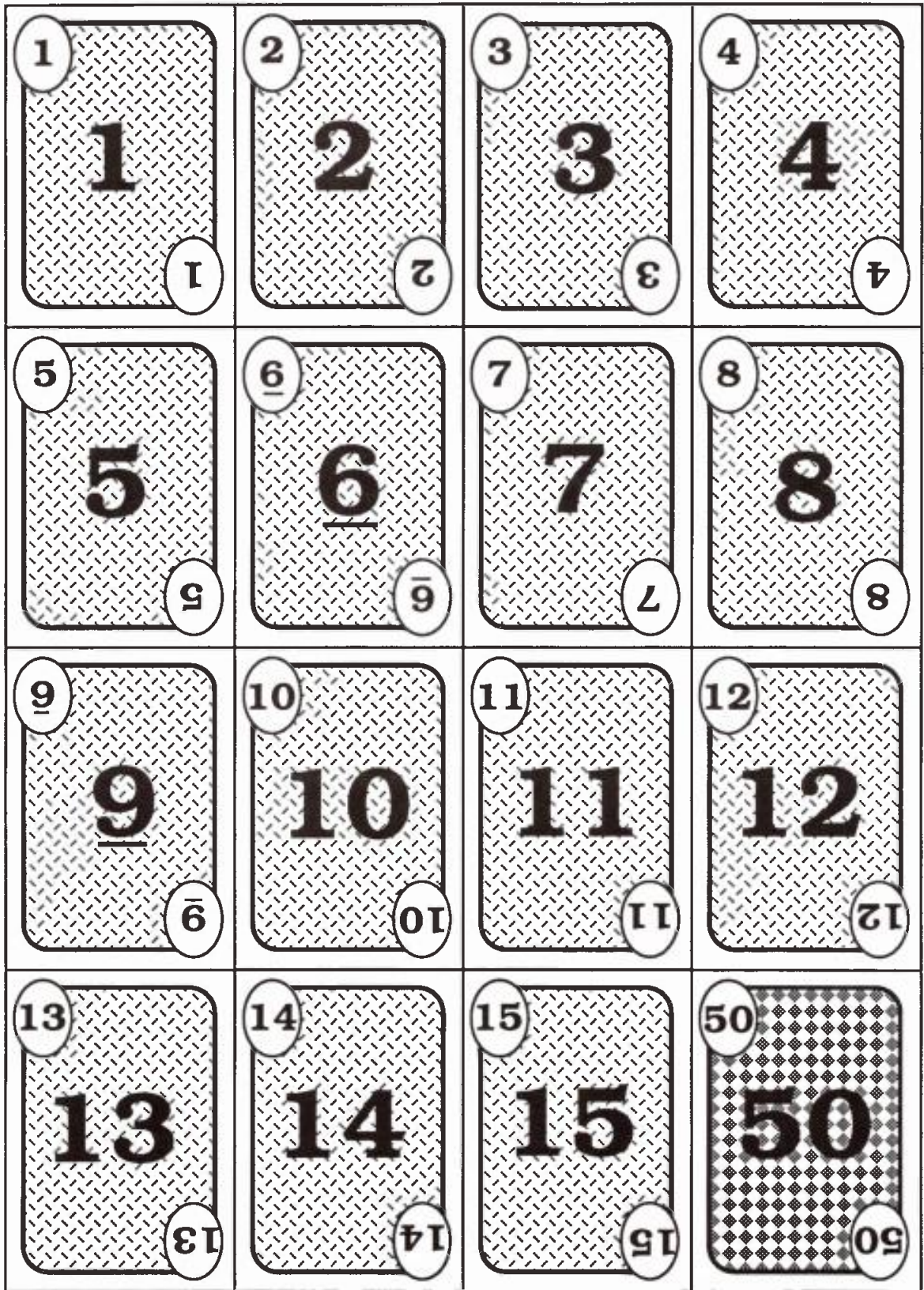
Rules

(a) Players decide whether they are playing for the highest mean, median or mode.

(b) Three cards are dealt face down to each player. The remaining cards are then placed face down in a stack to create the draw pile. The top card is turned over and placed beside the draw pile to start the discard pile.

(c) The person to the left of the dealer begins. This player has the choice of either taking the top card from the draw pile, the top card from the discard pile or knocking.

(d) If the player chooses to take the top card from the draw pile, he/she adds it to his/her hand, and then must discard (face up in the discard pile) one card from his/her hand. Play then proceeds to the left.

(e) If the player chooses to take the top card form the discard pile, he/she exchanges it with one card from his/her hand. Play proceeds to the left.

(f) When a player decides that the cards in his/her hand probably have a higher mean (or median or mode) than that of any of the other players, he/she knocks on the table and passes play to the left. Each of the remaining players gets one more turn.

(g) After each player has had one final turn (except the person who knocked), all players lay down their hands and compare to see who has the highest mean, median or mode. The player with the highest score wins.

(h) If all the cards in the draw pile have been used up before anyone knocks, the cards in the discard pile are shuffled and turned over to form a new draw pile.

Game Variations

(a) Players are dealt more than three cards, such as four or five. Not too many cards should be dealt, however, as it makes it too difficult to calculate the mean mentally.

(b) Each player is initially dealt four cards, three of which he/she keeps in his/her hand and one of which remains face down on the table in front of the player. When the mean, median or mode is calculated at the end of the game, this card is added into his/her hand.

1 1	**2** 2	**3** 3	**4** 4
5 5	**6** 6	**7** 7	**8** 8
9 9	**10** 10	**11** 11	**12** 12
13 13	**14** 14	**15** 15	**50** 50

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1 1 1	**2** 2 2	**3** 3 3	**4** 4 4
5 5 5	**6** 6 6	**7** 7 7	**8** 8 8
9 9 9	**10** 10 10	**11** 11 11	**12** 12 12
13 13 13	**14** 14 14	**15** 15 15	**0** 0 0

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