TECHNICAL REPORT: STUDENTS' SELF-RECORDING
OF MANUSCRIPT LETTER STROKES¹

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A method to allow students to self-record manuscript letter strokes was applied to three groups of first-grade school children. These children learned to use plastic overlays in some 80 to 120 min, with agreement between students and experimenter concerning correctness averaging 79%, 82%, and 84% in the three groups. A practical method allowing children to record their letter writing, thus receiving immediate feedback appears to have been demonstrated.

DESCRIPTORS: education, handwriting, self-recording, measurement, recording and measurement reliability, observer agreement, primary school children

Evaluating handwriting legibility by using handwriting scales has proven unreliable (Anderson, 1965; Askor, Otto, and Askor, 1971; Feldt, 1962). However, some current attempts utilizing other procedures have reported high reliability scores (Fauke, Burnett, Powers, and Sulzer-Azaroff, 1973; Hopkins, Schutte, and Garton, 1971; Salzberg, Wheeler, Devar, and Hopkins, 1971). Helwig, Johns, Norman, and Cooper (1976) used plastic overlays to report high reliability scores on lower-case manuscript letters.

Although there are now procedures to measure objectively manuscript letter strokes, no studies report whether students can use these instruments to self-record their written samples. Experimental results have shown that subjects learn most quickly in environments where there are strong reinforcers for the behaviors, immediate and consistent feedback, and opportunities for the subjects to work at their own pace (Hamblin, Hathaway, and Wodarski, 1971). If students can reliably self-record manuscript

letter strokes, these self-monitored behaviors may set the occasion for objective and immediate feedback for instruction in handwriting.

In the present report, procedures to teach primary-aged elementary school children how to measure manuscript letter strokes, as outlined in Helwig *et al.* (1976), are described. Emphasis was on feasibility of application in classroom settings in terms of teacher time, instructional materials, and interobserver agreement measures on student self-recording.

Subjects and Setting

Twenty-two first-grade students in a regular classroom were selected as subjects during the second half of the school year. The 14 males and eight females ranged from 6 to 8 yr of age. Eighteen students were white and four were black. The majority of students' families received some form of federal financial assistance. The classroom teacher instructed students for approximately three months on handwriting skills before subject selection. Students practiced manuscript letter formation using slates, chalk, paper, and pencils.

All students demonstrated a minimum 75% mastery on an entry level assessment. This assessment was administered to determine if students had the preskills to use the evaluative overlays (Helwig *et al.*, 1976). Skills assessed

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were: writing name, drawing lines, writing and counting numbers from one to 20, letter recognition, shape recognition and other concepts such as long, short, above, below, inside, outside, and intersecting lines.

The study took place in a public, inner-city elementary school. The classroom was selected after describing the nature of the study to a first-grade teacher whose school was close to The Ohio State University. Criteria for selection were the cooperation and interest of the first-grade teacher and the building principal.

Students were seen from two to five days per week during the period following their lunch. All sessions for teaching the use of the overlays were 15 to 20 min long and conducted outside the subjects' classroom in a room equipped with a chalkboard and appropriately sized tables and chairs.

Materials

Materials used in this report included model letters, copy paper, writing implements, and

evaluative overlays as described in Helwig *et al.* (1976).

Materials for teaching the use of the overlays. A set of materials was developed to teach the students how to use the evaluative overlays to measure their manuscript letters. Five training sheets were used to teach the correct placement of the overlay (one sheet of copy paper), the concept of strokes being too long (Figure 1.a), or too short (Figure 1.b), concepts of the intersection of strokes and closed curves (Figure 1.c), and the concept of the inside parameters of closed curves and dotting the letter 'j' (Figure 1.d).

A set of three practice sheets was used to determine if the students had mastered the necessary skills to use the evaluative overlays. The first two sheets contained correct and incorrect examples of the 10 model letters. The students were instructed to check each letter stroke and complete their self-recording forms. The third sheet was of model letter copy paper. The students were instructed to copy the 10 letters from

Fig. 1. (a) Top-left two lines training sheet for teaching the concept of strokes that are too long, (b) top-right two lines training sheet for teaching the concept of strokes that are too short, (c) bottom-left two lines training sheet for teaching the concepts of the intersection of strokes and closed curves, (d) bottom-right two lines training sheet for teaching the concepts of the inside parameters of closed curves and dotting the letter j.

a model letter training sheet, check each letter stroke, and self-record the correct letter strokes on their forms.

