REVIEW OF LITERATURE
STIMULUS DISCRIMINATION  
IN MENTALLY RETARDED CHILDREN

Stimulus over selectivity (i.e., responding to only a few of the relevant cues available in a learning task) has been observed in both retarded and autistic children (e.g., Lovaas, Schreibman, Koegel, and Rehm, 1971; Wilhem and Lovaas, 1976). In an investigation Lovaas et al. (1971) trained retarded, autistic and non-handicapped children to respond to a complex stimulus consisting of visual, tactile, and auditory components. Subsequently, the three components were presented individually to single out the controlling component of the responses. It was observed that the autistic children responded to one component only, retarded children responded to two components, and the non-handicapped children responded to three components. Moreover, Wilhelm and Lovaas (1976) reported an inverse relationship between I.Q and stimulus over selectivity.

The tendency of stimulus over selectivity necessitates developing and effective teaching procedure to teach the retarded children. The studies of Terrace (1963 a; 1963 b) on “errorless” strategies to establish discriminations challenged the assumption of the traditional learning theories on the importance of errors and offered new educational perspectives for developmentally impaired individuals who often fail to acquire even relatively simple discriminations with trial and error training (Schreibman, 1975; Sidman and Stoddard, 1966; 1967; Touchette and Howard, 1984).

"Errorless learning procedures preclude students from performing an incorrect response. In reality, some errors may occur even with errorless learning procedures.... Despite the possibility of some errors, errorless procedures produce fewer errors than strategies where no antecedent information (prompts) is provided". (Wolery, Bailey, and Sugai, 1988, p. 220). Quite a few reasons have been cited in favor of 'errorless' learning strategies by Wolery et al (1988). Firstly, the students learn little from errors. Secondly, the errors reduce the opportunities for reward to the learner., Thirdly, there might be learning of incorrect response because of the practice of incorrect response by the learner, Fourthly, "errorless" learning procedures promote positive inter-relationship with instructor and the learner because the learner makes frequent correct responses and receives reward for the same. Lastly, few inappropriate behaviors occur during the "errorless" learning procedures.

There are studies which have demonstrated that the students tend to be engaged in disruptive behaviors (Carr and Durand, 1985; Weeks and Gaylord-Ross, 1981) and self-injurious or aggressive
behaviors (Carr, Newson, and Binkoff, 1976; Weeks and Gaylord-Ross, 1981; Durand, 1982) when frequent errors are made on difficult tasks, Weeks and Gaylord-Ross (1981) found that errors and inappropriate behaviors decrease under "errorless" learning procedures. Carr and Durand (1985) systematically investigated the relationship between difficulty of the task (i.e. those with frequent errors) and inappropriate behaviors. The difficulty of the task was varied while other conditions were kept identical. More number of inappropriate behaviors in the presence of the difficult tasks were attributed to the difficulty level of the task.

During the last three decades, extensive research has been carried out to develop techniques of "errorless" discrimination training. The "errorless" strategies for teaching discrimination invariably involve use of prompting procedures. It is then important to devise an effective prompting strategy for teaching discrimination to the retarded persons. Further the teaching of a task should enable the learner to understand the requirements of the task being taught. The prompting strategies may involve either the activities of the teacher (response prompts) or modification in the dimensions of a stimulus (stimulus prompt). The response prompt can be delivered through pointing, pictorial representations, modelling, verbal statement, partial or full physical assistance. Past research has shown that all prompts are not equally effective with mentally retarded students. Nelson, Cone, and Henson (1975) for example, demonstrated that physical guidance was more successful than modelling in teaching meal time skill. The kind of prompt, then, has to be selected on the basis of its effectiveness in consistently evoking the target response with the particular student.

The studies with severely and profoundly retarded have demonstrated that during the initial training of acquisition stage of learning, the response prompts like modelling (Nelson et al., 1975), verbal instructions (Glendenning, Adams, and Stemberg, 1983) and partial physical prompts, (Mosk and Bucher, 1984) often failed to elicit the correct response. Moreover, the response prompts, in and themselves, may fail to convey the requirements of the task to the learner. It is left on the learner to infer the task requirements. But because of limited intellectual and behavioral repertoire the severely and profoundly retarded children may not be able to understand the key feature of the task. Furthermore, if the prompt fails to convey the task understanding, it may then actually interfere with the learner's attempt to understand the task by other means because it distract their attention away from the relevant task features (Burleigh and Maholin, 1977; Glendenning et al. 1983).
Another alternative is the use of stimulus prompts. Stimulus prompts have been studied primarily in the context of visual discrimination tasks (Schoen, 1986). Stimulus prompts differ with regard to functionality in directing a subject's attention to features of the training stimuli. They may emphasize a distinctive feature (Egeland, 1975; Guralnick, 1975; Rincover, 1978) or a non-distinctive feature (Rincover, 1978) or no feature of the training stimulus (Schreibman, 1975; Terrace, 1963a).

The criterion related manipulations or distinctive feature prompting has been reported to be superior (Etzel and Le Blanc, 1979; Lambert, 1980; Lancioni and Smeets, 1986; Zawlocki and Walls, 1983). Criterion related manipulations involve changes on a dimension of the stimuli (e.g., shape or size) relevant for the final discrimination. For example, if the final discrimination concerns a larger versus a smaller bottle, the size difference between the bottles may initially be emphasized and then gradually reduced to the target level (Etzel and Le Blanc, 1979; Richmond and Bell, 1983; 1986). Distinctive feature prompting involves the use of known stimuli as prompts for the discrimination of new stimuli (Egeland, 1975; Rincover, 1978; Wolfe and Cuvo, 1978). The prompts superimposed on a differentiating portion of the new stimuli, are then removed by fading, shaping, or time delay (Guralnick, 1975; Smeets, Lancioni and Hoogeveen, 1984; Smeets, Lancioni, Strriefel, and Curfs, 1988).

Schreibman (1975) compared two prompting procedures to teach visual and auditory discrimination to the autistic children. One procedure incorporated the extra-stimulus prompt and the second one within stimulus prompt. The results indicated that the subjects learned the discrimination task through within stimulus prompt than with extra-stimulus prompts. Other investigations have also reported the ineffectiveness of extra-stimulus prompts (Koegel and Rincover, 1976; Schreibman et al., 1982). Zeaman and House (1963) compared the learning of retarded and non-retarded children. The low performance of the retarded children was attributed to the attention to the irrelevant dimensions of the stimulus by retarded children.

Wolfe and Cuvo (1978) compared extra-stimulus and within stimulus prompting procedures on letter discrimination task. 24 severely retarded children were taught six alphabets, three via extra-stimulus prompting and three via within stimulus prompting (accentuating the critical features of the stimuli themselves). The findings revealed that significantly more proportion of letters were learned through within stimulus prompt.
Tawney (1972) tested four year old children in letter discrimination task on match to sample apparatus. The subjects were divided into three groups viz; experimental critical group, experimental non-critical group, and control group. The subjects in experimental critical group were rewarded for responding to critical features. The subjects in non-critical experimental group were rewarded for responding to non-critical features. The subjects in control group did not receive any training. The three groups were post-tested after training on letters. The subjects in experimental critical group made significantly fewer errors.

