

LESS THAN 4 HOURS TO FLUENT LIBRARY LOCATIONAL BEHAVIOR *

David E. Gayler
Sarasota County Public Schools

Abstract: The effects of precision teaching (direct, daily measurement) on the library locational skills of secondary learning disabled students was investigated. Timed locational activities were charted on the Standard Celeration Chart over a period of ten days to determine speed of learning for each of six students. In addition, student frequencies were compared to an exemplary (skilled) group of teachers and library aides. Results indicated a x1.4 (40%) rate of growth or higher, per week, for five of the six students, significant differences in beginning and ending frequencies ($p=.038$), and no significant differences between student and exemplar groups ($p=.158$) at the conclusion of the study. It was concluded that precision teaching was an effective tool for creating fluent locational behavior in secondary learning disabled students, and that "harder to do" activities may actually be "easier to learn" when growth factors are taken into consideration.

Teaching learning disabled (LD) students to locate materials in the card catalog and on the shelves in libraries is a neglected component of the curriculum in secondary public education. For the LD adolescent confronted with reference assignments, knowledgeable and fluent use of the library is requisite to survival in school settings. Alley and Deshler (1979) have noted that LD adolescents who have not acquired strategies necessary to use reference materials are at an educational disadvantage. A method for producing rapid acquisition and fluency of locational skills is essential if LD adolescents are to successfully complete library assignments.

* The procedures described in the following article are intended to encourage precision teachers to look at their students' needs outside the immediate classroom setting. Media Centers and libraries are full of activities which can be adapted to a PT model, as are art, music, computer, and vocational areas. Further, even the simple activity of locating books in the library can be conducted as a study and shared with other precision teachers and researchers. We have to go a little further than "see/say add facts"; let's grow past the basics and mere practice sheet teaching.

Although the amount of data-based information available on teaching locational skills is limited, other instructional publications have provided suggestions that may benefit teachers. Dallman (1958) recommended that students browse the card catalog for titles being used in their own classroom. In addition, she suggested book placement diagrams and simulated card catalogs for use in the classroom. A comprehensive, semester or year long training program was suggested by Jones (1966) and Peterson (1974) as the ideal method for producing students competent in library use. Components of those comprehensive programs included: teaching alphabetizing skills, location and use of reference materials, demonstration and instruction in card catalog use, explanation of Dewey decimal and Library of Congress classification systems, limited practice of locational exercises, and oral book reports. Although these programs would seem to have value initially, it should be noted that they have not been empirically validated, nor do they suggest techniques for teaching basic locational skills in a minimum amount of time.

The present study reports the effects of precision teaching (direct, daily measurement and practice) on the library locational skills of high school level LD students. This method of teaching uses frequency of response as its basic datum with growth measured on a proportional scale rather than an additive one. Precise and timely curriculum decisions preclude wasted instructional time and decrease the number of lessons necessary for students to reach fluency (an automatic level of responding). Efficacy of these procedures has been demonstrated and documented numerous times by various projects, teachers, and researchers. Albrecht (1982) used frequency-based procedures to encourage creative writing in middle school students. Data indicated a significant increase in ideas and words produced per unit of time. Miller and Calkin (1980) monitored learning among high school science students in the areas of science equipment, microscope, skeleton, and science facts. Immediate and significant improvement (correct responses accelerated, incorrect responses decelerated) was observed in 75 of 92 total phases. A validation study conducted by the Great Falls Precision Teaching Project (1981) in the areas of math operations, English vocabulary, and parts of speech resulted in significant improvement for high school students using frequency-based practice sheets.

In the present study, precision teaching was used to teach locational skills to LD adolescents. The primary concerns were the time required to learn the skills, and the production of accurate, fluent, locational behavior. Due to the data-based decision component of precision teaching, independent variables were not ascertained prior to baseline, but were contingent upon students' rate of learning. The criterion variable, frequency of response per minute, was used to measure the number of books located in the card catalog and on the shelves.

