Trained, Generalized, and Collateral Behaviour Changes of Preschool Children Receiving a Behavioural Treatment Package for Improvement of Gross-motor Skills

by

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A Thesis submitted to the Faculty of Graduate Studies
in partial fulfillment of the requirements
for the degree of Master of Arts

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TRAINED, GENERALIZED, AND COLLATERAL BEHAVIOUR CHANGES OF PRESCHOOL CHILDREN RECEIVING A BEHAVIOURAL TREATMENT PACKAGE FOR IMPROVEMENT OF CROSS-MOTOR SKILLS

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ABSTRACT

The present study bridged some of the conceptual and methodological gaps between educational and behavioural research in the area of perceptual gross-motor training. The study simultaneously rectified methodological inadequacies of previous investigations from the educational field and redirected behavioural research toward training situations most commonly found in public school settings. Five subjects from a public school nursery in a low-income area of Winnipeg, Manitoba participated in the investigation. A combined non-treatment control and multiple baseline across behaviours design was used to assess the effects of an adapted version of a popular gross-motor training program (Capon, 1975). Revisions in the training program included supplementing the recommended training procedure by systematically employing behavioural training techniques. The behavioural training components included: (a) instruction; (b) modelling; (c) physical guidance; (d) fading; (e) social reinforcement; (f) descriptive and corrective feedback; as well as (g) train-to-criterion and (h) mediate generalization procedures (Stokes & Baer, 1977).

Because the training program included several features which have been shown to promote generalization, a variety of behaviours were monitored to assess generalization and collateral behaviour changes produced by the program. Of the 16 dependent measures employed, 10 reflected a group of non-generalized gross-motor operants, three were generalized gross-motor behaviours, and three represented collateral measures of social and pre-academic behaviours. The non-generalized group was measured in the training setting and

included: (a) balanced staiding; (b) balanced walking; (c) ball bouncing; (4) catching; (e) throwing; (f) crawling; (g) rolling; (h) hopping; (i) running; and (j) jumping. These behaviours were rated in terms of quality of the skilled movement via a behavioural checklist.

The generalized gross-motor responses were measured during regular physical education classes conducted in the gymnasium, away from the training area. These behaviours included one trained response; rolling, and two untrained responses; hopping and skipping. Of the untrained responses, one response belonged to an operant category which received training (i.e., hopping) and the other did not (i.e., skipping). These responses were also rated in terms of quality of movement via a behavioural checklist.

The collateral measures were taken in the regular classroom situation. Two pre-academic responses; compliance and maze-drawing, and one social behaviour; social play, were measured. Social play and compliance were measured via an interval recording system and were expressed in terms of percentage of time spent engaging in social play and percentage of instructions followed. Maze-drawing was collected by the teacher and was scored by the experimenter in terms of number of errors in traversing the maze.

The results of the study indicated that the gross-motor training program was highly successful in increasing the gross-motor skill levels of the trained children. Generalization effects of the program were limited, however. Of the behaviours measured in the gym, only the trained behaviour indicated improvement due to treatment. This suggested that the program could produce transfer of a trained skill to a new setting, but would not produce improvement in other untrained gross-motor behaviours measured in the new setting. No clear changes in collateral behaviour resulted from the gross-motor program.

Implications of the study for educational and behavioural practice and research. were discussed. The three major applied implications were as follows: (1) Only gross-motor benefits should be expected to result from gross-motor training curricula such as the revised Capon program. 2) To ensure improvement in other behaviours or settings, you must either program for generalization or actually give training in the other behaviour or setting. 3) Component analysis of the training program is an important topic for further research; however, until ineffective components can be identified and eliminated, all the components included in the present package program should be systematically employed in gross-motor training procedures.

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Trained, Generalized, and Collateral Behaviour Changes of Preschool Children Receiving a Behavioural Treatment Package for Improvement of Perceptual Gross-motor Skills

In the past two decades the domain of early childhood education has experienced a proliferation of publications and materials devoted to the assessment and training of a category of behaviours known as perceptual-motor skills (Goodman & Hammill, 1973). Perceptual-motor training programs have been widely implemented in schools and much time and funding has been dedicated to these programs (Hammill, Goodman & Wiederholt, 1974). Despite the great expenditures of time and funds over the 20 yr. period for the development, implementation, and evaluation of perceptual-motor programs, professionals are still in disagreement with regard to both specific components for programs and expected benefits for the young participants.

PROGRAM COMPONENTS AND EXPECTED BENEFITS

Programs for training perceptual-motor skills vary from highly sequenced packages to loosely structured collections of activities. Examination of the variety of programs does, however, reveal some points of commonality. The majority of the most popular programs include training in balance, locomotion, eye-hand coordination, and body and spatial awareness (cf. Goodman & Hammill, 1973; Meyers & Hammill, 1976, pp. 316-375).

The benefits expected from training in these areas are even more varied than the prescribed programs. Some professionals are very conservative in expounding the benefits of their programs, asserting that the only direct benefit of perceptual-motor training is the improvement of gross-motor skills (cf. Meyers & Hammill, 1976, pp. 325-328). Side-effects of increased motor ability are noted (e.g., increased social contact due to increased motor ability in play), but the presence of other unknown and uncontrolled factors in the development of desirable side-effects is acknowledged (Meyers & Hammill, 1976, pp. 325-328).

Other professionals in perceptual-motor training are much more liberal in making claims regarding beneficial effects of programs, citing everything from enhanced intelligence (Flinchum, 1975, p. 64) to sound teeth (Getman in Cratty, 1974, p. 40). Although the claim that dental improvements are due to perceptual-motor training is rare, the assertion that these programs improve intelligence or academic functioning is more common. Most professionals in the perceptual-motor area are unified in assuming that the development of perceptual-motor skills will directly affect children's cognitive development. They believe that the ability to form motor generalizations is the foundation for the ability to generalize in the higher mental processes (Meyers & Hammill, 1976, p. 314). This assumption apparently arises from a strong developmental orientation and is based on Piaget's (1952) observation that overt motor learning precedes the covert, inner language method of problem-solving. Support for the assumption is also drawn from developmental neurology. Although a matter of controversy now (Meyers & Hammill, 1976, p. 314), it was once firmly believed that during embryonic development the growth of the association system was dependent on the prior functioning of the motor and perceptual system (Sherrington, 1948).

The validity of the assumption that perceptual-motor adequacy is important, if not essential, for cognitive and academic development has been widely accepted by members of educational and lay communities

(Hammill, Goodman, & Wiederholt, 1974). As a result, a vast number of children are screened for perceptual-motor deficiencies and subsequently run through hours of perceptual-motor training -- often at the expense of academic activities (Hammill et al., 1974). The following list was taken from Flinchum (1975, pp. 63-64) and is presented here as an example of the types of behavioural deficiencies which are commonly thought to result from perceptual-motor deficiencies and therefore are presumably remediable through perceptual-motor training programs.

1. lack of coordination in motor skills
2. clumsiness in daily activities
3. difficulty in colouring large symbols
4. difficulty in matching symbols and shapes
5. constant inattentiveness
6. consistent short attention span
7. inability to recognize and interpret symbols correctly
8. inability to interpret pictures correctly
9. difficulty with letter and number sequences
10. inability to reproduce letters, numbers, and symbols correctly
11. difficulty in form and depth perception
12. difficulty in interpreting lateral directions
13. short retention duration
14. lack of consistent dominance
15. poor self concept
16. lack of desire for participation in games
17. poor performance in movement and dance activities
18. inability to name body parts

PERCEPTUAL-MOTOR TRAINING RESEARCH

Examination of the research pertaining to the efficacy of perceptual-motor training programs for improving these deficits leaves one wondering why educators hold these programs in such high esteem. A series of reviews conducted by Donald Hammill and his colleagues during the early 1970's revealed a dismal picture for advocates of these training programs (Hammill, 1972; Goodman & Hammill, 1973; Hammill et al., 1974). The conclusion consistently drawn from reviews was that perceptual-motor training did not result in significant improvements in pre-academic skills (i.e., skills in such areas as listening, matching, copying and knowledge of the alphabet), intelligence scores, or academic achievement. Further, conclusions from studies showing that perceptual-motor training led to improvements in perceptual-motor skills were spurious, leading the authors to conclude that perceptual-motor training is probably of limited value. In order to be fair to the professionals developing and advocating these programs, however, Hammill and his associates acknowledged that a few studies (e.g., Getman & Kane, 1964; Okada, 1969; Halliwell & Solan, 1972) did show positive results. However, major problems remained in the available body of research (Goodman & Hamill, 1974). Most studies on perceptual-motor training did not meet minimum criteria of methodological adequacy and among those which did, results were sometimes theoretically inconsistent, showing improvements in untrained, but not in trained skills. Further, more carefully designed research was recommended.

Problems With Available Research

Apparently, Hammill and his colleagues considered carefully designed research to include studies which (a) had at least 20 experimental subjects, (b) provided at least 12 weeks or 60 sessions of training, and (c) utilized an experimental-control group design (Goodman & Hammill, 1973; Hammill et al., 1974). Conclusions regarding program efficacy were generally based on a body of research conforming to these specifications. Although unacknowledged by Hammill and associates, serious problems exist even in the research conforming to these specifications. These types of studies have major drawbacks in design and methodology which may be obscuring program benefits. The specific drawbacks include use of a large-N research design and type of assessment measure utilized.

Use of large-N or Group Comparison Design

The vast majority of perceptual-motor research utilizes the traditional large-N or between-groups comparison design. An aspect of this design which is problematic to perceptual-motor studies is the necessity of averaging results for the experimental group and for the control group prior to group comparison. This averaging obscures individual reactions to treatment. In studies where some experimental subjects improve while others get worse, the averaging of results leads to cancellation of these opposite effects, yielding the overall result of little or no effect when compared to the control group (Bergin, 1966; Hersen & Barlow, 1976, pp. 13; 15-16). Difficulties due to such cancellation effects are more likely to occur when a group of subjects with quite different problems are recommended for the same treatment (Hersen & Barlow, 1976, p. 13). As the list on page 3 demonstrates, students with quite diverse problems are considered to be suitable candidates for perceptual-motor training. It is likely, therefore, that the heterogeneity of subjects recommended for perceptual-motor training programs combined with the use of group comparison design, leads to masking of the effects of these programs.

A second factor which may increase the probability of cancellation of effects through averaging concerns the frequency with which dependent measures are taken in perceptual-motor training research. Traditional group comparison designs require dependent measures to be taken only twice, once prior to program implementation and once after. Although multiple measures can be taken in large-N research, typically they are still infrequent, occurring once every several months. The problem with such infrequent measurement is that it leads to loss of important information regarding the course of behaviour change and any possible fluctuations in behaviour occurring throughout the course of the experiment are omitted from analysis (Hersen & Barlow, 1976, p. 71). Failure to account for such fluctuations at pre- and posttests would also increase the probability of cancellations when results are averaged.

Given the above considerations it becomes apparent that large-N research utilizing infrequent dependent measures on groups of subjects with diverse behavioural problems is a weak tool for assessing the effects of perceptual-motor training programs. The viable alternative is, of course, the small-N or single organism design which utilizes frequent measures and does not average group results. Further strength would be given to the small-N design which chose its subjects on the basis of similarity in behavioural problems (Hersen & Barlow, 1976, pp. 56-67).

Use of Indirect Assessment Tools

As previously noted, a second major drawback of the body of available research on perceptual-motor training programs concerns the type of assessment measure utilized. Assessment measures often cited in the research (e.g., Goodman & Hammill, 1973; Hammill et al., 1974) include the following tests: Visual-motor Gestalt Test (Bender, 1938), Developmental Test of Visual Perception (Frostig, Maslow, Lefevre, & Whittlesey, 1974), Purdue Perceptual Motor Survey (Roach & Kephart, 1966), Developmental Test of Visual-Motor Integration (Beery & Buktenica, 1967), and Primary Visual Motor Test (Haworth, 1970).

All of these measures are indirect in nature. Indirect tests assume that test responses are indicative of more enduring traits which may be observed in diverse stimulus situations and which will manifest themselves in diverse aspects of an individual's behaviour. Particular responses on the tests are, therefore, rarely examined in terms of their overt qualities but are interpreted in the context of the theoretical structure (Hersen & Barlow, 1976, pp. 114-115).

Since the indirect approach puts little emphasis on individual overt responses, ratings for different behaviours are averaged to give a standardized score which is thought to be representative of the more general underlying trait. This averaging procedure (as the previous one across subjects, p. 5) leads to loss of information regarding changes in specific behaviours which may be occurring as a result of some aspect of a perceptual-motor training program. If averaging of behaviour ratings occurs across behaviours which are very similar in nature, loss of information will be less severe as discrepancies in ratings among specific behaviours will likely be less. However, the more diverse the behavioural ratings, the more likely that such averaging will produce cancellation of effects.

As mentioned above, indirect assessment measures make use of diverse stimulus situations and diverse behaviours in order to reveal the underlying, enduring traits (Hersen & Barlow, 1976, pp. 114-115). It is likely, therefore, that the use of scores on indirect assessment tests as dependent variables in experimental evaluation reduces the probability that changes in behaviour will be detected and attributed to the perceptual-motor training program. Perceptual-motor tests are weak tools for assessing changes in behaviour due to perceptual-motor training, as they are indirect assessment techniques which limit the conclusions that can be drawn when the data are examined.

It is important for experimental purposes to have dependent measures that do not weaken the experimenter's ability to detect changes and draw conclusions. It is equally important, however, that the dependent measure be representative of behaviours which are socially or clinically important. Although it is legitimate for researchers to ask questions about changes which may be occurring in the experimental situation and to take measures which are specific to this situation, it is also important to have measurements which are likely to give some indication of what is occurring in the classroom or other settings in the child's natural environment. It is, of course, the student's daily perceptual-motor functioning which is of primary concern. Therefore, it is important that the behaviours sampled in the assessment situation be representative of those in the natural environment.

Administration of indirect assessments requires the construction of a test situation which is unlike the situation in which the subject normally functions. Tests are typically administered by a trained clinician or experimenter in a quiet environment outside of the classroom. Materials involved in the test include special forms or equipment which are somewhat unfamiliar to the student being tested. These factors lead to the rather large discrepancy between the assessment situation and the regular classroom where the teacher, peers, and familiar equipment and material are present. Generally, the greater the discrepancy between the assessment situation and the natural environment, the less representative the assessment measures will be (Hersen & Barlow, 1976, p. 116). If the assessment measures are not representative of classroom behaviour, scores on the assessment tests will poorly predict how the child will behave in daily classroom activities.

For some time now, a number of researchers have been aware of the low predictive validity of perceptual-motor surveys for a variety of classroom behaviours (cf. Hutt & Briskin, 1960; Shick & Plack, 1976) and have noted that indirect assessment tools generally do not demonstrate good predictive validity (Mischel, 1968; 1972). Despite this fact, perceptual-motor surveys continue to be used as assessment devices (cf. Goldfried & Kent, 1972).

Given that perceptual-motor surveys are weak tools for detecting specific treatment effects and do not provide information particularly relevant to a child's classroom functioning, it becomes apparent that an alternate assessment approach is desirable. The obvious alternative is the direct assessment approach where a specific response is viewed as a sample of similar responses elicited under particular stimulus conditions (Hersen & Barlow, 1976, p. 116). No underlying, general trait is assumed; therefore averaging of responses occurs less frequently and only when very similar behaviours and similar stimulus conditions are involved. Observation of individuals in their natural environment is favored and predictive validity is therefore enhanced (Hersen & Barlow, 1976, p. 116).

REVIEW OF THE BEHAVIOURAL RESEARCH

The experimental analysis of behaviour involves a research approach which favors direct measurement and single organism designs. Unfortunately, perceptual-motor programs have evoked little interest in the field of behaviour analysis. Although a number of studies have been concerned with perceptual-motor skills involving visual discriminations and fine-motor coordination among children labelled "learning-disabled" (cf. Hopkins, Schutte, and Garton, 1971; Salzberg, Wheeler, Devar, & Hopkins, 1971; Tawney, 1972; Hasazi & Hasazi, 1972; Smith & Lovitt, 1973; Stromer, 1975; Lahey, 1976; Lahey, Busemeyer, O'Hara, & Beggs, 1977; Trap, Milner-Davis, Joseph & Cooper, 1978), very few studies have examined the gross-motor skills which are prevalent in most perceptual-motor training programs. A review of the literature revealed only three studies which utilized single organism design and direct measurement of general gross-motor activity.

Johnson, Kelly, Harris and Wolf (1966) were the first behavioural researchers to examine the development of motor skills. Their single subject was a preschool child who avoided vigorous physical activity; particularly activities involving climbing. They utilized an ABAB reversal design with subsequent training for generalization to demonstrate that contingent teacher attention could increase rate of climbing on a large climbing frame and produce generalizations to other climbing apparatus. Although the social reinforcement was contingent only on contact with climbing equipment and not on improvement in climbing skills, a marked improvement in climbing skills was noted. Unfortunately, however, no empirical data were available on this dimension. It was thought that the apparent improvement in skills could be due to practice alone, but the fact that teachers tended to reinforce more skillful climbing with greater enthusiasm was acknowledged as a possible contributing factor. The authors also noted that their treatment seemed to have produced desirable modifications in two other classes of behaviour which they had not attempted to control or record. These behaviours were (a) improved skill with all active play equipment and (b) an increase in social and verbal skills enabling more effective interaction with peers.

A second study investigating preschool children's large-motor behaviour was conducted by Buell, Stoddard, Harris and Baer (1968). Their subject was a 3 yr. old girl with deficits in both motor and social repertoires. These authors also utilized a reversal design to examine the use of teacher attention for increasing contact with outdoor play equipment. In addition, they attempted to provide more objective data regarding collateral changes in a variety of social behaviours and one class of undesirable baby-like behaviour (i.e., monosyllabic, repetitive talk, hand flapping, hopping from one foot to another, and speaking incomplete sentences).

Because baseline rate of equipment interaction was very low, a priming plus reinforcement technique was first implemented so that more examples of the behavioural class would be available for reinforcement. The priming (or physical prompting) technique consisted of simply lifting the child onto a piece of play equipment once each play session and holding her there at least 30 sec. if necessary. During this period (and during any unprompted occasions of equipment use) the teachers gave social attention to the child. A different piece of play equipment was used for priming each successive day. After nine days of priming plus reinforcement, priming was discontinued and reinforcement for interaction with equipment was given first on a continuous schedule, then on an increasingly intermittent schedule.

Examination of the data for this study revealed clear increases in the rate of equipment use due to the priming plus reinforcement procedure. Although there was a slight drop in rate of equipment use when initially switching to the reinforcement alone condition, the rate quickly recuperated and increased during subsequent reinforcement phases.

Collateral changes in social development were also noted. Increases in occurrences of touching and verbalizing to other children were observed. Cooperative play increased and increased usage of other children's names surfaced late in the study. Teacher-oriented behaviours (i.e., touching and verbalizing to teacher) remained constant throughout the study as did the rate of parallel play behaviour. Undesirable baby-like behaviours decreased in frequency.

The authors concluded that teacher-supplied social reinforcement was effective for increasing the target behaviour of interaction with playground equipment. They also noted that the study quantitatively demonstrated that different kinds of correlated behaviour changes may accompany behaviour modification programs, especially when the behaviour chosen for direct modification is a sound tactical choice, in view of the child's total range of behavioural deficits. Although the authors did not state this directly, they seem to suggest that a productive therapeutic tactic is to examine all of a child's deficits, then to determine if training on any one deficit is likely to produce entry to natural communities of reinforcement which may correct other behavioural deficits. The authors did directly note that increasing the use of play equipment was apparently successful for producing entry to a social environment which had the potential to shape a wide variety of social skills.

One of the authors, Donald Baer, has discussed this particular phenomena in detail elsewhere (Baer & Wolf, 1970) and has been among those who have considered the more basic issue regarding the control of response classes of behaviour (Bijou & Baer, 1967; Wahler, 1975). These authors have argued that physically different behaviours can be controlled as a response class. Data have supported the contention that problem behaviours emitted by a child are functionally associated with other behaviours she or he emits (Wahler, 1970). It is therefore felt that modification of some problem behaviours can occur indirectly through setting contingencies for the other covarying behaviours in the response class. Entry into a natural community of reinforcement is one of the mechanisms through which these contingencies for covarying behaviours may be set.

The third, and most recent, behavioural study examining preschool children's large-motor skills was conducted by Hardiman, Goetz, Reuter and Le Blanc (1975). They examined the effect of prompts, contingent attention, and training sessions on the frequency and skill level of the large-motor activities of a cerebral palsied preschool girl. Activity on six pieces of playground equipment was involved. The activity equipment included (a) a stepping ladder placed horizontally on the ground, (b) a set of wooden steps, (c) a slide, (d) a balance board, (e) a grassy slope which was used for rolling, and (f) cement steps leading to the playground. The cement steps were not actually trained as a part of playground equipment, but were used to assess generalization to an adjoining setting.

Assessment of the child's activity was based on four levels of interaction with the equipment: (a) being within a radial proximity of 2 m to the equipment, (b) touching or sitting on the equipment, (c) unskilled performance, and (d) skilled performance. The latter two categories were given detailed definitions specific to each piece of equipment.

Two aspects of the treatment were evaluated. First, the effects of components of teacher behaviour were assessed separately and in combination using reversals in the design. Second, the effects of the training package were assessed with a multiple baseline across playground equipment. As mentioned, the components of teacher behaviour were prompts and contingent attention. In prompting phases of the study, the teacher made a verbal request for the child to engage in an activity (e.g., "let's see you walk on this balance board"), then turned away from her. In the contingent attention phases, the teacher waited until the child engaged in one of the six specified activities, then attended to her briefly by giving praise or physical support. In the combined prompt and contingent attention conditions the child was prompted once daily for each playground activity and was given contingent attention for following the prompt.

The training package was applied to only four of the activities (stepping ladder, wooden steps, slide, and grassy rolling slope). During training sessions one of the teachers prompted the child to the equipment, praised her, gave limited physical guidance, and gave reinforcement (choice of a small toy) for reaching criterion level of skilled performance. Although Hardiman et al. identify the critical features of the training package as physical assistance, a requirement to participate, teacher attention, and prompts, their description of the training procedure seems to indicate the presence of two more features. First, authors indicate that praise sometimes included descriptive feedback. The example given for the use of praise is "Good, Penny, you put a different foot on every step" (p. 403). Second, description of the use of physical assistance indicates that corrective feedback or detailed instruction sometimes evolved: "Limited physical assistance was given only when needed for safety or to show Penny where to place her hands or feet" (p. 403).

The results of the study revealed that before training, prompting was more effective than contingent attention for increasing frequency of interaction with all five playground activities. Contingent attention was successful in increasing frequency of activity above baseline, (but not above prompting levels) only in the case of the wooden steps. In contrast, prompting produced a frequency above baseline on all equipment. However, it produced increased skill on only one activity, movement on the balance board. The combined prompts plus contingent attention phases, surprisingly, did not produce responding notably different from the prompting alone condition.

Training of the four activities effectively increased skill level in each activity as it was trained. Generalization of increased skill level to the untrained playground activity (balance board) was noted. Generalization of improved skills on the cement steps in the adjoining setting also occurred. After training, prompts and contingent attention were sufficient to maintain skill level and participation in all the activities.

The authors concluded that prompts were successful for increasing frequency of interaction with playground equipment, but that training on the equipment was necessary to improve gross-motor skills. Unlike Johnston et al. (1966) and Buell et al. (1968), Hardiman and her colleagues did not find collateral changes in social behavior during the study.

Summary of the Research Findings

The behavioural studies addressing gross-motor activity have indicated that adult attention will lead to increases in frequency of interaction with playground equipment (Johnston et al., 1966; Buell et al., 1968; Hardiman et al., 1975), but will not ensure improvements in gross-motor skills (Hardiman et al., 1975). Training of gross-motor skills has, however, produced improved skill in activities trained, plus generalization of skill improvements to other gross-motor activities in the training situation and surrounding area (Hardiman et al., 1975). Collateral improvements in social behaviour have been noted in two of the three studies (Johnston et al., 1966; Buell et al., 1968) suggesting this is a possible positive side effect of increased gross-motor activity. The results of this behavioural research seem to provide support for the educators who advocate the use of perceptual-motor training programs which concentrate on gross-motor skills. There are, however, certain issues which warrant careful consideration before the results of the research are allowed to reflect on perceptual-motor training programs.

The first issue concerns the side effects of perceptual-motor training. It should be noted that although the behavioural research generally provides support for the frequent claim that perceptual-motor training leads to increased social behaviour (Fretz & Johnson, 1973), the behavioural analysis of this phenomonon suggests that such modifications are not the direct result of training. Improvements in social behaviour are instead thought to be the result of entry into a social environment which has potential to shape social skills. Further, as the Hardiman et al. (1975) study indicates, entry into the social environment through motor skills training does not ensure the potential for social skills shaping will be realized.

In addition, none of these studies addressed the issue of collateral changes in attention span, matching ability, game participation, colouring, aggression, etc., all of which have been claimed as positive effects of perceptual-motor training programs (e.g., Fretz & Johnson, 1973; Flinchum, 1975, pp. 63-64). The collateral changes examined in behavioural studies have been limited primarily to a small number of social behaviours exhibited in the training situation. Claims regarding changes in other behaviours, particularly those outside the training situation, are completely unsubstantiated by the behavioural studies.

The second important issue concerns the disparity between training procedures. Each of the behavioural studies utilized a limited amount of equipment and addressed a limited number of activities in comparison to most perceptual-motor training programs. Only one study (Hardiman et al., 1975) trained and measured changes in movement skill, and "skilled movement" was defined in a manner quite different from that of perceptual-motor educators. Hardiman et al., (1975) defined skilled movement in terms of behaviours exhibited on each specific piece of activity equipment utilized in the study. In contrast, perceptual-motor educators define skilled movement in terms of the topography of different operant responses, irrespective of the equipment utilized (cf. Godfrey & Kephart, 1968).

An additional procedural discrepancy that is noted when examining teacher-student ratios. Although other children were often present during behavioural training procedures, treatment in all three studies was specifically directed to only one child. In the one study which actually trained motor skills (Hardiman et al., 1975), the teacher-student ratio was one to one. In most educational settings such a ratio is a rare luxury. Ratios of four to six students to one teacher are generally considered the optimum which can be expected (cf. Capon, 1975, p. 4).

Finally, in each of the behavioural studies the subject of the study was apparently chosen because she or he was an extreme case in terms of low frequency and/or skill in engaging in gross-motor activity. Although such homogeneity is a design strength with reference to single case methodology (as previously discussed, pp. 6-7), it does initially limit conclusions to the homogeneous population studied (Hersen & Barlow, 1976, pp. 56-57). The children most often recommended for perceptual-motor training in the educational setting are not part of the aforementioned group, as they do not necessarily exhibit gross deficiencies in large-muscle activity. As stated previously (pp. 3-4) educators recommend children to these programs for a variety of reasons. Most children recommended have some motor defects, but they are not likely to be as severe as those exhibited by children in prior behavioural research studies.

To summarize, behavioural studies provide limited information regarding the effects of elaborate perceptual-motor training due to discrepancies in procedure and severity of behavioural deficiencies of the children involved. In addition, behavioural research has not been addressed to assessment of a variety of collateral behaviour changes outside of the training situation. Therefore, the results of behavioural studies can at best be considered to provide promising suggestions for future research concerning perceptual-motor training programs.

DESCRIPTION AND RATIONALE OF PRESENT STUDY

The present study bridged some of the conceptual and methodological gaps between educational practice and behavioural research by rectifying the methodological problems of educational investigations and redirecting behavioural research toward situations and procedures most commonly found in public school settings. Rectification of many of the methodological problems of educational studies was achieved through use of small-N design and direct assessment techniques. Subjects with similar behaviour problems were selected for participation in the study. As previously discussed (pp. 5-10), these factors strengthen the ability to detect changes due to training. The use of direct assessment in both experimental and natural environments also enhances the relevance of the information obtained from the investigation, as predictive validity is increased by such direct measurements (p. 9). In order to redirect behavioural research to address questions more relevant to the common public school situation and procedure, the research was conducted with a group of children in a public school setting and involved a more complex training program than had been utilized in the previous behavioural literature. Several different collateral behaviors which educators claim to be affected by perceptual-motor training were monitored for changes throughout the study.

Training Program

The training program involved a variety of behavioural techniques which were implemented in a standardized training fashion. This behavioural training procedure was applied to a series of tasks outlined in a perceptual-motor training program developed by Capon (1975).

Rationale For Use of Capon Program

The Capon program was chosen in favor of other perceptual-motor programs because it meets all the conditions necessary for a behaviour modification study without becoming largely discrepant with the common educational situation and procedure. There are several factors which produce this compatibility. First, the program provides a clear outline for treatment procedures. It is a highly structured program which specifically identifies a total of 150 activities. Therefore, it meets the criterion of similarity to common programs by providing numerous activities on a variety of equipment. At the same time, it defines behaviours specifically, meeting an important criterion for a behavioural program.

A second factor producing compatibility is that Capon (1975, pp. 7-8) advocates the use of behavioural techniques for the training of tasks. Teachers are instructed to inform students of correct technique and skill for successful participation, then to model the task or have a student do so. Shaping and physical guidance are suggested for children who need them, and gradual fading of physical guidance is recommended. Social reinforcement for successful performance is advocated. Although Capon does not set clear guidelines for training to criterion, some form of train-to-criterion is suggested (Capon, 1975, pp. 7-8). Because guidelines for behavioural training procedures were already provided for this program, it seemed that standardizing behavioural training procedures for the purpose of this study did not alter the actual perceptual-motor program significantly. Therefore, the program allowed the use of a structured behavioural procedure without producing large discrepancies to what is found in educational practice.