Training Children to Self-Record Letter Strokes

During each of the sessions, the experimenter praised students who exhibited on-task behaviors such as listening to directions, following directions, and emitting appropriate responses with the overlays ("Good, you remembered to place the slash marks over the lines."). Instructional groups of seven or eight students were determined by classroom seating arrangement. Groups were then trained in the following areas: (1) proper alignment of the overlay, (2) using the training sheets and overlay to determine which letter strokes met the behavior definition, and (3) using the practice sheets and student samples to self-record correct letter strokes. Individual groups worked in a vacant room adjacent to their classroom during training sessions.

Aligning the overlay. Each student was given a sheet of copy paper and a 3-mm evaluative overlay. The experimenter demonstrated the correct placement of the horizontal lines on the overlay over the lines on the copy paper. Once the students imitated this response they were told to slide the overlay back and forth on the copy paper so the lines remained on top of each other. The experimenter gave verbal feedback and provided further demonstration until every student demonstrated the correct alignment of the overlay.

Training sheets. Four training sheets were used to teach the behavior definition of strokes being too long (Figure 1.a) or too short (Figure 1.b), the intersection of strokes and closed curves (Figure 1.c), and the inside parameters of closed curves and dotting the letter j (Figure 1.d). The sequence of presenting the training sheets was identical to the order in Figure 1. Once all students mastered the skill contained on a sheet, the group progressed to the next concept.

During each of the sessions used to teach these concepts, every student was given the appropriate training sheet and a 3-mm overlay. They were told to use their overlays to determine why the solid stroke in the first letter on the top set of lines was incorrect. When at least half of the students indicated by raised hands that they knew the correct answer, the experimenter selected one student to explain why the letter stroke failed to meet the behavior definition. If the answer was incorrect, the experimenter gave the student prompts (e.g., "Is it too long?" "Do the strokes touch each other?") until the correct response was given. The identical procedure was then repeated for the next letter.

When all letters on the top set of lines were evaluated, the same procedure was used for those on the bottom set of lines. The children were cautioned to check these letters very carefully, since some of the solid strokes were correct. Once all letter strokes were evaluated, the training sheets were collected and new ones distributed.

Practice sheets. Three practice sheets were used to teach the students to self-record manuscript letter strokes. The first two were prepared by the experimenter and the third was a sample of the model letters written by the student.

Each experimenter-prepared practice sheet contained examples of the 10 model letters. Examples were given where two, one, and none of the strokes met the behavior definition. Each student was given a practice sheet, 3-mm overlay, self-recording form, and a pencil. The experimenter then drew dotted letters on a chalkboard to represent the letters on the self-recording form. The students were told to trace only over the strokes that they scored as correct. Once all letters were measured, they were instructed to add all of the traced strokes in a box on the right edge of their form. Although the experimenter gave the students verbal feedback on their performance for the first practice sheet, no feedback was given on the second sheet.

After each group had completed the experimenter-prepared practice sheets, the students were told to bring their handwriting samples to the training sessions. In addition to his or her own sample, each student received a self-recording form, pencil, and an overlay of the same tolerance (*i.e.*, 1, 2, or 3 mm) used by the experimenter to evaluate the student's handwriting responses. As each student finished evaluating and self-recording letter strokes, the experimenter checked the self-recording form and gave the student verbal feedback on the accuracy of responses. No experimenter feedback was given while the students were self-recording. Training was terminated once the mean percentage of correct responses for the group met or exceeded a 75% criterion level.

Students' Self-Recording

Students were seated at their classroom desks. When the experimenter was ready to begin a session, he took from 1 to 3 min for some form of positive, verbal interaction with the students. They were then instructed to clear off their desks, while a primary pencil, eraser, writing paper, and a set of model letters were passed out to each child. The students were instructed to copy the top five letters on their paper, after the experimenter first demonstrated this at the chalkboard. When these letters were copied, they proceeded to copy the five letters on the bottom lines, after the experimenter again demonstrated at the board. On completion of the 10 letter responses, the students returned the model letters and erasers and picked up their self-recording sheets and appropriate evaluative overlays. All students then traced over the dotted strokes on their self-recording sheets to indicate those strokes they scored as correct. Once all strokes were evaluated, the students added all of the traced strokes, and entered the total on the right edge of their self-recording sheets. When finished, they returned all of the materials, including the 10 letter responses and self-recording sheets, to their proper locations (*e.g.*, pencil box, overlay folders, *etc.*).

The students received no feedback from the experimenter or classroom teacher on the accuracy of their self-recording.

Interobserver Agreement Measures

Two individuals were used in collecting interobserver agreement measures on students' self-recording of manuscript letter strokes. Experimenter 1 was trained to use the evaluative overlays by measuring at least 252 letter strokes. Following training, the experimenter measured 10 handwriting samples and 21 strokes each. The experimenter then compared the results with the samples from the original evaluation of the samples reported in the Helwig *et al.* (1976) report. The range of agreement on these samples was 81 to 98%.