Method

Subjects

Six male students in the study had been previously identified as learning disabled and exhibited a significant discrepancy between ability and performance according to state criteria. Each student was receiving instruction in English and math in a special education resource room model. All students were below the fourth-grade level in reading as measured by the Woodcock-Johnson Psycho-Educational Battery (achievement section) and were below sixth-grade level in math according to the same battery. Four of the students were fifteen-year old ninth graders, one student was a seventeen year-old tenth grader, and one was a seventeen year-old eleventh grader. Each student had been recommended for instruction in library utilization by regular classroom teachers, and by the librarian on the basis of performance on a teacher (librarian) made library skills assessment test.

Setting

All activities took place in the library of a large public high school. The library was 20 x 40 meters with the card catalog located centrally, and the shelves situated around the perimeter. Books on the shelves were arranged sequentially according to the Dewey decimal system. Media equipment and periodical materials were located in a room adjacent to the main room and did not obstruct students during periods of timed activity.

Equipment and Materials

Five instruments were used for the study: a stopwatch, card catalog, cue cards, the Standard Celeration Chart, and a celeration finder. The stopwatch was a Casio F-81 wristwatch/chronograph. The card catalog was a two section 10-drawer by 6-drawer unit. The sections stood seven feet apart and could

accommodate several students simultaneously. Cue cards were ordinary 5 x 8 file cards. Five randomly selected references from the card catalog were listed on the cue cards. References were printed clearly on the cards in the following format: author last name, author first name, title, and date. A margin was provided at the left of each reference to allow students to write the call number on the cue card when the reference had been located.

Student progress was charted daily on the Standard Celeration Chart (Lindsley, 1968). The vertical axis of the chart is logarithmically scaled and represents frequencies ranging from one per day to one thousand per minute. The horizontal axis is an equal interval scale and represents days of the week. When frequencies are plotted on the chart they become time-series points through which a celeration line (line of best fit) can be drawn. The standardization of the chart enables celeration lines of equal slope to maintain equal value regardless of placement on the chart. The chart then, provides a picture of student progress showing absolute number correct and incorrect, percent correct and incorrect, and overall rate of growth. The most important dimension, growth, can not be determined from an equal interval chart, but may be easily found on the Standard Celeration Chart by using a celeration finder. This instrument is a protractor calibrated to the logarithmic scale of the chart and is used to assign a numeric value to a rate of growth by determining the slope of a celeration line. Accelerations are assigned a "times" (multiply) value, e.g., x1.5, x3.1. Decelerations are assigned a "divide by" value, e.g., /2.6, /1.9. A flat celeration is given a value of x1.0. Celerations assigned these values may be then converted to percent improvement or decay per week or day, and may be used to compare growth rates among students.

Procedure

Establishing performance standards. Prior to implementing the practice sessions, an exemplary performance standard was established. This was accomplished by requesting that several teachers and experienced library aides perform the locational exercises that would be required of the students. These exemplars performed the exercises twice to assure their understanding of the task, and the best performance (least number of minutes taken to locate all books) of the two trials was recorded and charted. The median of these

performances then became the practical standard for students to achieve, and provided them with a goal.

Student training. In order to begin the sessions, the following information was given to students: location of card catalog and shelves, alphabetical nature of cards in the catalog, numerical sequence of the books on the shelves, location of author, title and call number on catalog cards, location of call number on books, and format of cue cards. Students were then instructed to locate, in the card catalog, each book listed on the cue card, and to write the call number for each book in the space provided on the cue card. This was referred to as the card catalog task (CC). When this task was completed, they were to proceed to the shelves and locate each book. This was referred to as the on-shelf task (OS). Further instructions were to locate cards and books as quickly as possible, and to minimize extraneous activity.

The first day was baseline, and students were given no help before, during, or after the session. As students began the session the stopwatch was started, and the instructor watched closely as the tasks were performed. Individual difficulties observed at this time would be used to develop intervention procedures. When each student had located his last book, the stopwatch was stopped, the time noted, and the number of books located per minute was charted. The charting procedure was performed by the students and confirmed by the instructor.