Gold and Barclay (1973) attempted to train retarded individuals to sort bolts into two piles, according to length. One group (Hard group) began with the criterion pile. A second group (Easy group) was trained on bolts of greatly differing lengths, and subsequent piles were increasingly similar. Verbal instructions were provided, and pointing prompts were used to correct errors. All individuals in the Easy Group, but none of the subjects in the Hard Group, learned the task.

Mosk and Bucher (1984) conducted two experiments to assess the relative effectiveness of stimulus shaping and traditional prompt procedures. Pegboard skills were trained in Experiment-1. In Experiment-2 a self-care skill was trained, in which children learned to hang a tooth brush or a wash cloth on a specific hook. Six low functioning retarded children were studied in each experiment, using a within subject alternating subjects design. Each participant received concurrent training on two related tasks using stimulus shaping for one and a standard prompting procedure for the other. Training with the stimulus shaping procedure required less training time to criterion, always resulted in fewer errors, always required fewer and less intrusive therapist’s prompts, and always resulted in greater density of reinforcement.

Smeets (1990) compared two time delay conditions for teaching complex visual discrimination to preschoolers and children with mild and moderate intellectual handicaps. One condition involved spatially separating the distinctive components from the redundant parts of stimuli (multiple dynamic distinctive-feature prompts). The other condition involved adding a colored field to the correct stimulus (single static non-distinctive feature prompt. The results indicated that time delay of multiple dynamic distinctive feature prompts consistently produced learning, and time delay of the single static non-distinctive feature prompt almost never produced learning and frequently lead to a completely loss of discriminative performance on previously learned tasks.
The ineffectiveness of extra-stimulus prompt may be because of selective stimulus control (Allen and Fuqua, 1985). Presentation of even a single extraneous cue may overshadow the student's attention to the training stimulus (Mackintosh, 1977). Therefore, transfer of stimulus control from extraneous stimulus to target stimulus may not take place (Schreibman, 1975; Schreibman et al. 1982; Sidman and Stoddard, 1966; 1967).

Due to over selectivity, the retarded children may respond to the non critical dimensions of the stimuli; thus interfering in the acquisition of the relevant responses to an array of the stimuli. Similarly if the student attends only to the prompting stimulus and does not attend to the training stimulus then the student will be unable to perform the correct discrimination when the prompt is removed. Some prompts distract the child from the relevant stimulus dimension (Cheney and Stein, 1974; Schilmoeller, Schilmoeller, Etzel and Le Blanc, 1979; Schreibman, 1975; Wolfe and Cuvo, 1978), so that the child's behavior remains under the control of the prompting cues. The studies have demonstrated that this may be improved by directing the attention of the retarded children to the relevant cues of the stimulus (e.g., Zeaman and House, 1963). Directing the retarded children to the critical cues by highlighting or exaggerating the relevant aspects of a stimulus is found to be more effective.

Stimulus prompts have been criticized on grounds of inefficiency and limited applicability (Schoen, 1986). Some applications of stimulus prompts require many trials, and much instructional time to teach the task (Riley, 1990).

The use of stimulus and response prompts in combination offers a promising means of minimizing the difficulties associated with the other procedures. Since response prompts have the potential for distracting attention from the relevant features, the learner would first be given the opportunity to make the response on the basis of the stimulus prompts alone. If the correct response was not made, then partial physical prompts and other suitable prompts like modelling or verbal prompts would be given. If these failed to elicit the response, full physical prompts or pointing would be given. These would be used as last resort. This combined procedure may be the most effective than the isolated use of stimulus prompts, modelling, partial physical or verbal prompts because it may give the learner more assistance in trying to understand the task.
DELAYED PROMPTING AND SKILL ACQUISITION

The delayed prompting procedure (Touchette, 1971) involves the introduction of a time delay between the presentation of a stimulus and a prompt, providing the learner with an opportunity to anticipate or make a correct response prior to the delivery of the prompt (Handen and Zane, 1987). In an investigation, Touchette (1971) taught three mentally retarded subjects initially to press an illuminated red key in the presence of a white distractor key. The subjects were then presented with a two choice discrimination task consisting of a different figure flashed on each key. The key with target figure (stimulus) was illuminated with the red color (Prompt) and subsequent pressing of that key were reinforced. A time delay was then gradually introduced between the figure presentation and illumination of the key. It was found that the subjects required relatively few trials (5-16) before correctly responding to the figure prior to the onset of the color cue. Once the first anticipated response occurred, subjects continued to respond correctly to the figure prior to the onset of the color cue on virtually all subsequent trials. Therefore, transfer of stimulus control was complete at the time of the first correctly anticipated response.

Touchette (1971) and Howard (1978) offered a number of advantages of delayed prompting. Firstly, the delayed procedure minimizes the probability of a subject attending to an irrelevant stimulus. Secondly, stimulus delay does not require the modification of training stimuli. Finally, with knowledge of the exact moment of the transfer of the stimulus control, more time may be allocated to teaching skills not yet acquired. Some potential difficulties associated with the delayed prompting procedures have been identified. Firstly the procedures may be contra-indicated if response can not be prompted (e.g., verbal behavior), and secondly a subject may fail to respond prior to the prompt and continues to wait for cues from the experimenter. Conversely, a subject may fail to wait for the prompt and persist in making anticipatory errors.

Handen and Zane (1987) reviewed 26 studies relevant for delayed prompting procedures. The analysis suggested that rapid acquisition rates have been reported in the studies. But some subjects had failed to learn or required major changes in the procedures after failing with the standard training method. A number of studies reported that one or more subjects failed to meet criterion on trained stimuli (e.g., Bradely-Johnson et al. 1983; Oppenheimer, 1985; Saunders and Spradlin, 1985;
Touchette, 1971). Additionally, investigators had to change the delayed prompt procedure in some fashion to enable the subject to learn (e.g., Kleinert and Gast, 1982). Others have included procedural variations involving the use of training procedures such as prompting or fading or shaping in combination with the delay method.

The most poor results were obtained by Saunders and Spradlin (1985) who found that only six of 24 subjects demonstrated complete transfer of stimulus control. One explanation for these results was that none of the subjects had prior experimental histories, some subjects with prior training histories may have already acquired stimulus control but simply needed to extend stimulus control to a relatively new situation. Conversely, subjects without prior learning histories are trained to acquire a new area of stimulus control. Thus they would be expected to require more training trials than subjects who are simply extending previously acquired stimulus control.

Some researchers have suggested that rapid acquisition rates found in much of the delayed prompt literature may be unrelated to the delayed prompt method itself. For instance, some studies (e.g., Braam and Poling, 1983) reported that their subjects made correct anticipated responses on the first training trials involving a delayed prompt. Each of these studies utilized a procedure in which training began with four or more trials of simultaneously presented instructions and prompt (zero second delay) suggesting that actual transfer of stimulus control may have occurred during these trials. Touchette and Howard, (1984) confirmed this possibility and suggested that transfer of stimulus control may be due to either post prompt responding or the pairing of the prompt and neutral stimuli as is found in simultaneous presentation trials. Therefore, acquisition may occur during simultaneous presentation with the delay method functioning merely as a probe rather than a teaching procedure.

Bradley-Johnson et al. (1983) compared delayed prompting and fading for teaching pre schoolers easily confused letters and numbers. The delayed prompt group met Criterion on an average of 3.23 training stimuli versus an average of 4.33 training stimuli for the fading group (number of training trials was held constant). Error rates were significantly lower for the delayed prompt group during both training and a one week follow up.
Charlop and Walsh (1986) compared the efficacy of delayed prompting and peer modelling procedures to increase autistic children's spontaneous verbalizations of affection. While delayed prompting was found to be a quick and effective procedure for all four subjects, peer modelling was unsuccessful in teaching the target behavior.

