TEACHING FUNCTIONAL SKILLS TO AUTISTIC CHILDREN IN NATURAL SETTINGS: SKILL ACQUISITION, MAINTENANCE AND GENERALISATION

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A significant goal in the education of autistic children is to ensure the generalisation of newly acquired responses from the training milieu to the natural environment. The learning patterns of autistic children demonstrate a handicapping context-specificity which does not allow for easy transfer of skills to a novel setting. Unfortunately, the highly structured training environment that is most conducive to initial acquisition of a response may be least conducive to generalisation of the response. In the training environment, the removal of distracting stimuli and the consistent use of instructional procedures, discriminative stimuli, reinforcement and feedback, provide a contrived simplicity and continuity of stimulation that are not found in the natural environment.

To overcome the difficulties of generalising from a training milieu to the natural environment, the training environment should be transformed to either mirror or approximate the characteristics of the natural setting. If what children learn is to be of any value to them, it is necessary that they be able to apply their skills to new situations outside the instructional setting (Rutter, 1985). To ensure the functionality (occurrence in the natural environment) of a child's programme, instruction must take place in settings outside the classroom. Unless a skill can be successfully demonstrated in context, it is not functional.

Relatively little attention has been devoted to the training of autistic children in the skills necessary to participate in community activities enjoyed by normal children. Donnellan (1980) claimed that the education offered to many students with autism was "...irrelevant, artificial, age-inappropriate and nonfunctional" (p.55) with little likelihood of positively impacting on their adult functioning. The need for the development of educational programmes to teach students with autism to function in a wide variety of heterogeneous community environments, has become increasingly apparent. Brown, Nietupski, and Hamre-Nietupski (1976) discuss "the criterion of ultimate functioning" (p.8) and call for curriculum strategies which include teaching chronological age-appropriate functional skills in natural environments

in response to natural cues and consequences. Similarly, Koegel, Rincover and Egel (1982), asserted that a functional curriculum would increase the opportunities autistic children have to use their learned skills.

Because of the generalisation difficulties of autistic learners (Koegel and Rincover, 1977), teachers are being encouraged to utilise 'low inference' teaching techniques. In a low inference teaching model, it is not assumed that training to criterion in one situation (e.g., in the classroom) will result in criterion performance in a different situation (e.g., non-school or post-school environments) which requires behaviour that is slightly different. Rincover and Koegel (1975) related the failure of generalisation in autistic children to overselectivity; that is, analyses showed that many children responded in clinic sessions to idiosyncratic and often irrelevant stimuli (e.g., mannerisms of the therapist) which were not necessarily present in extraclinic situations. Investigating the effects of a language training programme, Dyer and Peck (1987) reported that higher levels of generalisation were obtained with language forms that were compatible with the student's current language level than language forms that were not. Hung (1976) proposed that the lack of generalisation was also largely due to the teaching of irrelevant behaviours, foreign to the child's daily behavioural repertoire. While such fine motor skills as fitting puzzles or putting pegs on a peg board are often taught, such skills are not immediately functional in the child's environment. Conversely, self-help skills (e.g., turning a jumper in the correct way), social skills and language skills, are behaviours that are both

readily reinforced by the child's community, and functional in terms of increasing the child's behavioural repertoire and promoting development.

When teaching is conducted in situations where there is less restricted stimulus control (many discriminative stimuli), generalisation to other settings is maximised due to a decrease in the discriminality of the teaching setting from the generalisation setting. That is, when there is an increase in similarity between the teaching setting and the task performance setting, generalisation of skills is heightened. An examination of the literature investigating functional skills instruction (e.g., Hung, 1976) indicates that learning in a natural setting should precipitate enhanced generalisation of skills learnt. Carr and Darcy (1990) argued for the inclusion of multiple behaviours and objects in brining about acquisition and generalisation of skills. The authors documented consistent improvement and generalisation of imitation skills with autistic children, following multiple exemplar training. The use of multiple training settings and materials may further serve to enhance skill generalisation and maintenance in autistic students.

