M&M's®

According to officials of Mars®, makers of M&M's® Plain Chocolate Candies, there are 30% brown, 20% yellow, 20% red, 10% orange, 10% green and 10% tan candies in each bag.

Conduct an investigation to determine the validity of these numbers. Do your investigation results agree with these numbers? Are the officials right?

Grade Levels 6 - 8

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Context

I read this interesting "Did You Know...." tidbit in the February 1995 *NCTM Bulletin*. I had used M&M's® in the past for calculating fractions, percents, assigning probability and collecting statistical data. As I was in the middle of working with my heterogeneous group of sixth and seventh grade students on fractions and percents, I thought they might enjoy testing the credibility of the Mars® Corporation.

What This Task Accomplishes

This task addresses nine of the 13 NCTM Curriculum Standards for grades 5 - 8. (See the *Exemplars* matrix.) It definitely engaged the students and provided an opportunity to use skills for scientific discovery, as well as math problem-solving skills.

What the Student Will Do

Students were asked to bring in 47.9 gram (1.67 ounce) bags of plain M&M® candies as a homework assignment. I suggest you ask them to bring them in the day before you want them, as some are bound to forget. A few brought different sized bags and that only added to the complexity of the task, as the news item did not specify any one size of bag. If students were without M&M's®, I paired them up with those who had them. You can do very nicely with two students per bag.

I had them estimate the number of M&M's® in the bag before opening as an added exercise. They then sorted, counted, established fractions and percents for each color. At this point they posted individual results onto a class chart and determined the percentages from the larger sample. They then decided if they agreed with the Mars® statement. Many attempted to determine why the numbers might be different. Most were concerned since the net weight of the package was listed to the nearest tenth of a gram, and if each M&M® weighed almost a gram that there was a range of 10 M&M's® per bag in the class sample. They felt that the company should be more consistent than that. They were madly calculating the mass of various M&M's® at press time, looking for an explanation.

Time Required for Task

60 minutes

Some groups did work outside of class time to complete the write up of the task.

Interdisciplinary Links

Learning to question statistics read in the press is a useful life skill and crosses all disciplines. Students used their science discovery skills to carry out the investigation.

Teaching Tips

Have the students bring in the M&M's® the day before you do the investigation to be sure they do not forget them. Have them empty the bags onto clean paper rather than desk tops if they plan to eat them at the end. The task of compiling class data is easier if all students use the same size bag. Perhaps challenging them to compare results with large size bag numbers, as an at home assignment, would be interesting. It takes a long time to count them all in class. Encourage kids to think of reasons for the wide range of numbers of candies in the bags within the class. Have a scale or balance available to mass a sample.

Suggested Materials

- Calculators
- Balances or scales (for massing/weighing M&M® samples)
- Extra bags of candy (for those you know are unable to bring one)

Possible Solutions

Solutions will vary. The larger your sample size, the closer to the Mars® percentages you will come. Their numbers are quite close to those we found.

Benchmark Descriptors

Novice
This student does not recognize the difference between the number of candies and the percent of each color candy in the bag. The student managed to count and sort the colors. S/he did attempt a mathematical representation (the original was color coded). The final chart contains information about the individual bag only and not the class result figures.

Apprentice
This student has a basic understanding of the task, but fails to communicate the solution clearly. "Using a chart" is not actually the way in which the solution was derived. The chart does list the student's percentages as compared to Mars® percentages, but the "Class Average" column leaves one guessing. The student makes no attempt to explain the origin of the

percentages listed. While the "connection to life" comments are interesting, they are not mathematically relevant comments.

Practitioner
This student understood the task and set about successfully finding percentages of each color in one bag and comparing those percentages with the class average percentages. The bar graphs are accurate, but might have been more effective as a communication tool if all three sets of percentages (individual, class avg. and Mars®) were graphed on the same axes for comparison purposes. Additionally, I wish the student had pursued the point that, "All the percentages equaled 114%." I think it had to do with "rounding up" both by individuals and again in finding the class average.

Expert
This student communicated understanding of the task clearly. While lacking a title, the chart does present information clearly. The observation that the results might not agree with Mars®, "because the numbers are way off from each other," shows good reasoning. In the discussion of finding percents, the student uses the term "estimating" in place of "rounding", which is actually what was done. A true Expert might have gone further by trying to account for the discrepancy between Mars'® claim and the students' findings, but this student did Expert work to this point. Perhaps a discussion of "next steps" would encourage students to take the initiative to do so.

Novice

M+m task!

What I was asked to do was how many of each Color were there in a 1.64 oz bag of M+m's. the mars makers said that Theye Shauld be 30% Brown, 20% yellow, 20% Red, 10% orange, 10% green and, 10% Tan candies, what I found out was there were noT thaT many OF each of the fdlawing color's.

what I DiD iS I Drew a Pitchure Showing the mtm's and how many of each cold there is.

what I found aUT is altogether there were 57 candieS and there were noT 30% Brown, 20% yelbw, 20% Red 10% orange, 10% green or 10% tan. So the mars makers were wrong.

