Skill Acquisition by Children With Autism: Influence of Prompts

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Visual, verbal, and physical prompting systems promote motor skill acquisition in learners who are autistic (Collier & Reid, 1987). The purpose of the present study was to contrast the effectiveness of two instructional models, one that emphasized visual prompting and one that stressed physical prompting. Both models were designed to teach autistic children a bowling skill that was subdivided into 19 task analytic steps. All four subjects received 120 trials under both instructional models in a counterbalanced fashion. It was hypothesized that physical prompting would be the most effective model, but only limited support was generated in this regard. The subjects did benefit from carefully designed instruction, however, thus replicating previous findings.

Prior to 1980, physical educators were silent regarding their role in the delivery of services to persons who are autistic (Reid & Morin, 1981). During the past decade the motor behavior of those individuals has been the focus of several review papers that have weaved educational literature with practical experience to suggest teaching principles, physical activity content, objectives, and organizational hints (Freundlich, Pike, & Schwartz, 1989; Kraft, 1983; Mangus & Henderson, 1988; Mosher, 1981; Reid & Morin, 1981; Schmidt, McLaughlin, & Dalrymple, 1986). Moreover, a number of empirical studies have emerged which view autism from one of four perspectives.

First, play behaviors have intrigued researchers since lack of appropriate play is frequently noted as a salient characteristic of autism. Thus motor behavior has been investigated in the context of play and especially the relationship between play and symbolic mediation, language, and social behavior (Strain & Cooke, 1976; Ungerer & Sigman, 1981).

A second perspective has attempted to reduce stereotypic behavior via physical exercise (Kern, Koegel, & Dunlap, 1984; Kern, Koegel, Dyer, Blew, & Fenton, 1982; Reid, Factor, Freeman, & Sherman, 1988; Watters & Watters,
1980). Stereotypic behaviors are repetitive, apparently purposeless movements that may include total body rocking, rapid hand flapping, or smacking of the lips. This approach has produced some promising findings; a sufficient intensity of exercise seems to lead to a reduction, at least temporarily, in repetitive behaviors.

Motor development is a third research avenue. Ornitz, Guthrie, and Farley (1977) demonstrated that the early motor development of children who are autistic is delayed, and DeMyer (1976) described overall motor performance differences between autistic and nonautistic children. Morin and Reid (1985) asked whether the deficits in motor performance shown by these children were a result of autism or of the usually concomitant mental retardation. Their overall findings pointed to acute movement deficiencies which seemed to be associated with mental retardation.

Skill acquisition is a fourth research front. This of course is related to the increasing literature on educational intervention with respect to the behavioral, academic, and social skills of the learner with autism (e.g., Dunlap, Koegel, & Egel, 1979). Killian, Joyce-Petrovich, Menna, and Arena (1984) showed that autistic children proceed through the same aquatic skill levels of water orientation as nondisabled peers. Also, Mangus, Henderson, and French (1986) have explored the effect of a token economy on the time involved in a physical activity.

Collier and Reid (1987) investigated the overselective responding of children with autism and its relationship with motor skill acquisition. Persons with autism are purported to have an abnormally limited attentional scope to environmental stimuli and a tendency to choose cues that are either minor or irrelevant to the task or situation. A commonly cited example of overselective behavior is an individual discriminating between a male and female figure solely on the basis of shoe color (Schreibman & Lovaas, 1973). The overselective responding phenomenon was of interest because of the extensive use of prompts in special education and physical education.

Prompts are usually considered to be extra stimuli added to a learning environment to ensure correct responding (Lovaas, Koegel, & Schreibman, 1979). Indeed, Doyle, Wolery, Ault, and Gast (1988) have identified 90 studies over a 12-year period that have employed prompting systems labeled by 35 different names. It is argued that extra-stimulus prompts, that is, an extra stimulus provided to guide an individual to a correct response, will be particularly difficult for learners with autism because the prompts might shift their attention away from the relevant cues (Koegel, Egel, & Dunlap, 1980). Therefore, Schreibman (1975) designed a series of studies that evaluated a new type of prompt, one that was an exaggerated feature of the training stimulus, and termed these within-stimulus prompts.

Collier and Reid (1987) compared within-stimulus prompt and extra-stimulus prompt models in teaching a bowling task to six boys with autism. The literature on overselectivity would suggest that the within-stimulus prompt model would be superior. However, in a movement context, extra-stimulus prompts such as visual demonstrations and physical guidance have been standard procedures for many years. The Collier and Reid results were very clear, the extra-stimulus prompt model being superior to the within-stimulus model.

The extra-stimulus model used by Collier and Reid (1987) was fashioned after the prompting system of the PREP Play Program of Watkinson and Wall.
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(1982), referred to as the response prompting continuum. Verbal, visual, and physical prompts were included. Wing (1976) and Schreibman (1975) have suggested anecdotally that physically moving a person through a desired action would be effective in teaching, the overselective phenomenon notwithstanding. Also, Frith and Hermelin (1969) and Prior and Chen (1975) indicated that autistic subjects appear to be particularly aided by haptic cues. These suggestions/findings and the superiority of the extra-stimulus prompts of Collier and Reid led us to the current study.