Other factors, besides the convenient adaptability of the Capon program to behavioural research, contributed to choosing this program. One of these factors was the prevalence of the program's use in educational settings. The program was reported to be widely implemented throughout America (Capon, 1975, p. 1) and casual survey of a number of schools indicated that it is indeed widely utilized in the public schools in Winnipeg.

A second factor was that the program is directed exclusively to gross-motor skills, as were the previous behavioural studies. Yet, the program provides training in the same skills as the majority of popular educational perceptual-motor programs. As mentioned previously (p. 1), these skills include balance, locomotion, eye-hand coordination, and body and spatial awareness. In addition to these skills the Capon program addresses eye-foot coordination (Capon, 1975, p. 2).

Analysis of Skills Trained

An examination of the numerous training tasks in the Capon program revealed that a large number of different responses are involved in training the aforementioned skills. However, types of responses most often involved in the training tasks can conveniently be divided into 10 operant classes. Each of these operant classes encompasses a group of similar behaviours which may, during different activities, take on altered topographies. Each of these operants is also exposed to a variety of stimulus conditions, as the equipment is altered from activity to activity.

1. Balanced standing. This category refers to a variety of behaviours where the weight of the body is maintained in a static position on one or both feet only. Specific behaviours in this class include standing on one foot and balancing in a variety of positions, or standing in one spot while bending to pick up objects. Activities involving the class of responses may take place on the floor or on a balance beam. The qualities of skilled balanced standing include maintenance of relatively straight position. Shoulders, hips and feet should be in fairly straight alignment when viewed from both front and side. Feet may move to slightly new positions on the floor, as long as the movement does not produce movement of the entire body. (Godfrey & Kephart, 1969, p. 98).

2. Balanced walking. Behaviours in this class include movement forward, backwards, and sideways on feet only. Arm movement is not involved and body movement is limited to a confined path. Activities involving balanced walking may occur on ropes, geometric shapes and ladders laid horizontally on the floor as well as on balance beams. In skilled balanced walking, shoulders, hips, and feet remain in straight alignment, eyes are focused ahead (not at feet), and arms are held away from the body to be used to adjust body weight (Capon, 1975, pp. 14-16).

3. Ball bouncing. This operant category is fairly restricted, referring only to responses which involve propelling a ball in an area between the hands and the floor. Bouncing and catching or dribbling a ball are specific activities in this category. These activities involve, of course, a ball and the floor. Additional apparatus may be used however, including hoops, bicycle tires, traffic cones, ladders, geometric

shapes, ropes, and the balance beam. In skilled bouncing, the ball is pushed down to the ground, not dropped or slapped. Eyes are directed toward the ball, hand and floor (Capon, 1975, pp. 16; 45). The ball is maintained in a verticle path between the hand and the floor.

4. Catching. This category is also limited, referring only to responses which involve receiving and retaining an object which has been propelled through the air. Specific behaviours may include catching a bean bag or ball which is tossed by another person, bounced off a rebound net, or launched off a launching board. The activities make use not only of the equipment just identified, but may also utilize the balance beam, requiring the performance of catching while maintaining balance on the beam. In a skilled catch, standing or walking balance is maintained and the object is received and held by a hand grasp rather than by a clasp involving the arms and body (Godfrey &Kephart, 1969, p. 131).

5. Throwing. This category includes a variety of behaviours where an object is propelled by the hands and arms. It may occur in an overhand or underhand fashion and may result in the object following an airbound trajectory or rolling along the ground. Activities involving throwing make use of bean bags, balls, bicycle tires, waste paper baskets, geometric shapes, a rebound net, and bowling pins. In a skilled throwing pattern the hand moves back behind the body then swings forward in front of the body, releasing the object, then continuing to follow through. The hand should move in a straight path parallel to the side of the body throughout. In the overhand throw, the hand snaps downward at the end of the follow-through. The foot pattern for both throws should be such that a step is taken forward with the foot opposite the

preferred arm at the time of the release (Godfrey & Kephart, 1968, pp. 119-120).

6. Crawling. The crawling category involves a large number of responses of very different topography. The element which all responses have in common is a cross-lateral movement pattern where left and right sides of the body (i.e., arms and legs) must be moved together in the same or opposite directions. Unlike jumping patterns of movement, in crawling movements the body maintains contact with the floor. Crawling activities include a vast array of pieces of equipment which serve primarily as obstacles. Such equipment may include a ladder, traffic cones, geometric shapes, hoops, auto tires, bowling pins, a jump box and cross-bars. Scooter boards may also be utilized to support body weight as the arms engage in the cross-lateral pattern. In skilled crawling there should be even use of body sides. Unequal use will result in movement toward the side rather than a straight forward pattern (Godfrey & Kephart, 1969, p. 82). Skilled crawling requires constant repetition of the designated lateral pattern. (Left and right sides move either together or in an opposite fashion depending on the activity.) Hands and/or feet should generally point forward, limbs should be placed, not dragged, and the movement should generally be smooth in nature. Pauses, jerks, and hesitations should not occur (Godfrey & Kephart, 1969, p. 164). In activities involving obstacles, the obstacles should not be touched and should not fall over or move (e.g., Capon, 1975, p. 17).

7. Rolling. This category refers to behaviours where the body executes a circular path in contact with the floor and terminates in the same or similar position to that of starting. Two basic types of

rolls are trained, forward rolls and sideward rolls. Most rolling is done on mats, but some activities combine rolling with jumping so that they may include a bicycle tire and a jump box. In skilled forward rolls, hands should be placed flat on the mat, slightly in front of the body and pointing forward. The feet provide the push to give the roll momentum and the body should remain tucked during execution of the roll (Capon, 1975, p. 40). Both sides of the body should be used equally resulting in a straight path of movement and successful return to the starting squat position (Godfrey & Kephart, 1968, p. 165). In skilled sideward rolling, legs and arms are kept straight. The movement of the roll is produced through the muscles of the torso only (Capon, 1975, p. 24). Again, both sides of the body should be used equally resulting in a straight path of movement.

8. Hopping. This is a limited category of behaviour including only those responses which involve a jump using one foot only. This response may be performed on either foot. Activities involve equipment such as ropes, hoops, bicycle tires, and cross-bars. In a skilled hop, only one foot touches the ground (Capon, 1975, p. 10); the non-hopping foot has no contact with the ground at any point of execution (i.e., take-off, movement, and landing). The knee of the hopping foot is kept slightly bent, the body lifting action coming primarily through the ankle and hip (Godfrey & Kephart, 1969, pp. 75-76). Shoulder, hip and foot alignment should be fairly straight.

9. Running. This operant response group refers to behaviours which involve swift movement on the feet only. Lateral arm movement is involved and body movement is in a less confined path than that involved in balanced walking. The activities in this class are largely confined

to the behavior of running up the incline of the jump box in the jumping activities. The one exception is an activity which requires the child to run in the spaces of the horizontally placed ladder. It is included as an operant category here because of the importance of balanced running in executing the jump box activities. The only piece of equipment directly related to running behaviour in activities are the jump box and the ladder. A skilled running pattern consists of smooth movements in forward and backward directions only. Arms should not cross in front of the body, but move back and forth parallel to the sides. Feet should not be flung out to the side during leg movement. There should be minimal sideward weight shift, resulting in smooth travel in a straight path when observed from front or behind (Godfrey, & Kephart, 1968, p. 65).

10. Jumping. The jumping category of behaviors includes a variety of responses which follow a locomotor pattern where the knees, ankles and hips are bent, then forceably extended, to project the body up into the air or forward or both. Turns may also occur in mid air. In jumps which begin from a squatting position the arms are involved and hands make contact with the floor. In jumps beginning from a standing position, arms are used to promote movement but do not touch the floor. Activities involving jumping may utilize hoops, tires, cross-bars, a ladder, a jump box, balls, a trampoline, ropes and geometric shapes. In skilled jumping, both feet leave the take-off point at the same time and land at the same time (Capon, 1975, p. 10). In the case of upright jumping, the arms are brought back then swing forward, backward or upward, depending on the direction of the jump. At the point of take-off the jumper leans from the ankles in the direction of the jump. Knees

bend upon landing to absorb the shock. Both sides of the body should be used equally to avoid torque or veering (Godfrey & Kephart, 1969, pp. 66-75).

It should be acknowledged that although the 10 operant classes are the basic skills trained, a variety of other responses involving reflexes or muscle strength (e.g., reaction drills and modified push-ups) are practices less frequently. Furthermore, in the process of training these gross-motor skills, several other skills are involved and receive incidental practice and/or training due to the nature of the activities. A list of these incidentally-trained skills follows:

1. Compliance to instructions and attention span. In virtually all activities the children must attend carefully to instructions, then follow them, in order to receive reinforcement for correctly completing the task.

2. Identification of body parts. Instructions during most activities include referral to different body parts. Children must know or learn the names of these body parts in order to execute the task or to make corrections.

3. Identification of shapes. In activities utilizing the geometric shapes, children must be able to discriminate between the shapes and must know their verbal labels in order to follow directions correctly.

4. Knowledge of positions. In several activities the child is asked to crawl under, walk beside, go over, move around objects and so forth. Such naming of positions must serve as effective discriminative stimuli for the child to succeed.

5. Right-left discriminations. Children are often told what hand or leg to use in throwing and hopping exercises. In addition they are

asked to make changes in movement or position of specific limbs. Because these communications are made referring to specific sides of the body as "left" or "right", this discrimination receives some training.

6. Verbal skills. In some activities children are told to describe what they are doing or with what equipment they are working. Some practice, reinforcement, and feedback on verbal skills and social behaviour therefore occurs.

The specific components which are involved in the incidental training of these behaviours likely follow the training techniques for the gross-motor behaviours. Although detailed instruction for correct technique does not apply, modelling on some of these behaviours would occur as the children watch their peers perform activities. Shaping of correct responses and social reinforcement likely occurs as well. Physical guidance or verbal prompting would also take place for many of these tasks.

In summary, an analysis of the Capon program led to the identification of many skills. A series of 10 categories of gross-motor tasks are directly trained frequently; other behaviours receive less frequent attention. Incidental training also occurs on six types of non-motor skills.

Generalization Training Components of the Program

If an educator wants to develop a training program that will lead to changes in more behaviours than just the ones trained and to produce those changes in a variety of settings she or he is, of course, addressing issues of generalization. Fortunately, there is a technology of generalization programming from which educators can now draw.

Recently, Stokes and Baer (1977) reviewed the generalization programming strategies used in previous research and conceptually organized the research, classifying strategies according to similarity of procedure. Five of the nine categories discerned by Stokes and Baer are relevant to Capon's program and therefore will be summarized here.

Train and hope. This was found to be the most frequent method of examining generalization in applied behavioural research. Apparently, it is also the prevalent approach in perceptual-motor training. This strategy is essentially a lack of programming. It is hoped that some generalization will occur and any changes which are noticed are subsequently reported, but a method for promoting generalized changes is not actively pursued.

Sequential modification. This is a more systematic approach to generalization than train and hope. It involves assessing generalization effects of a program and if generalization is absent or deficient, measures are taken to produce the desired effects. The program is implemented sequentially to every non-generalized condition (e.g., across behaviours or settings) until the desired changes occur.

Train sufficient exemplars. If the result of teaching one exemplar of a generalizable lesson is only the mastery of the exemplar taught, another exemplar of the same lesson is trained, and then another, and another and so on until the desired generalization is induced. This strategy differs from sequential modification in that during sequential modification, training of exemplars occurs until all are exhausted whereas in train sufficient exemplars, additional exemplars are trained only until the desired generalizations occur.

Introduction to natural maintaining contingencies. In this strategy, behavioural control is transferred from the trainer to stable, natural contingencies that can be trusted to operate in the environment to which the student returns. This is usually accomplished by choosing behaviours to teach that will meet maintaining reinforcement after training. In discussing this strategy, Stokes and Baer examined the Buell et al. (1968) study reviewed earlier (pp. 11-13). To reiterate, these authors suggested that therapists examine all of a child's deficits, then choose to train the deficit which is likely to produce entry to natural communities of reinforcement for other behavioural deficits. If a child can be "trapped" into natural communities of reinforcement, trained behaviours will be maintained and new behaviours required for successful functioning in the community will develop.

Mediate generalization. In this strategy a response which will likely facilitate correct responding in new situations is trained as a part of a program. If the trained response constitutes sufficient commonality between the original learning situation and the new situation, generalization of the correct response will occur.

The most commonly used mediating response is apparently language. Since a verbal response is also a stimulus for both speaker and listener, it meets perfectly with the logic of the salient common stimulus to be carried by the subject from the training situation to any new setting.

Relevance to Capon program. The Capon program is essentially a train and hope strategy in that none of the generalization training strategies is systematically applied. The program does however, have components which approximate the strategies described above. As the behaviour analysis of the Capon program revealed, a large number of behaviours are directly or incidentally trained during the program and training for each skill involves a variety of stimulus situations which are produced through the use of several types of equipment arrangements. This approximates a sequential modification and a train sufficient exemplars strategy.

With regard to gross-motor behavior, the Capon program trains all behaviours of concern as does a sequential modification strategy. The program does not train them in a sequential manner however, and does not therefore make any generalization checks before exhausting behaviours. Thus, Capon's approach only approximates the strategy and therefore, may be less cost-effective as it will train all responses irrespective of generalization which may result from the initial training. This approach may have its strengths, however. Logically there is no reason to train responses sequentially if the initial training does not result in generalization and all responses are eventually going to be trained. Although it has generally been the behavioural strategy to train one response at a time, the simultaneous training of a number of responses may be just as effective as long as care is taken to insure that the student is not overloaded. Indeed, the variety of the approach may have added benefits. Each student in the program is likely to master a number of behaviours easily and to have difficulty mastering others. The reinforcement she or he receives for the former tasks is easily obtained and present throughout the program. It is possible that this factor increases enjoyment in the program and helps to maintain responding on the tasks which are more difficult to master.

As mentioned previously (pp. 1-3), the benefits of perceptual-motor training are expected to extend beyond gross-motor improvements to a wide variety of other behaviours which typically occur in other situations. In this aspect, the Capon program is similar to the strategy of train sufficient exemplars. The strategies differ in that the other behaviours and situations are not monitored systematically during the training program as is the case in the generalization strategy. This lack of systematic measurement leads to uncertainty as to whether generalization has occurred to other behaviours or other situations, and it therefore is not known if sufficient exemplars have indeed been trained.

As the Buell et al. (1968) study demonstrated, gross-motor programs can produce entry into natural communities of reinforcement. Since the Capon program is also concerned with gross-motor skills, it is likely that it, too, results in leading students into natural maintaining contingencies. It does not however, program for gradual transfer of training from teacher to student, nor does it analyze the deficits of each student carefully before deciding which behaviours to train. Therefore, the strategy of introducing to maintaining contingencies is not systematically applied, although such a result may occur.

As mentioned earlier (p. 20), Capon recommends the use of instruction regarding the correct technique for performing a task. For each operant the instructor is to verbalize the essential features of the skilled movement. This constitutes an extremely close approximation to the mediate generalization strategy. It is not quite mediate generalization, because the student is not actually trained to emit the verbal response.

To summarize the preceding discussion, it is apparent that although Capon's program is essentially a train and hope strategy, there are several features of the program which approximate generalization strategies. Many behaviours are trained under numerous stimulus conditions, producing a sequential modification strategy with regard to gross-motor activity and resembling a train sufficient exemplars strategy with regard to other situations and other behaviours. Because gross-motor skills are an important factor in children's interactions, the program is likely to produce entry into a natural community of reinforcement where improved gross-motor skills will be maintained and new behaviours will be shaped. Finally, the program recommends the use of verbal mediators which may facilitate generalization when the child moves to a new setting.

Assessment Measures

In light of the preceding discussion, it becomes apparent that the Capon program has potential for producing many desirable behaviour changes. Because this potential exists, several different behaviours in several different situations were assessed for changes due to treatment.

Gross-motor Behaviour

Non-generalized. Measurement of skill level of a gross-motor response in each of the 10 different operant categories occurred within the training situation. These assessments were conducted by the trainer; therefore, the data represent non-generalized behaviours in a non-generalized situation.

Generalized. Measurement of skill level of several gross-motor activities also occurred during the children's regular physical education classes. Since this class was conducted by the classroom teacher in a room other than the training room, it constituted a different situation. One of the behaviours measured was forward rolls, which directly received training during the program. Two other behaviours, hopping and skipping, were similar to trained responses, but were not specifically trained by the program. Of these two untrained responses, one response belonged to an operant category receiving training (i.e., hopping) and the other did not (i.e., skipping). These data therefore reflect generalizations involving trained and untrained responses in another setting.

Collateral behaviours. Measurement of several behaviours which are not gross-motor skills occurred in the regular classroom. These behaviours were chosen because they are skills which educators commonly cite as behaviours receiving improvement from gross-motor training. Two of the behaviours, compliance and social play (or verbal behaviour), received incidental training in the program. A third behaviour, maze-drawing, received no incidental training, but does involve motor skills, although refined small muscle rather than gross large muscle movements are concerned.

Data on collateral behaviours therefore examined varying types of generalization assessment. Two behavioural measures (compliance and social play) examined generalization of indirectly trained responses to another setting, while one other (maze-drawing) addressed the issue of improvement of an untrained response in another setting.

HYPOTHESES

To summarize, the present study examined the effects of a complex perceptual gross-motor training program on a number of gross-motor and collateral behaviours exhibited in varying situations. It should be noted that in order to help discern program effects from the effects of maturation and training in the regular classroom, two untrained students were also montiored for improvement. Since the program used systematic application of behavioural techniques to train a large number of skills under a wide variety of stimulus conditions, it was considered possible that some generalization to untrained behaviours and non-training situations would occur as a result of the program. In order to thoroughly assess program effects, a number of behaviours representing varying degrees of generalization were monitored for changes in different situations.

Gross-motor Behaviour

Movement skills in each of the 10 operant classes assessed in the training situation might conceivably improve for all children with practice. However, the main hypothesis of the study was that the improvements for children receiving training would be much more dramatic than those for untrained children and would coincide with treatment implementation. Since this category of assessment measures represented non-generalized responses, these improvements were expected to be the greatest of all behavioural enhancements.

The gross-motor skills exhibited in physical education classes might also improve more for trained than untrained children. Since the training strategy incorporated a variety of stimulus conditions and utilized an approximation of a mediate generalization strategy, generalization of the trained behaviour (forward rolls) to this setting was feasible. Generalization of the untrained behaviours (hopping and skipping) was also considered possible, although it was thought that skill level might not improve as much as for the trained behaviour.

Some generalization was plausible as the training procedure incorporated a large number of motor behaviours which would promote generalization to new behaviours. For the untrained response of hopping, generalization could be promoted because other very similar responses in the operant category of hopping received training. Since the untrained behaviour of skipping involved a cross-lateral movement similar to movements trained in crawling, it was conceivable that generalization to this untrained behaviour in the untrained setting (i.e., the gymnasium) might also occur.

Collateral Behaviours

Social Play and Compliance

Although the training program did not directly assess these behaviours, they did receive reinforcement in a wide variety of situations. Social play behaviour, in addition to receiving indirect attention through verbal skills training, had been noted to improve in some of the earlier behavioural research (i.e., Johnston et al., 1966; Buell et al., 1968). As previously mentioned (p. 12), this presumably occurs because improvement in gross-motor skills produces entry into a natural community of reinforcement for social skills. It was considered plausible, therefore, that the examination of classroom data in the present study would likewise reveal improvements in social play behaviours for the trained subjects. Less noticeable improvement in social play behaviour of untrained subjects was also considered possible, since this behavior is thought to be subject to maturation (e.g., Wadsworth, 1971, p. 88). Improvements in compliance behaviours of the trained children might occur due to indirect training of compliance in the gross-motor program. However, such improvement was considered unlikely for untrained children, because compliance is generally not thought to be subject to rapid maturation in the age group of the present research (e.g., Duska & Whelan, 1975, pp. 5-6;101) and classroom training procedures would not be systematically directed toward producing improvements.

Any changes in collateral behaviours for the trained children were expected to be less dramatic than the changes in gross-motor behaviour in the training situation and any changes that might occur in the physical education classes. These differences were anticipated because it was only gross-motor behaviour which received concentrated, direct training.

Maze-drawing

Slight improvements in maze-drawing behaviour might occur for all children due to the effects of maturation and classroom training. Because the behaviour did not receive any training of an incidental or direct nature during the training program, it was considered unlikely that the trained children would show increases in performance above those of the untrained group. Although maze-drawing does involve motor skills, it was felt that the fine muscle movements concerned were not similar enough to gross-motor activity to warrant the expectation of generalization. It should be noted that this prediction is in direct contrast to that of the educational perspective which views gross-motor skills as a necessary precursor to fine-motor skills, and therefore would predict more dramatic improvements for the trained children.

Summary

The main hypothesis of the present study was that the gross-motor training program would produce substantial improvement in the non-generalized gross-motor skills of the trained subjects. It was thought that all children might show some improvement in generalized and non-generalized gross-motor skills and in social play and maze-drawing. The improvements in the non-generalized gross-motor skills of the trained children were expected to be greater than the maturation improvements exhibited by the untrained children. It was considered possible that the trained children might also show greater improvements than the untrained children with respect to generalized gross-motor skills and social play behaviour. As maze-drawing is a fine rather than a gross-motor skill, it was thought that it was likely to show at best maturation and practice effects for both groups of children. Improvements in compliance were considered possible for trained, but not for untrained subjects.

The treatment-produced changes in the trained subjects were expected to be maximal on non-generalized gross-motor responses measured in the training setting, as these were the only behaviours directly addressed by the program. Any improvements in gross-motor responding measured in the physical education classes were likely to be less dramatic than those of the training situation as these behaviours represent generalized effects of the program. Correspondingly, improvements during gym classes were considered less likely for hopping and skipping (which were untrained in the program) than for forward rolls (which were trained in the program).

Social play and compliance were the only collateral behaviours for which improvements due to training were thought to be possible, as they were the only collateral behaviours receiving indirect training. Any improvements which might occur were expected to be of a small magnitude, relative to gross-motor improvements.

METHOD

Subjects

The subjects were five preschool children (four female and one male) ranging in age from 4 to 4.5 yrs.. Six children were originally chosen for the study, but one subject left on holiday during the baseline phase and never returned. All subjects attended a public school situated in a low-income area of central Winnipeg. They were chosen from a preschool class of 10 students. Prior to choosing subjects, a letter explaining the experimental program was sent home to the parent(s) or guardian(s) of each student. Selection of subjects depended on granting of parental approval and a past record of regular attendance at the preschool.

Training Setting and Equipment

Gross-motor training procedures were conducted in a concourse situated between the regular classroom and the school gymnasium. Specific equipment utilized in this setting varied depending on the tasks being trained on each particular day. Table 1 provides a list of the training equipment used. Diagrams for some of the items listed here are provided in Appendix A. Equipment required for each task is identified in the task specification of the altered Capon program (Appendix B).

Dependent Measures and Data Collection Procedure

As discussed earlier, the effects of the gross-motor training program were examined with regard to a number of gross-motor and collateral behaviours. All gross-motor behaviours were measured in terms of quality or skill of performance. This type of rating occurred for only one collateral behaviour; maze-drawing. The other collateral behaviours were scored in terms of quantity of behaviour.

Table 1

List of Equipment Used in Modified Capon Training Program

Item	Quantity
1. low walking board (18 cm off ground)	1
2. intermediate walking board (30 cm off ground)	1
3. high walking board (52 cm off ground)	1
4. coordination ladder	1
5. jump box with incline board	1
6. balance rod (mop handle)	1
7. scooter boards	3
8. rebound net	1
9. launching board	1
10. traffic cones	4
11. rope cross-bars	2
12. tire holder	1
13. tumbling mats	7
14. waste paper basket	1
15. paper hoops	8
16. geometric shapes (4 shapes; 1 circle, 1 square, 1 rectangle, 1 triangle)	4
17. rubber ball	1
18. ropes	6
19. bowling pin	1
20. tracking ball (small plastic ball on cord)	1
21. auto tire and stand	1
22. bicycle tire	1
23. bean bags	10
24. blind fold	1

Data Collection Procedure

Assessments on all behaviours were scheduled twice weekly; however, on three occasions special outings or school inservices resulted in the loss of one of the scheduled assessments, and therefore only one assessment was conducted that week. On three other occasions, one to two additional weekly assessments on the non-generalized gross-motor behaviours were collected. These additional assessments were undertaken because although all the lessons for a particular training phase had been completed, additional data were needed to indicate that responding had stabilized. Stabilized responding had to be present before proceeding to the next phase of the research and time constraints made it infeasible to wait an additional one or two weeks to gather the data. On both regularly scheduled and additional assessment days, no training occurred. Time of day was always kept constant for all of the assessment measures taken on a recording day.

Non-generalized gross-motor behaviours. The experimenter (who also functioned as the trainer) conducted the assessments of gross-motor behaviour in the training setting. Again, although assessments occurred in the training setting, they were not conducted on training days. These assessments occurred between 9:00 and 10:30 a.m. Order of recording children was kept constant to further mimimize confounding for time of day. The children were taken one at a time to the training setting and were asked to perform a series of nine tasks. These nine tasks were representative of the 10 operant classes which were directly trained in the motor program. The operant classes of running and jumping were measured in a combined task for expediency in assessment and because of their close association in the training program. Total assessment time for each child was approximatley 10 to 15 min. The nine different tasks were rated in terms of the quality of movement by means of a behavioural checklist (see Table 2, pp. 48-50).

Generalized gross-motor behaviours. Two observers collected data in the physical education and regular classroom situations. The data for the physical education classes were collected between the hours of 10:30 and 11:00 a.m. Since physical education was scheduled daily from Monday to Thursday, it was always an available recording situation on assessment days. The assessment conducted during a given physical education class initially involved either hopping, skipping, or forward rolls. Only one activity was scheduled per gym class in order to mimimize the demands on the classroom teacher (who conducted the activities) and to maximize the amount of classtime for the children's regular physical education program. After six weeks of assessing one activity per gym class, the number of activities assessed was increased to two per gym class. This change was made so that during the following five weeks of the school year enough data could be collected on these behaviours to accurately assess generalization.

The teacher scheduled gym activities at the beginning of each assessment period on a rotating basis. For example, on the first day observers entered the gymnasium to record, the hopping activity occurred. On the next day, a non-assessment day, the teacher scheduled any activities she desired into the class. The activities may or may not have included those measured in assessments, as the teacher was told to follow her usual curriculum irrespective of assessment procedures. On the following day, another assessment day, the skipping activity was assessed. Again, the teacher followed her regular schedule untilthe next assessment day whereupon the activity for forward rolls occurred.

Observers used behavioural checklists to rank quality of movement. For hopping and skipping, they each recorded two or three pre-designated children, taking care that the children designated to each observer changed from assessment to assessment, so that the data of each child were collected by two different sources. In the case of forward rolls, the observers recorded the five children in an alternating fashion so that each observer still recorded two or three children, but the specific children recorded by each observer was determined by the order in which the children lined up for the activity.

Collateral behaviours. The same observers discussed above also collected data on social play and compliance behaviours in the regular classroom betwen 9:00 and 10:30 a.m., simultaneous to the observation in the training situation. Order of recording children was kept constant here also, and followed a pattern which did not conflict with the trainer's observation schedule (i.e., a child who was scheduled to be removed from the classroom for recording in the training situation was not simultaneously scheduled for recording in the classroom). As was the case in the gymnasium, the observers varied which children they recorded so that the data of each child were collected by two different sources.

The observers used a continuous 10 sec. interval recording system. The occurrence of one of the target behaviours was scored only once in a 10 sec. interval. Therefore, the data for each 10 sec. interval reflected whether or not the behaviour was noted during that 10 sec. period. Observations for each child continued for a 20 min. period.

Cueing for recording interval changes occurred through the use of tape recorders. Two tape recorders with ear phone attachments were used for independent recording by the two observers. On days when inter-observer reliability checks were made, a tape recorder with a spliced ear phone attachment was used for the reliability checks while a second tape recorder with a single ear phone attachment was used by the observer who was not involved in the check.

Data for maze-drawing were collected by the classroom teacher and scored by the experimenter. The teacher scheduled a maze-drawing activity once a week for the purpose of collecting assessment data. A variety of mazes were available in the classroom and were grouped into simple, intermediate, and difficult categories. The teacher always presented a maze of the intermediate category first and asked the children to find the correct path. This sample of maze-drawing was set aside for data analysis. After this sample had been collected, the children were allowed to continue maze-drawing, if they so desired. The teacher, however, was instructed to leave the maze-drawing area, so that the assessment procedure would not produce a situation where she was giving more reinforcement and feedback than was typical for maze-drawing.

Interobserver reliability. The experimenter developed and conducted measurements on all behaviours prior to training the two classroom and gymnasium observers and the two individuals who conducted reliability checks. During observer training interobserver reliabilities (IOR's) were conducted directly between the two observers to ensure consistency. Once consistency had been obtained (i.e., three consecutive IOR's above 80% had occurred) and baseline measures commenced, IOR's were not collected directly. This was due to the time restrictions which required strict adherence to the recording schedule in order for all five children to be recorded for the day. Instead of direct comparison between the measurements of the two observers, a third trained observer was used for the reliability checks in the classroom and gymnasium.

A fourth individual who was blind to treatment manipulations was used to check reliability of the data collected in the training situation by the trainer. This was a different individual than the person used for reliability checks in the classroom for two reasons. First, training and classroom assessments occurred simultaneously, so two individuals were needed for IOR's. Second, if the same person were to have recorded in both situations, she or he might have promoted generalization of trained behaviours to the classroom. This might have occurred because for the children receiving training from the experimenter, the experimenter herself was a relevant stimulus in the training situation. The individual assisting in IOR measures was associated with the experimenter and hence could have become a generalized stimulus of the training situation. Therefore, generalization of trained behaviours might have been artificially promoted, if the person collecting IOR's had entered the classroom.