Snell in 1985 (see Handen and Zane, 1987) reviewed several unpublished research reports which tested the effectiveness of delayed prompting versus other procedures. In three of these studies, experimenters compared delayed prompting with a system of least intrusive prompts (e.g., verbal, model, and physical). In two of the studies, the subjects learned the required task (signs, object identification, a board game) with fewer errors and in fewer trials/sessions when taught with delayed prompting. Snell also described a fourth study in which researchers compared delayed prompting with a stimulus fading strategy when teaching sight words. Subjects learned a greater number of words when taught by the delay method.

In delayed prompt procedures the errors are relatively infrequent with reported error rates generally falling below 9%. However, some studies have reported error rates ranging well over the 10% level (e.g., Oppenheimer, 1985; Saunders and Spradlin, 1985). It is likely that error rates are higher during the initial training sessions when the first stimuli are taught. As the subjects become more familiar with the procedure, they would be expected to make fewer errors.

The literature indicates that target stimuli are acquired quite rapidly, usually within a few training sessions or limited number of trials. This would imply that transfer is indeed both rapid and permanent. However, post training performance, (usually conducted at the end of the trials for all stimuli) has ranged from a low of 10% to a high of 100% suggesting that performance of transfer may be short lived in some cases.

Several studies report excellent generalization of skills taught with delayed prompting. For example, Charlop et al. (1985) reported generalization of responding to unfamiliar setting, unfamiliar settings with an unfamiliar person, and generalization to untrained stimuli (with five of six subjects). Mc Donagh et al. (1984) assessed 54 matching relations involving coin equivalencies. In the baseline, the subjects showed criterion performance on only two equivalencies. The subjects were taught six equivalencies. The subjects exhibited a substantial generalization to the remaining 46 equivalencies without any direct training.
RESPONSE DELAY PROCEDURE

It is a common observation with the autistic children that they appear to respond to the task before actually attending (Oppenheim, 1974). This phenomena has been reported to be characteristic of many children receiving special education (Epstein, Cullinan, and Sternberg, 1977; Hallahan, Kauffman, and Ball, 1973; Harcum and Harcum, 1973; Hays and Prinz, 1975; Keogh and Donlon, 1972). One remedy to the problem is a “response-delay” procedure. In this procedure the child is refrained from making a response to an instruction for a specified period of time. Response delay procedures have been demonstrated effective in improving the performance of mentally retarded children (Harcum and Harcum, 1973) on a variety of tasks. Koegel, Dunlop, Richman, and Dyer, (1981) found that requiring autistic children to label relevant cues verbally prior to responding served to facilitate learning on discrimination task. Response requirement in this case may have served to delay children’s responding. Dyer, Christian, and Luce (1982) investigated the influence of a response delay requirement of the discrimination performance of the autistic children. Two conditions, a no response delay condition versus a response delay condition (three seconds) were compared in the context of multiple baseline design with subsequent repeated reversals. The results showed that the response delay condition produced higher levels of correct responding than the no-response delay condition. In addition, teachers in the research setting rated the response delay procedures to be a practical and effective teaching technique that could be implemented in a classroom setting.
Error correction refers to assistance provided by teachers after students respond incorrectly to a target stimulus or when another response should have been performed (Falvey, Brown, Lyon, Baumgart, and Schroeder, 1980). The error correction procedures, thus aim at providing the students how to perform the behavior correctly, in contrast to the consequent events that tells the students whether the behavior was correct or incorrect.

The types of assistance provided for error correction include gestural, verbal, models, pictorial and physical or a combination of these (Doyle, Wolery, Ault and Gast, 1986). The difference between prompts and error correction is that prompts are always provided before occurrence of the target behavior and error correction procedures are applied after a student makes an incorrect response. The error correction procedures in fact, serve as prompt for next occurrence of the behavior which has been just performed incorrectly. The error correction procedures are frequently used in combinations. For instance, a model, and partial physical manipulation are both provided when errors occur (Faw, Reid, Schepis, Fitzgerald, and Welty, 1981), or a consequent event plus a correction procedure such as verbal reprimand and a model (Palyc, Cooke, Schuler, and Apolloni, 1979). Reinforcement for correct responses used with error correction is found to be more effective than reinforcement alone or error correction alone (Foxx, 1984; Matson, Esveldt-Dawson and Kazdin, 1982).

The analysis of the type of error made by a student on a given task is critical because different teaching procedures are needed when the different type of errors occur (Bellamy, Horner, and Inman, 1979). Bailey and Wolery, (1984) identified four general error types: First, errors of unlearned prerequisite skills that occur during initial acquisition training, are consistent, and may be difficult to detect. Second, systematic errors refer to incorrect responses that appear to occur because the student applies an incorrect strategy or rule. Third, random errors occur after students have learned the basic requirements of a skill and have no apparent pattern. Fourth, noncompliance errors occur when students have demonstrated that they can do the skill correctly and are able to do the behavior (Haring et al. 1980).
For errors of unlearned conceptual prerequisite the student should be taught the prerequisite skill. To counter systematic errors, antecedent prompts can be given. Also, it is to be ensured that the student is not reinforced for applying the incorrect rule or strategy. To eliminate random errors quite a few changes in consequent events are required: (a) reinforcement to be provided to a higher rate of correct responding, (b) providing different reinforcer, (c) giving the reinforcer less often, (d) providing extra practice (f) implementing a response cost component contingent upon errors. To deal with non-compliance errors one can move to a more difficult task, or the schedule of reinforcement can be revised (Haring et al., 1980).

Handen and Zane (1987) in their review of literature on delayed prompting reported that out of 26 studies reviewed considerable variation was noted in the way errors were corrected. Error correction typically involve two components: (a) the experimenter's immediate response to the subject's error, and any subsequent changes in the delay length resulting from that error. Most experimenters either prompted a correct response (ten experiments), and/or removed attention for a short period of time (ten experiments). Other approaches included providing physical guidance (Browder et al. 1981), removing the subjects hand from the stimulus and presenting the next trial (Smeets and Striefel, 1976 a), modelling the correct response (Smeets and Striefel, 1976 b), repeating the trial (Braam and Poling, 1983) or terminating the trial (Touchette, 1971). Two experiments failed to report responses to subject error (Charlop et al., 1985; Mc Donagh et al., 1984) and one experiment (Charlop and Walsh, 1986) reported simply interacting with the subject until the next trial. The second component of error correction involves changes in delay length for trials following an error. Seven experiments utilized a standard delay in which there is no change following errors (with one exception in the study of Braam and Poling (1983). Of the 20 experiments which used a gradual delay, three failed to describe changes in the delay interval during the correction procedure. In three experiments the instructors reset the delay length to zero second following an incorrect response. The delay length was decreased to that of the previous trials in seven experiments and was ,maintained at the same length in three experiments.
Stokes and Baer (1977) defined generalization as

the occurrence of relevant behavior under different nontraining conditions (i.e., across subjects, settings; people, behaviors, and/or time) without the scheduling of the same events in those conditions. Thus, generalization may be claimed when no extratraining manipulations are needed for extratraining changes; or may be claimed when some extra manipulations are necessary, but their cost is clearly less than that of the direct intervention. Generalization will not be claimed when similar events are necessary for similar effects across conditions (p 350).