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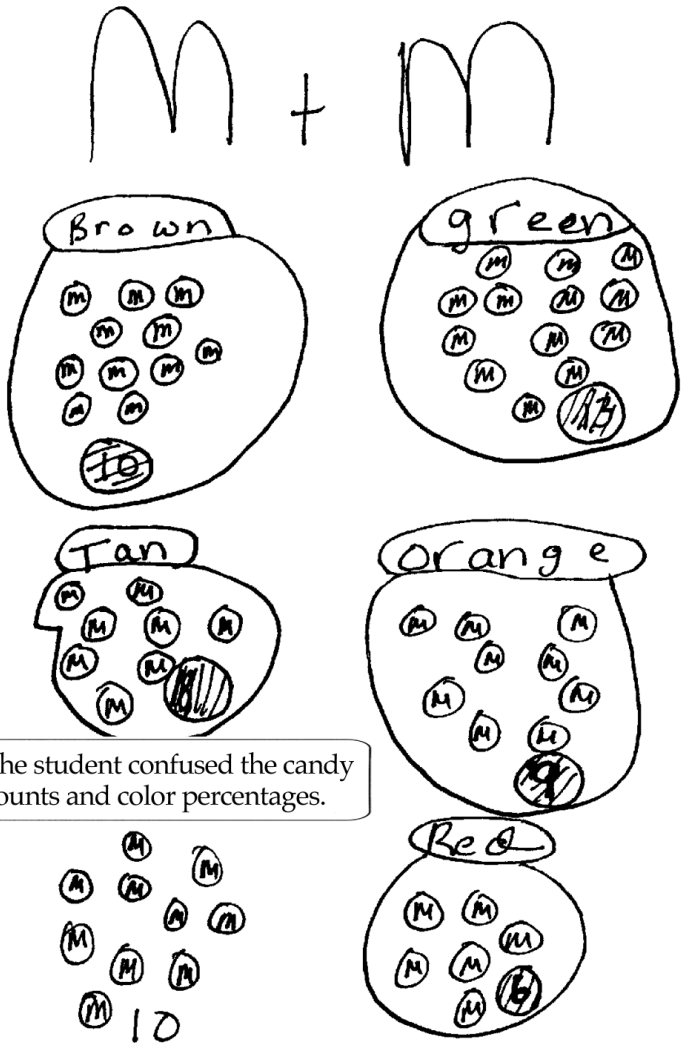
Novice

These drawings do not enhance the solution.

Little or no math language is used to communicate.



The student confused the candy counts and color percentages.

	PKg Size	# total	# of Brown	# of Yellow	# of Red	#8 orang	# 8 gren	#8 tan
mine	1.69	57	11	10	6	9	17	8

The student does not have an approach that will work.

Apprentice

It is unclear what the student's solution is.

These comments are not mathematically relevant.

I was asked to see how valid the percentages of colors are (given by Mars) & know what the claimed percentage are and I have a bag of M+Ms & need to know the # and % of M+Ms in the bag. (1.69 or 42.95.)

colors # and % of M+Ms

Color	# of M+Ms	percent of color	claimed percent	class average
Brown	21	38%	30%	14
yellow	13	22%	20%	13
red	9	15%	20%	12
orange	5	9%	10%	8
green	5	9%	10%	6
tan	4	2%	10%	6
Totals	57	100%	100%	59

To solve this problem I used a chart.

In conclusion these numbers are somewhat valid however in a life or death situation I wouldn't lean on them. On the other hand M+Ms and a life or death situation don't fit together. Although if the percentages were for an explosive chemical formula. Do its would be crucial to get the correct formula

It is unclear how the student arrived at these results.

Practitioner

Accurate and appropriate math language is used.

For this task, we each (our class) had a certain size bag of M+Ms. We all counted how many of each color we had because Mars(makers of M+Ms) says that there is 30% brown, 20% yellow, 20% red, 10% orange, 10% green, and 10% tan candies In my bag of M+Ms, I had 56 M&Ms. I had 12 brown. 7 red, 15 yellow, 8 green, 7 orange, and 7 tan. To find the percentage of each number I knew I had to divide 56, into each of the colors, and then move the decimal point 2 spaces to the right. For brown I got 21%, for red I got 12%, yellow I got 27%. For green I got 14%, For orange I got 12%, Same with tan, 12%. I had to conduct this investigations to see if this was valid my bag of M+Ms were off, so it wouldn't really be valid. The class averages that we found out were that brown was 36%, yellow-22% Red-19%, Orange-14%, Green 13%, Tan-10%. Tan was the only

The student explains his/her approach and reasoning.