Reliabilities on maze-drawing scores were also calculated. This was done by presenting the week's data on maze-drawing to one of the observers and having her score it. These scores were compared to those already obtained by the experimenter.

Interobserver reliability checks were made approximately every two weeks. Care was taken to ensure that at least one check occurred during each phase of the experimental design.

Assessment Instructions and Behavioural Definitions

Non-generalized gross-motor behaviour. As already mentioned, the experimenter (trainer) took each child individually to the training situation to assess performance on activities representing the 10 operant behaviours. Upon arriving at the training area, she told each child that she or he could refuse to attempt an activity if afraid to do so. (Refusal to perform an activity was considered the lowest level of skilled performance, and as such, received a score of zero.) The experimenter then took the child to the balance beam and gave instructions for the first task. The instructions given for each of the nine assessment tasks varied somewhat, depending on the nature of the task. However, all instructions were general in nature, simply indicating the activity to be performed and not indentifying any of the critical features of the skilled movement. For example, in the case of the first activity, balanced standing, the child was simply asked to perform a swan balance on the beam with one foot then the other. Because many children did not understand what was meant by such instructions, the activity was modelled in its skilled form by the experimenter during the initial assessments. The critical features of the skilled movement were not verbalized, however, and modelling was faded quickly so that by the third assessment, modelling of the tasks no longer occurred.

A description of each task is given below. The checklists for the critical features of the skilled form of the movement and the method of assigning rating points are given in Table 2.

1) balanced standing - The student was to perform a 3 sec. swan balance on the intermediate balance beam (30 cm off the ground). A swan balance is a standing position where the body is supported on one leg while the child bends forward at the waist and extends the other leg out behind her or him. The activity was to be performed first on the right foot, then on the left.

2) balanced walking - The student was to walk forward, then

backward on the intermediate balance beam while visually tracking a swinging ball held at her or his eye level by the experimenter. The experimenter stood at the end of the beam.

3) ball bouncing - The student was to dribble the ball with one hand in a "figure 8" around two traffic cones. The preferred hand was to be used.

4) catching - The student was to stand 1 m in front of a rebound net and catch a bean bag tossed by the experimenter standing .5 m behind her or him. The toss was directed toward the student's body between the shoulders and the waist. Only tosses achieving such a trajectory were scored. Three scorable tosses occurred.

5) throwing - The student was to use the preferred hand to execute two overhand throws of a bean bag against a rebound net 1.5 m away. The bean bag was to land within the boundaries of a target (approximately 65 cm x 65 cm) designated on the netting. The experimenter stood behind the rebound net to score.

6) crawling - The child was to crawl on hands and knees between the rungs of a ladder lying flat on a mat.

7) rolling - The child was to execute two forward rolls down the length of a mat. She or he was to pause for at least 1 sec. between rolls.

8) hopping - The student was to stand on the preferred foot, hop over a crossbar, land in a hoop on her or his take-off foot, and pause. Then she or he was to hop sequentially through two more tires.

9) running and jumping - The child was to run up the incline board of the jump box, jump off the box, and land in a bicycle tire placed on the floor. The activity was begun from a point 3 m away from

Table 2

Behavioural Checklists for Scoring Gross-motor Activities *

Activity 1 - BALANCED STANDING SCORE - ____/10

Right foot

___attempts activity
___foot,shoulders,hips in line
___body parallel to ground
___arms held out
___position held 3 sec.

Left foot

___attempts activity
___foot,shoulders,hips in line
___body parallel to ground
___arms held out
___position held 3 sec.

Activity 2 - BALANCED WALKING SCORE - ____/10

Forward

___attempts activity
___shoulders,hips,feet in line
___arms held out
___eyes(not head)follow ball
___no pausing or falling

Backward

___attempts activity
___shoulders,hips,feet in line
___arms held out
___eyes(not head)follow ball
___no pausing or falling

Activity 3 - BALL BOUNCING SCORE - ____/10

___attempts activity
___ball is pushed(not dropped, slapped)
___traffic cones rounded within a .5m path
___no pausing
___one hand used throughout
___one hand used during all or part of the activity
___same hand used throughout
___ball maintained throughout
___ball lost only once or less
___correct pattern("figure 8")

Activity 4 - CATCHING SCORE - ____/10

Throw

1st	2nd	3rd	
___	___	___	hand catch and hold
___	___	___	scoop catch and hold or hand catch and hold
___	___	___	balance maintained

___attempts all of activity

Table 2. Behavioural checklists for scoring gross-motor activities continued...

Activity 5 - THROWING	SCORE - ______/10
First throw	Second throw
___attempts activity	___attempts activity
___hand moves in straight path	___hand moves in straight path
___wrist snaps	___wrist snaps
___foot steps forward	___foot steps forward
___bean bag hits target	___bean bag hits target

Activity 6 - CRAWLING	SCORE - ______/10
___attempts activity	___ladder touched once or less
___hands point forward	___ladder touched twice or less
___calves straight behind	___lateral pattern repeated throughout
___limbs placed, not dragged	___no pausing
___ladder not touched by hands, knees	___one pause or less

Activity 7 - ROLLING	SCORE - ______/10
First roll	Second roll
___attempts activity	___attempts activity
___correct start position	___correct start position
(squatting, feet and hands pointing straight ahead, hands flat on mat)	
___back of head placed on mat	___back of head placed on mat
___body remains tucked	___body remains tucked
___roll is straight	___roll is straight

Activity 8 - HOPPING	SCORE - ______/10
Hop over cross bar	Additional hops
___attempts activity	___attempts activity
___only preferred foot touches ground	___only preferred foot touches ground
___pauses after landing	___only 1 hop per circle
___hands do not touch the floor	___hands do not touch floor
___body alignment straight	___body alignment straight

Table 2. Behavioural checklists for scoring gross-motor activities continued...

Activity 9 - RUNNING AND JUMPING

RUNNING — SCORE - ______/10

On floor	On incline
___attempts activity	___attempts activity
___arm movement present	___arm movement present
___arm movement parallel to sides	___arm movement parallel to sides
(back and forth - arms do not cross midline in front of body)	
___runs in straight path	___no hesitation on incline
___feet do not fling out to side	___feet do not fling out to side

JUMPING — SCORE - ______/10

___attempts activity	___knees bend at landing (calves at 45° angle to floor)
___activity attempted from a run	___hands do not touch ground
___both feet take off box at same time	___body does not touch ground
___both feet land at same time	___lands in target
___correct arm movement (elbows bend, start behind body)	___no torque or veering, lands straight

* Each check mark equals a score of one point.

the incline.

Generalized gross-motor behaviour. As these activities were conducted by the regular classroom teacher in the gymnasium, all instructions were given by her. As was the case with the non-generalized behaviours, instructions varied depending on the specific activity. A description of the instructions, activity, and scoring method for each activity follows.

1) forward rolls - This behaviour was tested and scored as for the non-generalized form, except that the teacher executed the test. She had the children form a line at the end of the mat and one at a time, they executed at least two forward rolls down the length of the mat, pausing between rolls. Only the first two rolls were scored.

2) hopping - The teacher told the students to line up in a row side by side. She told them they were going to do a hopping exercise and that when she gave the instruction, they were to take one hop forward on their preferred foot, then pause on their hopping foot until she instructed them to hop again. The teacher gave the instruction to hop 10 times in a row, pausing for about 1 sec. after every hop. She then told the children to rest for a few seconds before she repeated the exercise. She ran this exercise a minimum of three times to allow the two observers to record their two or three designated children. Pauses between the three trials gave the children a rest and allowed the observers to prepare the checklist for the next child.

Defining characteristics of skilled hopping remained the same as for the non-generalized movement (i.e., only preferred foot touches the ground, body alignment is maintained, hands do not touch the floor), except the requirement to pause between hops was added. Scoring was different, however, in that the children simply earned one point for every instance of a skilled hop. This alteration in scoring was made as the cross bar and tires were eliminated from this activity to make it more consistent with the situation in the regular physical education class.

3) skipping - This was executed in a manner similar to the hopping exercise in that the children lined up and performed the exercise at least three times, pausing between trials. Each exercise involved skipping half the width of the gymnasium, therefore, the teacher only had to instruct the children as to when to start and stop the skipping. The defining characteristics of skilled skipping and the method for scoring the behaviour are given in Table 3.

Collateral behaviours. These behaviours, except for maze-drawing, were simply recorded as they occurred in the classroom and therefore, no instructions were involved.

1) social play - Play behaviour was defined as being either isolate, proximal, or social in quality. For each interval in which a child was playing alone (i.e., no one was within 2 m of the child), an "I" (isolate play) was recorded in the appropriate 10 sec. interval of the recording sheet. For each interval in which the child was playing in the proximity of another child (i.e., within 2 m of another child), but was not making verbalizations to another child, a "P" (proximal play) was recorded in the interval. Social play was defined as periods of play in which a child verbalized to another child irrespective of proximity. Each time an instance of social play occurred, an "S" was recorded in the respective interval. If a child switched from one type of play to another during an interval, the highest form of play was recorded (isolate play was the lowest form, proximal play was intermediate, and social play was

Table 3

Behavioural Checklist for Scoring Skipping Activity	
___uses step-hop pattern both sides	___feet move back and forth in straight path
___uses step-hop pattern at least one side	___arms move back and forth in straight path
___swinging arm movement present	___elevation on hop,no shuffle
___arm movement opposite foot movement	___no jerking or pausing
___path travelled is straight	___no tripping or falling

Each check mark equals a score of one point. SCORE - _____/10 considered the highest). The final measure for this category of behaviour was expressed as percentage of total time spent in social play.

2) compliance - This was defined as the redirection of behaviour in accordance with a directed statement from the teacher. Directed statements could be suggestions or commands as long as they specified the production of a behaviour not being displayed or the cessation of a behaviour which was being displayed. Each time the teacher gave an instruction either to the child or the whole class, a "t" was recorded in the respective interval. If the child followed the instruction either in the same 10 sec. interval or in the interval following, a check mark was recorded. The final measure for this category was expressed in terms of percentage of instructions followed.

3) maze-drawing - As indicated earlier (p.44), the teacher prompted children asking them to come and do maze-drawing with her. Upon presentation of the mazes, the teacher asked the children to find the correct path and to show it to her by drawing it with the pencil provided. She told the children to be very careful to stay within the lines of the maze which designated the path.

Scores for maze-drawing were calculated by counting (a) the number of times the child's pencil mark touched the sides of the maze and (b) the number of times the child's pencil mark actually crossed over the side of the maze. The final measure for this category was the total error score.

Training Procedure

Once the five children had been selected, a period of baseline recording occurred where dependent measures were taken in accordance with the regular data collection procedures. Once baselines had been established for all five children, they were assigned to a treatment or non-treatment group. Two factors were considered when determining group assignment. First, level of baseline responding on non-generalized gross-motor behaviours was examined to detect any subjects who had exceptionally high baselines. One such subject was detected (Ezra). He was subsequentially assigned to the non-treatment group, as such high baseline levels limited the potential to demonstrate improvement due to treatment.

The second factor which was considered involved matching of subjects with regard to baseline skill levels of non-generalized gross-motor performance. This was done to attain relative equality between treatment and non-treatment groups. Baseline levels were examined and matching was possible for all four operant groups of non-generalized gross-motor behaviour. Three children were assigned to the treatment group while the other two were assigned to the non-treatment control. The latter two children continued to receive baseline assessment throughout the experiment while the three treatment children came to the training area as a group three days a week to participate in the perceptual gross-motor program. Training occurred between the hours of 9:00 and 10:30 a.m. and varied in duration from a minimum of one half hour to a maximum of one and a half hours, depending on how much skill training was necessary for the various activities.

Session Preliminaries

Upon entry to the training situation, the children were assisted with any necessary clothing adjustments. Regular clothing was worn by all children, but bulky sweaters or other excess apparel was removed. All children were asked to remove their shoes and socks to increase safety of movement on the training equipment. Before proceeding to the first station, children were reminded that if they were afraid to attempt the task at hand, they were not required to do so.

Training Components

The training components recommended for the Capon program were encorporated and expanded in the training procedure used here. An additional behavioural technique not suggested by Capon was also included. The components suggested by Capon were instruction on correct technique, modelling, shaping, physical guidance and fading of physical guidance, social reinforcement, and train-to-criterion. The added component in this training procedure was descriptive and corrective feedback. In addition, the component of instruction on correct technique was expanded so that the critical features of the skilled movement were not only identified by the instructor, but also were trained as verbal mediators for the children.

In introducing each station, the experimenter first briefly described the activity to be performed, then identified the critical features of the skilled movement in detail. For example, when training a child to walk on the high balance beam, the experimenter said: "While you are walking on the beam, remember to stand up straight so that your shoulders, hips, and feet are in a straight line. Hold your arms away from your body and don't pause or fall." The experimenter then modelled the task, again verbalizing the critical features of the movement.

Each child, in turn, then had the opportunity to attempt the task. The order in which the children attempted the task was rotated. As each child attempted the task, the other two children were encouraged to watch, so as to benefit from the peer modelling as well.

When a child had difficulty in executing a task or refused to try a task, several steps were taken to shape the desired behaviour. One shaping strategy involved the modification of equipment or tasks such that they required less skilled movement. In the example of training balanced walking on the high beam, the experimenter modified the equipment by moving the child to the low level beam and trying the activity there. For some activities equipment was not easily modified. A task requiring the child to walk and dribble the ball was such an activity. This task was shaped by breaking the task down into simpler components and training the task in small steps. The child was asked to first master a bounce and catch while walking, then to try dribbling the ball while standing, then to dribble the ball while walking.

In addition to shaping through modifying equipment and tasks, children having difficulty with a task were offered physical guidance. In the case of training walking on the high beam, the experimenter often straddled the beam and held both of the child's hands prompting and reinforcing successive approximations to forward steps. Once the child could manage this, physical guidance was faded to support with one hand, then to standing nearby, and finally to standing at further and further distances until the child was walking the beam alone.

The experimenter provided many prompts regarding the critical features of the task and actually trained the children in the use of verbal mediators before activities were reviewed and while the children were practicing them. Often before beginning a series of activities, the trainer would sit down with the children and discuss the critical features of the skilled movements in the activities of concern for that day and in all operants trained prior to that point. For example, on a day where throwing activities were reviewed the experimenter would say:

"What do you have to remember when throwing the bean bag?" If the children needed additional prompts they were given (e.g., "Where do you put your hand to start?"). Should the additional prompts be insufficient, the experimenter gave the children the answer, then asked the question again so the children could answer (e.g., "You start with your hand by your ear. Now...where do you put your hand to start?"). Once the children could identify all the critical features of throwing, the critical features of previously trained tasks (e.g., balanced standing and walking, rolling, crawling, hopping, bouncing, and catching) would be reviewed in the same fashion.

Training of verbal mediators also occurred while the child was practicing movements in various activities. For example, while the child was walking on the balance beam, the experimenter said, "You are supposed to be doing something with your hands. Do you remember what that is? You are looking at your feet. Where should you be looking?" In this fashion, the experimenter not only trained the children in mediate generalization but also gave corrective feedback.

Social reinforcement and descriptive feedback were also given for any improvements in the child's movement pattern. Again, using the example of the balance beam, a child who made the corrections specified in the preceding paragraph would have been told, "Good! You have moved your arms so that they extend away from your body to help you balance. You are looking ahead now, too, as you should be. You are doing a really good job!" Besides social reinforcement through verbal approval, physical reinforcement was also given. Upon getting off the balance beam, the child described above would have been given a pat on the head or a hug.

In addition to the behavioural training techniques described above, a train-to-criterion procedure was used. Each training session employed a variety of stations for training different activities. At each station a different lesson consisting of one to five activities was taught. Training continued until all children had achieved a perfect performance or had executed three trials of the task. At this point the next station was trained. When all children had reached criterion performance on an activity, that activity was eliminated from future training sessions. When all activities at a station had been performed to criterion by all children, the station was eliminated from future sessions and a new one was introduced.

Exceptions to the above criterion were made in training the activities which were measured in the assessments of non-generalized gross-motor behaviour. When one of these nine activities was being trained, the three trial limit was suspended. Trials were repeated until all subjects had reached perfect performance on these tasks. This stringent criterion was not used for all activities for two reasons. First, since the main purpose of the additional activities was to provide different stimuli and different responses to promote generalization, perfect mastery of the activities was not considered essential. Second, time constraints limited the amount of repetition which could be devoted to a particular activity. Some of the activities were so difficult that even the experimenter could not master them; therefore, it seemed unlikey that the children could master them before the school year ended.

The criterion for perfect performance on a given activity was determined through use of the behavioural checklists in Table 2 (see pp. 48-50). Once all the critical features of a given oprant response were displayed during execution of the activity, performance criterion was reached. For example, once all three children could walk on the balance beam keeping shoulders, hips, and feet in line, arms held away from the body and eyes ahead, without pausing or falling off the beam, the activity was terminated. A new activity such as walking backwards on the beam, took its place in the next session.

Contingencies for Participation in Training Sessions

Because the training procedure described here required the young subjects to attend rather carefully for long periods of time, it was felt that some reinforcement should be delivered to encourage the children to participate for the duration of the session. A variety of tangible reinforcers (e.g., colourful stickers, balloons, wafer cookies) were made available for this purpose. The use of activity reinforcers was initially considered, but this strategy was rejected because of time constraints and because many of the children's favorite activities would have provided additional practice on gross or fine-motor skills. It was felt that such additional practice would confound the results of the study.

In order to avoid a situation where only three of the children in the preschool class had the privilege of earning these special reinforcers, it was decided that all children in the class would be given such treats after each training session. This strategy, in addition to avoiding unhappy responses from untrained children, had the advantage of keeping reinforcement constant for the trained children and their matched controls.

It was explained to the children that they could earn their treats by helping either the experimenter or the classroom teacher. The trained children would earn their treats by going with the experimenter to practice their exercises, while the other children would earn treats by staying in the classroom and playing with the teacher. Once in the training situation, the three trained children were told that in order to help they had to pay attention to the experimenter and to comply to instructions They were told they would be given three warnings to help them remember how to help, but that if after three warnings they were still not being helpful they would have to return to the classroom and would not be able to earn a treat. It was explained that they were free to return to the classroom at any time if they wished, but that they could not earn a treat unless they stayed until the end of the training session.

Order of Task Introduction

The training lessons were implemented in a different order from that suggested by Capon. Unlike the Capon program, a sequential modification procedure was used. This alteration was made because the training procedure utilized here was more intense than Capon's recommended procedure. It required a rather stringent criterion of skilled performance on some activities and it trained verbal mediators for different operant movements. Given these increased demands, it was thought that the standard Capon procedure, which trains all operant movements throughout the program, would "overload" the student by requiring too many behaviours to be learned at once. To avoid this problem, only two to three operant classes were trained at a time.

Although the order of introducing lessons was modified by selecting only those lessons which involved the operant response classes presently being trained, the order of presenting activities concerning those response classes corresponded to the standard Capon program. For example, in training balanced standing and walking, the Capon program was surveyed to find the first lesson where balanced standing, balanced walking, or both were trained. This lesson was trained first in the modified program also. The second lesson for the modified program was chosen by continuing to look through the standard program until the second lesson involving these operants was found. This procedure continued until all lessons involving balanced standing, balanced walking, or both had been found.

The order in which the operants were trained is as follows: (a) balanced standing and balanced walking; (b) rolling, hopping, and crawling; (c) bouncing, catching, and throwing. The fourth operant group; running and jumping, did not receive training.

The reasons for grouping the operants in this particular fashion was mainly that these activities often occurred together in lessons. The second group: rolling, hopping, and crawling was the exception. These three operants were the ones remaining after the others had been grouped according to the above rule.

The order of training the operant groups was chosen because of time constraints. Balanced standing and walking were trained first because they consisted of the fewest number of lessons (i.e., 18) and could therefore be trained relatively quickly, leaving more time for training two more operant groups. Rolling, hopping, and crawling were trained second because they incorporated only 35 lessons in comparison to running and jumping which involved 53 lessons. Although bouncing, catching, and throwing encompassed only 25 lessons, training on this group was delayed. This delay occurred because it was thought that this group of behaviours would be particularly difficult to train because of the complex coordination skills involved. The original intention was to leave bouncing, catching, and throwing as the fourth, untrained operant group and to train running and jumping third. However, a high baseline on running and jumping for two subjects and an increasing baseline for the third made this strategy unwise. Bouncing, catching, and throwing was therefore trained third and running and jumping was maintained on baseline.

There are a number of lessons in the Capon (1975) program which involve combinations of operants which are inconsistent with the groupings employed here. For example, a number of activities involve bouncing, catching and throwing balls while engaging in balanced walking. In the revised Capon program, these lessons were included in training once all components of the lessons had begun to receive training. The activity exemplified above was therefore included in the training of the third group of operants. A lesson involving balanced walking, crawling, throwing and catching was trained in the third operant group also. This method of training lessons resulted in continued training and review of earlier operants when moving on to training of new groups of operants. The activities involved in the various lessons, the order of training lessons, and the equipment utilized are specified in Appendix B.

Research Design

Research design considerations provided a second reason for the program modifications described above. A combination of a non-treatment control and a multiple baseline across behaviours design was utilized. In order to implement the multiple baseline component of this design, subjects had to receive training on the operant groups of behaviours in the separate, sequential manner described above.

Rationale for Design Choice

One of the most relevant factors leading to choice of this design was the practical limitations of collecting 16 dependent measures for all subjects within the 2 1/2 hr. period in which the preschoolers were available. Such restrictions necessitated the involvement of a minimum number of subjects and therefore eliminated the possibility of using a multiple baseline across groups of subjects.

Baselines across individuals was avoided as the one-to-one training procedure which would have resulted from this approach would have been inconsistent with the typical educational situation. As mentioned earlier, one of the purposes of the research was to examine a training situation which was consistent with educational practice and resources. One-to-one training situations are rare in public school settings and thus it was decided that training should occur in small groups producing a situation which is more consistent with educational practice.

As one of the objectives of the study was to assess the generalization produced by the training procedure itself, a multiple baseline across situations design was infeasible. Some generalization to the other settings was expected, therefore independence of situations was questionable. Reversal design possibilities were eliminated, as once a skill was trained, it was neither desirable nor likely to reverse. In addition, pauses in treatment were considered undesirable as they would have reduced the amount of time available for training the children and might have jeopardized generalization by limiting the variety of stimulus situations and behaviours to be trained.

Although some generalization across behaviours was considered possible (as discussed pp. 35-36, 38.), the multiple baseline across behaviours design was not anticipated to be weakened should generalization occur. The design would have been weakened if improvements on remaining baselines occurred after treatment commenced on previous operant groups.

Since the four operant groups consisted of behaviours which were quite dissimilar, generalization across operant groups was not expected. Training on one operant group therefore, was not likely to effect the baselines of the remaining operant groups. Hence, the multiple baseline across behaviours design was expected to and, indeed, did remain a viable tool for assessing treatment effects.

Implementation of the Design

Baseline recording commenced on all five subjects simultaneously. For the two subjects comprising the control group, the baseline condition was maintained throughout the experiment. These subjects would be screened for motor deficits and would receive perceptual gross-motor training in the following academic year.

The baseline phase on balanced standing and balanced walking terminated for the three remaining subjects when stable or downward trends were noted for all subjects with regard to gross-motor behaviour. At this point, treatment was implemented on this operant pair while baseline for the other three operants continued. After all the lessons specific to the first operant group had been trained and an upward trend or stable, improved responding of treated subjects was observed, treatment on the next group of operants: rolling, hopping, and crawling commenced. Again, baseline on the remaining two groups continued. When all lessons on rolling, hopping, and crawling had been trained and upward or stable, improved trends were noted, treatment on bouncing, catching, and throwing commenced. Running and jumping remained on baseline until termination of the study. Treatment was not implemented here because, as mentioned (p. 63), the baseline for this behaviour was increasing for one treatment subject and the baselines were at fairly high levels for the other subjects. It was felt that implementation of treatment on running and jumping would show less dramatic changes in behaviour in comparison to the other two operant groups because of these problematic baselines. Therefore, it was decided to keep this operant group on baseline, allowing intrasubject comparisons of treated and untreated behaviours.

Probes for Generalized Gross-motor and Collateral Behaviours

Because the purpose of the assessments conducted in the gymnasium and in the classroom were to assess generalization effects of the revised Capon program, no training and therefore no research design was implemented with regard to these behaviours. Instead, generalization probes were taken regularly throughout all phases of the study. Examination of changes in the behavioural trends corresponding to different training phases was one feature allowing assessment of generalization for trained subjects. Comparison of data from trained subjects to untrained subjects was the second feature employed for detecting generalization due to training.

RESULTS

Observer Reliability

Gross-motor Behaviour

Interobserver reliabilities for gross-motor behaviour were calculated by dividing the number of agreements (checkmark by checkmark) by the number of agreements plus disagreements and then multiplying by 100. For the non-generalized gross-motor behaviours, reliabilities ranged from 79.0 to 94.7%. Mean rate of agreement on each of the four operant groups of behaviours was as follows: balanced standing and walking - 84.6%; rolling, hopping and crawling - 83.2%; bouncing, catching and throwing - 88.9%; running and jumping - 86.1%. Reliability, therefore, remained very close to the accepted range of 80 to 100% (Hartmann, 1977).

Reliabilities for the generalized gross-motor activities which were assessed in the gymnasium ranged from 60 to 100%. The low reliability of 60% occurred on the first reliability check for forward rolls. This problem was corrected by reviewing the behavioural checklist with observers and clarifying components of the skilled movement. All subsequent IOR's ranged from 80 to 100%. Mean rates of agreement on rolling, hopping, and skipping were 80, 100, and 93.3% respectively.

Collateral Behaviors

For the collateral behaviours of social play and compliance, reliability was calculated by using the statistic phi (Ø). Phi is a product-moment correlation between two sets of dichotomous (occurrence - nonoccurrence data. It ranges from -1.0 through 0.0 to +1.0. Phi equal to 0.0 indicates an absence of relationship between two observers' ratings, and phi equal to +1.0 indicates complete agreement (c.f. Hartmann, 1977).

The statistic phi was used in calculating reliability on collateral behaviours because several features of these collateral data would have made the typical occurrence and/or non-occurrence reliability calculation unrepresentative of the actual degree of observer agreement. Occurrence reliability on these behaviours would not be representative of agreement because the behaviours of concern were of quite low frequency and difficult to detect. Using this measure, one disagreement between observers would lower reliability substantially. Calculating occurrence and non-occurrence reliability, however, would have inflated the reliability estimate such that complete disagreement on occurrences could be present, yet agreement on non-occurrence would be high enough to result in an estimate of reliability above 80%. The statistic phi seemed to over-come these problems, as in calculating phi the proportion of observer agreements on occurrence and non-occurrence is corrected for the proportion of expected or "chance" agreement (Hartmann,1977). Thus, phi could be used to estimate reliability on both occurrence and non-occurrence without being artifically inflated by the non-occurrence agreement.

For social play behaviour, phi ranged from .81 to 1.00. The mean phi calculated for this behaviour was .92. Therefore, reliability for social play was comfortably within the accepted range of .60 to 1.00 (Gelfand & Hartmann, 1975, p. 219).

Observer agreement for compliance behaviour ranged from 0.0 to .93 with the mean phi equalling .69. Observer agreement for compliance was calculated in a conservative manner as agreement on the occurrence of an instruction was required as well as agreement on the occurence of compliance. (Agreement on compliance alone was 1.00.) The phi of 0.0 occurred during one reliability check when the subject being observed received only one instruction. One observer recorded the occurrence of an instruction while the other did not. This resulted in zero agreement on occurrences of the response and therefore a phi of 0.0.

Compliance was a difficult behaviour to record, as it required that the observer hear the instruction to determine if it were followed. In the noisy preschool classroom this was often impossible. In instances such as this, when behaviours are difficult to detect, occur infrequently, are quite variable, and are expected to show small magnitudes of change, higher interobserver reliability should be required before assessing treatment effects (e.g., Hartmann, 1977). Therefore, for compliance a phi of .80 or higher was considered to define the acceptable range. On two occasions (in addition to the occasion when a phi of 0.0 occurred) phi dropped below .80 to .66 and .72, indicating that reliability was a problem for compliance behaviour. However, it soon became evident that other methodological problems in measurement of compliance would lead to few conclusions being drawn on the basis of these data. The low reliability of compliance, therefore, was no longer an issue of concern.

Reliabilities for maze-drawing were calculated by placing the lower error score obtained for the maze-drawing sample over the higher total and multiplying by 100. Reliability on maze-drawing ranged from 84.6 to 96.8%. Mean rate of agreement was 92.1%.

Non-Generalized Gross-motor Performance

The dependent measure for non-generalized gross-motor performance is stated in terms of the total score on the behavioural checklist for each group of operant behaviours. For balanced standing and walking and for running and jumping the total possible score is 20 points. Rolling, hopping, and crawling and bouncing, catching, and throwing each have a total possible score of 30 points. The subjects' raw checklist scores for each of the 10 individual oprant behaviours are given in Appendix C.

Trained Subjects

As previously mentioned (p. 55), three of the five children were assigned to the treatment group while the other two children were maintained on baseline to serve as matched controls. Each of the treated subjects will be examined individually first, then the control subjects will be examined and compared to the treated subjects with regard to the measures on which they were matched.