Drabman, Hammer, and Rosenbaum (1979) reviewed 188 studies on child behavior modification and concluded that there are four major descriptive categories of generalization of training outcomes: (1) across time (i.e. maintenance), (2) across settings (i.e. stimulus generalization), (3) across behaviors (i.e. response generalization), and (4) across subjects. They conceptually combined these four basic forms of generalization and developed a generalization map. A total of 16 different forms of generalization have been identified with all possible combinations of these four basic forms. The sixteen classes of generalization map range from maintenance (class-I) to subject-behavior-setting-time generalization (class-XVI). Some of the forms of generalization relevant to the present investigation are described below:

(1) Generalization Across Responses:

Response generalization is the extent to which a student performs those behaviors to which no specific contingencies have been applied for alteration. For example; Schumaker and Sherman (1970) rewarded three children for the correct production of past and present tense forms of verbs. The usage of some verbs was also obtained without direct training. Gracia, Baer, and Firestone (1971) made a topographical analysis of generalized imitation among four retarded children. The subjects were trained to imitate three category of topographical responses, small motor, large motor, and short vocal. The subjects were also probed for imitation of other small motor, large motor, short vocal and long vocal non rewarded responses. The Generalization was obtained within the dimensions of particular topographical responses.
Baer, Peterson and Sherman (1967) observed that when various motor imitations by the retarded children were rewarded, other imitations continued to be performed without training or reinforcement.

(2) Generalization Across Settings:

It is the extent to which a behavior is emitted in non training settings. For example, Kifer, Lewis, Green and Phillips (1974) taught parent-child pairs to negotiate in conflict situations. The instructions were carried out in classroom settings through role playing, practice and feedback. The data showed increased use of negotiation behaviors and reaching agreements in actual parent child situations at home.

Van Don Pal et al. (1981) assessed generalization in two ways. They evaluated the effectiveness of classroom instructions in teaching three mentally retarded young adults to eat independently in fast food restaurant. All of the participants had eaten in the restaurants previously but they were unable to order or pay for the meal independently. The task analysis for the steps required to order, pay for, and eat a meal in a fast food restaurant was conducted. The task analysis comprised of 22 steps which were divided into four major components: locating, ordering, and eating and exiting. The instructions in classroom were given through role playing in simulated environment. After mastery of each component in the classroom, a probe was conducted at a McDonald's restaurants. In addition follow-up probes were also conducted in Burger King restaurant. The results indicated that substantial stimulus generality occurred from classroom environment to two restaurants even though none of the materials or instructional contingencies from the classroom were operating in the actual restaurants.

Schwarz and Hawkins (1970) videotaped the behavior of a sixth grade child during the math and spelling classes. Later, the reinforcement was given to the subjects for maintaining good posture, absence of face touching and appropriate loudness by displaying the videotape of math class. The desirable improvements were maintained during the spelling class also.

(3) Generalization Across "Experimenters":

This form of generalization is evident when a response trained by one person is emitted into the presence of another person who was not present during the training sessions. For example,
Redd and Bimbrauer (1969) assessed generalization across "experimenters" and found that control over the co-operative play of retarded children did not generalize from an adult who dispensed contingent edible reinforcement to five other adults who had not participated in the training.

Gracia (1974) taught a conversational speech form to two retarded children and, upon discovering a lack of stable generalization across "experimenters" after one training input, programmed generalization across experimenters by having a second experimenter teach the same response.

Stokes, Baer, and Jackson (1974) established that training and maintenance of retarded children's greeting responses by one experimenter was not usually sufficient for the generalization of the response across "experimenter". However, high level of generalization to over 20 members of the institutional staff (and new comers as well) who had not participated into the training of the response were recorded, after a second experimenter trained and maintained the response in conjunction with the first experimenter. Thus, when generalization was not evident with one stimulus exemplar, it was programmed by training several diverse examples.

4. Generalization Across Time:

Two forms of generalization across time have been identified. That is, within training setting and beyond the training setting. The generalization across time within training settings is evident, when upon discontinuation of the training program, the training outcomes persist in the experimental settings. The second form, extra-training setting is evident when a behavior appears under non treatment conditions and persist. Koegel and Rincover (1977) in their first experiment recorded responding of the subjects in both the therapy and extra-therapy setting. The results showed that one child did not generalize to the extra-therapy setting, but that other children did. However, the children who generalized to the extra-therapy setting, their responding was not maintained.
This form of generalization attempts to assess the effect of training in one modality on the acquisition in other modality. Traditionally, it has been suggested that auditory comprehension of the stimulus labels precedes verbal production. Early theory (Myklebust, 1957) and research (Fraser, Bellugi, and Brown, 1963; McCarthy, 1954) on language development confirmed this notion. Recently, however, conceptualizations of language have led to a skeptical view of the traditional theory. According to Cuvo and Riva (1980) from a behavioral framework, there is no reason to assume that comprehension is related in a specific way to production. Comprehension involves an implicit or explicit response to a linguistic utterance, whereas production involves a linguistic response controlled by a specific stimulus or environmental situation. Because different responses and stimuli are present in the two performances, they could develop independently of each other. Hence, it is not inevitable that comprehension must precede production (Seigel and Spradlin, 1978). Some authors have assumed that both language comprehension and production are a reflection of underlying cognitive or linguistic competencies (Seigel and Spradlin, 1978). Advocates of this theory also do not believe that comprehension must necessarily precede production.

Guess (1969) taught the receptive use of the plural morpheme to two severely retarded individuals and concluded that language reception and production may be independent of each other. A follow-up study (Guess and Baer, 1973) supported the previous results when generalization again did not occur when mentally retarded persons were trained in one modality. Chapman and Miller (1975) on the other hand, found that some children used an appropriate form productively before they did so on a comprehension task. Several other studies have also concluded that production may precede comprehension (Keeney and Wolfe, 1972; Strohner and Nelson, 1974).

Productive articulation of non-retarded children has been shown to be improved substantially by receptive discrimination training in the case of nonsense words (Mann and Baer, 1971) and individual sounds (Winitz and Preisler, 1965). Ruder and his colleagues (Ruder, Hermann, and Schiefelbusch, 1977; Ruder, Smith, and Hermann, 1974) taught Spanish vocabulary items in a comprehension task to non-retarded preschool and school age children. The results showed that initial comprehension training resulted in some verbal production. Other recent studies with non-retarded children have shown the same trend of facilitation from comprehension to production (Shipley, Smith, and Gleitman, 1969; Vasta and Teitelbaum, 1976; Whitehurst, 1977). This body of research suggests that prior training of comprehension facilitates acquisition of production by non-retarded children and adults.
In contrast, studies with mentally retarded individuals seem to suggest the converse order of facilitation: verbal (i.e., productive) pretraining of relevant dimensions enhanced motor (i.e., receptive) performance on match-to-sample concept formation (Hamilton, 1966) and geometric form discrimination tasks (Dickerson, Girardeau, and Spradlin, 1964). Smeets and Striefel (1976) found that with little exception, manual sign discrimination had little effect on the expressive usage of these signs by a retarded deaf girl. Thus, the studies using retarded subjects have shown that there is facilitation from production to comprehension in mentally retarded which is converse in non-retarded subjects.

