CHARTING TO COMPARE CHILDREN'S LEARNING AT FOUR DIFFERENT READING PERFORMANCE LEVELS

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Abstract: The present study used the Standard Behavior Chart and its related research principles to compare learning at the inventory instructional level and three other widely spread performance levels. Two weeks of daily frequencies collected from the reading behaviors of 49 fifth graders provided celerations for the four performance levels tried minutes apart. The findings showed no significant differences in the distributions of celerations at the four performance levels. The authors challenged reading teaching practices that place a premium on high performance levels and called for careful evaluation of the Standard Behavior Chart as a research tool.

Many reading teachers place children in reading materials at the instructional level of an informal reading inventory believing that placing children at this performance level promotes highest learning. This study used the Standard Behavior Chart and its related research principles to validate a performance level for highest learning. The question was: Is the instructional level of the informal reading inventory or any of three other performance levels a level that promotes highest speed or accuracy learning.

BACKGROUND

The Standard Behavior Chart

Natural scientists and mathematicians have long recognized the advantages of the semilogarithmic chart for showing proportional and percentage relationships. Since Skinner's pioneering work in operant conditioning (1938), scientists have recognized the precision and universal applicability of frequency for measuring behavior. However, it was not until the middle 1960's that Lindsley (1971) combined the semilogarithmic chart with frequency to form a chart, now called the Standard Behavior Chart, that measured proportional changes in behavior.

Early users of this Chart noticed that behavior frequencies on the Chart often accelerated or decelerated as time passed. Also, these "celerations" were generally linear. If indeed, the changes in behavior frequencies were linear on a semilogarithmic scale, then behavior changes by a constant multiple rather than by a constant addend, or like the compounding interest of a savings account rather than like uniform deposits to a cash box.

In 1972, Koenig used over a thousand phases of behavior frequencies with over 10 percent change per week from research journals and the Behavior Bank (1971) to confirm that linear celerations on the Standard Behavior

Chart appropriately represented changes in behavior. The straight lines drawn through at least 10 frequencies bisected the frequencies and the variance on the Standard Behavior Chart. Since 1972, many research projects involving thousands of children have confirmed Koenig's findings and challenged traditional analysis of research data by add gains.

The Standard Behavior Chart is not new to the world of reading research. Of special significance to this study was Johnson's (1971) research that showed frequencies on the Standard Behavior Chart measured reading performance and learning in several curricula tried minutes apart. Another study (Stiles & Martin, 1973) showed reading frequencies and changes in reading frequencies were normally distributed on the semilogarithmic scale, that is, were spread across people by the same multiple up as down. Findings from both of these studies became part of the research design for the present study, which compared distributions of changes in frequencies from different grade levels of curricula tried only minutes apart.

The Informal Reading Inventory

The informal reading inventory (IRI) is a widely used technique for placing students in materials. The IRI uses a series of passages from materials representing different grade levels. The student reads the passages orally and answers comprehension questions while the teacher records incorrects. The teacher places the student for instruction in materials in which the student reads passages at some defined performance level.

Did highest learning data validate any of the currently used instructional performance levels of the IRI? Cooper (1952) tested 1000 elementary children and found that, as a group, children who made the fewest word recognition errors made the greatest grade equivalent score gains in reading achievement. Cooper concluded that instructional level criteria of the IRI should be 96-98 percent accuracy for word recognition and 60-70 percent accuracy for comprehension. No validation studies were found using a more immediate measure of highest learning, namely, the change in daily reading frequencies plotted on the Standard Behavior Chart.

METHOD

The present study included 49 fifth graders in a rural Kansas school district. Each child received an informal reading inventory using rate builders from Scientific Research Associates (SRA) reading laboratory IIb. Each child's instructional level was the highest grade level in which the child had at least 95-99 percent word recognition accuracy and 75-90 percent comprehension accuracy. Substitutions, mispronunciations, assisted words, punctuation skips, insertions, hesitations and omissions as defined by McCracken (1967) counted as incorrects. Of eleven authors reviewed by Powell (1971), these percentage levels and criteria for incorrects were recommended by more authors than any others.