April. Figure 1 represents the non-generalized gross-motor data for April. Baseline levels of responding are fairly low for April, being at mean levels of 40 to 45% of the total possible score on rolling, hopping, and crawling and on bouncing, catching, and throwing. For balanced standing and walking and for running and jumping, mean baseline levels are

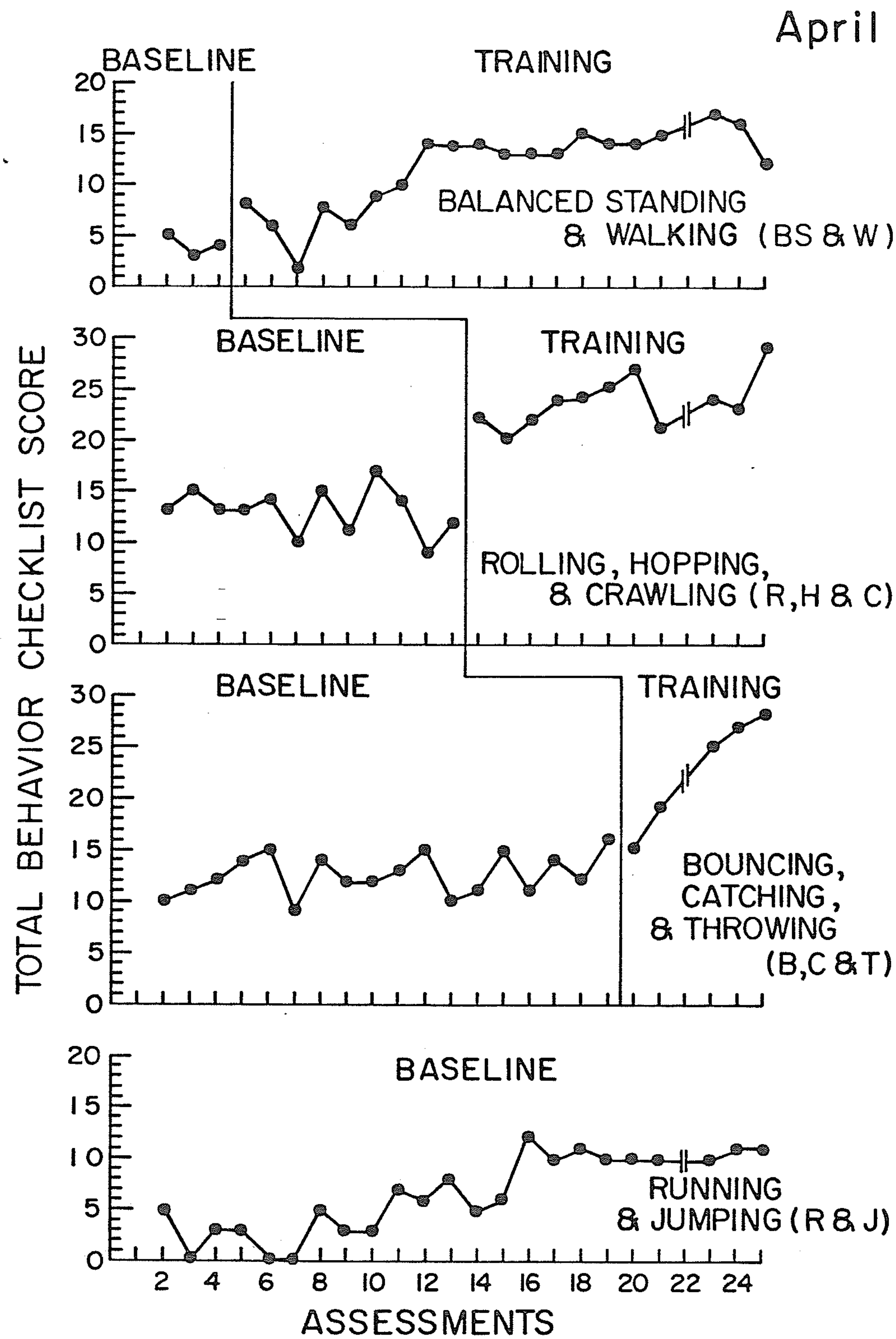

Figure 1. Total behavior checklist scores for April on non-generalized gross-motor operant groups.

even lower (20 and 32%, respectively), although baseline on running and jumping eventually increases to 50% of the possible total. With the exception of running and jumping, baselines tend not to increase, but typically fluctuate within a five point range.

For all three operant groups which received training, increases in the total behaviour checklist score occur subsequent to commencement of training procedures. For balanced standing and walking, the increase is gradual, one overlapping data point is present, and steady improvement does not occur until after the ninth assessment. At this point, however, improvement is dramatic and, with the exception of the last assessment, responding becomes relatively stable at a mean score of 14.2 points in comparison to the mean baseline score of 4 points. This represents a mean improvement of 10.2 points.

The delay in improvement in balanced standing and walking for April is likely due to two factors. First, April was ill for a short period after training commenced. In particular, she missed training sessions just prior to the seventh assessment, suggesting that this may have contributed to the low data point which overlaps with baseline. The second, and perhaps more influential factor involves the order of training activities for this operant group. Most of the activities trained in this group involved balanced walking. The few lessons on balanced standing which occurred early in the training program were easily mastered in comparison to the difficult assessment task of performing a swan balance. Therefore, little improvement in swan balances occurred during the first few assessments and the total score was therefore supressed. Once training on swan balances commenced, the dramatic improvement in total score occurred.

Rolling, hopping, and crawling show dramatic improvement directly after training commenced. Baseline scores fluctuate around a mean score of 13 points, while scores after training vary around a mean of 23.6 points, representing a mean improvement of 10.6 points.

Bouncing, catching, and throwing also show dramatic improvement after training began. From a relatively stable mean baseline score of 12.6 points, responding shows a sharp upward trend after treatment. Although the first data point after treatment overlaps with baseline, the increase in total score is sharp enough to indicate improvement due to treatment. Because the upward trend continues and there is no stabilization within a specific range, the mean training score of 22.8 is a conservative estimate of improvement. It appears, then, that a mean improvement of at least 10.2 points occurred.

When comparisons of performance on trained operant groups are made to performance of the untrained group of running and jumping, distinct differences in performance are evident. Even though there is a noticeable increase in the behaviour checklist scores for running and jumping, performance stabilizes at a mean of 50% of the total possible score, representing a level similar to the baselines of the other operant groups.

It should be noted that the increase in April's performance score for running and jumping was not primarily due to improvements in running and jumping skills. During the first assessment for April, the jumpbox used in the activity shifted slightly as she approached the top of the incline board leading onto the box. At this point April refused to continue the activity. In the next several assessments she refused to attempt all or parts of the task. After many assessments where the jumpbox remained stable during the running and jumping activity, April agreed to attempt the entire task. This point in time is represented in the sixteenth assessment. At this point, performance stabilizes at a low skill level. Therefore, although the untrained operant groups shows improvement over time, skill of performance did not increase significantly and terminal checklist scores are much lower than those obtained for trained operant groups.

Jane. Figure 2 shows the non-generalized gross-motor scores for Jane. Jane's baseline levels are at means of 40 to 50% of the total possible score for the operant group with the exception of running and jumping where the baseline is slightly higher (i.e., 64%). All baselines are fairly stable with the exception of rolling, hopping, and crawling which shows a slight downward trend.

As was the case for April, increases in Jane's total behaviour checklist score for each of the three operant groups correspond to the commencement of training on the group. For balanced standing and walking no overlapping data points are present, but again, improvement is graduate and sharp upward movement is not present until the ninth assessment. Unlike April, the delay in improvement of Jane's scores does not seem to be due to the delay in training the balanced standing assessment task. Examination of the separated data (see Appendix C) reveals that Jane's scores on balanced walking are very similar to those on balanced standing. Jane seemed to initially experience more difficulty on the balanced walking task and less difficulty on balanced standing in comparison to the other two trained subjects. Jane's responding on balanced standing and walking eventually stabilized at a mean score of 16.8, which is 8.3 points over the mean baseline level of 8.5 points.

Rolling, hopping, and crawling show immediate and dramatic improvement upon commencement of training. From a mean baseline rate of 12.4 points, Jane's score jumps to a mean of 25.4 points and eventually stabilizes above this level. This represents a substantial mean improvement of 13 points.

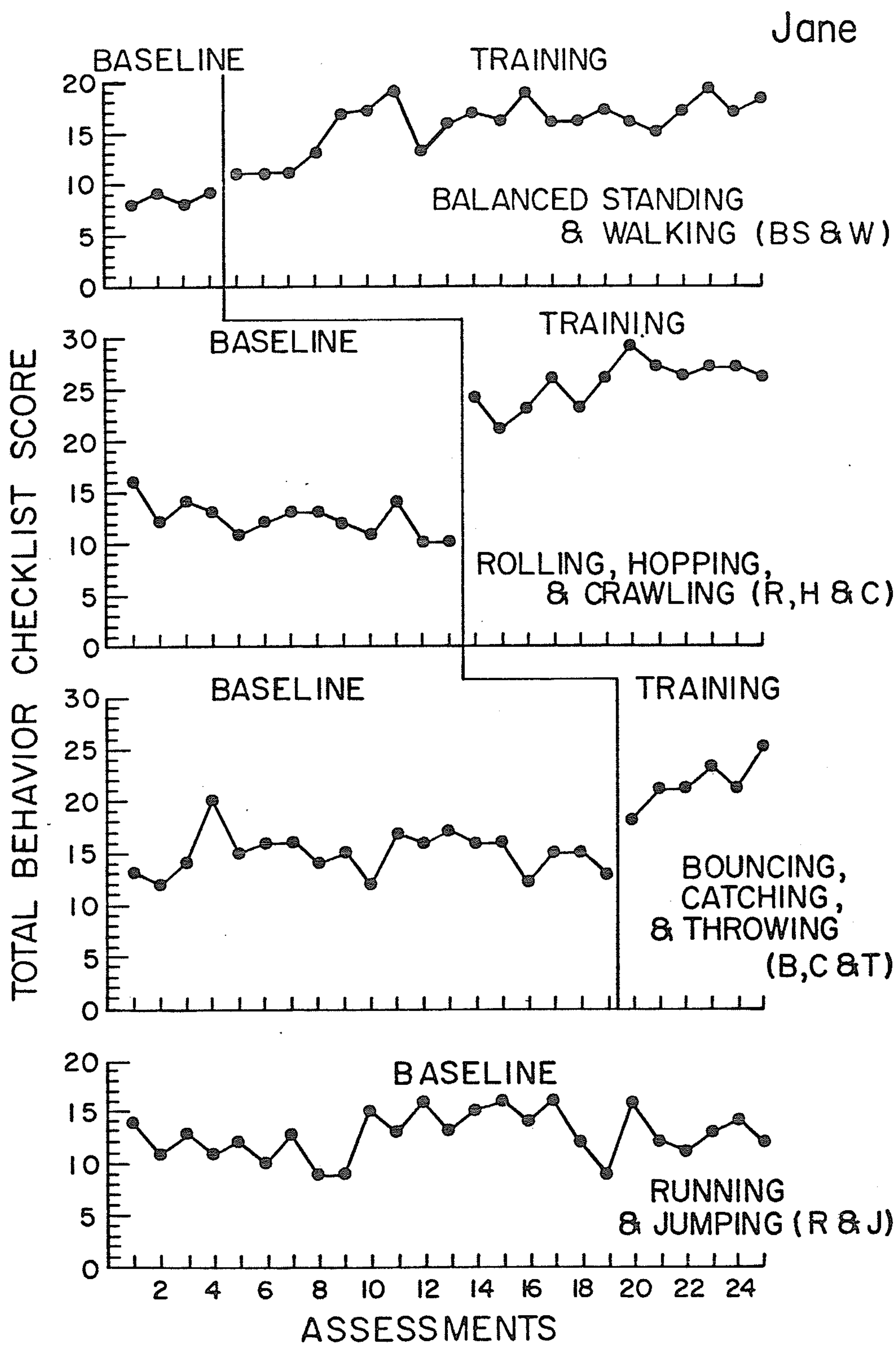

Figure 2. Total behavior checklist scores for Jane on non-generalized gross-motor operant groups.

Bouncing, catching, and throwing also show improvement over baseline, though much less dramatically than for the other two operant groups. Jane shows a high point early in the baseline phase which overlaps with the first assessment of the treatment. However, a steadily increasing trend in the data follows. From a mean baseline score of 15.0 points, bouncing, catching, and throwing underwent a mean improvement of 6.3 points in assessments during the training phase. However, responding did not stabilize, and an upward trend is present, suggesting that further assessment may have revealed even greater improvement.

Comparison of performance on trained operant groups to that on the untrained group of running and jumping again indicates differences. Jane's baseline for running and jumping was high but relatively stable. No distinct upward trend is present in contrast to the clear upward trends in the other groups during the training phase. Also, terminal score levels (i.e., mean score of last 3 data points) for running and jumping are lower than for the other operant groups. Scores for running and jumping fluctuate around a mean of 65% of the total possible score in comparison to the terminal levels on the other groups which are 76 to 90% of the total possible score.

Charmaine. Figure 3 shows that Charmaine's mean baseline scores are 45 to 50% of the total possible score. As was the case for Jane, Charmaine's scores on running and jumping are the exception, being 60% of the total possible score. Baselines are fairly stable although slight upward drifts are present for rolling, hopping, and crawling and for bouncing, catching, and throwing.

Unlike April and Jane, Charmaine's data shows a more immediate

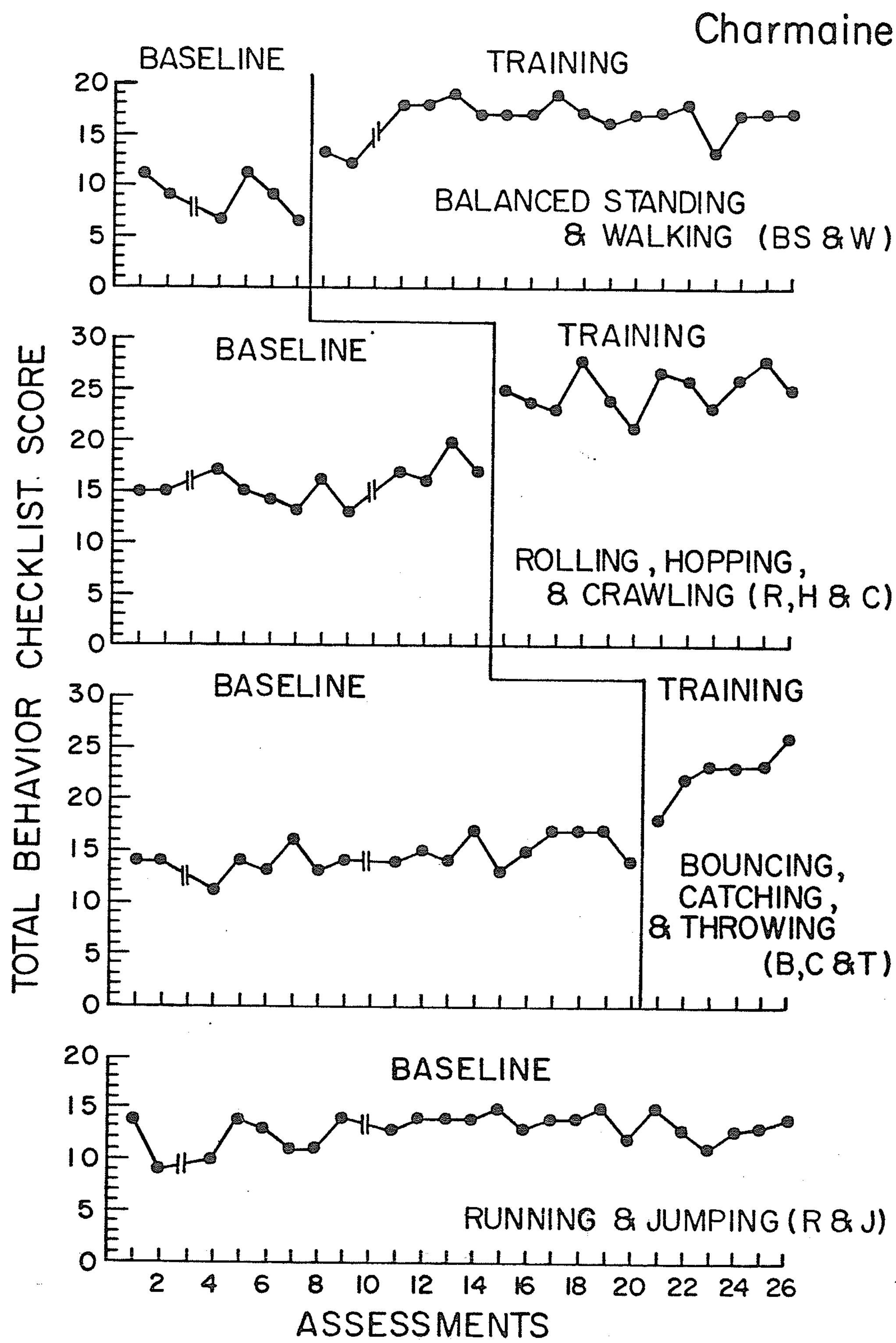

Figure 3. Total behavior checklist scores for Charmaine on non-generalized gross-motor operant groups.

increase in performance subsequent to commencement of training on balanced standing and walking. It should be noted, however, that Charmaine remained on baseline for a longer period than April and Jane. Charmaine's baseline was extended because she was absent from school and missed the first treatment session. Upon her return, her assessment data showed an upward jump in comparison to the sharp downward trend noted before her absence. Therefore treatment was delayed until the downward trend was again present. Although Charmaine's improvement appears more immediate, a sharp increase in her data is also noticeable at the ninth assessment suggesting that the delay in training swan balances also had an effect here. Performance on balanced standing and walking rises from a mean baseline score of 9 points to a mean training phase score of 16.6; indicating a mean increase of 7.6 points.

Despite the upward drift in baseline for rolling, hopping, and crawling, an immediate treatment effect is quite noticeable. From a mean baseline score of 15.6 points, Charmaine improved to a mean score of 25.0. The substantial increase of 9.4 points and the absence of any overlapping data points are the factors supporting the presence of a training effect despite the drifting baseline.

Unlike April and Jane, Charmaine's data show no overlapping points between baseline and treatment on bouncing, catching, and throwing. Again, an increasing trend in the data during the training phase is present and assessments subside prior to stabilization in responding. From a mean baseline score of 14.6 points, Charmaine increased her performance to a mean of 22.5 points, indicating a mean improvement of 7.9 points before assessments ended.

Comparison of Charmaine's performance on trained operant groups to that on the untrained running and jumping group reveals differences similar to those noted for Jane. Performance on running and jumping is fairly high, but stable. No distinct upward trends are present as is the case for other behaviours after training is implemented. Terminal scores for running and jumping are 67% of the total possible score in comparison to the terminal levels for the three trained operant groups which are from 80.0 to 87.7% of the total possible score.

Untrained subjects

Although it proved difficult to provide direct subject to subject matches for April, Jane, and Charmaine, the untrained subjects, Niki and Ezra, provided suitable matches when baselines for each operant group of each subject were compared separately. Niki's baseline on balanced standing and walking was quite similar to the balanced standing and walking baselines of all three trained subjects. She also had a rolling, hopping, and crawling baseline which matched to April and Jane, and her baseline for bouncing, catching, and throwing provided a match for April.

Ezra provided the rolling, hopping, and crawling match for Charmaine and matched bouncing, catching, and throwing baselines for Jane and Charmaine. This matching scheme is summarized in Table 4.

Niki. Figure 4 represents the data for Niki. Stable levels in responding are noted for all operant groups.

When comparing Niki's performance on balanced standing and walking to that of April, Jane, and Charmaine, sharp contrasts are present. No upward movement is present for Niki, although such a trend is present for all treated subjects (see Figures 1, 2, & 3). During the last few assessments, Niki's scores are very similar to those obtained in the

Table 4

Matching of Baselines

for Non-generalized Gross-motor Behaviour

Operant group	Treated subject: April	Jane	Charmaine
Balanced standing & walking	Niki	Niki	Niki
Rolling, hopping, & crawling	Niki	Niki	Ezra
Bouncing, catching, & throwing	Niki	Ezra	Ezra

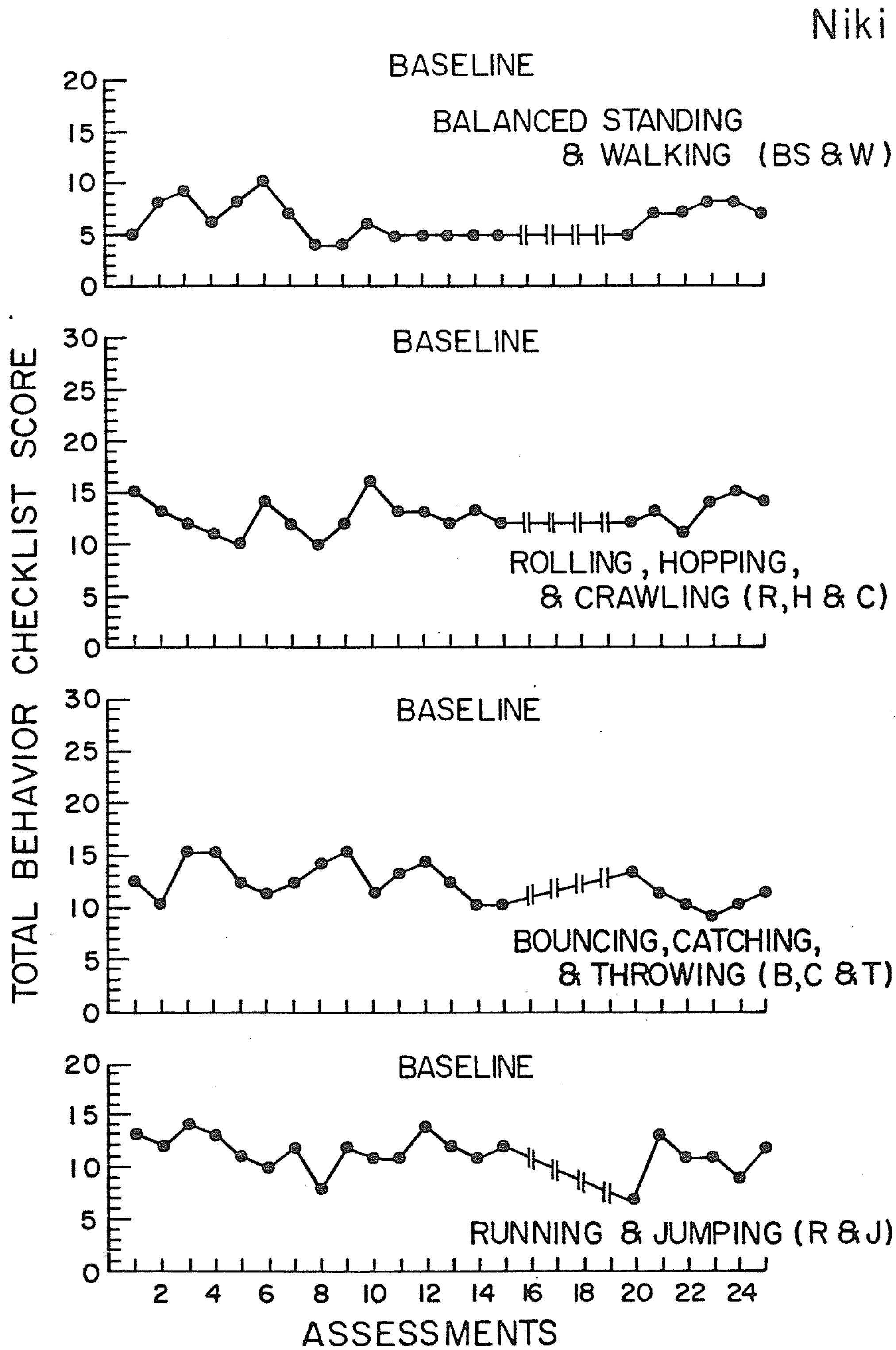

Figure 4. Total behavior checklist scores for Niki on non-generalized gross-motor operant groups.

first few assessments, unlike the situation for the trained subjects where mean improvements of approximately 8.0 to 10.0 points are noted.

Like balanced standing and walking scores, Niki's scores on rolling, hopping, and crawling remain stable throughout all assessments. There is no point where sudden improvement is noted as was the case for April and Jane (see Figures 1 & 2). Again, behaviour checklist scores on the last few assessments are similar to those on the first few, unlike April and Jane's terminal scores which are about 10 to 13 points in excess of baseline.

Niki's bouncing, catching, and throwing performance also remains stable. No sharp upward trend appears during the last five assessments as is the case for April (see Figure 1). Again, her terminal scores on this behaviour are similar to her initial scores, providing a contrast to the trained subject, April, for who improvements of about 10 points are noted.

Ezra. Ezra's non-generalized gross-motor scores are presented in Figure 5. Ezra's level of gross-motor skill appears quite stable for balanced standing and walking and for running and jumping. However, for the two operant groups on which he matched the baselines of trained subjects (i.e., rolling, hopping, and crawling and bouncing, catching, and throwing), slight increases in the checklist scores are present. This is quite similar to the situation noted for Charmaine (see Figure 3) with regard to rolling, hopping, and crawling. As previously mentioned, Charmaine's baseline for this operant group also increased gradually, but a sudden jump in the data occurred after treatment commenced, and responding stabilized at the higher level. Ezra, in contrast, shows no such dramatic jump. His scores on the last few assessments are a few

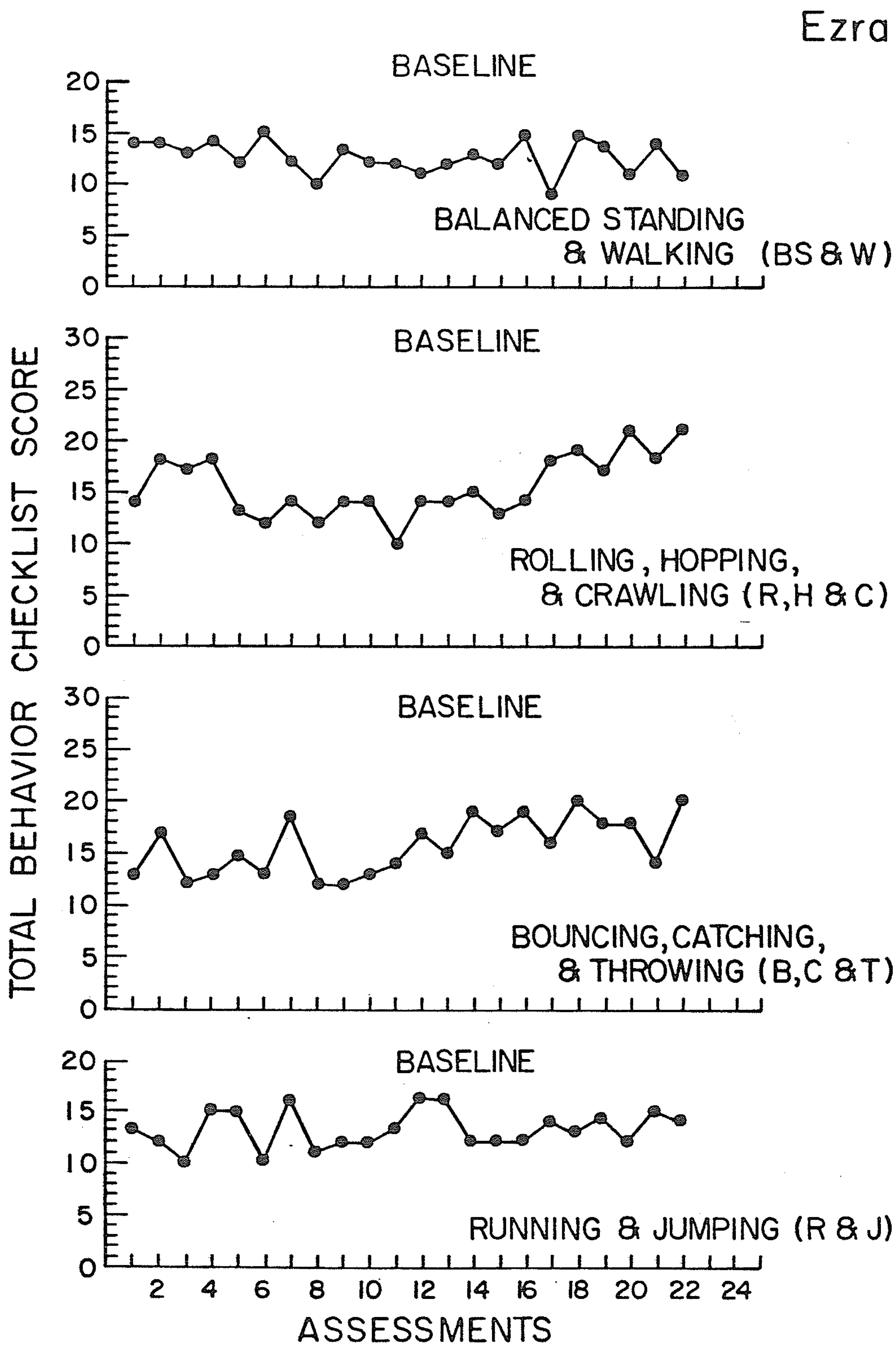

Figure 5. Total behavior checklist scores for Ezra on non-generalized gross-motor operant groups.

points higher than on the first assessments, but points do overlap. Charmaine, on the other hand, has no overlap when comparing initial and terminal points. There is instead a mean difference of about 10 points separating these two periods of assessment.