**Programming Generalization:**

To develop a successful treatment program one must be concerned with at least three major results: First the initial acquisition of a behavior change; second, the generalization of that change to settings outside of treatment, and third, the maintenance of change overtime in settings outside treatment (Baer et al. 1968; Bandura, 1969; 1976). Applied behavior research has generally focused on producing a behavioral change in the treatment setting with little attention given to studying the generalization and maintenance of change (Koegel and Rincover, 1977).

One of the most important findings in applied settings is the demonstration that skills taught in school frequently do not generalize to other situations where they are needed (Stokes and Baer, 1977; Wehman, Abramson and Norman, 1977). The persistence of this finding has laid some professionals to implement instructions outside the school and in the natural environment. A review of 115 studies in which training was conducted in the natural environment revealed that a train-and-hope approach in the natural environment is not associated with a high frequency of successful generalization. In fact, about five of every six students with severe handicaps and nearly two of every three students with mild and moderate handicaps did not generalize well when only train-and-hope approach was used in the natural environment (White, Leber, and Phifer, 1985). O'Leary and Drabman (1971) reviewed reports of classroom applications of behavior analysis and found little evidence of generalization from token economies to regular classes.

An important educational problem is developing an instructional technology for training appropriate generalized responding. Horner, Bellamy, and Colvin (1984) described this problem as developing a means "to deliver interventions that reliably and efficiently result in the acquisition of adaptive behaviors that endure over time, are performed across the full range of appropriate stimulus conditions, and are not performed across inappropriate stimulus conditions" (p. 288).
In 1977 Stokes and Baer published an article titled "Implicit Technology of Generalization. They reviewed 270 published studies relevant to generalization and made several points: (1) Generalization had been treated primarily as a passive phenomena. The discrimination on the other hand was regarded as an active process. The lack of generalization was attributed to the failure of practicing discrimination adequately. (2) Though the significance of generalization of behavior change was widely recognized but little attempts were made to analyze the same. Rarely specific strategies were employed to produce generalized behavior change. (4) The generalized behavior change is to be best approached from a practical point of view. Efforts should be made to plan generalization instead of expecting it to happen by its own. Considering the points made by Stokes and Baer (1977) in their review of generalization literature, Stokes and Osnes (1989) presented 12 programming tactics of generalization.

(1) Contact Natural Consequences:

One of the most fundamental guideline for programming generalization is that those behaviors should be taught that would come in contact with naturally occurring reinforcing consequences. Generalization programming seems to be well served by providing the least artificial and most natural positive consequences during intervention. Such programming closely resembles naturally occurring consequences.

The response-reinforcer relationship was examined by Koegel and Williams (1980). Three young severely retarded autistic children who had low rates of acquisition of new behaviors served as subjects. They were placed under two response-reinforcer contingencies. First was an indirect relationship in which the reinforcer was delivered by an external agent following the target behavior. The second was a direct relationship in which the performance of target behavior itself produced a reinforcer as a natural outcome, e.g., picking up an object resulted in obtaining the consequences which had been placed under it. The analysis of results showed that the behaviors were more quickly demonstrated under second condition. The study further suggests that generalization programming tactics should include both the choice of relevant behaviors that will meet the natural consequences but also attention should be paid to the naturalness and directness of the contingencies of training.
(2) **Recruit Natural Consequences:**

A behavior may not occur in sufficient magnitude or with adequate skill to naturally contact important consequences. With appropriate training directed towards the skill and recruitment strategies can reduce the problem. For example, Stokes, Fowler and Baer (1978) examined the interactions of both normal and behavior disordered preschoolers with their teachers. These four to six year old children were taught first to increase the quality of their academic performance. Then they were taught skill full ways to draw the attention of their teachers to that work through the use of infrequent cueing statements such as "How is this?" This intervention successfully resulted in recruitment of positive attention and praise from their teachers. The other appealing feature of these procedure was that the children became active agents of their own treatment, rather than being the recipient of procedures implemented and controlled by others.

The maintaining effects of the recruitment of consequences was also examined by Mank and Homer (1987). Six persons with severe disabilities were taught to self-monitor their work performance and productivity in a vocational settings. Subsequently, the clients were trained to evaluate their performance as it compared with generally acceptable criteria of performance and to recruit feedback about that performance from their supervisors. The clients kept record of their activity, evaluated the record against the standards, and made a notation on their records regarding productivity, according to whether it was above or below criterion performance. The feedback received was both praise recognizing productivity and disapproval and encouragement following substandard performance. Under these conditions of the recruitment of both positive and corrective feedback production rates better maintained than with the self-monitoring.

(3) **Modify Maladaptive Consequences:**

Inappropriate behaviors may be maintained by powerful consequences. The consequences that are occurring may be considered maladaptive. As such if these consequences can be interrupted or discontinued the behavior will decrease. Horner (1971) taught a five years old boy to walk on crutches in an experimental setting. They prompted the child to generalize the new walking skill to other settings and activities to which he used to be taken on wheel chair. The assistance given by care takers for taking him on the wheel chair was withheld. Within fifteen days of the termination of treatment, the child walked on crutches to all those activities and settings.
(4) Reinforce Occurrences of Generalization:

The occurrences of behavior in generalization setting should be rewarded. Parsonson and Baer (1978) provided an example of reinforcement of the occurrences of generalization in the impoverished use of tools by preschoolers when presenting with a task for hammering, filling containers or trying new or creative solutions for completing the task in the absence of the typical material (e.g., hammer, bag, shoe lace) were reinforced. The novel solutions to the problem were in fact generalizations that had not been seen before and their reinforcement by praise and feedback was an efficient strategy to promote further generalization.

In a similar fashion, Campbell and Wills (1978) developed creativity of essay writing by children in the fifth grade. Using procedures of social and token reinforcement they targeted originality and creative writing as compared to peers or to previous individual performance. In this manner, variability, i.e., occurrence of generalization was reinforced. These variant behaviors increased and maintained on removal of artificial consequences.

Goetz and Baer (1973) studied the block building behavior of three preschool girls. After a period of baseline, reward was applied in two ways for block tower building. In one phase, each new and different construction which did not appear previously in the same session were rewarded. In another phase repetition of previously constructed forms of block tower within the same session were rewarded. The data revealed that when form diversity were rewarded, the subjects constructed more diverse forms than under baseline or under the condition when only repetition of a form was rewarded. Thus, generalization was evident when more new forms were constructed because the different forms did not appear previously and did not meet reinforcement contingency previously.

(5) Use Sufficient Stimulus Exemplars:

A stimulus exemplar is a condition under which training is given e.g., the trainer, training room, training material. Usually, the occurrences of generalization are restricted to the training conditions only. If more than one training conditions are incorporated it is possible to obtain the generalization to extra-training but similar stimulus conditions.
Haring (1985) trained 4-7 years old handicapped children to play with various toys. Initial training was in the general use of the play skills e.g., holding and moving an aeroplane through the air. Multiple classes of toys were used. After the training included the use of the skill with different types of planes, for example, the children were able to play appropriately with a range of plane types. That is, the training program taught an initial skill, then expanded the scope of the procedures to include multiple stimulus exemplars in which the skill could be used. The result was the display of the generalized skill with toys not previously incorporated into training.