For at least 10 school days the children read and charted their progress at four performance levels: their instructional level, one grade level below, and two and six grade levels above that instructional level. At least 10 days were required to measure learning at each level for each

child (Koenig, 1971). The steps between grade levels increased by doubling (+1, +2, +4) and represented performance levels from nearly perfect to high incorrect.

The daily procedure was as follows: (1) untimed silent reading of a story from one of four randomly ordered SRA rate builders, with opportunity for help with new words or content; (2) one minute see-mark timing on SRA multiple choice comprehension questions; (3) checking of comprehension answers; charting frequency correct and incorrect on the Standard Behavior Chart; (4) one minute see-say word recognition timing; (5) checking words read; charting frequency correct and incorrect on the Chart; and (6) repeating steps 1-5 for the remaining three performance levels.

RESULTS

The daily procedure generated at least 10 frequencies for each of the 16 reading behaviors--corrects and incorrects in both word recognition and comprehension at each of the four placement levels--for each child. Charts 1 and 2 show an example of one child's frequencies for word recognition and comprehension recorded on Daily Standard Behavior Charts. Each Chart contains the reading frequencies and celerations for 4 placement levels.

For an index of speed learning, the study used freehand celeration lines drawn through each set of at least 10 frequencies. The celeration was measured with a celeration finder. The Pearson product-moment correlation coefficient between the celeration of these lines and the celeration of lines drawn by the linear regression formula was $r = .88$. This correlation between freehand lines and formula-drawn lines from /2.0 to x2.0 was comparable to the correlation of $r = .99$ shown by Hnetish (1977) for celerations from x1.05 to x13.00.

For an index of accuracy learning, the study used the accuracy improvement multiplier. The accuracy improvement multiplier tells how much the accuracy multiplier multiplied or divided each week. The accuracy multiplier is the number a median frequency incorrect is multiplied by to get its related median frequency correct. It tells the number of correct responses there were for each incorrect response. For example, a child has an accuracy multiplier go from x2.0 to x3.0 in one week, yielding an accuracy improvement multiplier of x1.5.

The speed and accuracy learning indices were analyzed in order to answer the central research question of the study: was the instructional level of the IRI or any of three other performance levels a level of highest speed or accuracy learning?

Visual comparisons of distributions of celerations-corrects, celerations-incorrects and accuracy improvement multipliers in word recognition and comprehension at the four placement levels showed normally spread distributions, but no differences for any placement level (see Charts 3 and 4). Median test (Siegel, 1956) comparisons yielded no significant differences at any placement level ($p < .01$).