The upward drift in Ezra's baseline on bouncing catching, and throwing is unlike the situation for Jane (see Figure 2), where no upward drift is present, or Charmaine (see Figure 3), where the drift is very gradual. However, Ezra still provides a good overall match for Jane and Charmaine on this group. Comparable to the two treated subjects, Ezra's initial baseline scores fluctuate around a mean of 15.6 points. The gradual upward drift results in Ezra's score improving about 2 points to terminate around a mean score of 17.3 points. This provides a contrast to Jane and Charmaine, who rather than showing a gradual increase to termination, show a sharp increase in checklist scores shortly after treatment begins. Mean improvements and terminal levels for Jane and Charmaine are much higher than for Ezra. Jane's scores show a mean improvement of 6.3 points and she terminates at a level of 23. Charmaine's mean improvement is approximately an 8 point margin, and she terminates at a level of 24 points.

Summary

The data for non-generalized gross-motor behaviours indicates that trained subjects show improvements in their behaviour checklist scores corresponding to commencement of training on each operant group of behaviours. Mean improvements of 6 to 13 points are noted for these subjects. Although responding stabilizes at these higher levels for balanced standing and walking and for rolling, hopping, and crawling, the third operant group; bouncing, catching, and throwing, shows an upward trend at the time assessments terminated. Dramatic improvements in checklist score are noted only on these three operant groups for the treated subjects. Running and jumping shows no dramatic increases for Jane or Charmaine. Although April's baseline does show a substantial drift upward, this drift appears to be a result of her willingness to attempt the task, rather than being due to an improvement in skill level. For all three trained subjects, terminal score levels on trained operant groups are noticeably higher than the terminal level for the untrained running and jumping group. Subjects who did not receive treatment show little change in terminal scores in comparison to initial scores. In instances where improvement is present, only slight 2 to 3 point increases occur.

Generalized Gross-Motor Performance

The dependent measure for the generalized gross-motor activities which were performed during physical education classes is stated in terms of the total behaviour checklist score. Forward rolling, hopping, and skipping all have a total possible score of 10. As the purpose of these probes was to assess the amount of generalization the program produced with regard to each of the behaviours measured, each of the three behaviours will be discussed separately.

Forward Rolls

As previously discussed (p. 34), this activity was directly trained during the gross-motor program. Therefore, improvements in this behaviour would indicate generalization on one dimension; that dimension being a new setting (i.e., the gymnasium).

The top graphs in Figures 6 and 7 represent the performance on forward rolling in the physical education class for each of the five subjects. April's data (see Figure 6) show a downward trend if baseline and balanced standing and walking training phases are combined. During the phase in which rolling, hopping, and crawling was trained this trend reverses, however, and the checklist score returns to the initial high level noted in baseline.

For Jane and Charmaine (see Figure 6) slight upward drifts from baseline to balanced standing and walking phases are present. This upward drift continues for Charmaine during the rolling, hopping, and crawling phase, and peaks during the final phase where bouncing, catching, and throwing was trained. For Jane, a jump in the behavioural checklist score occurs during the training phase for rolling, hopping, and crawling. Here performance peaks at a perfect score of 10, then drops slightly during the final training phase. Both Jane and Charmaine show improved checklist scores during the final generalization probes in comparison to the probes prior to the training phase which included rolling. April is the only trained subject who does not display such a trend, her initial probe score being equal to the final ones.

The data for Niki and Ezra (see Figure 7) do not show the same progressive upward drifts noted for Jane and Charmaine. Niki's data show very stable performance until the second last assessment. Here performance jumps dramatically upward. Improvement appears to have been temporary, however, as performance returns to the initial low level by the next assessment. Ezra, on the other hand, demonstrates very unstable performance. His behaviour checklist score begins at a high level, dips down to lower levels during the next four assessments, then gradually returns to approximately the same performance level demonstrated in the first assessment. Neither Ezra nor Niki, therefore, show the upward

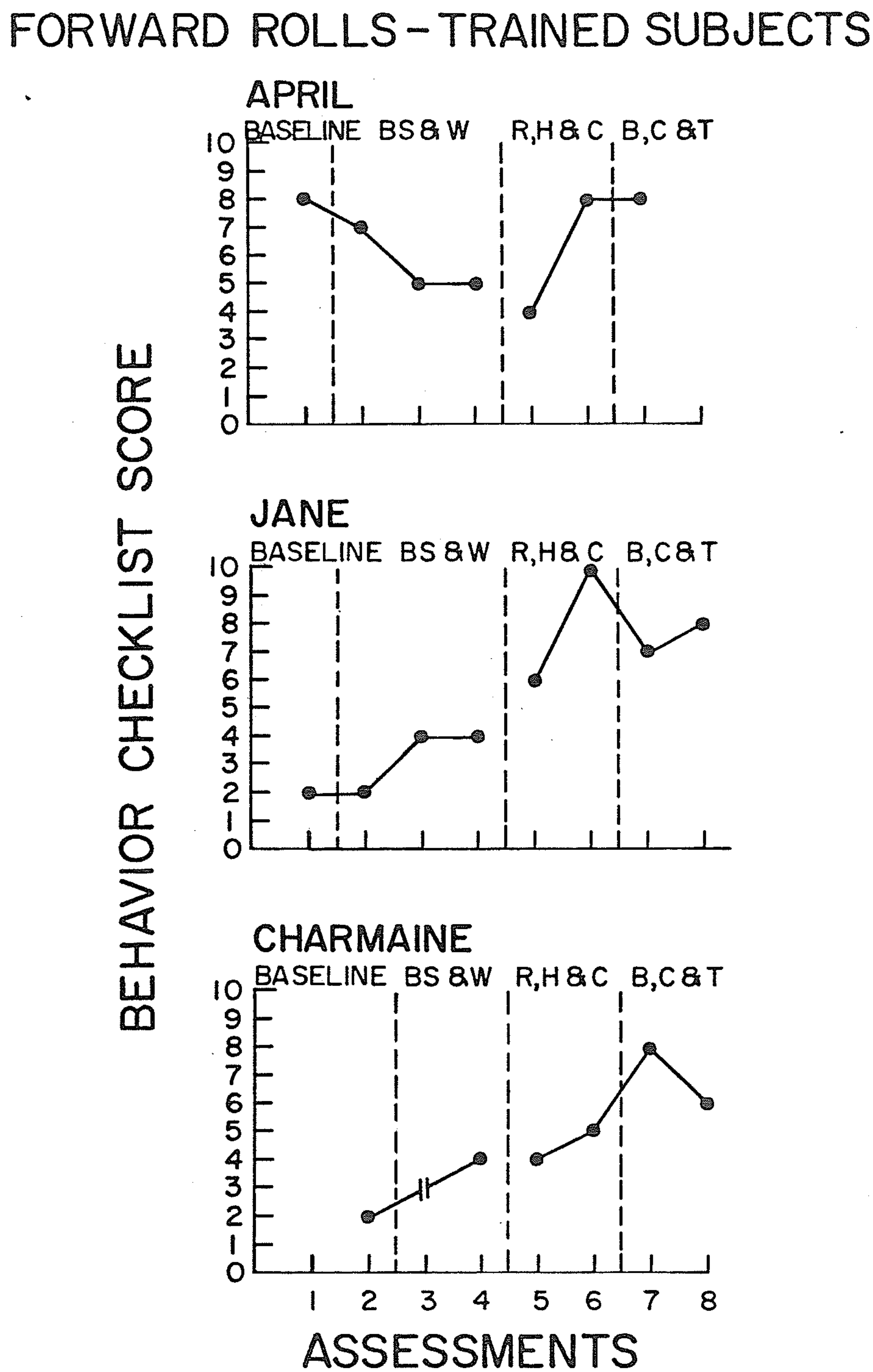

Figure 6. Behavior checklist scores on forward rolls for trained subjects.

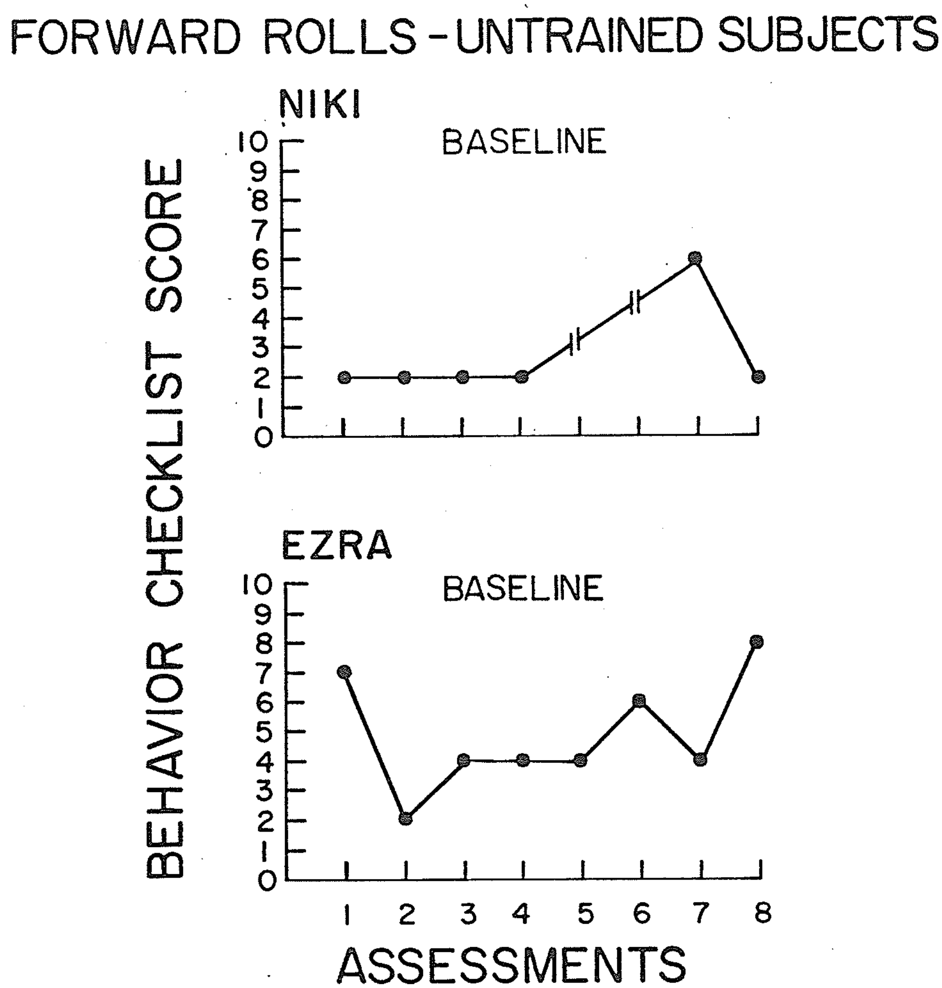

Figure 7. Behavior checklist scores on forward rolls for untrained subjects.

trends which are evident in the probes for Jane and Charmaine.

To summarize, of the three treated subjects, two (Jane and Charmaine) show upward drifts in the probes for generalization of gross-motor behaviour to a new situation. The third subject (April), shows an initial downward trend which eventually reverses, resulting in terminal checklist scores which are similar to the initial ones. One of the untrained subjects (Ezra) shows a somewhat similar pattern to this, while the other untrained subject (Niki) demonstrates very stable and unimproved performance relative to all other subjects.

Hopping

This activity was earlier identified as an untrained response which belonged to an operant category of behaviours which received training (p. 36). Thus, changes in hopping performance would indicate degree of generalization across two dimensions. As for forward rolls, one of these dimensions is that of a new setting; the gymnasium. The second dimension is that of generalization to new behaviours within the operant category of hopping.

The graphs in Figures 8 and 9 show the behaviour checklist score for each subject with regard to hopping performance. For the most part, the subjects' performances remain very stable at the 0 point level, indicating that the children were unable to perform the task.

Jane and Charmaine (Figure 8) provide the only exceptions to this rule. Although both subjects were totally unable to perform the task during baseline and balanced standing and walking training phases of the study, a score of one is noted for Jane during a single probe in each of the last two phases and for Charmaine during one probe in the last training phase. Therefore, after training occurred on rolling, hopping,

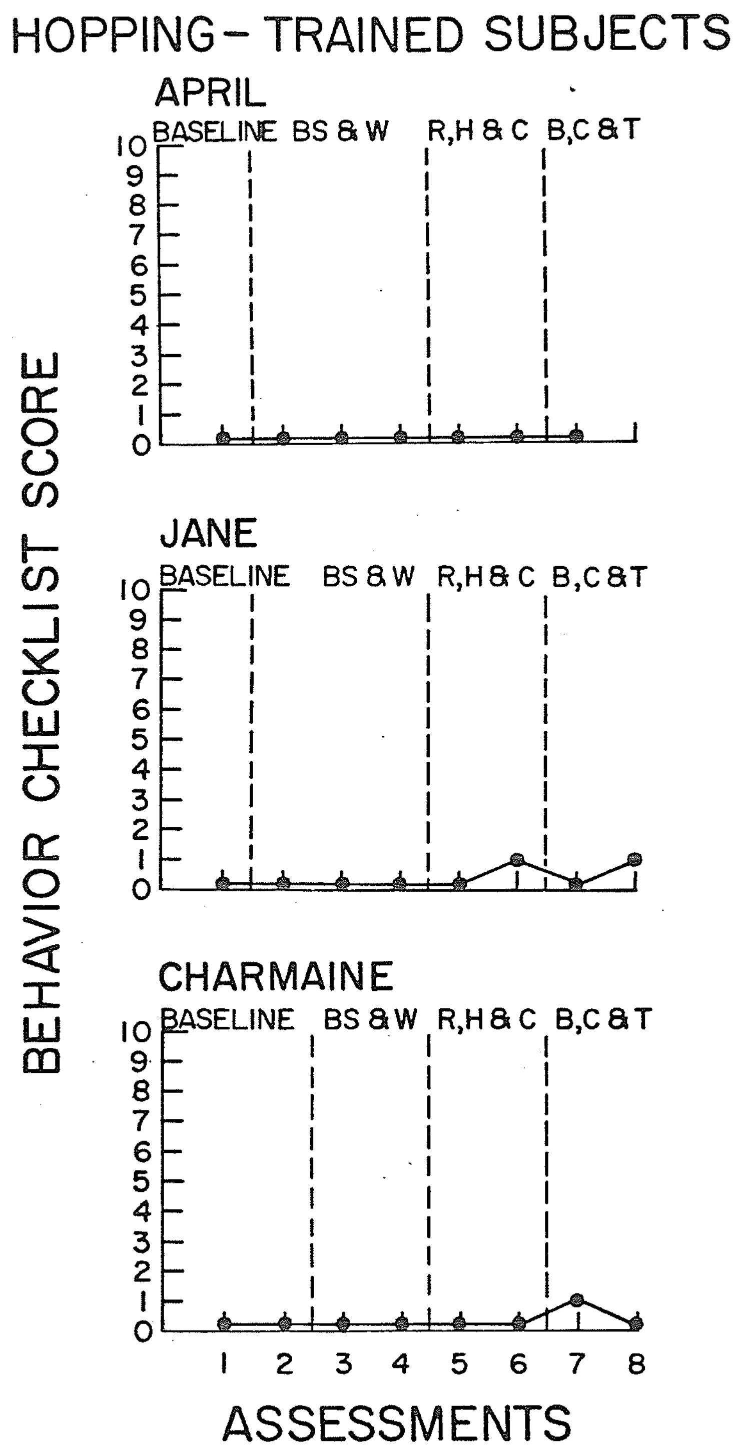

Figure 8. Behavior checklist scores on hopping for trained subjects.

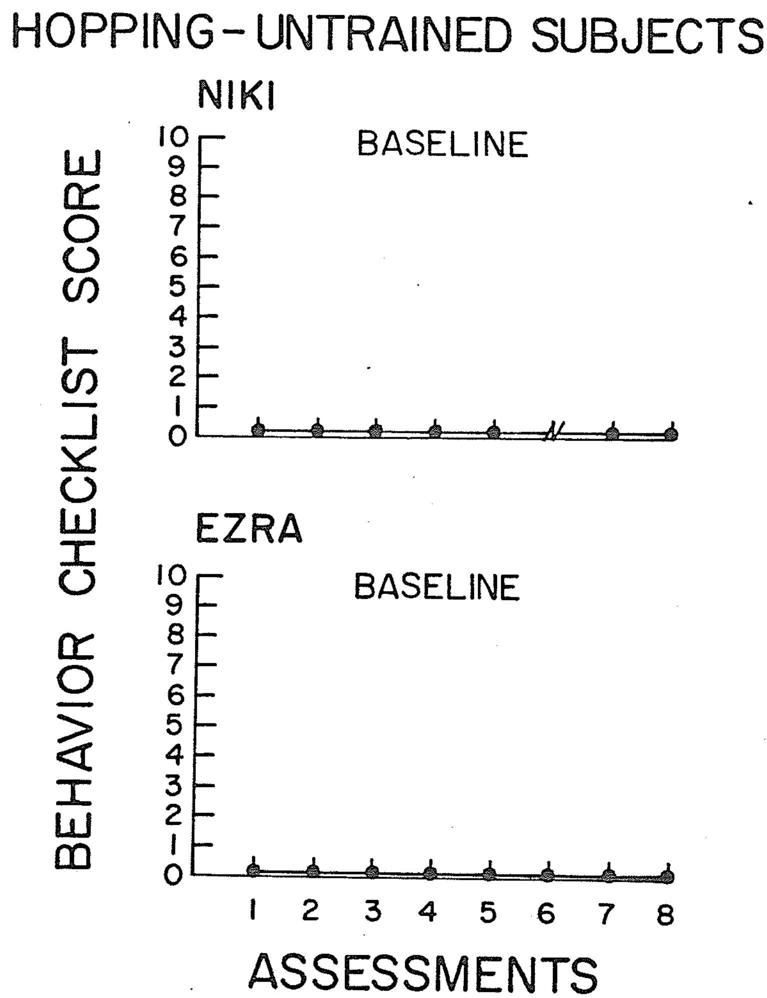

Figure 9. Behavior checklist scores on hopping for untrained subjects.

and crawling very slight improvement is occasionally noted for two of the three trained subjects. The remaining trained subject and the two untrained subjects show no improvement at all.

Skipping

This activity is, as previously mentioned (pp. 36 & 38), an untrained response which does not belong to any operant category receiving training, but does involve cross-lateral movements similar to those trained for crawling behaviours. Training-produced changes in performance on this activity would therefore indicate degree of generalization across two dimensions. Again, one of these dimensions is setting. The other dimension involves generalization to new behaviours which are untrained, but similar to trained operants.

The graphs in Figures 10 and 11 show the performance on skipping for each of the subjects. The three trained subjects (see Figure 10) show gradual overall increases in performance in skipping. Unlike April, who shows steady improvement throughout all assessments, Jane and Charmaine display unstable performance during baseline and balanced standing and walking training phases. However, steady improvement occurs after training commences on the operant group which includes the similar response of crawling.

Examination of the data for the untreated subjects provides little contrast to the data of the trained subjects, however. For Niki and Ezra (see Figure 11) overall improvement is also present. Niki's improvement is rather slight. Although the downward trend apparent in the first four assessments reverses during the last few probes, responding only increases to a maximum of 1 point above the first probe. Ezra's improvement is a bit more pronounced, although highly variable. Increases become

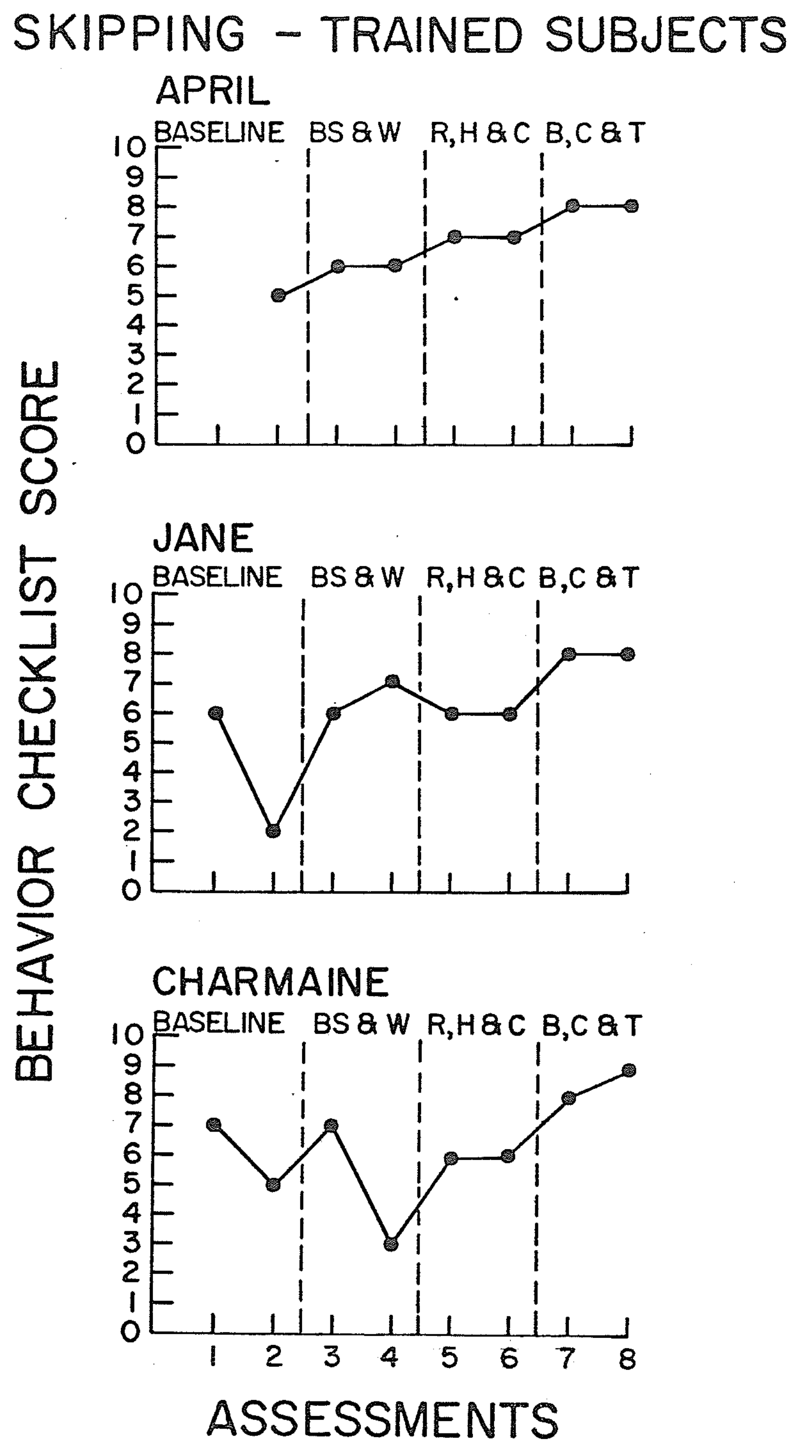

Figure 10. Behavior checklist scores on skipping for trained subjects.

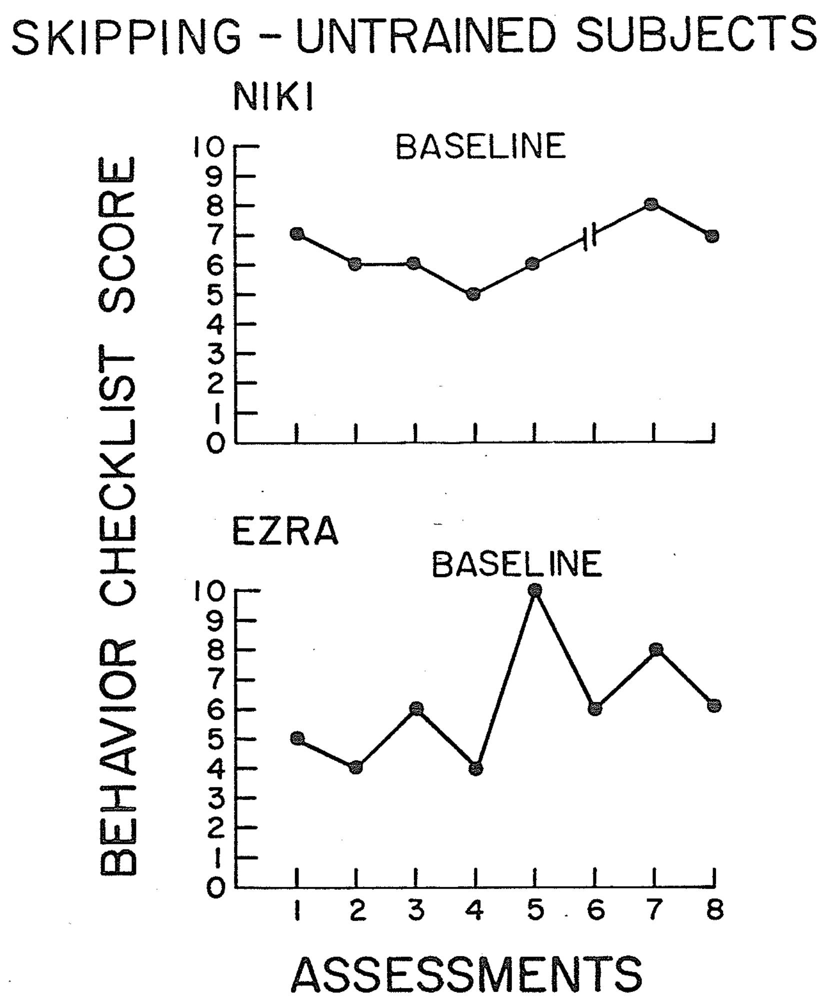

Figure 11. Behavior checklist scores on skipping for untrained subjects.

noticeable during the last few probes which correspond to the period where Jane and Charmaine received training on the similar crawling response and began to show steady improvement.

To briefly recap, the trained subjects all show overall increases in performance on skipping. For two of these subjects improvement is most noticeable during the last several assessments. Examination of the untrained subjects' data provides little contrast to these trends, however. For these two subjects overall increases occur and one of the subjects shows noticeable improvement during the latter probes, providing little contrast to the trends noted for the two trained subjects.

Collateral Behaviours

The dependent measures for the collateral behaviours of social play and compliance are expressed in percentage of time spent in social play and percentage of instructions followed, respectively. The dependent measure for maze-drawing is expressed in terms of the error score which was calculated by counting the number of times the pencil mark touched or crossed the sides of the maze (see p. 54 for specific scoring procedure). As the purpose of probing collateral behaviours was to assess the indirect effects of the program on each of these behaviours, each of the three collateral behaviours will be discussed separately.

Social Play

As previously mentioned (p. 36), social play (or verbal behaviour) received incidental training in the gross-motor program. This behaviour therefore assesses the presence and degree of generalization of an indirectly trained response to another setting.

The data for social play behaviour are shown in Figures 12 and 13. For all five subjects, responding is variable, but generally shows little

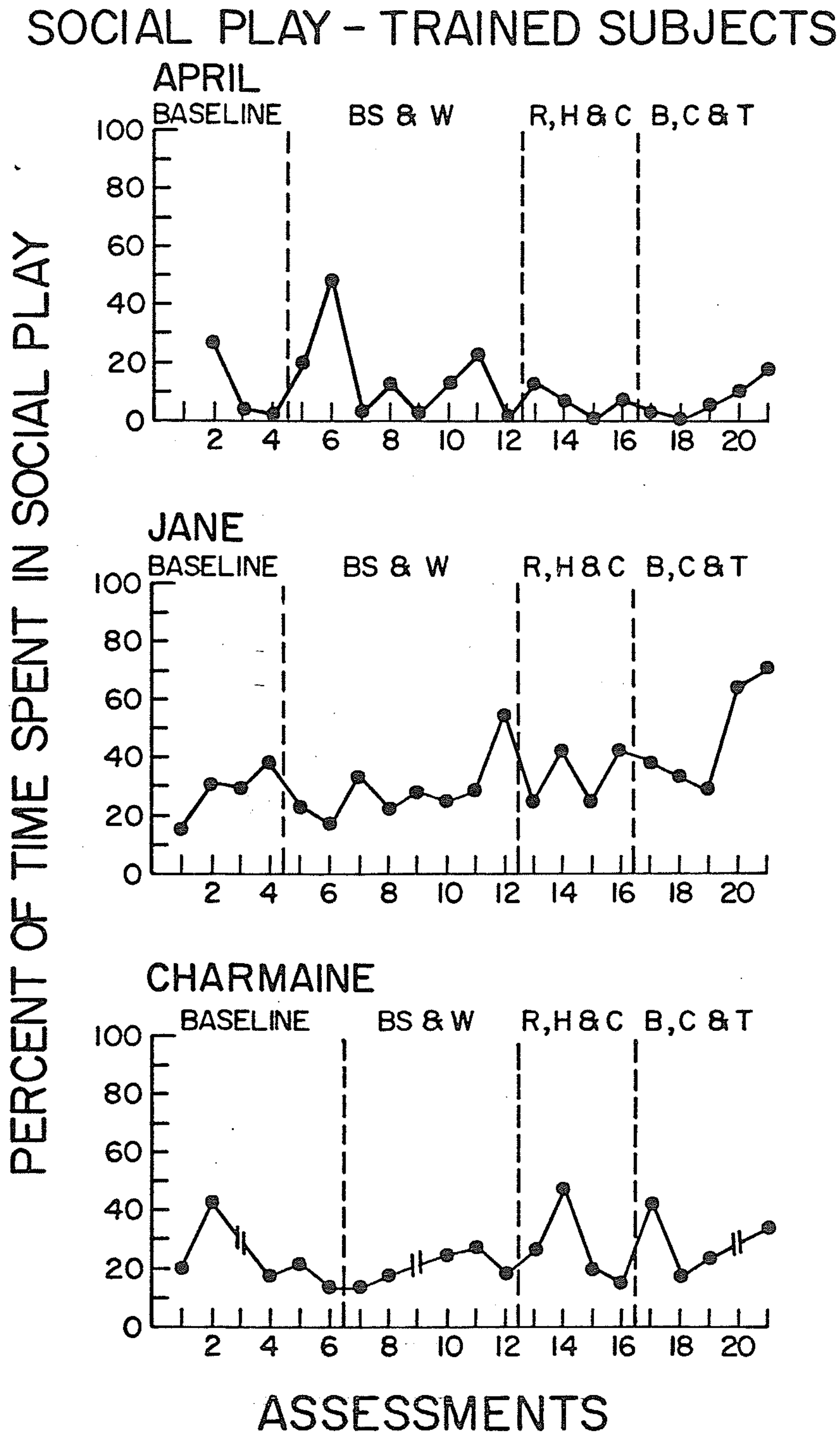

Figure 12. Percent of time spent in social play for trained subjects.