After the initial day of activity, it was determined that each student needed basic alphabetizing skills to aid in locating books in the card catalog. A simple ten word list (e.g. check, chip, chat, chin, car, etc.) was prepared each day for the next four days, and given to each student prior to the timed activity in the library. A ten minute period of time was set aside for the students to place the words in alphabetical order and receive feedback and instruction from the instructor. After four days, the alphabetizing intervention was discontinued on the basis of performance data, and a modeling session was scheduled to provide students with an example of exemplary locational performance. The session took place on the sixth day, and was performed by the instructor. In this way, each student was able to observe fluent locational skills that could be applied to their own performance. After the modeling session, the timed locational activities continued for

four more days, before termination on the tenth day.

Results

Charted data from the study were analyzed to provide a descriptive summary of individual student performance and learning. In addition, group figures were calculated and compared with the exemplar (standard) group.

Individual Student Results

As an example, charted data are presented for one student in Chart 1. This chart shows total task (TT) frequencies (both tasks combined), card catalog (CC) frequencies, and on-shelf (OS) frequencies. Celerations for each task can be visually analyzed to determine rate of growth, and to compare growth among tasks. Celerations for each student are summarized in Table 1. An examination of these celerations revealed that 5 of the 6 students had greater acceleration on the card catalog task than the on-shelf task. The same 5 students had total task celerations of x1.4 per week or greater. To compare the on-shelf with the card catalog celerations, the larger celeration was divided by the smaller. This resulted in an "easier to learn" factor (degree by which learning on one task was greater than on another) which showed that 5 students found the card catalog task easier to learn than the on-shelf task (see Table 1).

Table 1

Student Celerations and Learning Factors

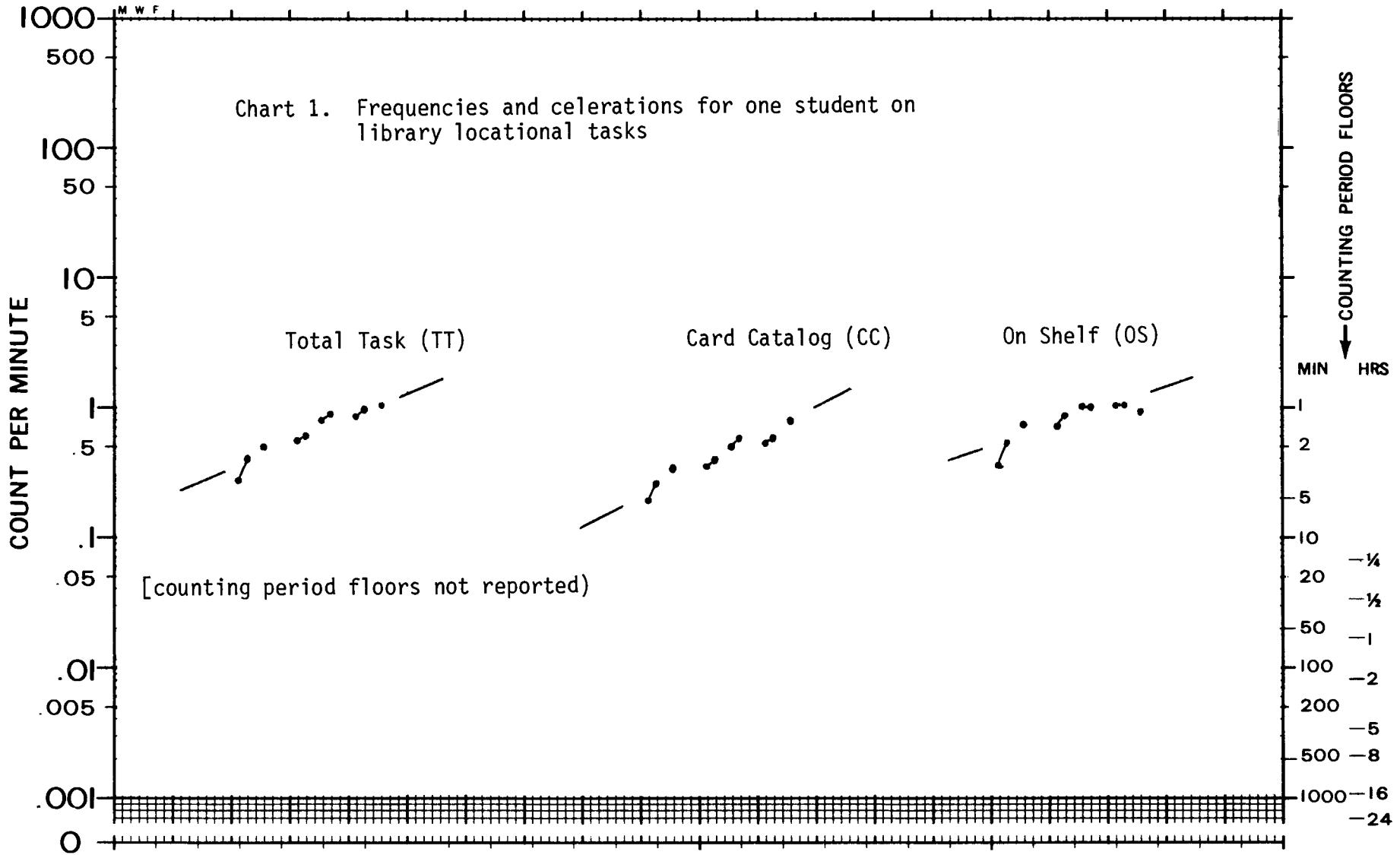
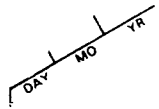
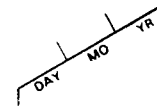
Student	Celerations			"Easier to Learn" Factors	
	TT	CC	OS	CC	OS
Vince	x1.1	/1.4	x1.8	--	x2.5
Steve	x1.6	x1.6	x1.1	x1.5	--
Chris	x1.4	x1.3	x1.2	x1.1	--
Clay	x1.4	x1.4	x1.2	x1.2	--
Bobby	x1.6	x1.7	x1.4	x1.2	--
John	x1.4	x1.2	x1.0	x1.2	--