Page, Iwata and Neef (1976) taught five retarded boys pedestrian skills in a classroom using a model built to simulate city traffic conditions. The boys manipulated a doll through the intersections and verbalised what the doll was doing. As soon as one of the boys learned a pedestrian skill on the model, he was allowed the opportunity to practice it in the natural environment. This approach yielded moderate success only. The study was replicated and extended by Matson (1980), who used a mock-up of an intersection with life-sized traffic sign props. After training, participants were exposed to a city intersection. Results showed that those who had utilised the life-sized traffic sign props and the mock intersection were most successful in crossing streets, followed by the students who received training on a model similar to Page et al (1976). Vogelsberg (as cited in Steinborn and Knapp, 1982), taught four severely handicapped students pedestrian skills in the natural environment, two of whom were finally able to cross streets independently while the other two required less assistance than they needed prior to training. While the above studies have not been conducted with autistic children, they do provide support for the application of naturalistic instruction.

Behavioural training programme. Behaviourist management seems to provide the most effective way of tackling autistic children's educational and behavioural problems (Rutter, 1985). Both clinical experience and systematic research have shown that such approaches bring about worthwhile improvements (e.g., Egel, 1981; Koegel, Egel and Dunlap, 1980; Lovaas and Newsom, 1976; Mason, McGee, Farmer-Dougan and Risley, 1989; Sadlier, Dixon and Moore, 1992). The application of learning theory principles to the instructional environment (e.g., behaviour management through the use of operant conditioning) has resulted in teaching autistic children a variety of skills; conversational (Sailor and Tanman, 1972) self-care (Marshall, 1966), and play skills (Rincover and Koegel, 1977). Unfortunately, much of this literature has limited applicability for developing functional teaching programmes in nonschool and post-school settings. While information gathered via nonlaboratory research is beneficial, examination of literature suggests a need for development of research programmes facilitating acquisition of skills taught in any of the child's natural environments.

The natural environment may provide an ideal setting for functional skill instruction with autistic children as it offers many naturally

occurring stimuli that may serve to reinforce childrenís behaviour (e.g., putting a jumper on rewards the child by providing warmth). In general, researchers have tended to rely on artificial reinforcers in enhancing autistic childrenís behaviours (i.e., food or tokens). While artificial reinforcers may be beneficial in initial skill acquisition, they can severely retard the generalisation process. Research needs to be expanded to consider the motivational properties of the natural

environment, in reinforcing and promoting skill acquisition, maintenance and generalisation.

Prompting and modelling instructional procedures are instrumental in initiating and extending behaviours in autistic children. Hemsley and Howlin (1976) intimate that autistic children are unable to learn from modelling alone, but that it must be accompanied by reinforcement, guiding or prompting. This was exemplified by Blew, Schwartz and Luce (1985) who found that while no identified skills were acquired during modelling conditions alone, when modelling was paired with verbal prompting, learning and maintenance of functional skills resulted. An examination of behavioural training programmes demonstrated that a combination of modelling, prompting and reinforcement procedures would expedite the skill acquisition of autistic children.

The present study was designed to evaluate a behavioural training programme designed to teach autistic children two functional skills: crossing the road and turning a jumper in the correct way. As training was conducted in the natural environment, utilising multiple training settings, it was hypothesised that generalisation and maintenance of skills would result.

METHODOLOGY

Participants. Four autistic boys, aged five to eight years, participated in this investigation. All participants had been diagnosed in accordance with the DSMIII-R criteria (American Psychiatric Association, 1987). The children were selected on the basis of task naivetÈ, classroom teachers' report, parents' report and informal observation. Language abilities extended from primarily nonverbal to possessing a range of communicative speech. Evaluation by both the researcher and classroom teachers determined that all four children possessed adequate comprehension skills to enable them to follow both verbal commands and physical prompts. All children engaged in low levels of appropriate play and social behaviour.