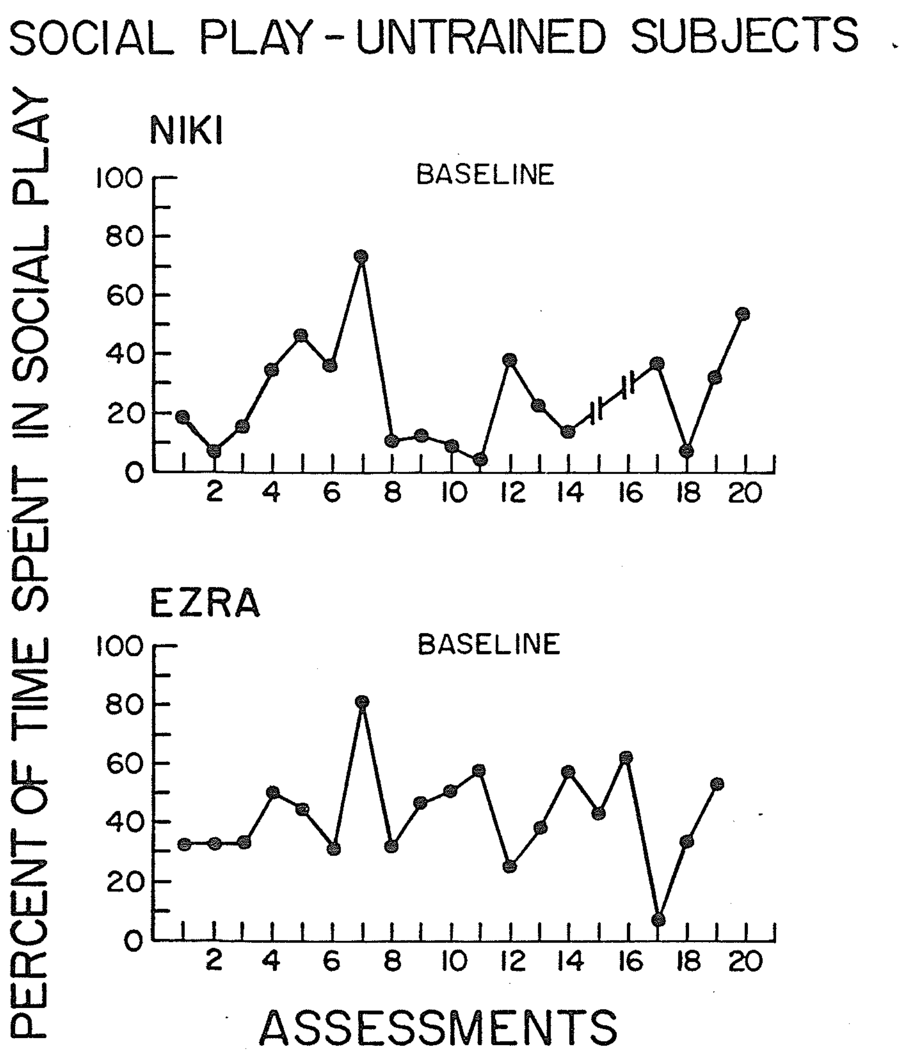

Figure 13. Percent of time spent in social play for untrained subjects.

movement in terms of an overall increase or decrease in behaviour. No upward or downward trend corresponding to any training phase occurs for any of the three trained subjects (see Figure 12). The data for the untrained subjects (see Figure 13) is quite comparable, displaying no systematic changes over the entire assessment period.

Compliance

As discussed earlier (p. 36), compliance, like social play behaviour, receives incidental training in the gross-motor program. Therefore, it too assesses the presence and degree of generalization of an indirectly trained response to another setting.

The data for compliance behaviour are displayed in Figure 14 and 15. A brief overview of the data for the five subjects seems to suggest that compliance improved for two of the trained subjects after training on balanced standing and walking began and that high levels of compliance were maintained for all three subjects until the final training phase on bouncing, catching, and throwing (see Figure 14). The data for the untrained subjects (see Figure 15) does at first glance appear to be more variable throughout the entire assessment period, suggesting that the subjects receiving indirect training of instruction-following during the gross-motor program improved in compliance in comparison to untrained subjects.

A finer analysis of the compliance data however, suggests that no definite statements regarding changes in compliance due to treatment can be made. Several problems exist in the data which make definitive statements difficult.

First, the short baseline period for the trained subjects (see Figure 14) does not give a clear indication of the variability of com-

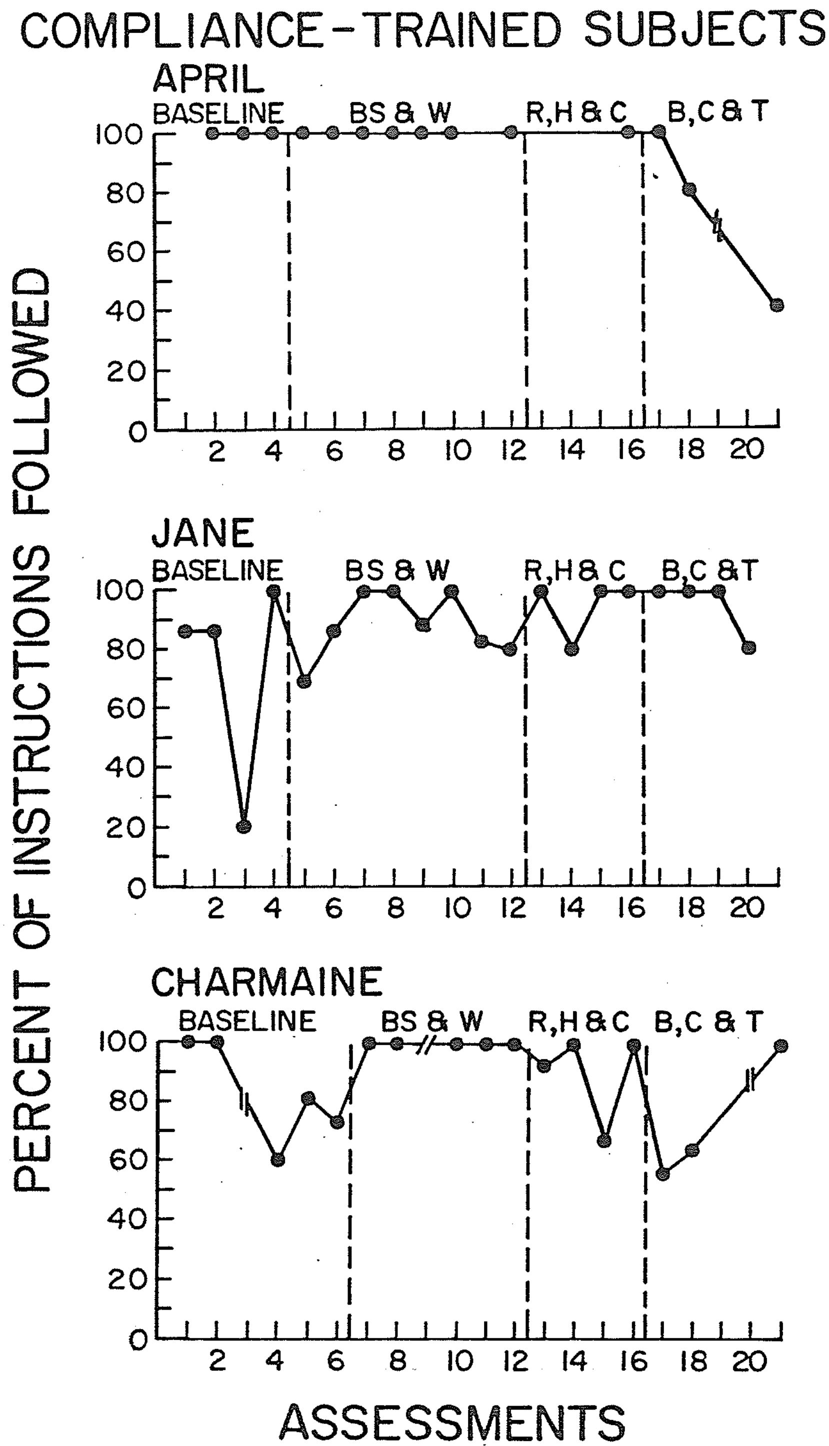

Figure 14. Percent of instructions followed for trained subjects.

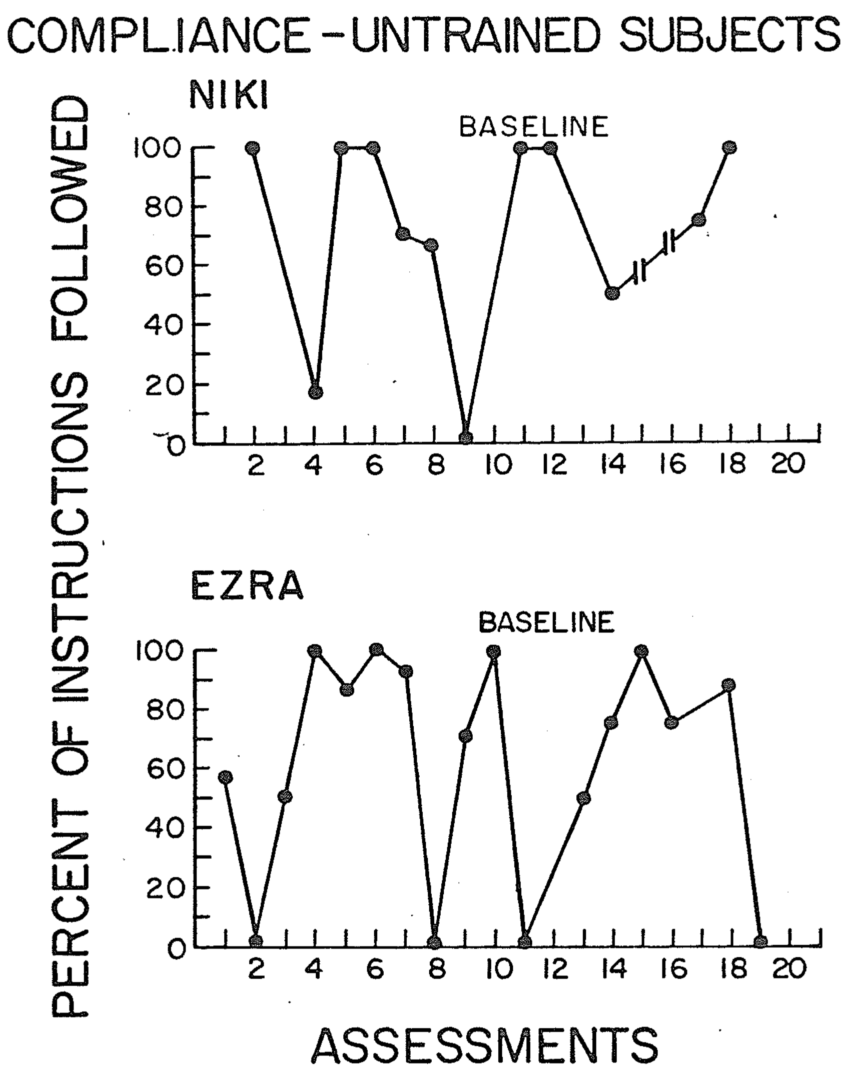

Figure 15. Percent of instructions followed for untrained subjects.

pliance behaviour. Also for one of these subjects April, baseline is at ceiling and therefore the high rate of compliance during training phases is no different from the behaviour during baseline. Finally, an important factor influencing variability of compliance was the number of instructions given during a single assessment session. Since number of instructions given was not kept constant across children, intersubject comparisons cannot prudently be made.

In sum, because of short baseline periods for trained subjects, it is difficult to make statements regarding changes in behavioural trends for these subjects. In addition to an inability to make statements with regard to changes within subjects, it is impossible to make comparisons in variability of behaviour between subjects, as a factor which produced variability (i.e., number of instructions given) was not kept constant.

<u>Maze-drawing</u>

Maze-drawing, as mentioned earlier (p. 37), receives no incidental training in the gross-motor program. Although it does involve muscle skills, the movements involve refined coordination of the small muscles of the body, and the behaviour is therefore quite different from gross-motor movement. As such, this behaviour assesses generalization to an untrained response in another setting.

The data for maze-drawing performance of each subject are shown in Figures 16 and 17. As was the case for social play behaviour, responding on maze-drawing is variable for all five subjects, but generally shows little movement in terms of overall increase or decrease in error score. No clear upward or downward trend corresponding to training phase occurs for any of the three trained subjects (see Figure 16). Although Jane's error score increases dramatically in the initial assessments during the

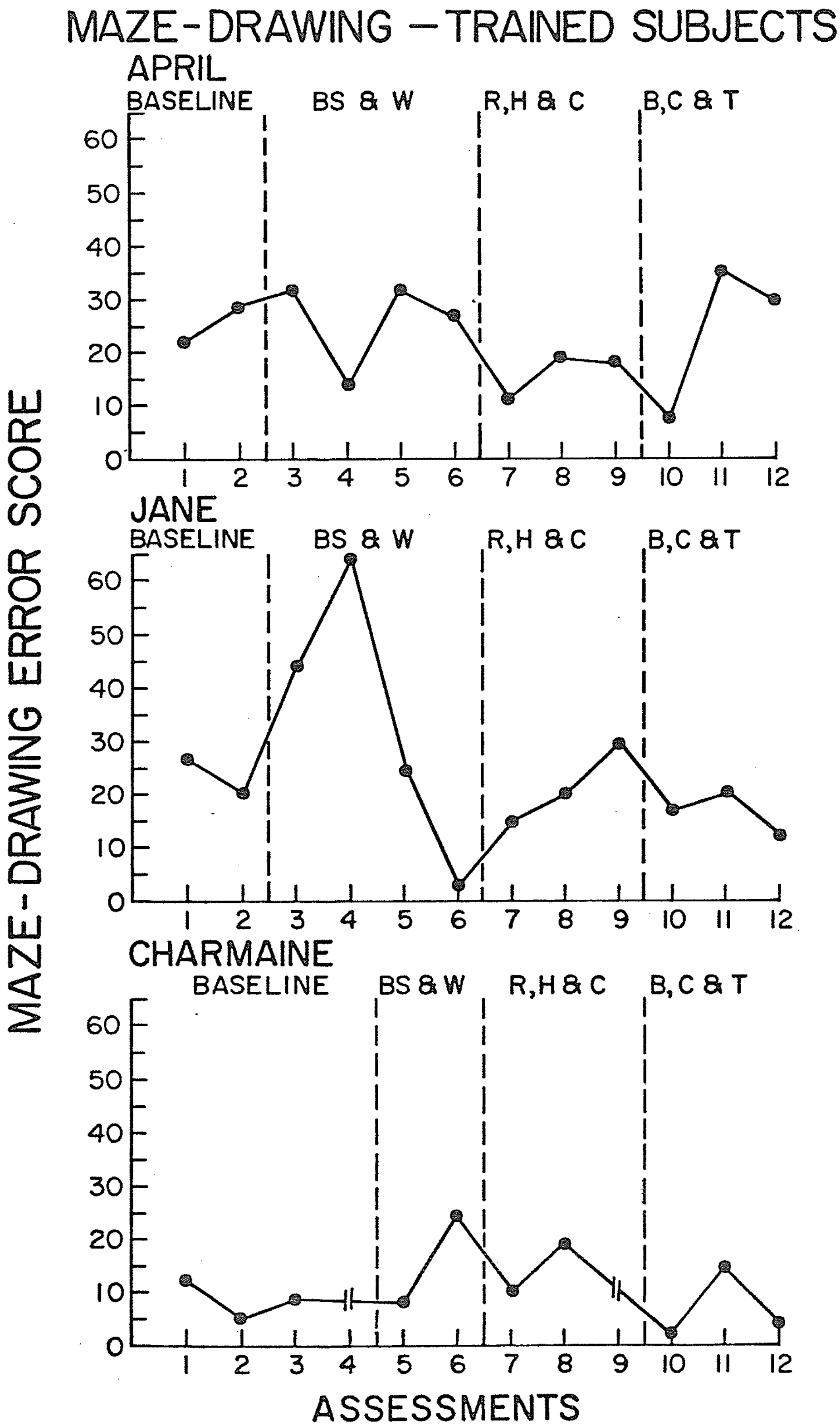

Figure 16. Maze-drawing error score for trained subjects.

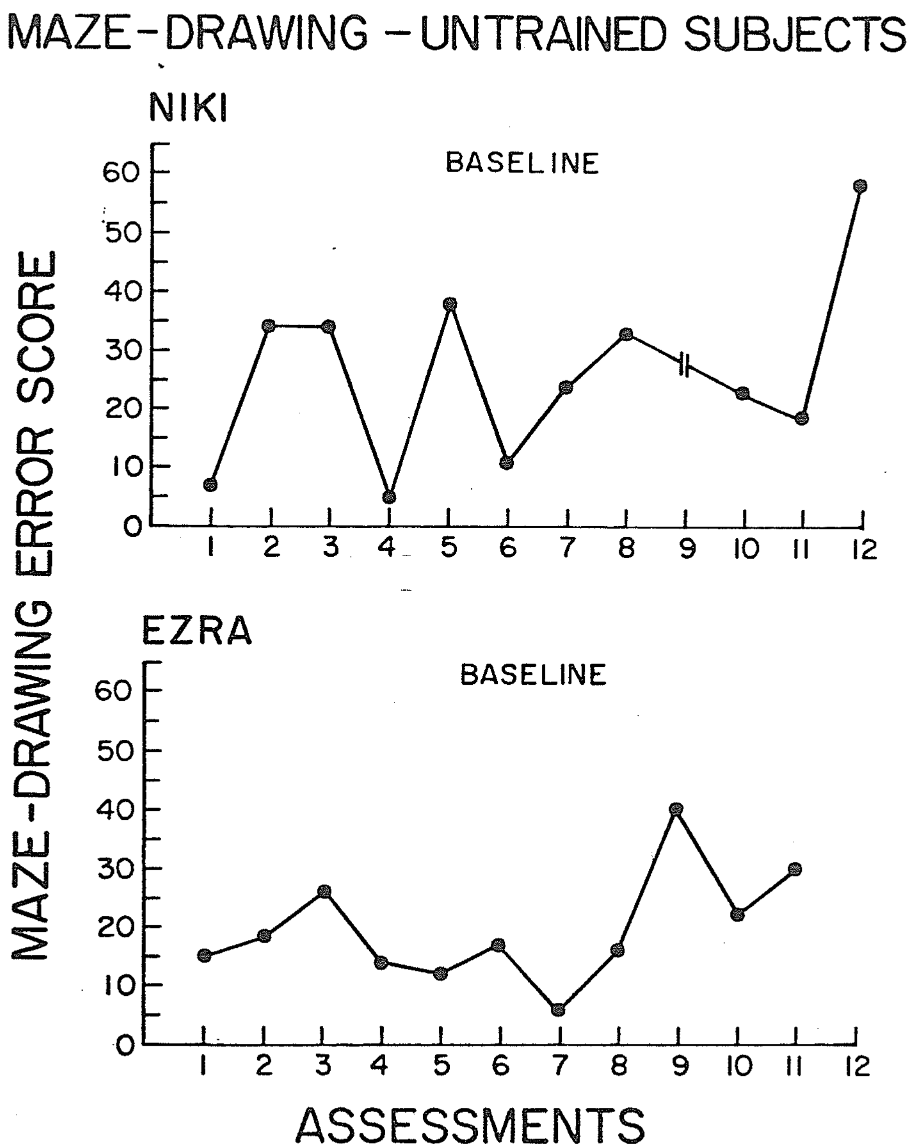

Figure 17. Maze-drawing error score for untrained subjects.

balanced standing and walking training phase, the subsequent reversal in trend suggests the variability is produced by spurious factors. The data for the two untrained subjects (see Figure 17) are quite comparable to that of the trained subjects, displaying no systematic changes over the the entire assessment period.

DISCUSSION

The implications of the results of the revised Capon (1975) gross-motor training program will be discussed first. Non-generalized gross-motor, generalized gross-motor, and collateral behaviours will be considered separately. Contributions of the study to educational and behavioural disciplines will then be evaluated with accompanying considerations for future research. Comments on social validity will follow, then a general summary and conclusions will close the discussion.

Implications of the Results

Non-generalized Gross-motor Behaviour

The data presented in Figures 1 to 5 indicate that the main hypothesis for non-generalized gross-motor skill was dramatically supported. As predicted, the trained children showed marked improvement each time treatment was implemented on an operant group of behaviours, suggesting that the revised Capon program was indeed an effective strategy for training gross-motor skills. Overall, as anticipated, the greatest and most consistent behavioural enhancements were noted on the non-generalized gross-motor behaviours.

Contrary to conjecture, general improvement in the gross-motor behaviour of all children did not occur. Baselines for the non-generalized behaviours were relatively stable and for most part tended not to drift upward. This finding seems to indicate that practice alone will not lead to gradual improvement in gross-motor skill, but that at least one of the previously identified components (pp. 56-60) of the revised program is necessary for improvement to occur. The relative contributions of the various components of the training package were not assessed, but corroboration of some of the important features of the package can be found by examining a recent study.

Allison and Ayllon (1980) compared a behavioural coaching package to standard coaching procedures for increasing gross-motor skills of athletes. The components included in this behavioural training package were 1) verbal instruction and feedback, 2) positive and negative reinforcement, 3) positive practice, 4) modelling, and 5) a time out procedure where the athlete had to freeze in incorrect positions.

Consistent with the findings of the present study, Allison and Ayllon found that standard coaching procedures which involved repeated practice of a task did not lead to improvement of skill level. The behavioural coaching practice lead to substantial improvements, however. The overlapping components of Allison and Ayllon's package and the revised Capon training program include verbal instruction, feedback, positive reinforcement, practice, and modelling. The fact that these components overlap successful training programs suggest that at least one of them is an effective component of the training packages. Examination of the relative effectiveness of these components alone, and in combination, would likely be a fruitful starting point for future investigation of gross-motor training strategies.

Generalized Gross-motor Behaviour

The data for generalized gross-motor skills (Figures 6-11) indicate different outcomes for each of the behaviours probed for generalization. Forward rolling skills seem to have transferred from the training situation to the gymnasium for at least two of the three trained subjects. Hopping appears to have achieved very little generalization and skipping seems to have improved primarily due to practice and training in the gymnasium, independent of the gross-motor program.

These results do not support all the generalizations which were thought possible. The one generalization which appears to have been realized concerns forward rolls. The rolling skills of two of the trained children showed greater improvement than the skills of the untrained children, indicating that rolling may have generalized to the new setting. Improvements in rolling were greater than those noted for hopping as was expected. Contrary to speculation, however, improvements in rolling were not greater than those displayed for skipping; they were approximately equal.

Although two of the three trained subjects do occasionally show slightly improved scores after training on hopping, these deviations from baseline are clinically insignificant and are displayed inconsistently. Generalization to the hopping task can therefore be dismissed; a result which does not support the presumed potential of the training program.

There are two issues which should be taken into consideration when noting that generalization occurred for rolling, but not for hopping behaviours. First, as discussed earlier (pp. 35-36, 83-88) the forward rolling task in the gymnasium required generalization across one dimension (setting) whereas hopping required generalization across two dimensions (setting and behaviour). It is unsurprising, therefore, that the rolling task, which had more features in common with the training situation, may have generalized more easily than the hopping task.

A second factor which should be examined when considering the probability of generalization concerns the relative difficulty of the task measured in the generalization probe. This issue was touched upon earlier when discussing the delay in improvement of balanced standing and walking in the training situation (p. 71). As was noted, training on less difficult balanced standing tasks did not produce improvement on swan balances. A similar situation seems to have existed for hopping. The hopping activity measured in the gymnasium required greater amounts and more control of hopping than activities in training. During the hopping task in the gymnasium the children had to balance on one foot for a period of 1 to 2 sec. between each hop. This interposed balancing period was not present in training tasks. Children were occasionally required to pause after hopping over an obstacle, but were never required to pause between hops in a series. Also, none of the training tasks incorporated as many as 10 hops; only two tasks required more than five. Therefore a greater number of hops and more controlled balance was required in the gym than in training. This situation contrasts to that for forward rolls where the tasks were identical and consequently of equal difficulty.

The data on generalization of gross-motor behaviour suggests that simply incorporating a large number of tasks and a wide variety of equipment into a training program will not ensure generalization of new behaviours to new settings. The number of dimensions across which generalizations are desired and the relative difficulty of trained and generalized tasks must be carefully considered.

Collateral Behaviours

The results displayed in Figures 12 to 17 suggest that few changes in the collateral classroom behaviors can be expected to result from gross-motor training. Social play and maze-drawing skills were clearly unchanged by the revised Capon program. While effects on compliance were not definitively absent, because of methodological concerns no claims of improvement can be made with regard to this behaviour either.

As was the case for generalized gross-motor behaviour, the generalizations which were presumed possible with regard to collateral behaviours were largely unsupported by the data. Social play did not increase as a result of training, and it did not appear to increase naturally through maturation of the subjects. Also contrary to conjecture, maze-drawing errors did not decrease for any of the subjects, indicating that practice alone does not improve fine-motor skills. This finding is consistent with that mentioned earlier, regarding lack of improvement due to practice of gross-motor tasks (pp. 103-104).

Two speculations made regarding collateral behaviour were supported by the data. First, changes in gross-motor behaviour of the trained children in the training and gymnasium situations were more prevalent than changes in the classroom. Whereas changes occurred in all the trained operants which were measured in the training situation and in two of the three behaviours measured in the gymnasium, no definite changes were noted in the classroom behaviours. Second, the ineffectiveness of the gross-motor program for producing improvements in the fine-motor skill of maze-drawing was accurately estimated. This seems to refute the educational view that fine and gross-motor skills are similar enough so that training in one skill will enhance the other.

As mentioned previously (pp. 68 - 69; 97 - 100), there were difficulties with compliance data involving poor observer reliability, baseline levels which were at ceiling, and variability produced by uncontrolled factors (i.e., number of instructions, p. 100). As such, statements regarding accuracy or inaccuracy of the speculation regarding this behaviour cannot be made on the basis of the results presented here. Future assessments of the effects of gross-motor training on compliance should involve several features not included in the present study. First, constructing an artificial situation in the classroom where a constant number of instructions are given to trained and untrained children would help reduce extraneous variability. Blocking data could also be used to further eliminate variability in the data. Finally, more frequent assessment and longer baseline periods could be employed to allow for assessment of presence and degree of any remaining variability in compliance behaviour. Such alterations as these would enable more clear comparisons both within and between subjects.

As the lack of improvement in social play behaviour in this study is inconsistent with the findings of previous behavioural research, additional comment on this collateral behaviour is warranted. To briefly review, two of the three behavioural studies which have addressed gross-motor behaviour noted improvements in social behaviour. The first study (Johnson et al., 1966) did not systematically monitor social behaviour, but the second investigation (Buell et al., 1968) did incorporate this feature. Both experiments took place in the playground during free-play periods and involved contingent teacher attention for interacting with the playground equipment. The Buell et al. (1968) study also utilized a prompting technique where the teacher lifted the child onto playground equipment.

It is apparent that the experimental situations described in these two studies are quite distinct from the training situation constructed in the present study. Training took place inside the school in the present study, rather than in the playground or classroom play area where social behaviour was measured. In the previous two studies the teacher reinforced gross-motor behaviour; whereas, the present experimenter was not an individual who was familiar to the classroom play area. Finally, the training procedure employed here was very structured and more similar to the classroom learning situation than to the free-play periods of the previous studies.

It is evident that the number of stimuli common to the gross-motor training situation and the social play situation were greater in the two previous studies than in this one. Recall also that entry into a natural community of reinforcement was the mechanism which was considered to produce contingencies for increasing social play (pp. 12-13; 36). The situations described for the Johnston et al. (1966) and Buell et al. (1968) studies seem likely to produce entry into such a "natural community" because the research took place in the natural environment (i.e., the playground). In order to be consistent with the common training setting utilized by educators, the gross-motor program employed here took place within the school in a setting divorced from the natural classroom or playground environments. Given these discrepancies in experimental situations, discrepancies in results, although not at first anticipated, now seem not surprising.

Summary

The results suggest that the revised Capon program was a successful strategy for training gross-motor skills in young children. Although it is yet unknown which components of the training package are critical, the package as a whole can be expected to produce desirable improvements. The extent to which such improvements will generalize is somewhat limited, however. Although some generalization to new settings is possible, generalizations across more than one dimension or to more difficult behaviours are not likely. Thus, such generalizations should not be considered an automatic feature of the training program. Given the limited generalization of the gross-motor behaviour, it is not surprising that the gross-motor training program does not produce improvement in collateral behaviours displayed in the classroom. Increased social play or maze-drawing skill is unlikely to result from such training. Although the effect of the program on compliance is yet unknown, it is wise at the present time to take a conservative approach and to assume no such benefits exist.

Contributions of the Study

The new information derived from the present research can contribute to both educational and behavioural fields. The implications of the study for educators will be discussed first, then contributions to behavioural research will be considered.

