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Bernard L. Heydorn
University of West Indies, Trinidad

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VISUAL-MOTOR TRAINING PROGRAM AND SYMBOL REVERSAL ERRORS

Bernard L. Heydorn

UNIVERSITY OF WEST INDIES, TRINIDAD

Since the 1920's, a wealth of data has accumulated on the subject of reversals. In this vast array of studies, such symbol reversal errors as b - d, M - W, 6 - 9, have been the focus of a wide and diverse variety of investigations. Many teachers and researchers have developed programs to remediate reversals (Polloway and Polloway, 1980; Kirshner, 1977; Bracey and Ward, 1980; Harman, 1982; Bannatyne, 1973; Stromer, 1977). These programs utilized a wide range of techniques and methods. The author conducted the following study to investigate the effectiveness of a visual-motor training program for the remediation of symbol reversals.

The program used in this study was an adaptation of the Kirshner Program (1977) for the remediation of symbol reversals. Symbol reversals referred to the misperception of single letters and numbers presented in a correct or left-right reversed spatial orientation as measured by the Jordan Left-Right Reversal Test Level 1 (1974).

Methods and Procedures

Thirty eight first grade students who demonstrated four or more symbol reversal errors (mean score 10.06) on the Jordan Left-Right Reversal Test Level 1 (1974) comprised the sample. These students were taken from seven different classes in two schools in a city. The students were given a series of remedial symbol training lessons by their teachers, 20 minutes per session, three sessions per week for eight weeks. They were then posttested at the end of eight weeks with the Jordan Left-Right Reversal Test Level 1 (1974) and the results analyzed.

Treatment

The author expanded the Kirshner Program (1977) to provide remediation for both uppercase and lowercase letters and also to include all the letters that could potentially be perceptually reversed. The following steps for the remediation of symbol reversals were then implemented:

1. The student used the 'magic ruler' of the Kirshner program (1977) modified, to get practice in making the reversed symbol (letter or number) in its correct orientation (Fig.1).
2. The student traced over the correct shape of a large form of the letter or number with his index finger several times,

articulating the letter or number as he traced.

3. The student practiced filling in the large shape of the symbol with smaller versions, without using the 'magic ruler'
4. The student colored the large symbol after it had been filled in with the smaller versions.
5. The student filled in a sheet containing blank squares with the appropriate symbol in its correct orientation without having access to the symbol, i.e., from memory.
6. In this step which is the criterion or mastery test, the student circled the correct form of the symbol which had been mixed in with an array of jumbled letters or numbers in various orientations.
7. If the student failed at Step 6, he was retaught the process and practiced from step 1 through to step 6 again.

The remedial program is thus based on the principle of providing a visual-motor directional pattern that is error free, right from the start. It is a task-analyzed procedure which gives students practice in recognizing and making the correct form of the symbol. The student is remediated for specific diagnosed symbol reversal errors, and only one error is remediated at a time.

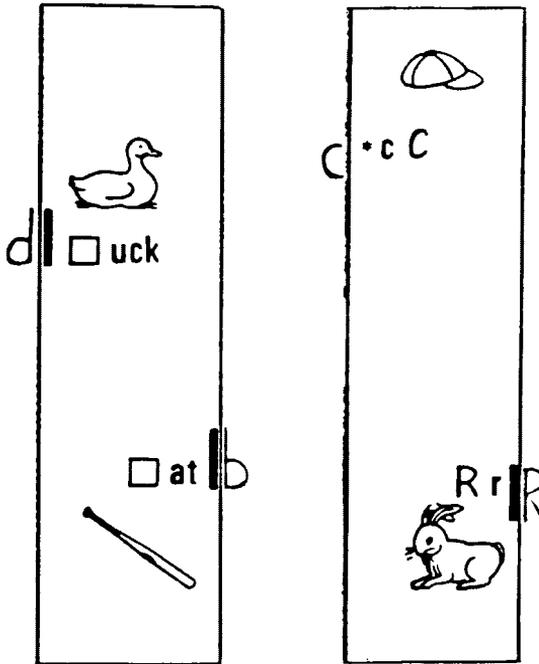


Figure 1 Use of 'Magic Ruler'

Results

The data presented in Table 1 showed the means and differences for pretests and posttests in symbol reversals on the Jordan Left-Right Reversal Test Level 1 (1974).

Table 1

Group	Pretest Means	Posttest Means	Difference
Treated Symbol Reversers	10.06	6.97	3.09

The results thus showed that there was a mean reduction of 3.09 in symbol reversal errors after 8 weeks of training.

In addition to examining the mean difference, a specific contrast was used to explore whether the difference in symbol reversals observed within the group was significant from pretest to posttest. Toward this end, an analysis of variance with repeated measures on the factor (time) was utilized. The results are presented in Table 2.

Table 2

Specific Contrast for Symbol Reversals
on Jordan Left-Right Reversal Test Level 1

Contrast	Degrees of Freedom	Sum of Squares	F-ratio	P
$T_2 - T_1 / G_1$	1	194.05	26.90	0.00**

**Significant at .01 level

G_1 = Treated Symbol Reversers T_1 = Pretest T_2 = Posttest

The above results showed that there was a significant difference at the .01 level of confidence in the reduction of symbol reversals for students in a treated remedial program.

Discussion

The results of the above study seem to indicate that a visual-motor training program which incorporated multisensory techniques is useful in the remediation of symbol reversals in first grade children. However, the teachers in the study reported that students seemed to have also shown a marked improvement in handwriting skills. The possibility for transfer to handwriting and eye-hand coordination skills could be a topic for further investigation.

A visual inspection of the students' test papers indicated that many students corrected the symbol reversals that they had been trained to correct but made a few new reversal errors on

the posttest. This observation seems to imply that the tendency of strong symbol reversers to continue to make symbol reverse errors is persistent. We might in turn infer the possibility of underlying factors such as maturation and cerebral organization at work.

Several teachers also reported that even though some students may have corrected their visual perceptual reversal errors in recognition, they may continue to make written reversals of the same letters or numbers. Thus we may also consider the possibility of a difference between visual perceptual reversals (decoding) and written reversals (encoding).

Conclusions

The results of this study showed that symbol reversals can be remediated with a visual motor training program. However, there is a need to investigate the effects of symbol reversal training programs on other aspects of language arts such as handwriting and reading. The effects of maturational and neurological factors on symbol reversals need to be investigated and also the differences that may exist between decoding and encoding reversals. The results of such investigations may throw some new light on the ubiquitous phenomenon of reversals.

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