Experimenter 2 was trained to use the evaluative overlays and record correct manuscript letter stroke responses from students' handwriting samples. Experimenter 2 was given handwriting samples, evaluation overlays, and individual recording sheets. Experimenter 1 explained the behavior definition and showed the correct procedure for placement of the overlay over the model letters. The use of the individual recording sheets for correct letter strokes was also explained. Experimenter 2 practiced using the evaluation overlays and recording sheets until meeting an average 85% agreement on total (correct and incorrect) responses with Experimenter 1. Interobserver agreement equalled the number of agreements divided by the sum of agreements and disagreements, multiplied by 100. Once the interobserver agreement measures of the experimenters reached an average 85% criterion, actual interobserver agreement measures were obtained on the students' self-recording.

Interobserver agreement measures were made between the two experimenters on 110 student samples containing 2486 letter strokes. The percentages of agreements on total letter strokes ranged from a low of 80 to a high of 100%, with a mean of 93.8%. Interobserver agreement measures were calculated by dividing the

number of agreements between the student and experimenter and/or the two experimenters by the sum of their agreements and disagreements multiplied by 100.

RESULTS

Training Sessions

Students were taught to measure their handwriting strokes. Training sessions continued until mean interobserver agreement measures between experimenters and student groups met or exceeded a minimum of 75% agreement.

The first group stayed in the training condition for 12 sessions, the second group for four sessions, and the third for six sessions. A longer amount of time was needed to train the first group, as new forms had to be developed to make it easier for students to record their correct responses. The original forms required students to place checkmarks next to correct strokes. On the new form, they traced over

dotted strokes to indicate correct responses. Solid lines were also drawn over the students' evaluative overlays to assist in the alignment of overlays on the copy paper. The lines were drawn so that their proper positioning over the headline and line at the bottom of the descender space, resulted in the correct vertical placement of the evaluative letters on the copy paper. Once these two procedures were implemented, the second and third groups could be trained in fewer sessions.

Interobserver Agreement Measures

Each student used the overlay with the particular tolerance (*i.e.*, 1, 2, or 3 mm) that had yielded an average of 50% correct handwriting strokes during the training. The experimenters used overlays with identical tolerances to record the percentages of interobserver agreement.

Table 1 represents the interobserver agreement measures between the experimenters and the students. Group 1 agreement measures

Table 1
Interobserver Agreements of Students'
Self-Recording

Students	Number of Samples Scored	Highest Agreement	Lowest Agreement	Average Agreement
First Instructional Group				
1	16	99%	60%	79%
2	42	100%	60%	86%
3	42	100%	50%	79%
4	39	90%	50%	77%
5	38	100%	70%	93%
6	41	95%	25%	70%
7	40	90%	40%	69%
Total	258			79%
Second Instructional Group				
8	20	100%	65%	89%
9	26	95%	60%	76%
10	21	100%	65%	86%
11	19	95%	65%	82%
12	24	100%	70%	84%
13	28	100%	55%	87%
14	24	95%	60%	78%
15	17	95%	40%	75%
Total	179			82%
Third Instructional Group				
16	11	95%	70%	83%
17	12	90%	70%	82%
18	12	100%	75%	90%
19	13	95%	65%	84%
20	13	100%	85%	92%
21	13	100%	50%	79%
22	12	90%	70%	78%
Total	86			84%

range from 25 to 100%, with an average of 79%. Group 2 agreement measures range from 40 to 100%, with an average of 82%. Group 3 agreement measures range from 50 to 100%, with an average of 84%.

DISCUSSION

The article by Helwig *et al.* (1976) reported a procedure to measure reliably manuscript letter formation. In that study, experienced evaluators measured some four letters per minute. While this rate of measurement would be acceptable for researchers, it is doubtful that it would be of value for classroom teachers since the time commitment would be too great to be practical. A solution to the amount of teacher time required in using the Helwig overlays would be to teach students how to measure their own responses. This brief report showed that after teaching procedures were corrected with the first group, first-grade students learned to use the overlays in approximately 80 to 120 min of instruction and practice. No instructional materials were needed other than the overlays and the five training sheets. After this pre-training, students demonstrated reliable recording in their classroom. Group one interobserver agreement measures ranged from 25 to 100%, with an average of 79%; Group two, 40 to 100%, with an average of 82%; and Group three 50 to 100%, with an average of 84%. These findings strongly suggest a practical self-measurement procedure for primary-aged school children that could set the occasion for objec-

tive and immediate feedback for instruction in handwriting.

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