Implications for Education

Although the present research suggests that gross-motor training programs like the revised Capon program are beneficial and should be available to young children with gross-motor problems, the need for changes in the present system of gross-motor training and research must be emphasized. An important alternative in the present procedure involves the components utilized in the training program. As mentioned earlier (p. 56), the standard Capon program recommends use of all the components utilized in the revised program with the exception of descriptive and corrective feedback. Until the relative merits of each component can be determined and effective components identified, descriptive and corrective feedback should be applied systematically in conjunction with all the other facets of the package. Since persons conducting gross-motor training in schools are typically teachers or paraprofessionals (i.e., teacher's aids or volunteers) who do not have specialized training in the systematic application of these behavioral training components, care should be taken to teach these specialized skills to the gross-motor trainers.

A second implication addresses the issue of generalization. The absence of widespread generalization from trained skills to new skills suggests that educators should carefully consider the final desired results of such training. Gross-motor behaviours which will likely be required of children should be identified and encorporated into training programs.

A very important implication for the practice of gross-motor training concerns the type of children who should be included in training programs. As indicated previously (pp. 1-3), educators have in the past expected a wide variety of benefits from these programs and have included children with a wide variety of problems in gross-motor training. The results of the present research suggest that only children with gross-motor deficits should be included in gross-motor training programs. Children with problems in social or fine-motor skills are given no assurance of improvement and may be wasting a great deal of academic time by participating in these programs. To date, no data clearly suggest that other collateral behaviours will benefit from gross-motor training. Until such data can be collected, gross-motor training programs should be assumed to improve only gross-motor skills.

It is possible that gross-motor educators would object to such conservative estimates of the results of their programs. The arguement might be offered that the short training period utilized in the present study did not allow the development of collateral improvements. It should be recognized, however, that the gross-motor improvements in this program were relatively immediate and of fairly large magnitudes. If collateral improvements were directly related to gross-motor skills and/or gross-motor training, changes in these behaviours should occur relatively immediately also. If long periods of time ensue before changes in collateral behaviours are noted, results of the program for individual subjects become hopelessly confounded with the effects of maturation and extraneous variables. Therefore, if changes in collateral behaviours are not fairly immediate and of a large enough magnitude to be clinically significant, gross-motor training should not be assumed to effect them.

In addition to having implications for the practice of gross-motor training, the present findings also offer promise that a new methodological approach to gross-motor research may prove especially fruitful. The small-N research design and direct assessment of gross-motor skills proved to be very useful strategies in analyzing contributions of gross-motor training. Because the strategy allows for better control through close monitoring of a few individuals, experimenters gain access to information regarding the important variables affecting behaviour. This provides direction for further research acertaining the relative importance of different variables which influence behaviour. Because the small-N strategy offers this important advantage, and because it avoids many other problems involved in traditional experimentation (see pp. 4 - 10), educational researchers should use it to full advantage. In addition to the experimental advantages of small-N design, practical advantages are also present. Small-N research does not require extra subjects or experimental settings discrepant with those present during the application of gross-motor training programs, therefore gross-motor educators can conduct research simultaneous to providing a service to children in need of gross-motor skills training.

Implications for Behavioural Research

The investigation of the gross-motor training programs which are prevalent in public schools has contributed to behavioural research by opening a rich area for further research. The present study defined skill in gross-motor movement in a novel manner which, in comparison to previous behavioural research, is more adaptive to research in a variety of educational situations. To review, previous studies (e.g., Hardiman et al., 1975) defined skilled movement specific to various pieces of playground equipment. This study defined skill in terms of the topography of different operant behaviours. Behavioural checklists were developed which can be used directly or modified slightly to apply to a large number of gross-motor skills which may involve a wide variety of classroom, gymnasium, and/or playground equipment.

The present investigation can benefit further behavioural research by serving as a reminder of the importance of task training order. The revised Capon program was constructed in such a manner as to maximize parallelism of the study to the common educational situation. As such, order of task training was kept fairly consistent with that advocated by the original Capon program. Because of these restrictions, there was a delay in training some of the assessment tasks. The effects of such delays were most dramatically apparent in the balance standing and walking operant group (recall the discussion on delay of improvement p.71). The present investigation can, accordingly, be considered a conservative estimate of the immediacy of training effect. Further research can maximize baseline to treatment shifts in responding by establishing training orders which include assessment tasks in the first training session.

As discussed in the preceding section, large-N design does not particularly facilitate the identification of important variables affecting the behaviour in question because it does not involve intense monitoring of individual behavior. The predominant use of large-N design in previous gross-motor research has produced a large body of literature reporting conflicting results with regard to gross-motor and collateral behaviour changes. Little information has been obtained regarding the variables which produce the discrepant results. Behavioural researchers can make important steps in identifying relevant variables by applying behavioural design and methodology to problems in gross-motor behaviour. A variety of areas for future research have already been implied. They will be expanded upon here.

The need for a component analysis of the revised Capon program has been suggested several times (pp. 103,110). This is a suitable topic for behavioural investigation which could have important implications for the training of gross-motor skills. The simplification of complex training packages through elimination of ineffective components is particularly important when mediators are largely paraprofessionals. Reducing the complexity of a training package makes it easier to teach the paraprofessionals proper use of the behavioural training components and increases the probability of proper implementation.

The need to further develop a technology of generalization has also been implied. This study clearly suggests that unsystematically throwing generalization training strategies into a training package will not necessarily promote generalization. The findings suggest that careful and systematic analysis of the desired generalizations should occur prior to constructing a program. Then, as Stokes and Baer (1977) suggest, generalization should be carefully programmed into the training strategy. Gross-motor behaviour seems to provide a suitable area for further investigation and development of the technology of generalization. It is an area which allows for probes for generalization across several dimensions (e.g., behaviours, settings, and students) and can accommodate assessment of varying degrees of generalization (e.g., to other gross-motor behaviours, to collateral behaviours, to more difficult versus less difficult behaviours).

One of the most interesting areas for investigating generalization involves collateral behaviours. Educators have suggested a vast variety of collateral responses which may be probed by behavioural researchers involved in gross-motor skills training. The results from this study suggest that further investigations involving compliance behaviors could prove interesting. Suggestions for improving measurement of this behaviour have already been made (p. 107). Using such assessments of compliance in a study similar to this one should provide fruitful information.

Social Validity

Besides providing benefits to educators and behavioural researchers, the gross-motor research appears to have significantly benefited the children involved in the study. Not only did the children experience improvement in gross-motor skill, they apparently enjoyed the program. Often when the experimenter entered the classroom, a child receiving training would approach her and ask if there would be lots of different exercises to do that day. Untrained children also approached the experimenter and asked if they too could come for exercise.

In addition to enjoying the gross-motor exercises, the children thoroughly delighted in receiving and playing with the reinforcers they earned. Great care and meticulous consideration typically went into choosing a reinforcer. Once this was done, children would spend time displaying their reinforcers and playing with them. Since all children in the classroom participated in receiving reinforcement, this procedure produced much gaiety and pleasant interaction among children and between the children and their teacher.

The classroom teacher reported that she felt the children enjoyed the gross-motor program and were benefitting from it. She also indicated she had observed one of the trained children practicing a training task during physical education classes. She reported that this child generally appeared more confident in gym class and that all of the trained children appeared to enjoy "showing off" their gross-motor skills.

In addition to benefitting the trained children, the teacher felt that untrained children had also prospered from the research. In removing three of the children for training sessions, the experimenter lowered the student-teacher ratio in the classroom. The benefit to the untrained children, therefore, was an increase in the amount of individual attention the teacher was able to provide.

Summary and Conclusions

Bridging conceptual and methodological gaps in behavioural and educational research proved to be a productive strategy in the investigation of gross-motor training programs. By incorporating behavioural assessment, design, and training srategies into traditional educational training programs new information was provided for educational researchers. Practical implications for gross-motor educators also arose.

Benefits for behavioural researchers were produced by redirecting the behavioural approach toward investigation of gross-motor behaviours. By utilizing a complex training program with a group of children and examining a variety of collateral classroom behaviours, many doors for further research have been opened.

In conclusion, a number of benefits have resulted from the present investigation of perceptual gross-motor training. Children, educators, and behavioural psychologists can all share alike in the profits of such a research enterprise. Cultivating research by spanning behavioural and educational fields has indeed proven to be a fertile venture; one which it is hoped will "sow the seeds" for further cooperation between the two disciplines.

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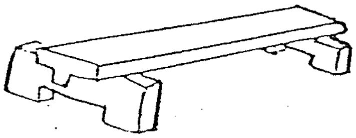
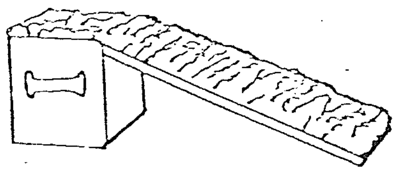
Appendix A

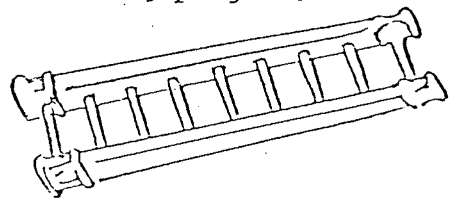
Diagrams of some of the items used in the modified training program.



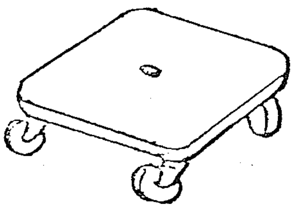
Balance board



Jump box and Incline board



Coordination ladder



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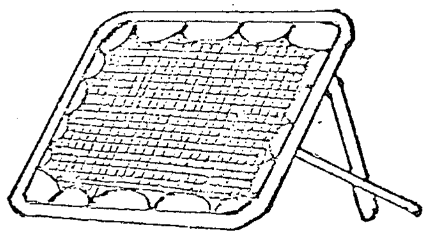
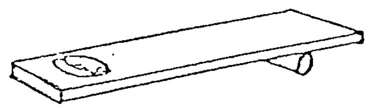
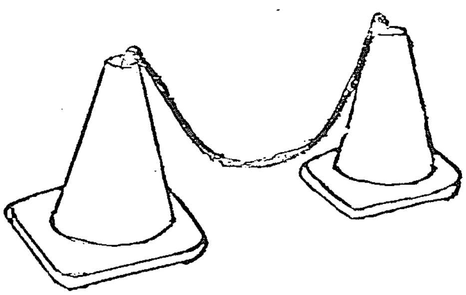


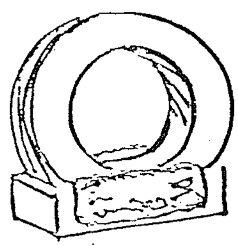
Rebound net



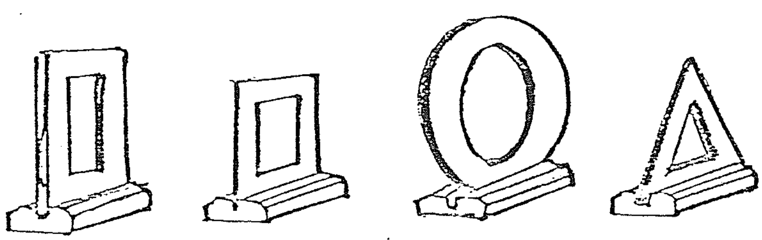
Launching board



Traffic cones and Rope cross bar



Auto tire and Tire stand

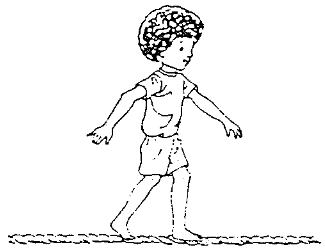


Geometric shapes

Appendix B

Task specification of altered Capon program: Order, description, and equipment use for training lessons.

OPERANT GROUP 1 - BALANCED STANDING AND BALANCED WALKING



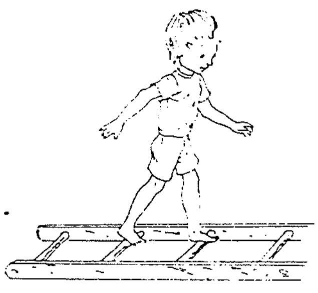
Lesson 1

Operants trained: balanced walking

Equipment: ropes

Activities

1) Walk forward on top of the rope.
2) Walk backward on top of the rope.
3) Perform a toe-heel balance walk forward on top of the rope. Touch heel of one foot to toes of the other foot while walking the rope.



Lesson 2

Operants trained: balanced walking

Equipment: coordination ladder

Activities

1) Walk forward stepping between the rungs of the ladder.
2) Balance walk forward on the rungs of the ladder.

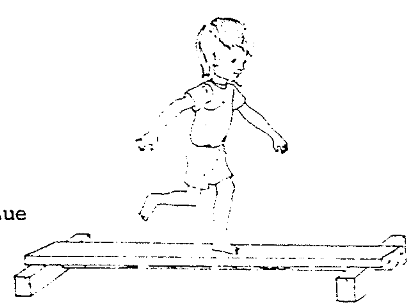
Lesson 3

Operants trained: balanced walking and balanced standing

Equipment: low walking board

Activities

1) Walk toward the end of the board with eyes focusing on the target (trainer's hand).
2) Walk forward, balance on one foot at the center of the board (stork balance) then continue walking to the end of the board.



Lesson 4

Operants trained: balanced walking and balanced standing

Equipment: low board, crossbar

Activities

1) review lesson 3, activity 2

2) Walk forward and step over cross bar placed across center of walking board

Lesson 5

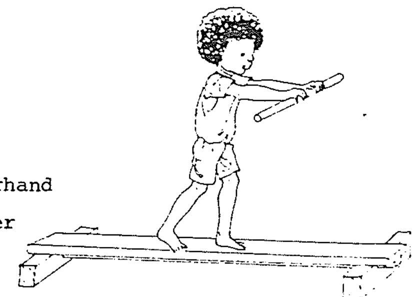
Operants trained: balanced walking

Equipment: low board, balance pole

Activities

1) review lesson 4, activity 2

2) Walk forward carrying a balance pole using an overhand grip with hands placed slightly wider than shoulder distance apart.



Lesson 6

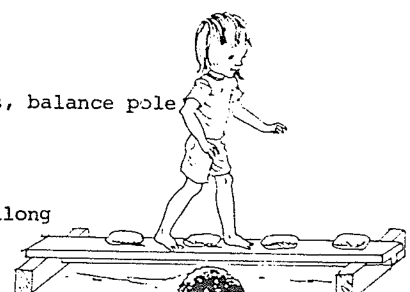
Operants trained: balanced walking

Equipment: low and intermediate walking boards, bean bags, balance pole

Activities

1) review lesson 5, activity 2 - use intermediate board

2) Walk forward and step over 4 bean bags spaced evenly along board, without looking at feet.



Lesson 7

Operants trained: balanced walking

Equipment:low and intermediate boards, crossbar, tires, bean bags

Activities

1) review lesson 6, activity 2 - use intermediate board

2) Walk forward, step into bicycle tires, and over crossbar.

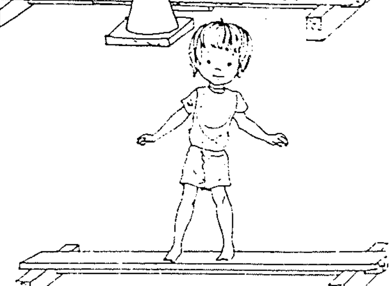
Lesson 8

Operants trained: balanced walking

Equipment: low and intermediate boards, crossbar, tires

Activities

1) review lesson 7, activity 2 - use intermediate board.



2) Walk sideways leading with right foot, then back to start, leading with left.

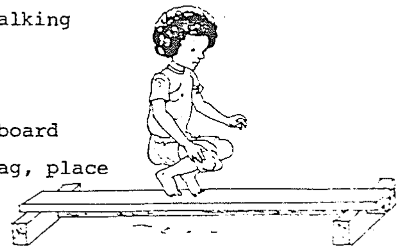
Lesson 9

Operants trained: balanced standing and balanced walking

Equipment: low and intermediate boards, bean bag

Activities

1) review lesson 8, activity 2 - use intermediate board
2) Walk forward to center of board, pick up bean bag, place on head, and walk to the end of board.



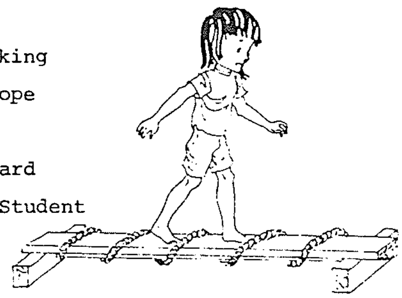
Lesson 10

Operants trained: balanced standing and balanced walking

Equipment: low and intermediate boards, bean bag, rope

Activities

1) review lesson 9, activity 2 - use intermediate board
2) Walk forward using coiled rope as visual target. Student steps into spaces provided by the coiled rope.



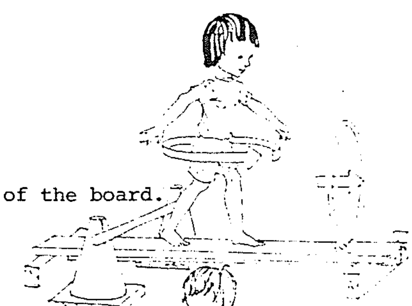
Lesson 11

Operants trained: balanced walking

Equipment: low and intermediate boards, crossbar, hoop

Activities

1) review lesson 9, activity 2 - use intermediate board
2) Walk forward, step over crossbar, make full turn at center of the board, go through hoop, and walk to end of the board.



Lesson 12

Operants trained: balanced walking

Equipment: low and intermediate boards, crossbar, hoop

Activities

1) review lesson 10, activity 2 - use intermediate board
2) Walk forward to center of board, make half turn, and walk backward to end of the board.

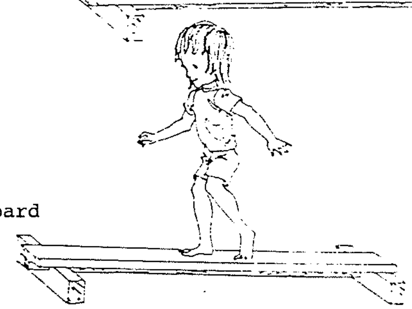
Lesson 13

Operants trained: balanced walking

Equipment: low and intermediate boards

Activities

1) review lesson 11, activity 2 - use intermediate board
2) Walk backwards to the end of the low board.



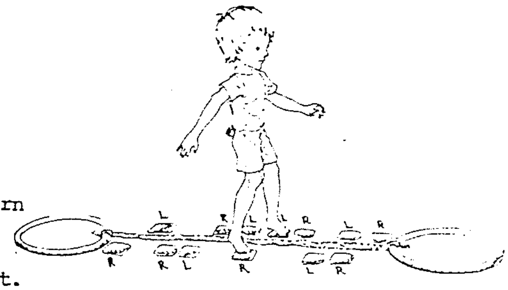
Lesson 14

Operants trained: balanced walking

Equipment: bicycle tires, rope, bean bags

Activities

1) Attempt to step on bean bags in a given pattern and not loose balance.
2) Walk backward, left-right pattern is constant.



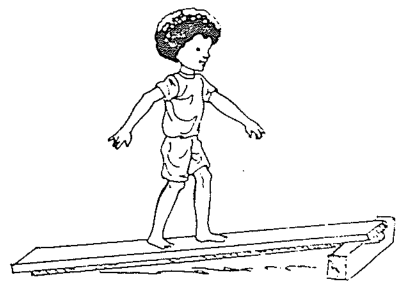
Lesson 15

Operants trained: balanced walking

Equipment: low and intermediate boards

Activities

1) review lesson 13, activity 2 - use intermediate board
2) One support of low board is removed making it into an incline. Walk forward, make half turn and walk back to start.



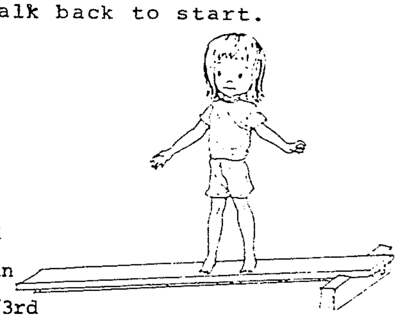
Lesson 16

Operants trained: balanced walking

Equipment: low and intermediate boards

Activities

1) review lesson 14, activity 2 - use intermediate board
2) One support of low board is removed, making it into an incline. Walk forward 1/3rd of way, walk sideways 1/3rd of way, then walk backward to the end of the board.



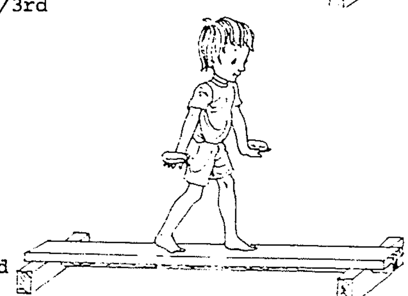
Lesson 17

Operants trained: balanced walking

Equipment: low and intermediate boards, bean bags

Activities

1) review lesson 15, activity 2 - use intermediate board
2) Walk forward to the end of the low board, balancing a bean bag on each hand.



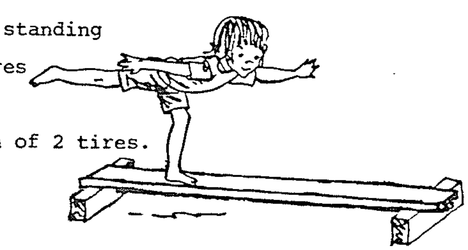
Lesson 18

Operants trained: balanced walking and balanced standing

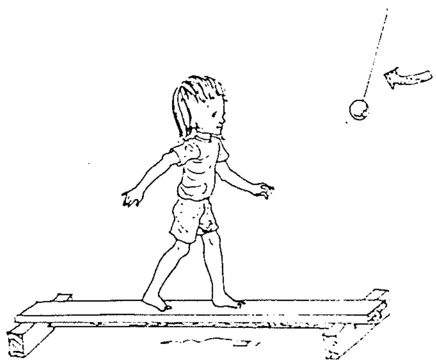
Equipment: low board, tracking ball, bicycle tires

Activities

1) Walk forward and perform swan balance in each of 2 tires. First on the left foot, then on the right.

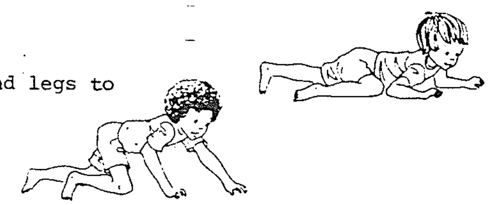


2) Walk forward and eye-track swinging ball.
Ball is held at eye level at the end of the board.

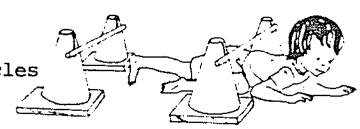


OPERANT GROUP 2 - CRAWLING, HOPPING, AND ROLLING

Lesson 1
Operants trained: crawling
Equipment used: mat
Activities
1) Crawl on stomach using bent arms and legs to maneuver body.
2) Creep forward on hands and knees.



Lesson 2
Operants trained: crawling
Equipment used: mat, crossbars
Activities
1) Crawl forward on stomach and go under two crossbar obstacles without touching them.



2) Crawl forward, but pass under obstacles on back without touching them.

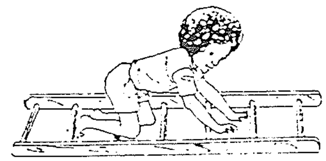
Lesson 3
Operants trained: crawling
Equipment used: mat
Activities
1) review lesson 1, activity 2
2) Creep backwards on hands and knees.

Lesson 4

Operants trained: crawling and balanced walking

Equipment used: coordination ladder, mat

Activities



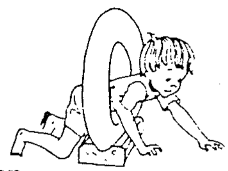
1) Creep on hands and knees between rungs of ladder.
2) Walk backwards between rungs of ladder.

Lesson 5

Operants trained: crawling

Equipment used: geometric shapes, mat

Activities



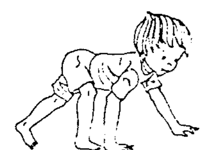
1) Explore shapes by crawling through them.
   (Shapes are held verticle to ground by holders.)
2) Crawl through specific shapes indicated by the instructor.

Lesson 6

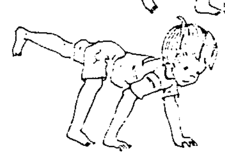
Operants trained: crawling

Equipment used: mat

Activities



1) Walk on hands and feet. (Four legged run with weight distributed evenly on hands and feet.)
2) Lame walk on two hands and one leg. (Three legged walk with weight on hands and hopping one leg forward.)

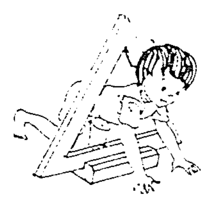


Lesson 7

Operants trained: crawling

Equipment used: geometric shapes, mat

Activities



1) review lesson 5, activity 2
2) Crawl through sequences of two shapes indicated by the instructor (i.e., Can you crawl through a circle and then a triangle?)

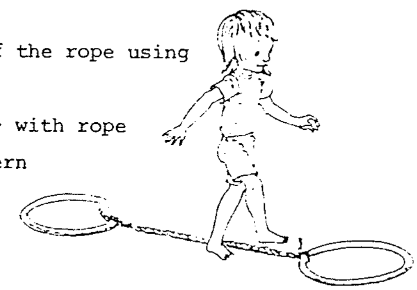
Lesson 8

Operants trained: balanced walking and crawling

Equipment used: bicycle tires, rope, mat

Activities

1) Starting with both feet in tire, walk the length of the rope using a cross-over step until reaching the opposite tire.
2) Walk on hands and feet as in lesson 6, activity 1 - with rope between hands and feet and using a cross-over pattern with only hands crossing over rope.



Lesson 9

Operants trained: crawling

Equipment used: mat

Activities

1) review lesson 6, activity 1
2) Bend over, grasp ankles with hands, then move one leg at a time, keeping legs fairly straight.

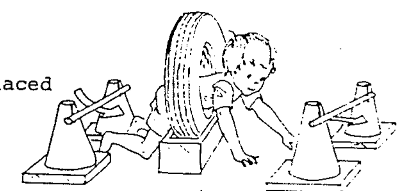
Lesson 10

Operants trained: crawling

Equipment used: crossbars, auto tire, mat

Activities

1) Crawl under first cross bar, through auto tire supported in tire box, and under second crossbar placed at a lower level than the first bar.



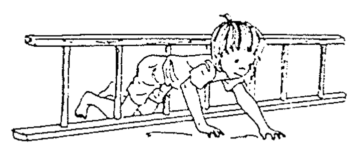
Lesson 11

Operants trained: crawling

Equipment used: coordination ladder, mat

Activities

1) Creep in and out between the rungs of the ladder held on its side.
2) Creep in and out this time moving backwards.



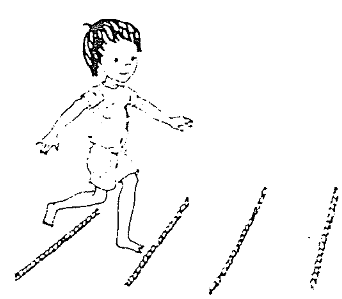
Lesson 12

Operants trained: hopping

Equipment used: ropes, hoops

Activities

1) Ropes are placed parallel to each other. hop over ropes in spaces between them, first on right foot, then on left.



2) Hoops are placed side by side in a straight line.

Hop into each hoop, using the right foot first, and then the left.

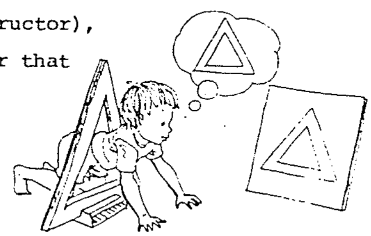
Lesson 13

Operants trained: crawling

Equipment used: geometric shapes, mat, picture cards

Activities

1) Look at card with geometric shape on it (shown by instructor), then respond by crawling through the shape on the floor that corresponds to the shape on the card.
2) Same as above, but two shapes are shown.
3) Same as above, but three shapes are shown.



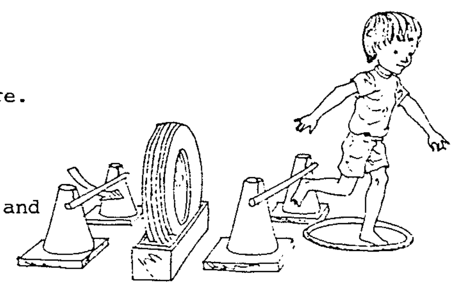
Lesson 14

Operants trained: crawling and hopping

Equipment used: crossbars, auto tire, bicycle tire.

Activities

1) Crawl under first cross bar, through the auto tire, hop over the second crossbar, and land in the bicycle tire on one foot.



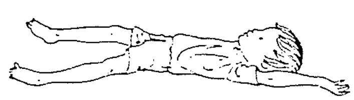
Lesson 15

Operants trained: crawling

Equipment used: mat

Activities

1) Lie on the mat on your back and place arms at side and feet together. Move your arms up over your head until they touch each other.
2) Lie in position as above and move feet apart and then bring them back together.
3) Do each of the following as instructed:



   i. Move just right arm out, then return it to side
   ii. Move just left arm out and return it to side.
   iii. Move just right leg out then, return to center.
   iv. Move just left leg out then, return to center.
   v. Move both arms out, then return to side.

vi. Move both legs apart, then return to center.

vii. Move right arm and right leg simultaneously, then return.

viii. Move left arm and left leg simultaneously, then return.

ix. Move right arm and left leg simultaneously, then return.

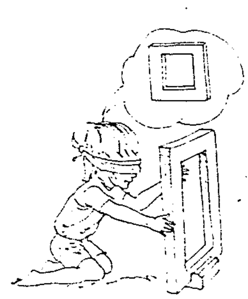
x. Move left arm and right leg simultaneously, then return.