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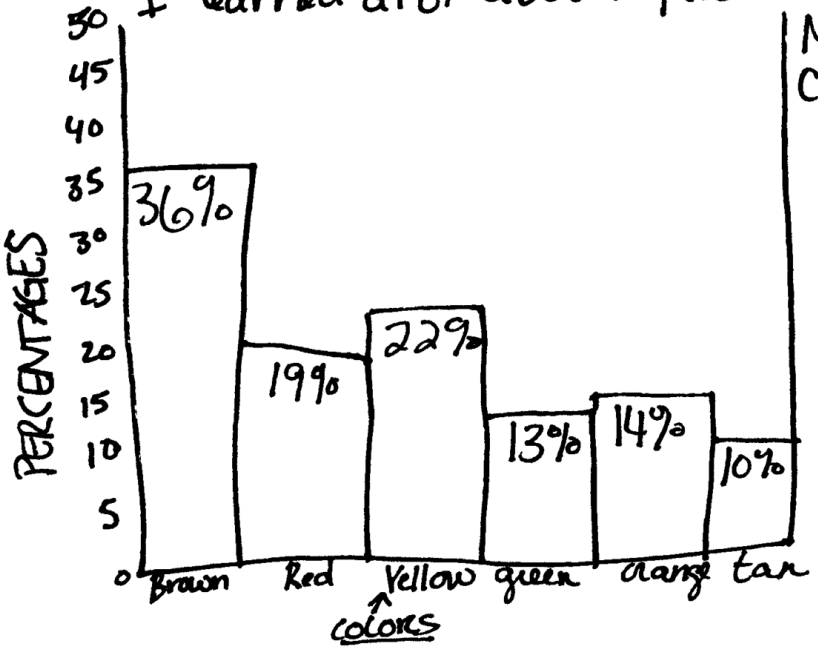
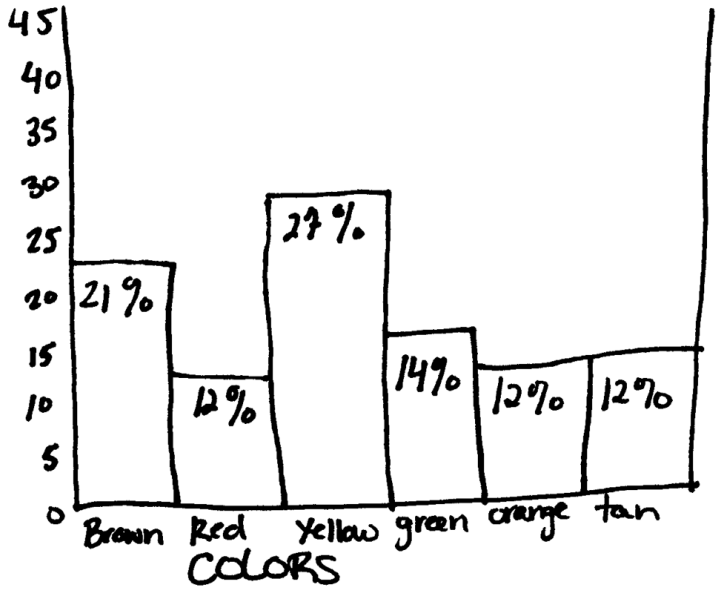
Practitioner

one that was right. All the percentages equaled 114%, so its not exactly perfect. We never done a problem like this, but it was fun, and I learned alot about percentages



The student evaluates his/her solution.



The student creates accurate graphs to display results.

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Expert

All work is shown.

An accurate and appropriate representation is created.

Class average

We were asked to conduct an investigation to determine the validity of the numbers. Do our investigations results agree with these numbers which are/

30% brown, 20% yellow 20% red
10% orange, 10% green, and 10% tan - candies in each bag.

In order to find the validity of the number I will first need to know how many candies are in each bag and from many of each color are in each bag. To do this it will be easier with a chart. There 11 bags of M+Ms in the class

average=	# of candies	# of brown	# of yellow	# of red	# of orange	# of green	# of tan
	Total 580	# 14	# 13	#12	# 7	# 6	# 6
percent							
	58	16	14	7	9	1	11
	57	22	13	9	5	5	4
	66	9	18	9	16	9	5
	55	13	9	3	14	8	8
	57	11	14	12	5	5	10
	66	13	11	20	13	12	1
	55	12	11	23	3	4	4
	58	21	14	9	6	4	1
	59	12	12	17	5	4	9
	59	13	10	12	10	5	9
	58	15	18	11	3	10	4

After making this chart I suspect that there will be less or more then the official think because the numbers are way off from eachother.

Good reasoning and analysis.

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Expert

The student's approach and reasoning are explained.

Accurate math language is used to communicate.

After making the chart I will proced to find the average of /st the total amount + then the average of each color. To do this I will add all of the numbers I have for one color + there devide it by 11 because there 11 bags of candy I am finding the average because after I find the average I can use the average numbers to get the percent. Then I can compare my results with the official.

I listed the averages under the color

* = average

On finding the percent it will be harder I will need to divide the average number of one color (at a time) by the average number of how many m+m's are in a bag. Even though while I am doing this then decimals I use the method of estimating. for example = .1436 estimated -1/4. Another method in getting 4 numbers .2163 and moving the decimal point over 2 places. .2163.

I listed the percents under the averages.

-%- = percent

I listed the percents below.

	Brown	Yellow	Red	Orange	Green	Tan
	24%	22%	21%	12%	10%	10%
officialpercents:	30%	20%	20%	10%	10%	10%

As I can see the officials in some are very very close on some they are exact.

I choose to get my answers these ways because its quicker, + easier / ended see no other way.

The student lists his/her conclusions and makes comparisons.