Two of the children (Child A and Child B) were classified as high functioning, and are currently enrolled in a normal preschool two days a week. Child A, a five-year-old, was primarily echolalic, although he possessed a small (40-70 words) functional vocabulary. Child B, also five-years-old, possessed a functional expressive vocabulary of several hundred words. Neither Child A nor Child B displayed self-stimulatory or disruptive behaviour during instructional sessions, although Child B was reported to display a high frequency of disruptive behaviour and tantrums outside the instructional setting.

Child C, an eight-year-old, was nonverbal. Productive communication relied upon changes in intonation and the manifestation of sounds. The child's behavioural repertoire was characterised by a high frequency of

self-stimulatory behaviour (e.g., repetitious vocalisations, clicking, repetitive rubbing) accompanied by frequent tantrums and self-abuse. Child D, a seven year old, was primarily echolalic, although verbal responses to direct questioning could be exacted when accompanied by constant prompting and guidance. High levels of repetitive speech

(e.g., mechanically repeating the words of songs) characterised the child's verbalisations throughout the instructional sessions. He engaged in moderate levels of self-stimulatory behaviour (e.g., finger flipping, gazing), was often non-compliant and exhibited poor eye-contact.

Setting and apparatus. The teaching of two specific skills [turning a jumper in the right way and road crossing] took place in context, that is, in the environments in which

they would normally occur. In order to facilitate generalisation, three training settings were adopted for the instruction of each task. The jumper turning sessions were conducted: (a) in an empty classroom, (b) seated at a table, situated at the rear of the school building, and (c) in the school playground. Furthermore, variation in the type of jumper used resulted in the presentation of both novel and familiar articles of clothing. The road crossing instructional settings operated outside the school on a quiet street with limited passing traffic. The children were taken to three different sites along the road: (a) directly in front of the school building, (b) two hundred metres from the school, and (c) approximately fifty metres from the street corner, which required the child to become increasingly aware of turning traffic and other bypassing vehicles. Each site was visually isolated from the other. Variation of instructional settings was used to provide the child with a range of stimulus variations and to avoid any conditioning of unwanted stimuli which may occur if all training sessions were conducted in the same environment.

Reinforcers used with each child were selected in advance by both the researcher and classroom teachers from lists of previously determined, functional [edible or social] reinforcers, specific to each child. A reinforcer was considered functional if it had previously been used to establish and maintain existing behaviours. Due to the specificity and individualistic nature of the autistic syndrome, it was critical that reinforcers were tailored to the individual child. Furthermore, each child was exposed to a set of possible stimuli in order to test for their usefulness and to re-affirm their power as potential reinforcers. If a child did not respond to a particular reinforcer, it was considered to be no longer functional and was discarded from the index.

Task Analysis. Road crossing and jumper turning tasks were broken down into small and relatively simple steps, minimising potential confounds

for learning while maximising effective elements for instruction. The more failures children experience, the less persevering they may be at a task and the less likely they are to learn much about it (Koegel and Egel, 1979). The children in this study had greater opportunities to attain subskills. The attainment of each stage was rewarded. Table 1 illustrates the task analyses of both road crossing and turning a jumper in the right way.

Table 1. Task analysis of jumper turning and road crossing skills

ROAD CROSSING
JUMPER
1a. Approach the kerb
1b. Grab waist band of jumper with one hand

2a. Stand Still on the kerb

2b. Push other hand inside jumper and up sleeve

3a. Look to the right
3b. Hold end of sleeve with hand

4a. Look to the left
4b. Pull hand out of jumper without letting go of cuff

5a. Look to the right again
5b. Release grasp on waistband

6a. If there is no traffic in sight, step onto the road
6b. Grasp waistband with other hand

7a. Cross the road looking both ways
7b. Push other hand inside jumper and up sleeve