Table 2 presents the beginning and ending durations (number of minutes to complete the task) for each student on total, card catalog, and on-shelf tasks. To compare card catalog and on-shelf tasks, the larger duration was divided by the smaller duration. This resulted in a "harder to do" (HTD) factor for beginning and ending task

CALENDAR WEEKS



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6 CYCLE - 140 DAYS (20 WKS)
BEHAVIOR RESEARCH CO.
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CALENDAR DAYS

SUPERVISOR			ADVISER			MANAGER			Bobby			locates books		
Center School District			Kansas City, MO						BEHAVIOR			AGE		
AGENCY			TIMER			COUNTER			CHARTER			COUNTED		
						Gayler								

performance. These factors are presented in Table 3. The card catalog task was harder to do than the on-shelf task for five of the six students at the beginning of the study, and for four of the six at its conclusion. Improvement factors (largest duration /smallest duration for each task) revealed improvement of x1.6 per week or greater for each student on the total task (see Table 3).

Table 2
Student Durations (minutes)

Student	Beginning			Ending		
	TT	CC	OS	TT	CC	OS
Vince	16	8	8	9	7	2
Steve	39	30	9	16	8	8
Chris	35	24	11	16	11	5
Clay	33	24	9	19	12	7
Bobby	38	24	13	11	6	5
John	23	13	10	14	7	7

Table 3
Performance and Improvement Factors

Student	"Harder to Do" Factors		Improvement Factors		
	Beginning	Ending	TT	CC	OS
Vince	x1.0	x3.5	x1.8	x1.1	x4.0
Steve	x3.3	x1.0	x2.4	x3.8	x1.1
Chris	x2.2	x2.2	x2.2	x2.2	x2.2
Clay	x2.7	x1.7	x1.7	x2.0	x1.3
Bobby	x1.7	x1.2	x3.5	x4.0	x2.8
John	x1.3	x1.0	x1.6	x1.9	x1.4

