BASEBALL, PARADOXES, AND SPREADSHEETS

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Spreadsheets can help us teach middle school students concepts related to ratios such as batting average paradoxes. Many baseball fans have heard an announcer rattle off an impressive statistic such as: "In the last three innings of a game, this batter, when facing a left-handed pitcher, has swung at the first pitch 27 out of 31 times." And, of course, the batter, facing a left-handed pitcher in the eighth inning, promptly swings at the first pitch, thus making the announcer a psychic. Most likely, major league baseball commentators avail themselves of database programs to guide their comments.

Our concern however, is with spreadsheets, which also offer potential for examining sports statistics in the form of ratios and percents. A rather interesting baseball dilemma can be analyzed with spreadsheet technology. The following baseball situation was analyzed by creating a spreadsheet using Appleworks on an Apple II GS computer. Consider this player's problem:

> Happy Hardball has been vying with Milt Splitfinger for the starting leftfield position. Happy is quite joyful; he expects to play because he has a higher batting average than Milt. Unfortunately, the first game of the season brings a disappointment for Happy – the manager informs him that Milt will start because today's starting pitcher is a righthander and Milt has a better average against right-handed pitchers. Happy is discouraged but remains hopeful. Tomorrow's pitcher is a lefthander and surely he will start then. Once again, however, the manager plays Milt, this time announcing to Happy that Milt has a better average against lefthanded pitchers. "How can this be?" muses Happy. "How can I have a higher overall average, yet have a lower batting average against right-handed and left-handed pitchers?" The following spreadsheet can help to unravel the puzzle. The spreadsheet, shown in Figure 1, allows for various frequencies at bat against right- and left-handed pitchers. The frequency at bat against right- and left-handed pitchers is different for Milt and Happy. This contributes to the apparent paradox where the overall batting average of Happy is higher than Milt's, but Milt prevails in the competition against both right-handed and

left-handed pitchers. Figure 1 points out how a spreadsheet can be used to clarify this ambiguity.

Player	Hits Right-Handed	No. of Right-Handed Pitchers	Hits Left-Handed	No. of Left-Handed Pitchers	Avg. Right	Avg. Left	Overall Avg.
Milt	12	35	3	6	.343	.500	.366
Happy	24	72	34	80	.333	.425	.382

Figure 1

Although Happy has a higher overall batting average than Milt, Happy has faced left-handed pitchers more than Milt. As we see, Milt has a .500 average against lefthanders, but he has only has six at-bats against lefthanders. The discrepancy between the overall averages and the averages obtained against right- and left-handed pitchers can be explained because of this frequency difference.

With a spreadsheet, students can try different values to obtain various results such as those that have been illustrated in our example. Several "what if" questions can be raised as well.

1. Assuming that Happy's statistics are held constant, determine the first point at which Milt's number of at-bats and number of hits against lefthanders, although preserving his .500 average, yields a higher overall average than Happy's.

2. What if the number of at-bats against right- and left-handed pitchers is the same for Milt and Happy? Try different values to see if the overall average of one can still be higher when the averages against right- and left-handed pitchers are lower.

3. What if you doubled all the values in the hits and at-bats cells for both right- and left-handed pitchers? Does the original relationship of greater overall average but lesser average against right- and left-handed pitchers hold?

4. Find another set of values that yields a greater overall batting average for one player but a lesser average against left- and right-handed

pitchers.

The examples considered in this article show how a spreadsheet can be used to provide interesting applications which can motivate the conceptual practice of ratio and percent topics. Furthermore, the spreadsheet's power to produce rapid results for changing conditions enables the user to play "what if" games to explore various mathematical scenarios. The potential for investigating concepts and problems via spreadsheet technology seems great.

Readers may wish to contact Bob Sovchik directly for information about programs and other technical details for these spreadsheets.

MATHSEARCH WINNERS!

Brenda Boes, Mohawk High School, Sycamore, Ohio, submitted the best entry, seen below. Her total, 49, is the highest ever. She wins a fine writing instrument (pre-sharpened), engraved "Miami University". This may be claimed in the Editorial Offices at the winner's convenience.

Second prize, a writing instrument similar to Brenda's, but shorter, goes to Ann Barnes, Gahanna, Ohio, whose total was 39. Ann used some letters more than once in the same word and would have been disqualified except for the kindness of our judges. Third prize, unclaimed, was to have been a weekend in Bermuda. The contest continues with winners, prizes, and rules announced as needed.

Brenda's entry:

R	E	C	T
S	N	R	A
O	S	I	N
C	E	L	G

line	rectangle	series
lines	rectangles	single
cosine	triangle	less
sine	triangles	sign
nine	cone	ones
angle	cones	
angles		

Rules: One point for each letter over three. No letter may be used more than once in a word. Plurals are acceptable. Only math words used in grades K-12 count.