8a. Step off road onto kerb
8b. Hold end of sleeve with hand

9b. Pull hand out of jumper without letting go of cuff

10b. Release hand from sleeve

11b. Grasp waistband with both hands

12b. Shake

Characteristics of Instruction. Instruction spanned a period of two months, with three sessions per week. Sessions were conducted in a one-to-one setting, each session spanned five to ten minutes in duration. There were four basic characteristics underlying each instructional session:

a. clear definition of the instructive stimulus, the target behaviour to be taught, and the consequence given to the subject
b. systematic delivery of reinforcement of correct responses
c. consistent interaction between participant and experimenter and
d. objective evaluation of the participant's trial to trial performance.

(Hung, 1976)

In order to achieve clear definitions and systematic delivery of reinforcement, each task had a prescribed procedure specifying instructional methods [modelling and prompting behaviour] and steps. To establish a baseline measure, an assessment of each child's performance level, in the targeted routine was conducted prior to commencement of the instructional sessions. At the commencement of each task, the entire routine was modelled to the child, utilising both verbal and physical cues. Following this, the specific step required of the child was modelled, followed by a verbal request to perform the act. Verbal instructions were given only once, the allowable latency for a response was five seconds. If the participant did not initiate a response independently within the latency period, the least intrusive level of assistance was offered. The level of assistance was systematically increased until the child performed the task and received a reward.

Generalisation assessment. Road crossing and jumper turning skills were assessed for performance maintenance and skill generalisation two months following completion of instructional sessions. To measure skill transfer, tasks were conducted in a new environment significantly different from those employed during instruction. Subskill attainments were not reinforced, and behavioural training procedures (i.e., modelling and prompting) were not engaged in cases of stagnated performance or inadequate response.

Graphical measures. Graphical analysis of data was preferred (e.g., Egel, 1981) as this has greater applicability for studies with small numbers of participants. Performance measures were graphed, with the two tasks presented separately. Data points were 'smoothed' for

graphing, using median measures of three. Each set of data was 'smoothed' a maximum of two times. The number of steps for each task are presented on the ordinate, while the number of instructional sessions for each task are shown on the abscissa (see Figure 1 to 4).

Reliability measures. Instructional sessions were videotaped and scored by two additional independent observers for level of attainment of skills. Percent agreement was calculated by dividing the total number of agreements (identical recordings by all three observers on a given session) by the total number of agreements plus disagreements in each session and multiplying by 100 (Egel et al, 1981, p.7). This yielded 95-100% agreement for all 17 sessions.

RESULTS

Figures 1 through 4 display the percentage of correct responding during training and follow-up sessions. A count of 1 was afforded for each step performed in the step breakdown of the task, up to the highest step performed with maximum assistance. For example, at session 7, Child A, who could perform step 1, step 2, step 3 and step 4 of the road task with maximum assistance, was awarded an accumulative score of 4. In this sense, the scores may be thought of as accumulative frequencies of performance.

Child A, Child B and Child C fully executed the skill of road crossing (Task 1) by the completion of session 16. Child D attained seven of the eight required task steps by the final session. Similarly, three of the children (Child A, Child B and Child D) accomplished all task steps in Task 2 (jumper turning). Child C reached step 11 (total number of steps = 12) at the completion of instructional sessions. The children did not demonstrate any decrement in performance once a particular step had been mastered (with the exception of Child D at session 10, Figure 1). Generally, children achieved task efficiency (executed all the task steps) comparatively earlier in Task 1 (mean = session 8) than in Task 2 (mean = session 12). Once again Child D was the exception, completing Task 2 in session 9 and failing to master Task 1. None of the children appeared to undergo satiation, with consistent levels of performance continuing once the highest task step had been acquired, as illustrated for Child A in both tasks (Figure 1), for Child B in Task 1 (Figure 2), Child C in Task 1 (Figure 3), and Child D in the jumper task (Figure 4).