Group Results

Celeration value distributions were constructed to show the dispersion of celerations for the group. Chart 2 presents the distributions as plotted on the Standard Celeration Chart. The total task celeration distribution showed a median of x1.4 and a range of x1.5. This distribution showed the least dispersion among the three distributions. The card catalog distribution showed the greatest dispersion of celerations having a range of x2.4, but the x1.35 median revealed that the group experienced faster growth on the card catalog task than on the on-shelf task (median of x1.2). By dividing

the larger celeration (x1.35) by the smaller (x1.2), a figure of x1.13 was derived which showed that the magnitude of growth was greater by 13% on the card catalog task.

Chart 2 also presents the beginning and ending duration distributions for the card catalog and on-shelf performances. Visual inspection shows, again, that the group experienced greater performance gains on the card catalog task. The magnitude of the gain was x3.2 as compared to x1.6 for the on-shelf gain. The comparative gain was x2.0 (x3.2/x1.6). Using the Median Test and Fisher's Exact Probability, a significant difference was found ($p = .038$).

Chart 2 also shows the total task beginning and ending durations, and the durations for the exemplar group. The total task distributions revealed a significant group gain of x2.3. The Median Test and Fisher's Exact Probability yielded a significant difference ($p = .038$). Furthermore, the dispersion (range) of durations, which divided by 1.14 or 14% (x2.4/x2.1), showed that the ending durations clustered more closely around the median than did the beginning durations.

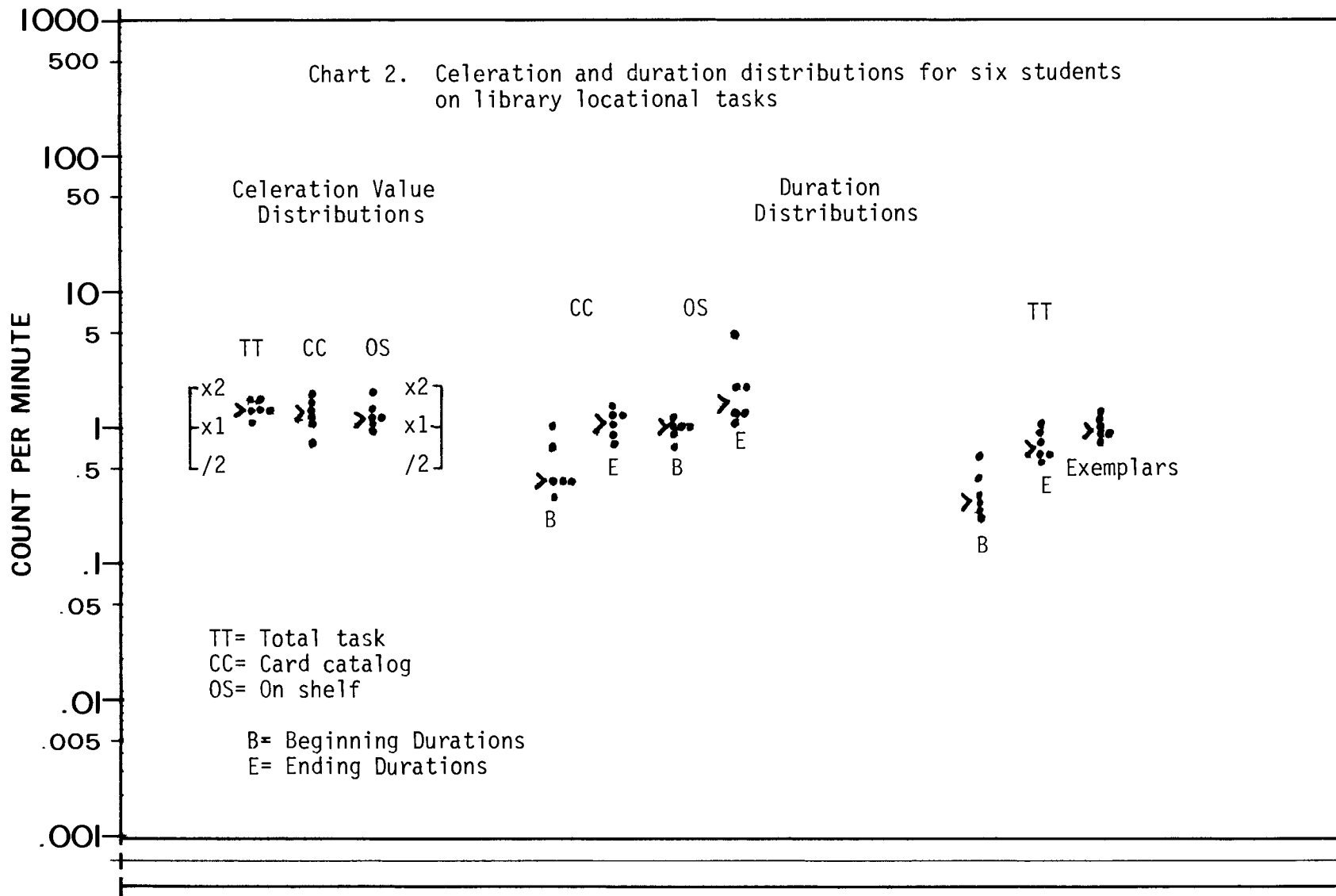
A comparison of the medians of the ending student distribution and the distribution of the exemplar group yielded a difference of x1.3. This difference was not found to be significant (Fisher's $p = .158$).