The purpose of this study was to contrast the relative effectiveness of visual and physical prompting. Together, visual, verbal, and physical prompting are effective in promoting skill acquisition in persons with autism. But which prompts are most effective? Increasingly, researchers are posing such questions (Demchak, 1990; Doyle et al., 1988, Repp, Karsh, & Lenz, 1990). The literature noted above led us to hypothesize that physical prompting would be the most effective. The two models of instruction compared in the present study were a verbal/visual model and a verbal/physical model. Verbalization was not isolated because, for all practical purposes, an instructor is going to speak with students.

Method

Subjects

There were four subjects, two boys age 15 and two girls ages 11 and 15 years (Table 1). They all lived at home and attended a special school for multiply handicapped youngsters in Montreal. They were diagnosed as autistic by school psychologists according to the criteria in the Diagnostic and Statistical Manual of Mental Disorders, commonly referred to as the DMS-III (American Psychiatric Association, 1980). The criteria include onset prior to 30 months of age, language and speech disorders, lack of response to people, abnormal reactions to environmental stimuli, and absence of delusions and hallucinations. They showed no ocular, orthopedic, or physiological impairment that might have affected performance.

Models of Instruction

The extensive extra-stimulus prompts outlined by Collier and Reid (1987) were subdivided for the current study to create two contrasting models. One model emphasized the verbal and physical prompts while the second stressed the verbal and visual prompts. The skill was to roll a softball toward 10 plastic bowling pins and knock down as many as possible. The verbal/physical instructional model included verbal descriptions of the task as well as manual guidance. The verbal/visual instructional model also included verbalization of the task as well as complete and partial demonstrations.

For all subjects, the bowling skill had 19 task analytic levels including the within-stimulus prompts outlined by Collier and Reid (1987). Indeed, the task analytic levels were identical to Collier and Reid with the exception that five

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1 For a more detailed description, see Watkinson and Wall (1982) or Collier and Reed (1987).
Table 1

Characteristics and Behaviors of Subjects

<table>
<thead>
<tr>
<th>Subject</th>
<th>Gender</th>
<th>Age</th>
<th>Specific autistic-like behaviors</th>
</tr>
</thead>
</table>
| 1       | Male   | 15  | Stereotypic behavior (jumping, twirling whole body)  
          |        |     | Inappropriate language use (critical and babbles to himself continually)  
          |        |     | Aggression toward others, verbally  
          |        |     | Aggression toward objects (smashes ball instead of bouncing) |
| 2       | Female | 15  | Stereotypic behaviors (gazing, swaying)  
          |        |     | Out-of-context laughing  
          |        |     | Single word utterances, short sentences  
          |        |     | Aggression toward others (pulling hair)  
          |        |     | Lack of interest in peers/social interaction (talks about wanting to hurt others) |
| 3       | Male   | 15  | Stereotypic behaviors (gazing, rocking)  
          |        |     | Spinning, twirling of objects  
          |        |     | Aggressive behavior (breaking objects, kicking)  
          |        |     | Echolalia, single word or short phrase utterances  
          |        |     | Lack of eye contact  
          |        |     | Lack of interest in peers or social interaction |
| 4       | Female | 11  | Stereotypic behavior (hand/finger rubbing, swaying, gazing)  
          |        |     | Lack of eye contact  
          |        |     | Lack of interest in peers or social interaction  
          |        |     | Echolalia, single word utterances  
          |        |     | Inappropriate fears  
          |        |     | Tactile defensive |

additional levels were added, 15–19 inclusively, all 20 feet from the pins (Table 2). In both instructional models the participants progressed through the task sequences by reaching the criteria of knocking down 25 pins over five consecutive trials.

Design of the Study

The initial bowling level of subjects was determined by having them attempt task analytic Levels 10, 5, and 1. As they did not reach criteria at Levels 10 or 5, baseline functioning was monitored at the first level of the task analyses. Two additional probe trials at Level 1 prior to the beginning of instruction (Wasson & Watkinson, 1981) confirmed that this was indeed the baseline. The dependent variable was the task analytic level achieved. The third author, experienced in working with children who were autistic and the task analysis perspective, administered both instructional models to all subjects. However, she was blind to the purpose of the study.

The four subjects had 120 trials under each instructional model in a counterbalanced fashion. A trial consisted of eliciting attention, verbal direction ("I want
Table 2
Bowling Task Analysis

Terminal performance objective: From a distance of 20 feet, the subject will roll a rubber seamless softball toward ten 12-in. red plastic bowling pins, knocking down at least 25 pins over five consecutive trials.

Within-stimulus prompts

<table>
<thead>
<tr>
<th>Task analytic level</th>
<th>Distance from pins (ft)</th>
<th>Orange pathway (track) length (ft)</th>
<th>Orange pathway (track) width (in.)</th>
<th>Barriers located 3 in. outside the track on either side</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>5</td>
<td>7</td>
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</tr>
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<td>5</td>
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</tr>
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<td>8</td>
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<tr>
<td>4</td>
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</tr>
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<tr>
<td>19*</td>
<td>20</td>
<td>**</td>
<td>**</td>
<td>No</td>
</tr>
</tbody>
</table>

*Task analytic Level 19 is the terminal performance objective. **No pathway.

you to roll the ball and hit the pins”), performance of the task with the appropriate prompts, and reinforcement. Sessions were videotaped to facilitate frequency recording of visual, verbal, and physical prompts as well as reinforcements.