Figure 1(a). Road Crossing Task

Figure 1(a). Jumper Task

Figure 1. Performance to criterion for Child A

Figure 2(a). Road Crossing Task

Figure 2(b). Jumper Task

Figure 2. Performance to criterion for Child B

Figure 3(a). Road Crossing Task

Figure 3(b). Jumper Task

Figure 3. Performance to criterion for Child C

Figure 4(a). Road Crossing Task

Figure 4(b). Jumper Task

Figure 4. Performance to criterion for Child D

Generalisation. Performance maintenance and skill generalisation were measured two months following completion of instructional sessions. Generalisation data, as indicated by session 17 (Figures 1 to 4), illustrates that all four children generalised skills from the training settings to a novel environment. The generalised performance of Child A, Child B, and Child C in Task 1 was consistent with task performance at
completion of instruction sessions (session 16). Child D showed a marginal decline in skill performance dropping from step 7 to step 6. Similar results were derived in Task 2, for Child A, Child C and Child D, all demonstrating constant response levels from session 16 to session 17. A reduction in skill attainment was measured for Child B, dropping from step 12 to step 11. The follow-up performance measures for both Child B and Child D were superior to their performance at the

beginning of instructional sessions. The fact that a lower level of performance was witnessed for Child D may be indicative of the fact that he did not reach task criteria during instructional sessions.

DISCUSSION AND IMPLICATIONS

Generalisation of learned skills by autistic children is a serious concern (e.g., Baine, 1980; Carr and Darcy, 1990; Koegel and Rincover, 1977). Many studies have shown that gains made by children in clinical or school settings do not automatically transfer to other environments (e.g., Stokes and Baer, 1977). Emphasis in the current study was placed on techniques that would enhance generalisation of skills to other environments (i.e., using more than one initial training situation, varying the materials used, varying the type of reinforcement, teaching functional skills). Examination of task performance two months following the completion of instructional sessions, confirmed both the generalisation and maintenance of skills. All children maintained a high level of performance at the follow-up measure, achieving the same subskill level as at completion of instructional sessions (except Child B on Task 2, and Child D on Task 1). The significance of these findings is underscored by the limited skill transfer typically evidenced by individuals with autism (Secan, Egel and Tilley, 1989).

In the natural environment a more diverse range of stimuli is presented to the child in contrast to a controlled experimental environment. The beneficial effects of using natural occurring stimuli to motivate autistic children to learn, has far reaching consequences. By not needing to use artificial reinforcers, there is a greater chance of response maintenance and generalisation of skills. To facilitate generalisation of skills, the training situation should provide the learner experience with the range of stimulus variations found in the natural environment (Baine, 1980). Further, the presence of multiple stimuli would reduce the possibility of satiation. The benefits derived from exposure in the natural environment and the inherent motivational stimuli should continue to be pursued.

The focus of functional instructional programming lies in the teaching of skills that are age-appropriate, useful in a variety of settings and are important to the childís functioning in the wider community. The skills of road crossing and jumper turning were taught in context when and where they would normally occur. By teaching functional skills in context, the generalisation and motivational difficulties experienced in contrived experimental conditions are not encountered. As skills were age-appropriate and ëusefulí to the child beyond the instructional setting, it was possible for children to practice these skills outside the training setting and with individuals other than the trainer.

Informal reports from parents indicated that the children in this study demonstrated skill attainment both at home and in other community environments (e.g., crossing the road with a sibling on the way to school). There are a basic set of skills and concepts that are more immediately functional for autistic children (i.e., self-help skills, conversational skills), therefore tasks containing these skills and concepts should be emphasised in designing instructional programmes for these children. By teaching autistic children skills that are functional in a variety of settings, it provides them with the opportunity to practice these skills, increasing the likelihood of skill generalisation and maintenance.