Discussion

The application of precision teaching to the locational skills of secondary level LD students was found to be an effective, efficient way of producing fluent locational behavior. Each student showed immediate improvement and, with the exception of one student, accelerated their learning by at least x1.4 (40%) per week. The student showing the least amount of growth (10% per week) was already quite proficient in locational skills as shown by his beginning duration of 16 minutes for the total task (see Vince, Table 2).

The card catalog task was generally more difficult to perform than the on-shelf task, and provided the students with a greater opportunity to improve their skills. In addition, celerations were greater for most students on the card catalog task.

One of the most important and useful comparisons of the study revealed the relationship between "hard to do" and "easy to learn", previously reported by McGreevy



6 students

locate books

(1980). In this aspect of the study, the card catalog task was consistently harder to do (both beginning and ending frequencies) than the on-shelf task. Traditional pedagogical opinion would hold that a task which is hard to do should also be hard to learn. In many cases the task would be modified to make it easier for the student to do, thus "enhancing learning(?)". In this study, no modifications were made, and students were instructed to perform the task regardless of difficulty. As the study progressed, it became clear that the card catalog task, although harder to do at first, became easier to learn. This factor was shown by the relatively steep celerations produced by the task, as compared to the on-shelf task. The steeper celerations indicated that faster growth and easier learning occurred even though task performance was comparatively more difficult. This "harder to do but easier to learn" phenomenon was further substantiated by the fact that the on-shelf task, which was easier to do for most students, resulted in less growth, thereby being harder to learn. This suggests that teachers should examine the difficulty level of their tasks in relation to growth, and quantify the "harder to do, easier to learn" relationship prior to subjectively modifying tasks on the basis of performance difficulty only.

As a group the students showed significant improvement in performance on both tasks. The first duration distribution in Chart 2 indicates the magnitude of improvement. Furthermore, a comparison of the ending durations for the total task with the total task durations of the exemplar group revealed that the two groups of durations could have come from the same population. Simply, the students became as proficient as the exemplar group after only 10 days (less than 4 hours per student) of direct practice and daily measurement of their own locational behavior. This suggests two practical implications for teachers. First, a group of students monitoring their own behavior daily can be expected to reach fluency, at their particular task, in a very short period of time. Second, when providing an aim for students to strive for, an exemplary (best ever) performance should be obtained to serve as that goal (Lindsley, 1983). In addition, the exemplar should come from a skilled, normal population rather than one characterized by handicapping conditions.