Guess, Sailor, Rutherford, and Baer (1968) developed the generative correct use of plurals by a retarded girl. After teaching a number of exemplars of the correct plural response it was observed that the girl labelled new objects in the singular or plural without further training relevant to those objects.

(6) Use Sufficient Response Exemplars:

A response exemplar is a response employed in training. Incorporation of more than one response of the same response class can facilitate generalization across responses. Plienis et al. (1987) evaluated a program of conversational skills and problem solving training for emotionally disturbed adolescents. During small group training, multiple exemplars of the skills were used during instruction, modelling, rehearsal, feedback, and shaping procedures. In addition, clients were prompted to identify, discuss and practice skills using examples of situations which occurred in daily living circumstances. The client's improved conversational and problem solving skills and showed generalization to new situations and topics as well as the maintenance of those skills across time.

(7) Make Antecedents Less Discriminable:

Many training programs require tightly controlled conditions that maximize the control over all aspects of the training conditions and the stimuli presented during training. This procedure inhibits the generalization beyond training settings. To promote generalization, a variety in the conditions of training should be introduced.
Hart and Risley (1980) developed incidental language teaching procedures that took advantage of naturally occurring interactions between handicapped and non-handicapped preschoolers and their teachers. The procedures capitalized on the approaches made by the children by requiring elaborated verbalization related to the topic raised by the child prior to the delivery of the attention, material or activity consequences. This training occurred in natural setting which contained a variety of stimuli. It occurred at time unplanned and spread non systematically throughout the day and was in large part controlled by the child. These procedures resulted both in improved frequency of talking, vocabulary use and the use of more elaborate sentences in spontaneous language.

(8) Make Consequences Less Discriminable:

The predictability of consequences restrict generalization. The schedule of consequences which makes it difficult to predict whether consequences will be available or not would enhance the generalization. Dunlop and Johnson (1985) provided training to autistic children under conditions in which the therapist would be present to provide consequences for being on-task and correct responding with the task. In the less predictable condition, the therapist's presence was intermittent and variable in length. Under these conditions, when left unsupervised, the children were on task more and completed more response tasks during the condition of less discriminable consequences.

(9) Incorporate Common Salient Physical Stimuli:

A common stimulus that facilitates generalization may be a physical object that is present in both the training and generalization setting or at least very similar items are present in both settings. Usually the physical stimulus is incorporated into the training situation in an obviously salient and functional way. That stimulus then may be taken to the generalization setting. Alternatively, physical items common and obvious in natural and relevant generalization environments are incorporated into the training. Charlop, Schreibman, and Thibodeau (1985) used the reinforcer from training as the common stimulus. That is, in language training for autistic children, the children were taught to name objects and ask for them. The stimuli used were food and drink, which were also the reinforcer for the correct response. In other settings, given the presence of these obviously salient stimuli, similarly correct and generalized performance could be facilitated.
10. **Incorporate Salient Social Stimuli:**

A social stimulus relates to the characteristics of a person, such as a certain gesture, or the presence of the person. In some cases, the trainer may be present in settings other than the original training setting. The use of peers and peer tutors in training and therapy is an obvious example of the therapeutic manipulation of environmental elements in a way to take advantage of discriminative properties of peers. Stokes, Doud, Rowbury, and Baer (1978) incorporated peers into the training of behavior disordered preschoolers completing an academic task. During training, the peer presented stimulus materials and provided consequences to the child learning the skills. Implementation of the procedures was monitored by an adult instructor. The children learned the prepositional recognition responses but did not generalize those skills to a regular academic setting, when the peer tutor was brought to the classroom during testing for generalization, no generalization was displayed. However, if the salience of the peer tutor was increased, either by the tutor's presentation of the stimulus cards or by the tutor's occasional provision of a positive consequence, generalization performance was facilitated.

11. **Incorporate Salient Self-mediated Physical Stimuli:**

A self-mediated stimulus is a stimulus that is maintained and transported by the client as part of the treatment. For example, use of a note book that specifies how to perform in a certain setting. Holman and Baer (1979) taught children to use a small bracelet with moving beads to record the amount of academic work they competed in training. They later used this same bracelet to self-record performance in a regular classroom. This self-recording of task completion facilitated improved (generalized) on-task activity and some improved academic measures.

12. **Incorporate Salient Self-mediated Verbal and Covert Stimuli:**

A distinction is made for the use of self-mediated verbal and covert stimuli because they are some times more difficult to monitor, not because they are considered to be fundamentally different processes of behavior control and generalization programming (Stokes, Osnes, and Guevremont, 1987). Many of these tactics relate to verbalization, language, and thought. Self-mediated verbal and / or covert discriminative stimuli are produced by the client across relevant settings in order to facilitate the demonstration of skill acquired as part of a training or therapy program conducted elsewhere.
Warren (1985) presented several guidelines for planning and measuring language generalization but they are applicable to other academic and social skills as well. First, teachers should develop a concise, detailed, realistic generalization plan. Second, a variety of individuals should be enlisted to observe the student's behaviors across different stimulus conditions. Third, generalized responding be assessed each time a training step is successfully acquired. Fourth, the generalization or lack of generalization be assessed in natural environment as frequently as possible. Fifth, a consistent, reliable and valid measurement system should be maintained. In addition, Stremel-Campbell and Campbell (1985) recommended thoroughly analyzing the natural environment to identify the relevant and irrelevant setting, antecedent, and consequent stimuli that will be present and may influence student's generalization.

Homer, Williams, and Knobbe (1987) studied the maintenance of learnt skills in severely retarded children. To each student they trained one high and one low opportunity behavior. After training, when students were probed, it was found that 12 of the 17 high opportunity skills were successfully performed, while only four of the 17 low opportunity behaviors were successfully performed. They hypothesized low opportunity rate as one of the reason for poor maintenance.

Rutherford and Nelson (1988) reviewed 103 studies that used behavioral principles in education published since 1977. In addition, they included 53 secondary sources reporting maintenance and generalization. They observed that though increasing number of researchers addressed the area but the technology of maintenance and generalization is still insufficient and scattered. The failure of treatment gains to generalize outside the intervention model irrespective of their theoretical or practical basis (Nelson and Rutherford, 1988).

According to Nelson and Rutherford (1988) the development of effective maintenance and generalization procedures is a hard task for any treatment program. There has been basically two approaches upon which researchers are working toward technology of generalization. One approach focuses on procedures to influence the client's behavior during treatment so that it will be maintained in the natural environment. Following strategies are included in this area: (1) selecting and training the target behaviors that will increase the probability that the behaviors will be reinforced in natural environment; (2) loosening experimental control over stimuli and
responses in the treatment setting so that differences between discriminative stimuli in treatment and natural settings are more difficult to discriminate; (3) using the stimuli in the training setting likely to be found in the natural environment, (4) making the limits of training contingencies unclear by manipulating the schedule and timing of reinforcement; and (5) teaching students to self-monitor, self-evaluate, and self-reinforce their behavior. The other approach focuses on modifying the environment to support subjects' new behaviors. Strategies in this area include: (1) identification of stimuli in the natural environment that can be incorporated into the program; (2) identifying significant persons in the natural environment and training them to model, prompt, and consequate behaviors; and (3) training subjects to recruit reinforcement (Kerr and Nelson, 1983; Nelson, 1981).