Lesson 16

Operants trained: crawling

Equipment used: geometric shapes, mat, blindfold

Activities



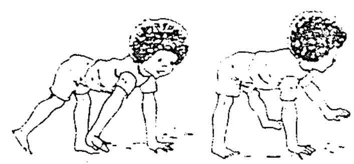
1) While blindfolded, creep on hands and knees to each shape. Feel each shape carefully with your hands, identify it, then crawl through it.

Lesson 17

Operants trained: crawling and rolling

Equipment used: mat

Activities



1) With weight on hands and feet, move one side of the body, and then the other, moving forward in a "bear walk".

2) Start in a kneeling position with arms crossed and elbows resting on mat. Roll over moving sideways, rolling on shoulders and back, and return to basic starting position.

Lesson 18

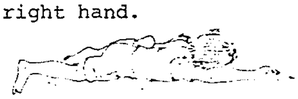
Operants trained: crawling and rolling

Equipment used: mat

Activities

1) review lesson 17, activity 2

2) Starting position is on stomach with left hand and right knee brought forward and head turned facing toward right hand. On command "flip", hands and knees alternate position with right hand and left knee moving forward, and head turning to face toward left hand. On command "flop" starting position is resumed.



Lesson 19

Operants trained: crawling and rolling

Equipment used: mat

Activities

1) review lesson 18, activity 2

2) forward rolls- Start in squat position with hands flat on mat, knees together inside of arms. Tuck chin against knees, raise hips up high, push with toes, lower back of head to mat, and roll over keeping tucked.

Lesson 20

Operants trained: rolling

Equipment used: mat

Activities

1) review lesson 19, activity 2

Lesson 21

Operants trained: crawling

Equipment used: scooter board, bowling pin

Activities

1) Take prone position on scooter board, and use hands and arms to propell board around bowling pin and back to start position.

2) Take kneeling position on scooter board and attempt same task as in activity 1.

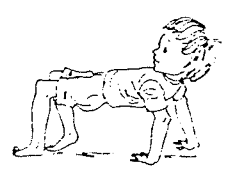
Lesson 22

Operants trained: rolling and crawling

Equipment used: mat

Activities

1) review lesson lesson 20, activity 2



2) Perform a crab walk. Starting position is with body placed in an inverted position (facing upward) with weight distributed evenly on feet and hands. Movement is started with head leading first, then with feet leading.

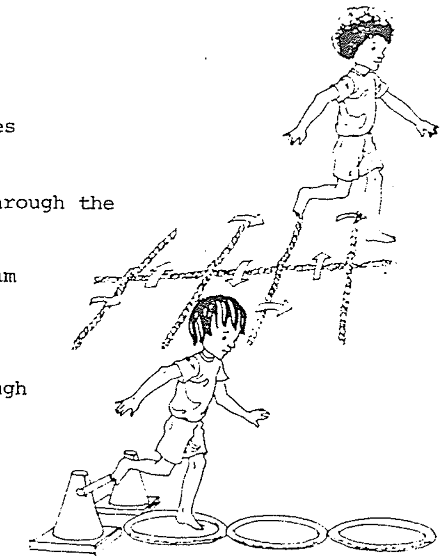
Lesson 23

Operants trained: hopping

Equipment used: ropes, crossbar, bicycle tires

Activities

1) Attempt to hop forward, sideways, etc., through the rope pattern, first on the right foot, then later, on the left. Arrows in diagram indicate movement pattern.
2) Hop over cross bar, land on take-off foot in tire, then continue hopping through remaining two tires. Hop through pattern first on right foot, then on left.



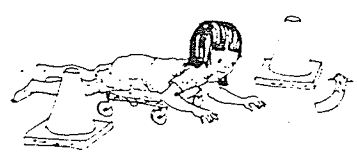
Lesson 24

Operants trained: crawling

Equipment used: traffic cones, scooter board

Activities

1) Take prone position on scooter board and use hands and arms to propell scooter board between and around cone obstacles.



2) Perform same task as in activity 1, except kneel on scooter board.

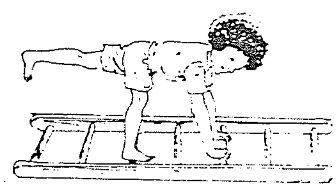
Lesson 25

Operants trained: balanced walking and crawling

Equipment used: coordination ladder, mat

Activities

1) Find a way to travel down the ladder using only two body parts.
2) Same as above, only using three body parts.
3) Same as 1 and 2, only using four body parts.



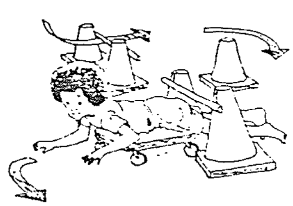
Lesson 26

Operants trained: crawling

Equipment used: crossbars, traffic cone, scooter board

Activities

1) Take prone position on scooter board and use hands and arms to propell scooter board between and under, and around traffic cone obstacles.

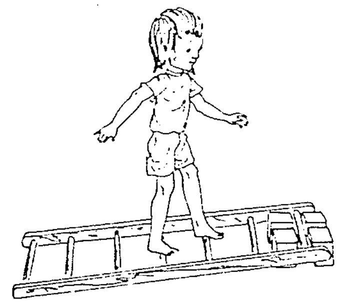


Lesson 27

Operants trained: balanced walking and crawling

Equipment used: coordination ladder, incline blocks, mat

Activities



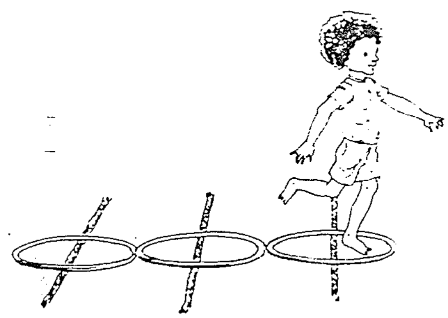
1) Intermediate walking board supports are placed under end rung of coordination ladder to place ladder in an inclined position. Walk forward on the rungs of the ladder, until reaching end supports, turn and walk forward back to starting position.
2) Walk forward on hands and feet (four-legged) position placing hands on side rails and feet on rungs. Proceed up, then turn and come down the ladder.

Lesson 28

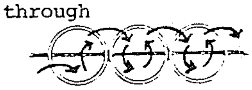
Operants trained: hopping

Equipment used: ropes, hoops

Activities



1) Hop within spaces created by three hoops divided by three ropes. Hop through on preferred foot, and then on opposite foot.
2) Hop in forward-sideward pattern within spaces provided by one rope dividing three hoops placed in a row. Hop through pattern on preferred foot, then on opposite foot.

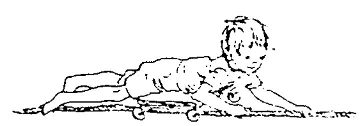


Lesson 29

Operants trained: crawling

Equipment used: rope scooter board

Activities



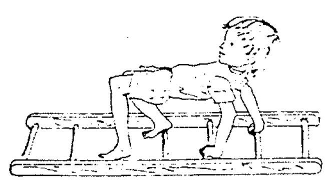
1) Take prone position on scooter board and grip rope at opposite end from instructor. Pull self forward toward instructor using a hand over hand grip on the rope.

Lesson 30

Operants trained: hopping and crawling

Equipment used: coordination ladder, mat

Activities

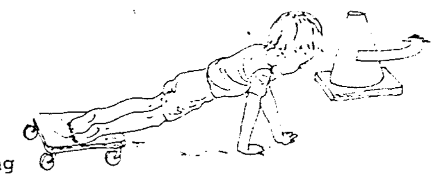


1) Hop between the rungs of the ladder.
2) Perform a crab walk on the sides or rungs of the ladder.

Lesson 31

Operants trained: crawling

Equipment used: scooterboard, traffic cone



Activities

1) Walk on hands with legs extended and feet resting on scooter board. Body is directed around traffic cone obstacle.
2) Attempt to move backward on scooter board.

Lesson 32

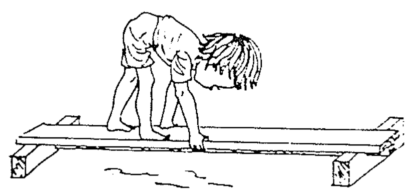
Operants trained: crawling

Equipment used: scooter board, traffic cones

Activities

1) Sit on scooter board and transport body using feet only.
2) Kneel on scooter board and transport body using hands and arms.
3) Lie with back on scooter board, support head with hands and transport body using feet only. In all activities the path of transport is a figure 8 around the traffic cones.

Lesson 33



Operants trained: crawling

Equipment used: low and intermediate walking boards

Activities

1) review lesson 18, activity 2 for balanced standing and walking - use intermediate board
2) Walk forward on hands and feet until reaching the end of the low balance board.

Lesson 34

Operants trained: crawling

Equipemnt used: crossbars, scooter board

Activities

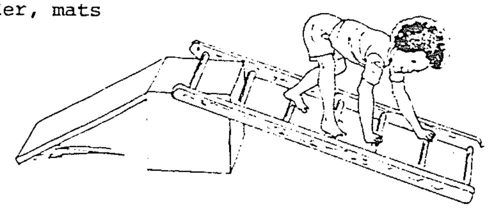
1) Assume prone position on scooter board and using hands in alternate movements, travel around traffic cones and under the crossbars. Complete a "figure 8" path of movement around and under obstacles.

Lesson 35

Operants trained: balanced walking and crawling

Equipment used: jump box, coordination ladder, mats

Activities



1) Perform a balance walk on rungs of ladder until reaching top of box and then walk down incline board.
2) Perform a four-legged walk on sides or rungs of ladder until reaching top of box, then move down incline board, using four-legged walk again.
3) Walk up incline board, then walk down the rungs of the ladder, using a balance walk.
4) Walk up incline board using a four-legged walk then move down the ladder using four-legged walk.
5) Creep up the incline board on hands and knees then perform a crab walk down the ladder.

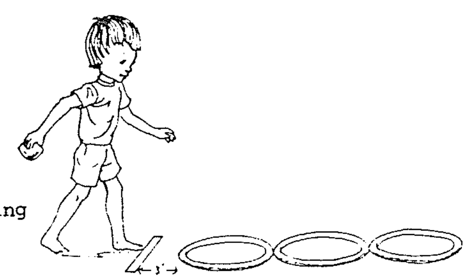
OPERANT GROUP 3 - BOUNCING, CATCHING, AND THROWING

Lesson 1

Operants trained: throwing

Equipment: bicycle tires, bean bag.

Activities



1) From behind a restraining line, make three underhand throws with the preferred hand, attempting to get one bean bag into each tire.
2) Review the above activity using the opposite hand.

Lesson 2

Operants trained: bouncing and catching

Equipment: bicycle tires, ball

Activities

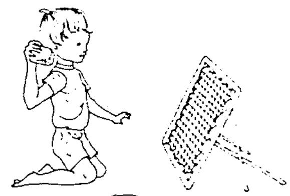
1) Bounce and catch ball once in each of 5 tires while walking outside of tires.

Lesson 3

Operants Trained: throwing and catching

Equipment: rebound net, bean bag, launching board

Activities



1) Use overhand throw and attempt to hit center of net with bean nag. Take position on knees, so that the bean bag will rebound at chest height. Do <u>not</u> attempt to catch the bag.

2) Step on the end of the launching board using heel of the preferred foot and launch bean bag so that it rebounds at about waist height. Do not attempt to catch the bag. (Activity is a prerequisite to future catching activities.)

Lesson 4

Operants trained: bouncing and catching

Equipment: ball, traffic cones

Activities

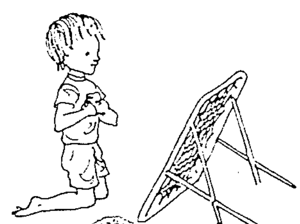
1) Using both hands, bounce and catch ball while walking around traffic cone obstacles.
2) Using two hands, dribble the ball around the obstacles.

Lesson 5

Operants trained: catching and throwing

Equipment: rebound net, bean bag, launching board

Activities



1) Use overhand throw and position body so that bean bag rebounds off net and hits chest. Bean bag is trapped against the chest with the hands. (Stand 3 - 4 feet away from the net.

2) Step on the end of the launching board using heel of the preferred foot. Launch and catch the bean bag at about waist height, using both hands.

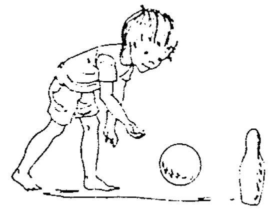
Lesson 6

Operants trained: throwing

Equipment used: ball, bowling pin

Activities

1) Attempt to roll a rubber ball at a bowling pin target and knock to down. Use two hands.
2) Attempt above activity using only one hand.



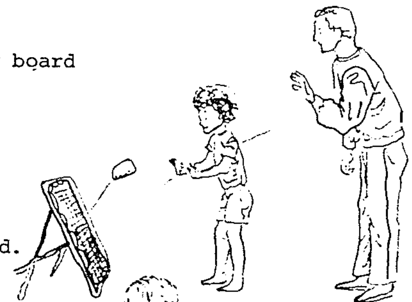
Lesson 7

Operants trained: catching

Equipment used: rebound net, bean bag, launching board

Activities

1) Stand in front of the rebound net. Instructor (standing behind) throws bean bag against net. Catch it using hands and fingers.
2) review lesson 5, activity 2 - use only one hand.



Lesson 8

Operants trained: throwing

Equipment used: geometric shapes, bean bag

Activities

1) Shapes are placed flat on the floor. Attempt to toss the bean bag into shapes.
2) Verbally identify the shape into which you toss the bean bag.
3) Toss the bean bag into a specific shape designated by the instructor.

Lesson 9

Operants trained: throwing and catching

Equipment used: rebound net, bean bag, launching board

Activities

1) Throw bean bag against net and attempt to catch it using two hands, with fingers pointing up to form a pocket.
2) review lesson 5, activity 2 - Use alternate hands, first right, then left, as instructor calls them out.

Lesson 10

Operants trained: bouncing

Equipment used: traffic cones, ball

Activities

1) review lesson 4, activity 2 - use one hand.

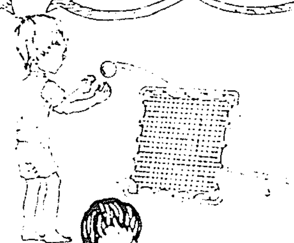
Lesson 11

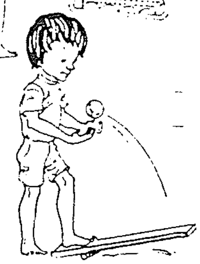
Operants trained: throwing and catching

Equipment used: rebound net, tennis ball, launching board

Activities

1) review lesson 9, activity 2 - use tennis ball instead of bean bag.
2) review lesson 5, activity 2 - use tennis ball instead of bean bag.





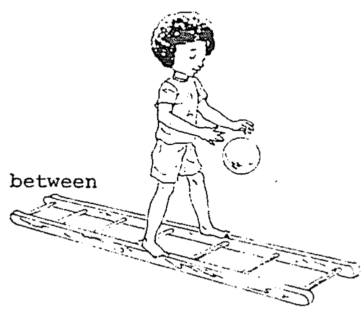
Lesson 12

Operants trained: balanced walking, bouncing, catching

Equipment used: coordination ladder, ball

Activities

1) Walk on outside of ladder (near right or left side) bouncing and catching the rubber ball in the spaces between the rungs.
2) Walk with one foot on each side rail of the ladder bouncing and catching the ball between the rungs.



Lesson 13

Operants trained: bouncing and catching

Equipment used: geometric shapes, ball

Activities

1) Shapes are placed flat on the floor. Bounce and catch rubber ball inside of designated shapes.

Lesson 14

Operants trained: throwing and catching

Equipment used: rebound net, launching board, bean bag

Activities

1) Throw bean bag against rebound net and catch it.
   One hand only is used for both throw and catch.
2) Launch bean bag, clap hands and catch bag.
   Then, launch bean bag, snap fingers, and catch it.
   Then, launch bean bag, slap knees, and catch it.

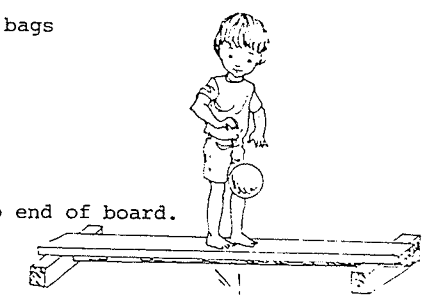
Lesson 15

Operants trained: balanced walking, bouncing, and catching

Equipment used: low and high walking boards, ball, bean bags

Activities

1) Walk forward on high board, then walk forward
   balancing bean bag on top of each hand.
2) Walk forward on low board to the middle. Stop
   bounce and catch the ball, then continue walking to end of board.



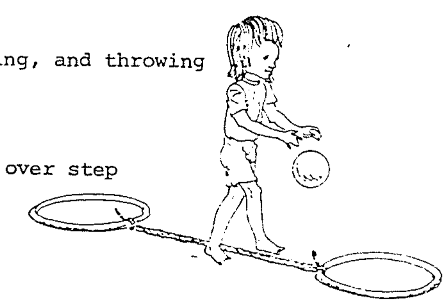
Lesson 16

Operants trained: balanced walking, bouncing, catching, and throwing

Equipment used: bicycle tires, rope, ball

Activities

1) Walk forward the length of the rope, using cross over step
   bounce and catch ball after each step.
2) Do criss-cross as above, but toss and catch
   ball with the instructor.



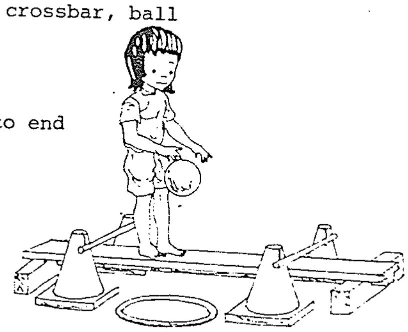
Lesson 17

Operants trained: balanced walking, bouncing, and catching

Equipment used: low and intermediate walking boards, hoop, crossbar, ball

Activities

1) Walk forward to middle of intermediate board carrying a ball, bounce and catch ball, then continue walking to end of the board.
2) Walk forward on low board carrying a ball, step over crossbar. Then walk to middle of board, bounce ball in a hoop placed on floor, catch ball, walk forward and step over second crossbar.



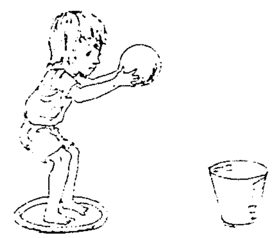
Lesson 18

Operants trained: throwing

Equipment used: bicycle tire, ball, waste paper basket

Activities

1) Attempt to shoot ball into basket while standing in tire. Use two-handed underhand throw.
2) Attempt as above, but use overhand throw.



Lesson 19

Operants trained: walking, bouncing, and catching

Equipment used: low and intermediate boards, ball, crossbars, tire.

Activities

1) review lesson 17, activity 2 - use intermediate board.
2) Walk forward on low board carrying ball. Bounce and catch the ball on floor after every two steps.

Lesson 20

Operants trained: balanced walking, bouncing, and catching

Equipment used: low and intermediate boards, tires, ball

Activities

1) review lesson 19, activity 2 - use intermediate board
2) Walk forward on low board, carrying ball, bounce and catch it in four tires placed on alternate sides of walking board (i.e., left tire, right tire, left tire, right tire).

Lesson 21

Operants trained: balanced walking and standing, bouncing, and catching

Equipment used: intermediate board, tires, ball

Activities

1) review lesson 20, activity 2 - use intermediate board
2) review lesson 18 -- balanced walking and standing activities -- activity 1 - use intermediate board

Lesson 22

Operants trained: throwing and catching

Equipment used: rebound net, bean bags, launching board

Activities

1) Throw bean bag against net and perform the following tasks: a) clap hands and catch bag, b) snap fingers and catch bag, c) slap knees and catch bag, and d) touch toes and catch bag.
2) Launch two bean bags simultaneously and catch one in each hand. Bean bags are placed side by side on the launching board.

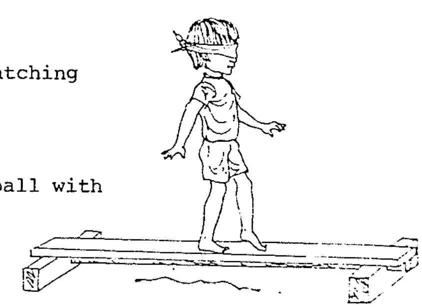
Lesson 23

Operants trained: balanced walking, throwing, and catching

Equipment used: low board, ball, blindfold, ball

Activities

1) Walk forward on low board, tossing and catching ball with instructor.
2) Walk forward on the low board while blindfolded.



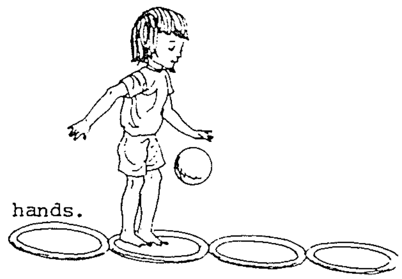
Lesson 24

Operants trained: bouncing

Equipment used: hoops, ball

Activities

1) Dribble ball through hoop pattern. Use two hands.
2) Do above task, using one hand.



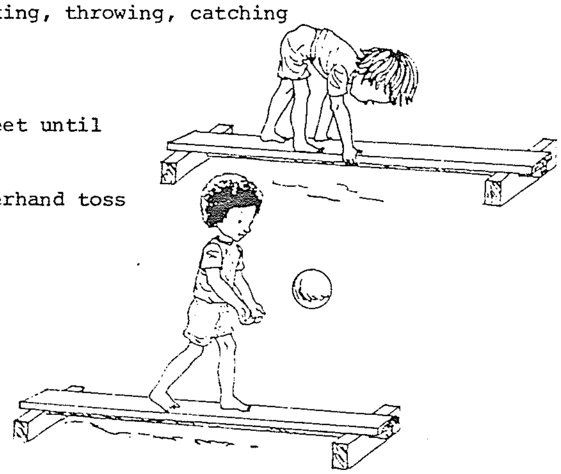
Lesson 25

Operants trained: crawling, balanced walking, throwing, catching

Equipment used: low walking board, ball

Activities

1) Walk forward balancing on hands and feet until reaching end of board.
2) Walk forward carrying a ball, use underhand toss and catch with instructor.



APPENDIX C

To ensure that the procedure of grouping operant behaviours for convenient management of data was not masking important information regarding the effects of treatment, the subjects' scores on each of the 10 individual operants were examined prior to averaging. As was noted earlier (pp. 71, 73, & 77), differences in the initial effects of training occurred for balanced standing versus balanced walking operants. These data are presented in graphic form for the trained subjects in order to provide a clear picture of the differential training effects.

As shown in Figure 18, April's performance on balanced walking shows immediate improvement upon commencement of treatment. With the exception of one overlapping point (taken after a period of illness, as discussed p. 71), improvement is dramatic and fairly stable. Balanced standing improvements are delayed, however. April's scores on this operant remain the same as in baseline until after the point where training commenced for the specific assessment task. On the second assessment after receiving training on the balanced standing assessment task, April's scores improve dramatically and stabilize at a level well above baseline.

Unlike April, Jane's performance on balanced standing and balanced walking are very similar. In comparison to the other trained subjects, Jane had difficulty mastering balanced walking. Her improvements on this task are very gradual and although an upward trend is noticeable in the first few assessments after commencement of training, improvement does not stabilize at a high level until the fifth assessment after training commenced. Also unlike the other trained subjects, Jane's data show improvements in balanced standing prior to specific training on the task. These improvements in balanced standing seemed to be due primarily to an increase in her ability to maintain balance on the beam for a period of 3 sec. This suggests that practice alone may have been an important factor in initial improvement of this behaviour.

Similar to April's data, Charmaine's data show differential treatment effects for balanced standing versus balanced walking operants. Although the differences are less dramatic and occur over fewer assessments due to Charmaine's extended baseline, differences are still quite noticeable. Charmaine's improvement in balanced walking occurs immediately after commencement of training and stabilizes at a level well above baseline. Balanced standing improvements are delayed, however. Although there is an initial jump in performance at commencement of training, the first two assessments during this phase are quite similar to the baseline assessments. In contrast, assessments following specific training on the balanced standing assessment task are dramatically improved. Responding on balanced standing stabilizes at a level well above baseline at this point.

Unlike the data for the balanced standing and walking operant group, the individual operant data for all other operant groups did not indicate such dramatic differential response to training. The raw data of the treatment phases for these operants were therefore simply presented in tabular form (see Table 5).

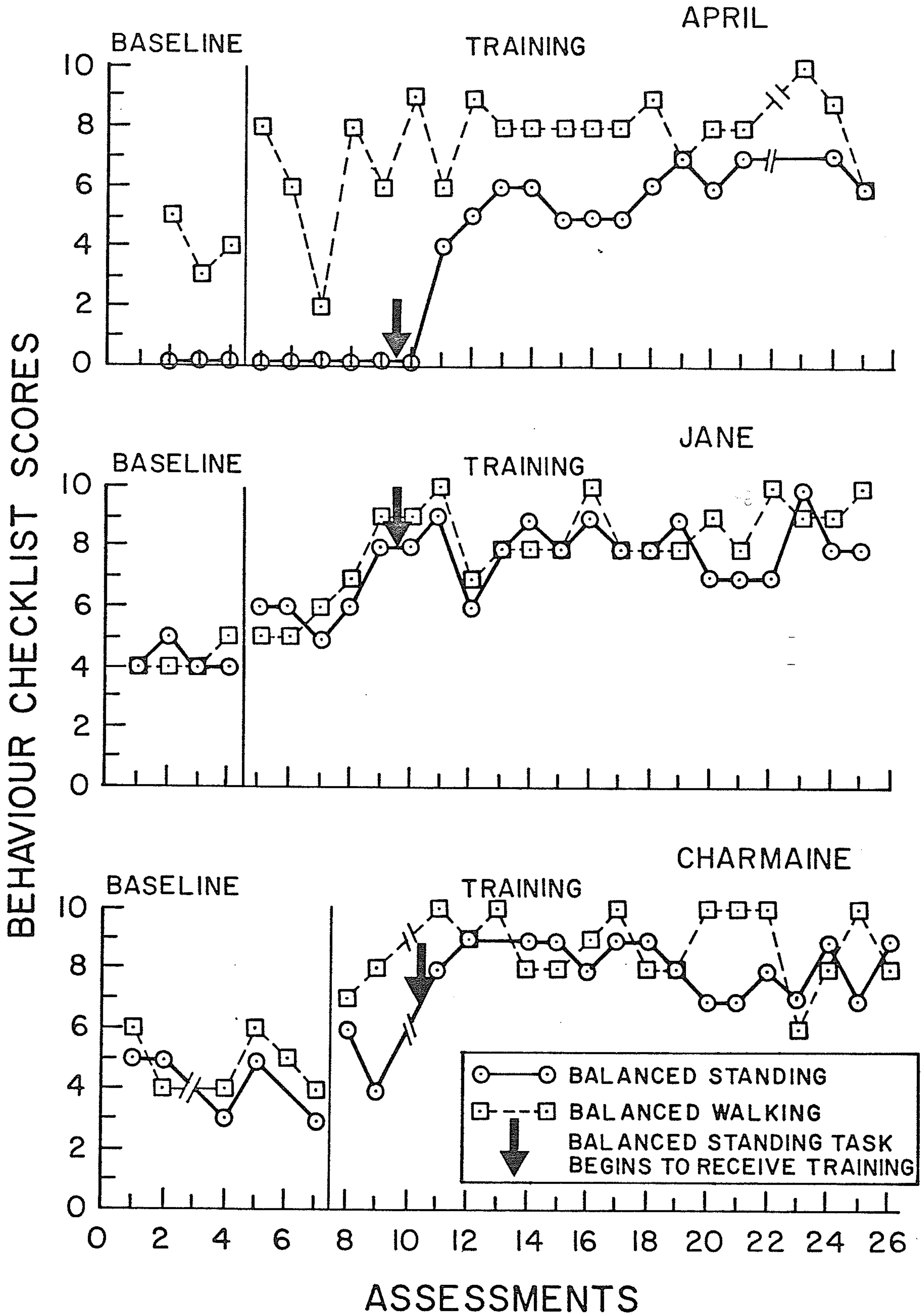


Figure 18. Individual behaviour checklist scores for balanced standing and balanced walking of trained subjects.

Table 5

Individual Operant Scores for Rolling, Hopping, and Crawling and Bouncing, Catching, and Throwing for Trained Subjects During Training Phases

Assessment	April			Jane			Charmaine		
	Rolling (R), Hopping (H), and Crawling (C)								
	R	H	C	R	H	C	R	H	C
14	6	8	8	7	8	9	-	-	-
15	5	7	8	8	5	8	7	8	10
16	5	9	8	8	7	8	5	10	9
17	6	9	9	10	9	7	6	9	8
18	9	7	8	8	7	8	9	9	10
19	10	6	9	8	9	9	6	8	10
20	9	9	9	10	9	10	6	8	7
21	7	6	8	8	9	10	10	8	9
22	-	-	-	6	10	10	9	9	7
23	8	7	9	8	10	9	8	9	6
24	9	7	7	8	9	10	9	9	8
25	9	9	10	8	8	10	10	9	9
26	-	-	-	-	-	-	7	9	9
	Bouncing (B), Catching (C), and Throwing (T)								
	B	C	T	B	C	T	B	C	T
20	3	6	6	5	10	3	-	-	-
21	7	6	6	8	6	7	4	8	6
22	-	-	-	7	6	8	7	8	7
23	8	8	9	8	8	7	5	10	8
24	9	8	10	6	7	8	7	6	10
25	9	10	10	7	10	8	8	6	9
26	-	-	-	-	-	-	6	10	10