This study was limited by two factors, both relating to the public school setting in which it was carried out. First, there was little chance for reliability measures to be

carried out because the availability of other teachers as timers and observers was limited. Second, the exemplar group was measured on only one performance of the task. A one or two week daily measure of growth for this group would have provided further information about the effectiveness of direct daily measurement and practice.

Areas for further research might include: traditional single subject research designs (e.g. multiple baseline) to replicate the locational behavior at different points in time; comparisons between experimental groups and exemplar groups on celeration factors; and expansion of the scope of locational behavior to include a periodicals index, microfilm catalog, and reference material.

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David Gayler is an assistant principal with the School Board of Sarasota County, 4450 Beneva Road, Sarasota, FL, 33583, 813-953-5000, ext. 239.

**RETENTION AMONG COLLEGE STUDENTS:
A COMPARISON OF TRADITIONAL
VERSUS PRECISION TEACHING**

**C.P. Olander, D.L. Collins,
B.L. McArthur, R.O. Watts,
and C.E. McDade**

Center for Individualized Instruction

The speed and accuracy of decision-making in a clinical situation is vital for the professional nurse. Except for the pioneering work of Dean (1973), nursing education has not emphasized fluency of correct responses. At the Lurleen B. Wallace School of Nursing of Jacksonville State University, retention of precision Pathophysiology was evaluated.

Retention of material is of concern to practically everyone in higher education. Methods of improving retention should be especially welcome by educators who are concerned when their students do not possess the knowledge and skills they were thought to have mastered. Retention of learned material is affected by the kind of feedback from evaluation (Sassenrath & Garverick, 1965), the type and frequency of evaluation (Spangler & Hankins, 1975), and the timing of feedback from evaluation (Olander, McDade, Grimsley, Yaracs, & Merbitz, 1981a). Spangler and Hawkins (1975) demonstrated that immediate retention (i.e., a week interval) of psychology students was significantly enhanced by precision teaching. The present study was designed to compare the long-term (eight months) retention of nursing students following a course in Pathophysiology taught using precision teaching and traditional methods.

Method

This study was conducted with a total of eighteen students in Biology 360: Pathophysiology. Nine students were taught using precision teaching and nine using traditional methods. The latter group attended two one and one-half hour lectures per week. Student performance was measured with an essay exam after every two chapters and a comprehensive final exam.

Students taught using precision teaching proceeded at their own pace without lectures (Olander, McDade, Ulrich, & Merbitz, 1981b). Testing consisted of students responding verbally to ten randomly selected questions on flash cards. Prior to the actual evaluation, students were allowed to examine the questions and assemble the cards in any order with unlimited time to contemplate their answers. Students were required to answer eight correct responses per minute at 80 percent mastery in order to proceed to new material. Students charted their daily progress on Standard Celeration Charts, plotting frequency correct, frequency incorrect, and record floor (Pennypacker, Koenig, & Lindsley, 1972). Comprehensive verbal review tests of ten questions from each chapter were given after every two chapters.

Both groups were taught by the same instructor using the textbook, **Basic Pathophysiology** (Groer & Shelton, 1979). Both groups received three semester-hour credits for the course and covered the same number of chapters. Students taught using precision teaching earned an average course grade of 3.00/3.00, while the students taught using traditional methods earned a mean course grade of 1.78/3.00.

The dependent variable, eight month retention, was measured by an evaluation tool prepared for this study. Part I of the evaluation measured retention for definition and explanation of the physiologic significance of thirty-six terms. Part II measured retention of six physiologic concepts in essay form, one from each chapter.

Each group was tested by an unannounced retention exam. The instructions on the evaluation were read aloud, and participants were informed that they had been selected for research in nursing education, with names remaining anonymous. After both groups were tested, the anonymous evaluations were double-blind graded by two instructors.

Results

The evaluations for both groups were compared by the Mann-Whitney U Test. The results were statistically significant with the calculated probability of wrongfully rejecting the null hypothesis $<.05$. As shown in Chart 1 the students taught using precision teaching were 1.8x more accurate and 1.8x more fluent than their traditionally taught counterparts eight months after their pathophysiology course. Surprisingly, these students, who never had