The second important aspect of generalization concerns with error patterns, that is, "when a learned response is performed in a non-trained, but inappropriate situation, or fails to be performed in a non-trained appropriate situation" (Horner et al., 1984 p. 288). Information obtained from an error analysis allows to (a) evaluate stimulus conditions or characteristics that affect unsuccessful generalization, and (b) modifying training procedures to enhance appropriate generalization.

Horner et al. (1984) described four error patterns that may be identified in an assessment of generalization and may require instructional modifications. First, the target behavior has come under the control of irrelevant stimuli. Second, irrelevant responses are under the control of irrelevant stimuli and are more likely to occur than the behavior being trained, even when the appropriate stimuli are present. Third, a response that should be under the control of multiple relevant stimuli is controlled by a subset of these stimuli, and Fourth, the student applies the wrong response variation whenever a new stimulus condition is presented.

To summarize, each individual must be tested to determine if any learning has occurred beyond that which was programmed. Desirable controlling relations, however, can emerge spontaneously following training of related discriminations (Sidman, 1971) but most should be directly taught (Stokes and Baer, 1977).
After the development of the principle of normalization, mainstreaming, and integration, there has been a growing concern to teach the retarded persons those skills which would facilitate satisfactory adjustment of the retarded persons in the community. Based on these principles, community based rehabilitation programs for retarded persons have been devised. For successful rehabilitation of the retarded persons, they must be trained in activities of daily living and other functional skills. Use of money is one of the important skills for successful rehabilitation. The monetary skills involves several sub-skills starting from discrimination of money from non-money objects to correctly computing changes. Several investigations have already attempted to teach various monetary skills to the retarded persons.

In the beginning of the researches on monetary skills, pictorial representations of coin and bills were frequently used as teaching aids (e.g., Le Blanc, Vogeli, Barnhart, Grimsley, and Scott, 1973; O'Neil, Keiter, and Benson, 1971). But such materials could not be established as effective teaching devices (Trace, Cuvo, and Criswell, 1977). Also, there were demonstrations from other skills, that training through pictures of objects does not necessarily facilitate generalization to real objects. Hence, the training program utilizing actual currency have been devised.

The most fundamental monetary skills are to discriminate the coins of different values, to recognize the coins of different values and to name the coins. The earliest attempts to examine coin discrimination among retarded were the studies of Strauss (1952) and Blount (1967). Strauss (1952) reported the reaction of normal children to various denomination of United States (U.S) change. He found that children of chronological age (CA)=3 to 4 1/2 years made no real distinctions among denomination of coins. At this age the choice of a larger denominations over a smaller one was either at chance level or because the larger denomination happened to also be a larger coin. By CA=4 years 8 months to 5 years 11 months children were able to distinguish nickels from other coins, but were not able to make further distinctions.

Blount (1967) examined the preferences of retarded individuals for the dimensions of form, size, and quantity of monetary stimuli. In a paired comparison procedure, subjects tended to choose either on the basis of coin size or quantity.
Wunderlich (1972) taught coinage to eight mentally retarded children. The subjects had a mean I.Q of 59 with a range of 49 to 70. Their CAs ranged from 9 years 5 months to 13 years 4 months with a mean value of 10 years 9 months. All subjects were selected on the basis of their inability to distinguish among coin values and to make change. A matching-to-sample procedure was used to teach discrimination between five American coins and combinations of coins that did and did not equal individual sample stimuli consisting of a nickel, dime, quarter, and half-dollar.

Mc Ivor and Mc Ginley (1983) successfully taught young children with mental retardation to recognize a single coin type (10 pence) by "errorless" discrimination technique. The technique was extended for entire set of British coins by Lorente and Gaffan (1989). They designed a program to teach coin recognition and relative value of coins to five long term institutionalized middle aged mentally handicapped persons. The training program was based on "errorless" discrimination techniques (Terrace, 1966; Lambert, 1980) Pre-test and post-test design (Thyer and Curtis, 1983) and multiple baseline design across responses (Barlow and Hersen, 1984) were used to determine the effects of the program. The program was carried out at two stages. The first stage focused on teaching coin recognition and the second one on teaching relative value of the coins to the subjects.

After collecting the screening and baseline data, the program for coin recognition was implemented. The intervention package of recognition consisted of a four step strategy: (1) training with target coin with match stick, (2) training with target coin with plastic model of the coin (3) training with target coin and one of each of the other six coin types (4) training with three coins of each type. The training commenced with first step and progressed upward up to fourth step. During intervention, the subjects were required to point out to the named value of coins placed on the table in random orientation. The criterion to move to next step was four consecutive correct responses. If during 2nd to 4th step, three consecutive errors were made the preceding step was reinstated. In steps (1) and (2) each correct response was followed by verbal praise and in remaining two steps, only half of the correct responses were praised. For half of the correct responses non-differential feedback 'OK' was given. After incorrect response, the subjects were shown the correct coin and explained about the distinguishing feature of the coin.
The intervention session continued for approximately 20 minutes per day. Before and after each intervention session a pretest and post test was conducted randomly three times for each coin. Not more than one intervention session was conducted in a day. The time gap between two sessions ranged from 1-27 days with a mean interval of nine days for coin recognition and two days for coin relative value. The program was implemented individually for each subject. During the coin recognition training the subjects were not required to explicitly name the value of coins.

For teaching coin relative value a simple form board, 260 X 90 mm was constructed. Two rows of seven outline, corresponding to the shapes and sizes of the seven coin types in order of value, were marked on the board; the actual coins could be placed along one row while the subject placed matching coins at their appropriate positions in second row.

During intervention sessions, the board was placed on the table with the long axis pointing forward, the small value coins nearer the subject. The left hand column was filled with examples of seven coin types. The subject was handed the pair of coins to be trained and asked to place them in the appropriate positions in the empty right hand column. If an error was made, the trainer assisted the subject in locating them, pointing out the need for each coin to match the outline and to be similar to the corresponding coin in the left hand column. Finally, the subject was asked to say which of the pair of coins had the larger value. At the next step, the form board was turned through a right angle so that the smaller value coin positions were to the subject’s left. It was now empty, so only the size/shape of the outlines was available as a cue for placement of coins. The subject was asked to place the pair of coins being trained in the appropriate holes of the nearer row, stating which had the larger value. Finally, the form board was removed. The subject was presented with six coins, three examples of each member of the pair being trained, and asked to group them into two sets with the similar coins together. Again the trainer asked “which group of coins has the greater value? With which would you buy more things?” The correct responses were always praised during stage (1) but only half the time during stage (2) and (3).

The follow up was conducted at the end of three weeks and six months. The analysis of data revealed that the training program resulted in substantially improved ability to recognize coins, which was well maintained at six month follow-up. The effect was attributed to the training program except for one subject.
The analysis of data revealed that the training program resulted in substantially improved ability to recognize coins, which was maintained at six month follow-up. The effect was attributed to the training program except for one case. Though, the subjects in the investigation were not required to explicitly name the value of coin during recognition training, most subjects learned to name the coin. The training program also resulted in ability to tell the relative value of the coins which was maintained at six month follow up.