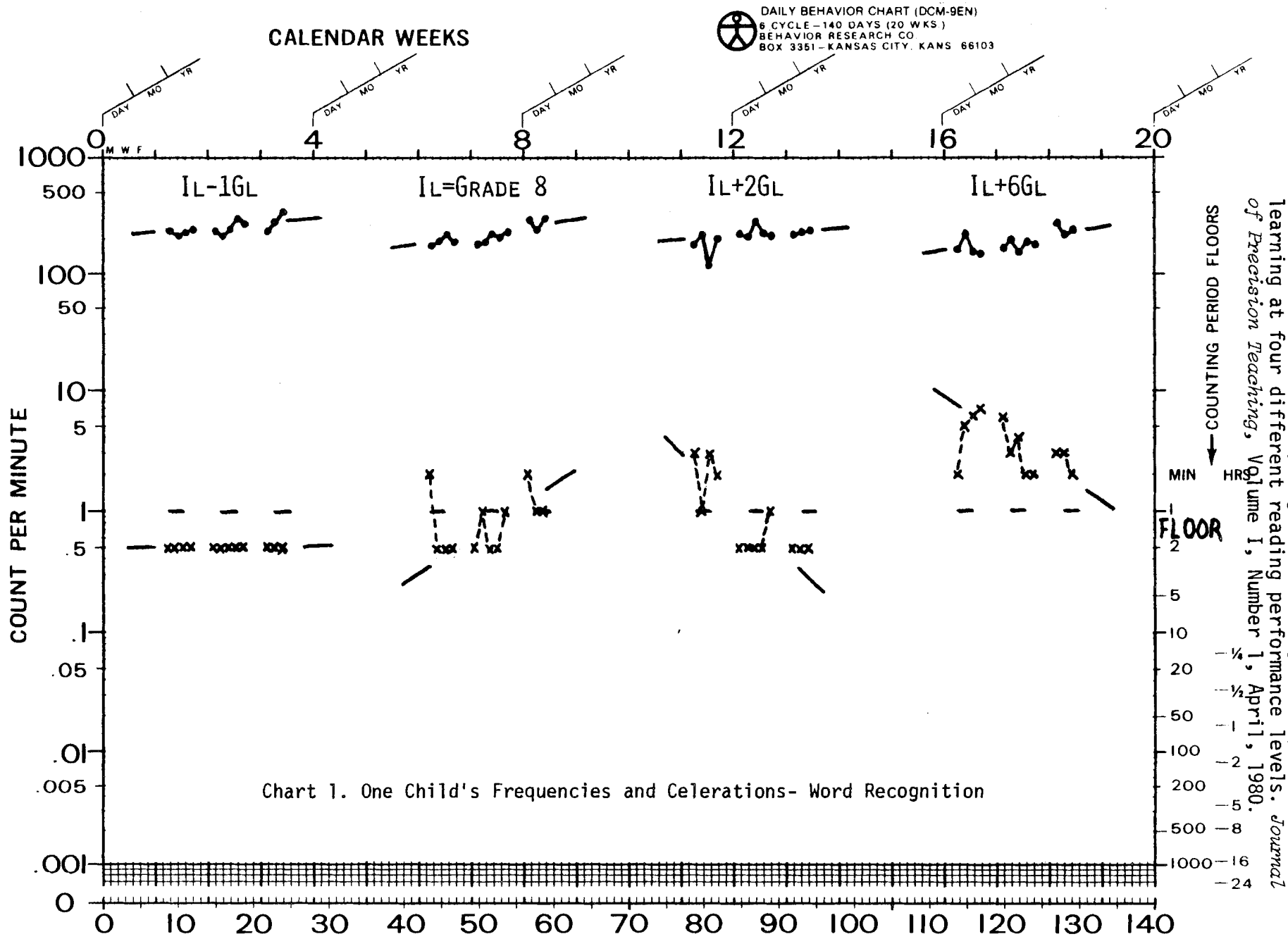

Chart 1. One Child's Frequencies and Celerations- Word Recognition

SUPERVISOR	ADVISER	MANAGER		BEHAVER	AGE	LABEL	COUNTED
	NEUFELD			FEMALE	10		SEE-SAY
DEPOSITOR	AGENCY		TIMER	COUNTER	CHARTER		
			(IL=INSTRUCTIONAL LEVEL GL=GRADE LEVEL)				WORDS

Neufeld, Karen and Lindsley, Ogden. Charting to compare children's learning at four different reading performance levels. *Journal of Precision Teaching*, Volume I, Number 1, April, 1980.