Procedures

Subjects received instruction in a one-to-one setting within the familiar surroundings of the school during regular hours. Sessions lasted about 20–25 minutes with approximately 20–30 trials per session. If behavior was considered incompatible with instruction, the session was terminated. The instructor had spent 3 hours prior to the study to become familiar with the subjects. Twenty-five trials,
including all subjects, were viewed by three trained coders to determine interrater agreement. After each trial the frequencies of prompts and reinforcements were recorded. The three coders agreed completely 70% of the time across all trials. When a more liberal agreement of acceptance was allowed (i.e., one coder disagreeing with the other two), the percent agreement rose to 92%.

Results and Discussion

On the basis of the interrater agreement, it was determined that the various prompts and reinforcement were sufficiently clear to warrant continuance of the study. Table 3 shows the frequency of prompts and reinforcement. It is apparent that both instructional models produced a similar number of verbal prompts and reinforcement. However, the physical prompts were more frequent in the verbal/physical condition while the visual prompts were more frequent in the verbal/visual condition. Thus the two instructional models were successfully differentiated on the defining variables.

Figure 1 shows the results of the two subjects who initially received physical/verbal prompting. There was steady progress over the 120 trials for both subjects under the physical prompting system. When they switched to visual instruction, the progress of Subject 2 leveled off almost immediately, as we had hypothesized. Subject 1 continued to show improvement, however, which we had not anticipated.

Figure 2 graphs the results for the other two subjects. There is some modest improvement under the visual condition for both subjects during the first 120 trials, but Subject 3 increased more dramatically under physical prompting of the next 120 trials, as predicted. Subject 4 showed continuous improvement in both conditions, in fact more with visual prompting.

The two instructional models were clearly differentiated with regard to the number of physical versus visual prompts afforded the subjects. Previous research (Frith & Hermelin, 1969; Prior & Chen, 1975; Schreibman, 1975; Wing, 1976) led to our hypothesis that physical prompting would be more effective than visual prompting in acquiring a movement skill. In terms of task analytic levels, the subjects under physical prompting improved a total of 34 levels whereas the visual condition produced improvements of 25 units. Three of the four subjects

Table 3

<table>
<thead>
<tr>
<th>Condition</th>
<th>Prompt</th>
<th>Reinforcement</th>
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<tr>
<td></td>
<td>Visual</td>
<td>Verbal</td>
</tr>
<tr>
<td>Verbal/physical</td>
<td>21</td>
<td>1287</td>
</tr>
<tr>
<td>Verbal/visual</td>
<td>801</td>
<td>1349</td>
</tr>
</tbody>
</table>
Figure 1 — Performance of Subjects 1 and 2 in the two instructional models.

Figure 2 — Performance of Subjects 3 and 4 in the two instructional models.
showed greater improvement under the physical prompting condition than under the visual prompting condition. Only Subject 4 improved more under visual conditions. This likely resulted from her dislike of touch, inasmuch as she was described by teachers as tactile defensive (Table 1). Thus the current data provide some limited support for the hypothesis.

Kolko, Anderson, and Campbell (1980) have shown that autistic learners demonstrate a preferred sensory modality when given a choice between auditory and visual stimuli. Modality preference on an individual basis has also been supported by Rincover, Cook, Peoples, and Packard (1979). The data from the four subjects in this study indicated a responsiveness to a prompting system, three of them demonstrating a preference for physical rather than visual prompting. It is possible therefore that a search for visual or physical prompting superiority as a general statement in autism is counterproductive, due to individual preferences. The sensitive instructor who determines a preference for an individual might be able to exploit it in promoting skill acquisition.

A weakness of the present study is the lack of a maintenance check following the 240 trials. It is possible that one of the models of instruction might have emerged as superior following such a period. Collier and Reid (1987) chose young, low functioning children with autism to maximize the possible influence of overselective responding. With training and age, the attentional scope of these learners does broaden (Schreibman, Koegel, & Craig, 1977). At ages 15 and 11, our subjects were older than those in the Collier and Reid study and might not have been as detrimentally influenced by the visual extra-stimulus prompts. Thus the hypothesized superiority of physical prompts may have been more evident had we used younger and lower functioning children.

Though the present study has not provided overwhelming support for physical prompting over visual prompting, the overall results replicate Collier and Reid (1987) in demonstrating improvement in goal-directed movement behavior by children with autism. Extra-stimulus prompts do not appear to divert their attention from the training stimulus on motor tasks. Thus overselective responding, from a prompting perspective, does not seem to be a detrimental influence when children with autism learn motor skills. It seems that reinforcement, task analysis, and physical prompting in particular are important for motor skill improvement by most persons with autism.

References


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