Miller, Cuvo, and Borakove (1977) designed an experiment to determine whether it would require fewer trails to teach verbal production of coin values directly or teach auditory comprehension first, comprehension training would generalize to production, and production training would generalize to comprehension. 14 mentally retarded subjects with a mean mental age (MA) of 4.83 years, (mean I.Q was 43.86) and mean CA of 12.67 years, participated in the study. A matched groups pretest-post test design, as well as a multiple baseline across responses within each group were employed. The comprehension-production group received coin-value training using two procedures sequentially; auditory comprehension (pointing to the correct coin in response to their verbally stated value) followed by verbal production (verbally stating the coin value in response to a pointing prompt). The production group was trained on the production procedure only. Each subject was repeatedly administered coin value comprehension and coin-value production tests, which provided the dependent measures. The results indicated that the two experimental groups improved significantly in their comprehension and production of coin values from pretest to post test and maintained those increments on one and four week follow-ups which ranged from 89 to 96% correct for the two dependent measures and two groups. Multiple baseline data showed pronounced increases in performance only after training was initiated on a particular coin. A comparison of the number of trials required for both group to complete their respective training programs indicated that teaching production alone (mean= 137.42) was significantly more efficient than training both comprehension and production (mean= 281.74). The failure of the comprehension procedure to facilitate production acquisition was evidenced by the fact that the comprehension-production group required as many verbal naming trials to achieve mastery as did the production group. On the other hand, there was generalization from production training to comprehension. Subjects in the production group who were not trained to point to the coins in response to verbal instruction averaged 99% correct on the comprehension test. It was suggested that an interaction between mental level and direction of transfer might occur. The mentally retarded may experience facilitation from production to comprehension training and for the non-retarded, the direction of transfer may be the converse.
In another experiment Cuvo and Riva (1980) compared the acquisition, generalization and transfer of language comprehension and production responses by persons at two I.Q levels: mentally retarded and non-retarded. One group of participants were taught comprehension of coin labels followed by training on production of coin label. The second group was trained only on production. Results indicated that both mentally retarded and non-retarded subjects attained a high level of acquisition and maintained their performance on one and four week follow up tests. No difference occurred between mentally retarded and non-retarded participants in magnitude of acquisition, but mentally retarded groups took approximately three times as many trials to complete training. Generalization data indicated no difference in magnitude between mentally retarded and non-retarded subjects. Comprehension training facilitated production in both retarded and non-retarded subjects.

Trace, Cuvo, and Criswell (1977) designed a program to teach coin equivalence to 14 mentally retarded adolescents divided into two groups. They employed a pretest-post test matched groups design in which monetary training was given to the experimental group and no training to the control group. A multiple baseline across coin-counting responses was also incorporated in the experimental group. Training was divided into six stages. At each stage one specific method of combining coins to equal 10 target values from 5 cent through 50 cent was taught. A three component chain requiring naming, selecting and counting, and depositing target monetary value into coin machine, was used. The results showed that experimental subjects improved significantly in coin equivalence performance and maintained their skill on one week and one month follow up tests; control subjects did not show any generalization across stages for the group as a whole or to any major degree, for individual subjects.

The mental age of the subjects in this investigation ranged from 6 years 4 months to 10 years 10 months with a mean of 8 years 7 month. Pollio and Gray (1973) had found that it was not until age 11 or 12 non retarded children chose a variety of monetary combination or were able to incorporate fewer number of coins to equal target amounts. The retarded subjects trained in the study of Trace et al (1977) had an average MA from 2 to 3 years younger than those in the Pollio and Gray (1973) study, and yet were able to acquire coin equivalence skills.
Lowe and Cuvo (1976) tested a procedure to teach coin summation to four mild and moderately retarded persons. Subjects were first taught a single target coin, and then sum that coin in combination with the coins previously trained. Five American coins and various combination were trained. Modelling, modelling with subject participation and independent counting by the subjects constituted the training sequence. A substantial improvement in performance was noticed during post-test which was maintained at four week follow-up. A multiple baseline design suggested that improvement in coin-counting performance occurred only after the coin was trained.

Borakove and Cuvo (1976) compared two methods of teaching coin summation to retarded adolescents. One method involved a coin-displacement procedure, the other did not. Displacement was designed to compensate for retarded persons' attention and retention deficits. Fourteen retarded subjects were assigned to either displacement or non displacement conditions. Subjects in both groups were first taught to count a single coin and then sum that coin in combination with coins previously taught. Both groups used the same finger-counting procedure; however, subjects in the displacement condition were also required to move each coin aside systematically after it was counted. The training method, were modelling, modelling with subject imitation and independent counting by the subject. Both groups improved from pre-to-post test; however, the displacement group performance was significantly better. Skill maintenance for both groups was evident on follow up. Displacement subjects required fewer trials and less time to complete training. It was proposed that coin displacement may compensate for attention and retention deficits of retarded persons.
RATIONALE AND OBJECTIVES

Several investigations (e.g., Schreibman, 1975; Sidman and Stoddard, 1966; 1967) have demonstrated superiority of "errorless" learning procedures to teach mentally retarded persons. Wölery, Bailey, and Sugai (1988) have cited many reasons in favor of "errorless" learning procedures. For example, students learn little from errors, few inappropriate behaviors occur under "errorless" learning procedures, students may learn error response due to the practice of incorrect responses, and "errorless" procedures promote positive relationship between student and teacher and so forth.


There is no tested procedure for teaching discrimination, recognition, and naming of Indian coins to the mentally retarded. These coin skills are functional skills which facilitate rehabilitation of the retarded persons. Further, these skills are precursor to higher level skills such as relative value of coin, coin summation, coin exchange and so on. Hence, it is considered worthwhile to devise teaching strategies for discrimination, recognition, and naming of Indian coins to the mentally retarded persons.

The issue of maintenance and generalization of training outcome to appropriate stimuli is of paramount importance for any teaching program for mentally retarded persons. Drabman et al. (1979) identified 16 classes of generalization based on four basic forms - across time, across subjects, across settings, and across behaviors. Guess and Baer (1973) described one more form of generalization which they termed cross-modal generalization. Previous investigations on coin skills (e.g., Llorente and Gaffan, 1989; Miller et al 1977) have reported fair maintenance of training outcome over time. Three investigations (Llorente and Gaffan, 1989; Miller et al. 1977; and Cuvo and Riva, 1980) investigated the cross-modal generalization of coin skill. This form of generalization involves generalization of coin recognition skill to coin naming skill and vice versa. Llorente and Gaffan (1989), and Cuvo and Riva (1980) found good generalization from recognition to naming of coin whereas Miller et al. (1977) suggested generalization from naming to recognition than recognition to naming.
The present investigation is further intended to explore cross-modal generalization. The other forms of generalization to be investigated are - generalization across untrained coins, generalization across settings, generalization across experimenters, and maintenance in training and extra-training settings.

Replication is a necessary aspect of scientific process. Two types of replication - direct and systematic, have been documented. Systematic replication is more desirable and practical form of replication. It involves extension of the experimental strategies with some modification in the procedure, setting, or environment (see Tawney and Gast, 1984). In the present investigation a replication of the strategies for coin skills on to paper money skills would be attempted.

The overall objectives of the investigation are summarized below:

1. to devise teaching procedures for coin matching, coin recognition, and coin naming skills,

2. to assess the effectiveness of the devised procedures on acquisition and maintenance of the coin skills,

3. to assess the effectiveness of the devised procedures on promoting generalization from coin recognition skill to coin naming skill and vice versa,

4. to assess the effectiveness of the devised procedures on promoting generalization across coins,

5. to assess the effectiveness of the devised procedures on promoting generalization across settings and across "experimenters", and

6. to replicate the devised procedures for training of coin skills on to paper money skills.