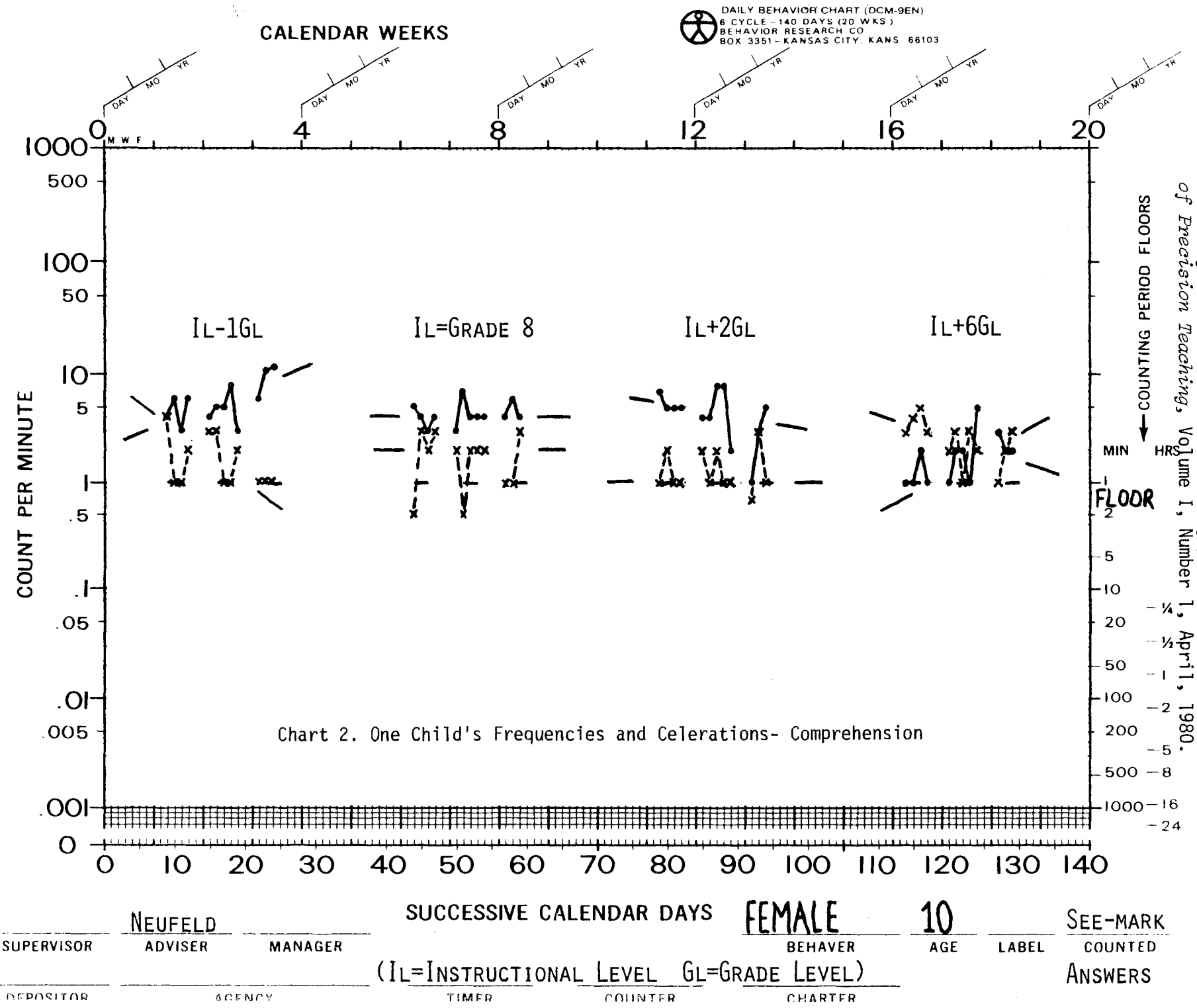

Chart 2. One Child's Frequencies and Celerations- Comprehension

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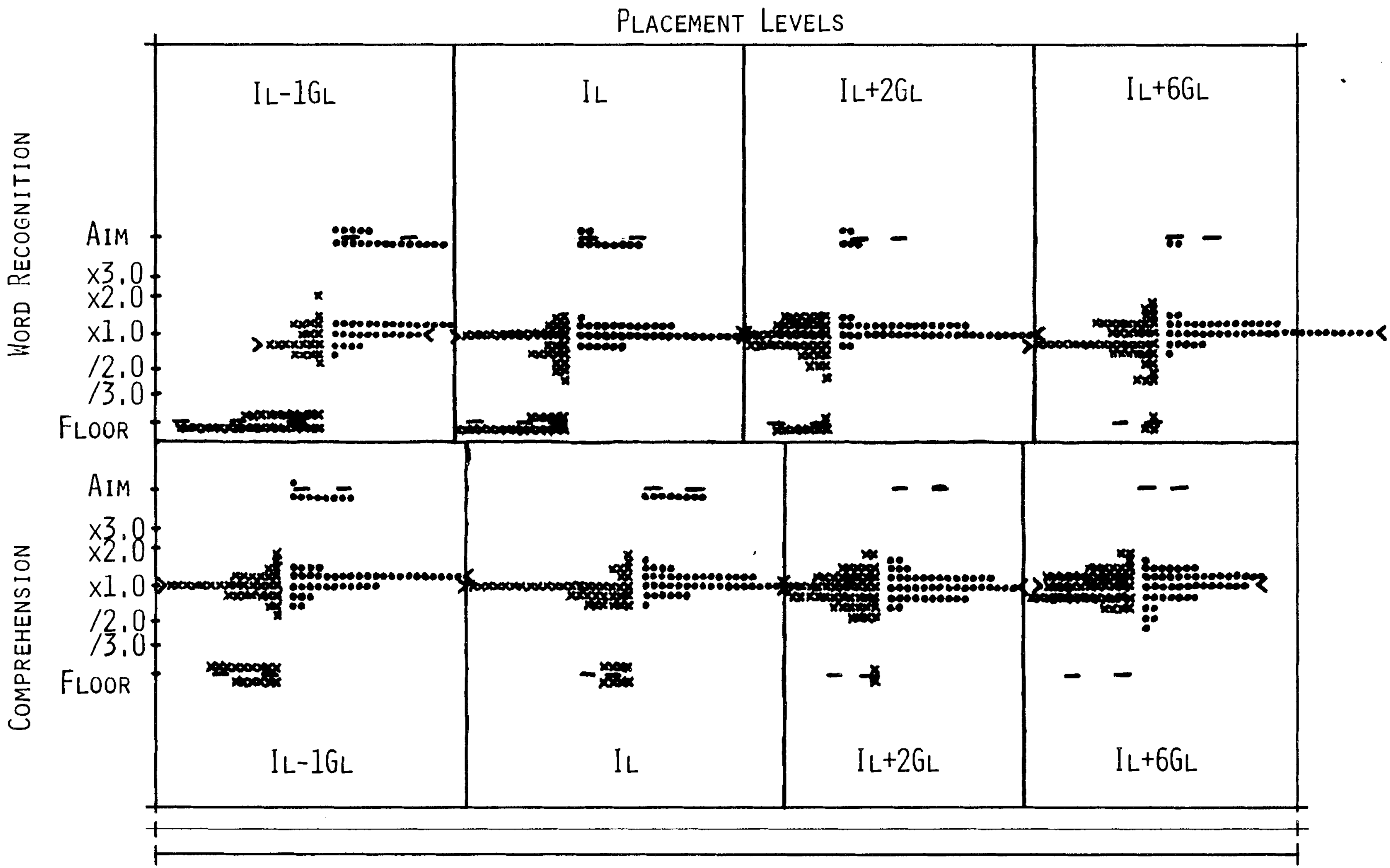

Chart 3. Distributions of Celerations- Corrects and Incorrects- at Each Placement Level

(IL=INSTRUCTIONAL LEVEL GL=GRADE LEVEL < =MEDIAN)

learning at four different reading performance levels. *Journal of Precision Teaching*, Volume 1, Number 1, April, 1980.