Evaluation of the present study reveals significant differences in the structure and effectiveness of this approach among various reported educational programmes. An important distinction between this study and studies of its kind, was the length of time taken for participants to reach task criterion. For example, Steinborn and Knapp (1982) taught an autistic child pedestrian skills in a classroom by use of a model of the streets and the intersection she most often frequented. It wasn't until the thirty-first trial that the child correctly executed the entire sequence, and on the forty-fifth trial, she reached mastery. In the present study the children reached task criteria comparatively earlier. All children completed the tasks by session 16, with the exception of Child C in Task 2 and Child D in Task 1. The differences in rate of skill acquisition between the two studies may be attributed to the influence of numerous criteria. The programmes differed in structure (task breakdown), curriculum, setting (artificial setting cf. the natural environment), and treatment approaches (collective use of prompting, modelling and reinforcement procedures).

Behaviour modification training 'packages' have focused primarily on refined techniques for presenting instructions, prompts, and consequences. Typically, studies have combined either prompting and modelling or reinforcement and modelling procedures in the experimental design. A significant and far-reaching contribution of the present study to the treatment of autistic children involved expanding the role of specific training procedures to incorporate all three behavioural components. The model suggests that reinforcement (natural and artificial), modelling and prompting procedures are viable methods for teaching independent self-help skills to autistic children in natural environments. These procedures combined, produced gains in children with verbal skills as well as a child who was nonverbal.

A high level of response and on-task behaviour was maintained by all four children. Motivation to learn was increased through the use of artificial reinforcers and naturally occurring stimuli. Task breakdown allowed children to achieve the desired behaviours more readily,

resulting in a higher frequency of reward. A task which is not broken down into smaller achievable units, whereby the child must complete the whole act before receiving a reward, has less potential for sustaining behaviour than a task which has been broken down and results in continuous and frequent reinforcement. The results are particularly encouraging for the education of autistic children. The study suggests that teachers can sustain a relatively high level of motivation in autistic children by merely implementing behavioural training procedures, such as reinforcement, modelling and prompting, in a natural environment. By conducting sessions in a functional environment, and across different instructional settings, the generalisation and maintenance of skills were enhanced.

The utilisation of more than one training site was critical in bringing about generalisation of these skills. This approach has proven effective in promoting generalisation across a variety of skills and clinical populations (e.g., Carr and Darcy, 1990; Stokes and Baer, 1977). It must be noted, however, that although the instructional and post-instructional settings differed, there were some common stimulus features. Specifically, the adult researcher was present in both settings and could therefore have been an additional factor in promoting setting generality. Nonetheless there are reasons to believe that the children may have not recognised the researcher after a two month absence (Williams, 1993). One explanation for the maintenance effect is that the activities or the settings were intrinsically reinforcing.

The present data are significant in demonstrating that autistic children can learn functional skills in a natural setting and that this can be accomplished in a shorter time frame than previously realised. The of structure learning activities (i.e., functional skills, natural environment, multiple settings, task breakdown, behavioural training procedures) is crucial in promoting skill generalisation and maintenance in autistic children. While further research is required to disentangle what are the most important elements of this design, the central issue is whether treatment can improve the long-term outcome of autistic children. The findings here suggest that it can.

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The present investigation examined a training package that included functional skill training, task analysis, reinforcement, modelling and prompting procedures in teaching four autistic children, aged 5-8 years, two self-help skills; crossing the road and turning a jumper in the correct way. A significant goal in the education of autistic children is to ensure the generalisation of newly acquired responses from the training milieu to the natural environment. Unless particular steps are taken to avoid the problem, the gains following treatment tend to be situation specific. Emphasis was placed on techniques that would enhance generalisation of skills to other environments (e.g., in situ instruction, multiple training settings, varying the materials used, and teaching functional skills). Three of the four children mastered task efficiency at the completion of the 16 instructional sessions. A two month post-test confirmed both the generalisation and maintenance of skills for all four children. Results are discussed with respect to the potentially important role of intrinsically motivational stimuli and multiple training environments in facilitating maintenance and generalisation of functional skills in autistic children.