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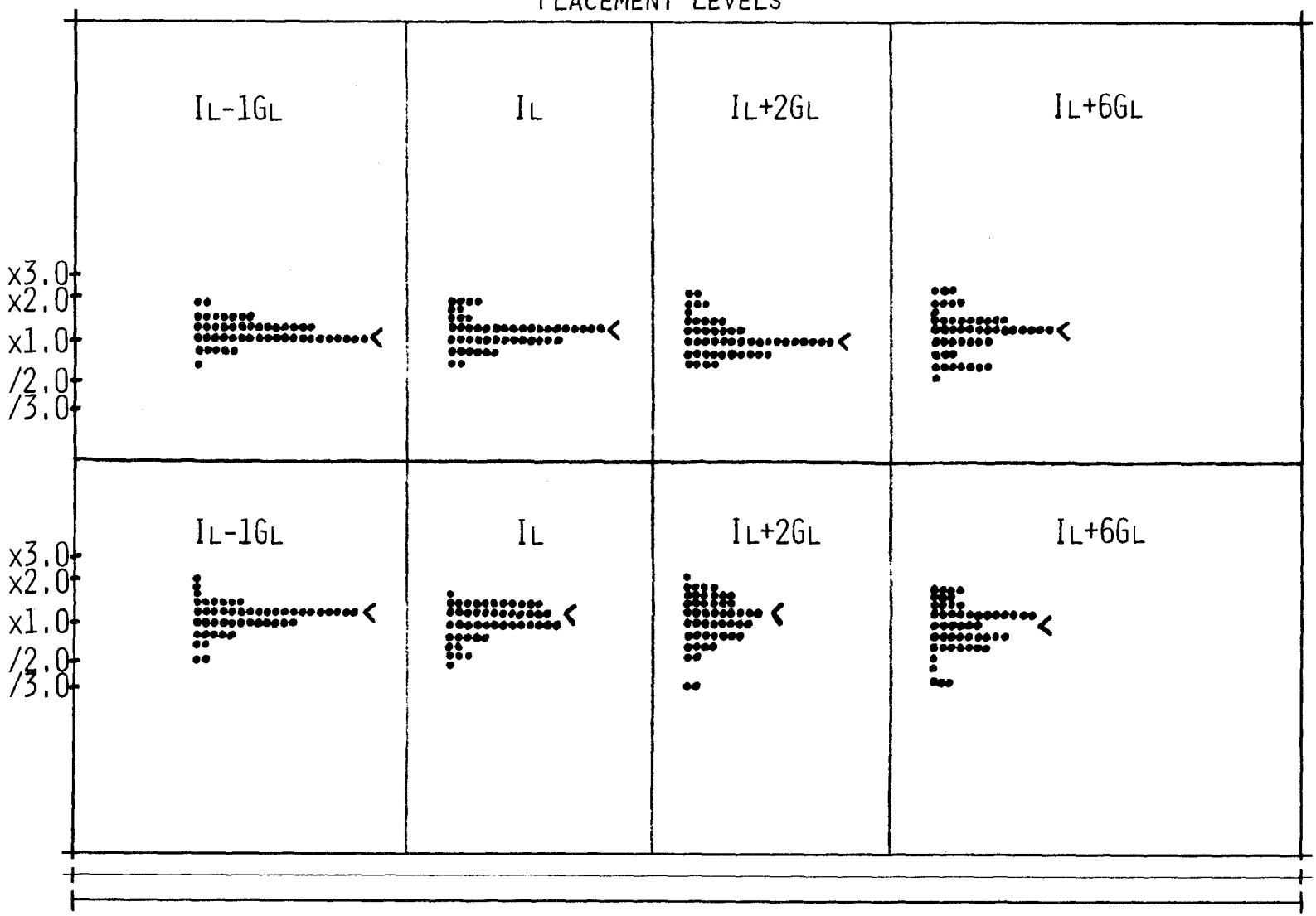

Chart 4. Distributions of Accuracy Improvement Multipliers at Each Placement Level

(IL=INSTRUCTIONAL LEVEL GL=GRADE LEVEL <=MEDIAN)

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DISCUSSION

This study used the Standard Behavior Chart and its related research principles to examine the question: was the instructional level of the informal reading inventory or any of three other performance levels a level that promoted highest learning? Distributions of speed and accuracy celerations showed no significant differences in children's learning at any of the performance levels. Thus, neither the inventory instructional level nor any of the other performance levels promoted highest learning.

Implications for Educational Practice

The findings from this study challenge reading teaching practices that place a premium on high performance. One of these practices is to place children in reading materials at the instructional level of the informal reading inventory. If placement at this level does not promote highest learning, should teachers use the level at all? Further research is needed to test whether or not placement at the inventory instructional level achieves any other purpose.

Did this study eliminate the need for the informal reading inventory? Although the inventory does not select a performance level for highest learning, it may still be useful for assessing strengths and weaknesses. This study challenged only one use of the informal reading inventory.

Observations on the Use of the Standard Behavior Chart

How effective was the Standard Behavior Chart as a research instrument? The Chart allowed visual comparisons of distributions, which had the same advantages over strictly statistical comparisons that a photograph has over a verbal description. The Chart also proved appropriate for comparing children's behavior frequencies. The celerations and distributions of celerations substantiated Lindsley's claims that learning is linear on the semilogarithmic scale and that human behaviors within and between people spread by the same multiple up as down. As a research tool, the Chart was very efficient. Although this study used both statistical and visual comparisons and drew celeration lines by both the freehand method and the linear regression formula, visual and freehand methods alone produced adequate information to formulate research conclusions. Finally, this study assumed from previous research that the frequencies were sensitive and specific enough to allow a comparative study between several curricula tried minutes apart. The results of this study confirmed this assumption.

A Prediction

Educators seldom question the use of high performance levels for reading instruction or the use of traditional statistical research techniques. This study challenged both. The findings and techniques described in this study deserve careful evaluation. If substantiated, they could revolutionize current research and teaching practices.

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