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ABSTRACT

A study was conducted to investigate the effectiveness of two procedures (1) in training children to perform sequences of emergency fire responses and (2) in facilitating long-term maintenance of correct responses. Subjects, 47 black third-grade children, were divided into external instruction, self-instruction, and control groups. In the self-instruction condition, children were trained to verbalize, monitor, evaluate, and reinforce themselves at different phases of responding; such self-instruction was omitted from the external instruction condition to establish a more passive involvement. All three groups were pretested and posttested. Children in training received additional assessments at 2 and 4 weeks and at 2, 3, 4, and 8 months following training. Generalization to an untrained situation and transfer of training to a second in-school setting and to a home setting were tested on a noncomprehensive basis. Results indicated that both training methods resulted in high levels of skill acquisition, a slight decline in response maintenance over the subsequent 4 months, and a substantial drop in maintenance over the second 4 months. Scores of subjects receiving external instruction declined more during the second 4 months than had both groups' scores during the first 4 months; they also declined more during the second 4 months than those of subjects receiving self-instruction. A high degree of generalization to an untrained response, a high degree of transfer to the second in-school setting, and moderate generalization to the home setting were found for both instruction groups. (Results are discussed with reference to factors potentially contributing to response maintenance.) (RH)

Refinement of a Primary Preventive Approach to Fire Emergencies: A Comparison of External and Self-Instruction Strategies for Training and Maintaining Fire Emergency Responding

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Abstract

The comparative effectiveness of external and self-instruction procedures in training children to perform several sequences of emergency fire responses and in establishing maintenance of correct responding was examined. The 47 children who served as subjects were divided into three groups--external instruction (15), self-instruction (16), and control (16)--for this purpose. All three groups were tested prior to and immediately following training. Children in the two training groups received additional testing in the form of postcheck assessments at 2 weeks, 4 weeks, 2 months, 3 months, 4 months, and 8 months following training. Generalization to an untrained situation and transfer of training to both a second in-school setting and children's homes were tested but not programmed comprehensively. The results indicated that both training methods resulted in high levels of acquisition, a slight decline in maintenance of responding over the first four months of postcheck assessment, and a substantial drop in maintenance of responding from the four- to the eight-month postcheck. An interaction between type of instruction (external versus self-instruction) and assessment period (the first four months versus the second four months of postcheck assessment) was apparent upon closer examination. More specifically, external instruction subjects' scores during the second four months not only declined more than both groups' scores had declined during the first four-month period, but also declined more than self-instruction subjects' scores did during the same time period (the second four months). Generalization probe data evidenced a high degree of generalization to an untrained response. There was a high degree of transfer to the second in-school setting and moderate generalization to the home setting. The results are discussed in light of factors that may contribute to response maintenance.

Introduction

Given the severity and extensiveness of the damage wrought by fire, the need for society-wide intervention in this area is evident. An estimated 12,000 people die in fires annually in the United States alone (National Fire Protection Association [NFPA], 1975). Of those who survive, an estimated 300,000 are injured (NFPA, 1975). The accompanying problems--e.g., loss of homes, jobs, money, and loved ones (The Report of the National Commission on Fire Prevention and Control, 1973) as well as neuropsychiatric difficulties (Lindemann, 1979)--may be equally devastating.

The present study is one of a series of investigations that have been conducted for the purpose of examining acquisition and maintenance of correct fire emergency responding. These studies have employed a primary preventive approach in that the goal of training has been to prevent the initial onset of the physical and emotional problems associated with fire (cf. Bloom, 1977). The first of these studies demonstrated and socially validated the effectiveness of a behavioral training package in achieving both acquisition and short-term (i.e., two-week) maintenance of correct fire emergency responding (Jones, Kazdin, & Haney, 1981b). The other two investigations primarily examined long-term maintenance. One revealed moderate declines five months following training in the original group of children and employed retraining as a method of reinstating correct responding (Jones, Kazdin, & Haney, 1981a). However, retraining resulted in only a temporary return to the high levels of correct responding necessary for emergency skills. In the other study (Haney & Jones, 1982), maintenance was programmed during training in a home setting through employment of several components posited to facilitate maintenance (i.e., fading of reinforcement, isolated followed by simultaneous presentation of stimuli, and self-reinforcement). Although programming of maintenance resulted in a relatively high degree

of maintained responding over six months of fairly frequent assessment, the 100% response maintenance necessary for skills such as emergency responding was still not obtained in most of the subjects.

The present investigation is an extension of these previous studies in that it examined the contribution of additional components to the acquisition and maintenance of fire emergency responding. In conducting this investigation, it was decided to study the effect of permitting more active involvement on the part of subjects through employment of self-instructional training. Although the findings concerning response maintenance are not sufficiently clear to permit precision in prediction and explanation of maintenance results (Drabman, Hammer, and Rosenbaum, 1979), self-instructional training is one of several procedures that have the potential of promoting maintenance of responding (Kazdin, 1980). More specifically, it has been theorized that self-instructional procedures, including self-verbalization, self-monitoring, self-evaluation, and self-reinforcement, may enhance the likelihood of maintained responding following treatment withdrawal through placing desired behavior under the control of the subject rather than an external agent (Kazdin, 1980; Meichenbaum, 1977). The present study was designed to test this assumption through providing a controlled comparison of a procedure in which subjects were more actively involved in training (self-instruction) with one in which subjects were more passively involved in training (external instruction).

In carrying out this study, strict assessment of maintenance was undertaken in that all contingencies, prompting, feedback, and practice were withheld during maintenance assessment except for a brief retraining session following the four-month postcheck assessment. Although retention of some treatment components following withdrawal of the formal intervention strategy may be desirable from a practical standpoint, this practice is undesirable from a methodological perspective. Inasmuch as environmental support (e.g., maintaining contingencies,

prompting, feedback, and practice) may not always be present following training periods, it is important to assess responding in the absence of such support in order to ascertain the extent to which additional maintenance programming and/or external support might be needed. Additionally, such removal of all support is of major importance in establishing sorely needed data bases with respect to novel target behaviors such as emergency responding.

As described above, the major purpose of the present investigation was to examine further the issues of acquisition and maintenance of fire emergency responding through a preliminary comparison of the effectiveness of external and self-instruction treatment packages. Both packages included trainer identification of the problem (i.e., to exit a "burning house" safely) at the outset of training. The self-instruction package promoted active involvement by subjects in that children were trained to self-instruct as well as to perform motor responses. That is, children learned to self-verbalize prior to each response, to self-monitor during responding, and to self-evaluate and self-reinforce following completion of responding. The external instruction package was intended to lead to more passive involvement by subjects and therefore omitted training in self-instruction (i.e., self-verbalization, self-monitoring, self-evaluation, and self-reinforcement). To ensure at least the moderate levels of maintenance obtained in previous research (Jones et al., 1981a, b; Haney & Jones, 1982), two strategies, fading of reinforcement (Kazdin, 1980) and an isolated followed by simultaneous approach to presentation (Cuvo, Kevans, Borakove, Borakove, Van Landuyt, & Lutzker, 1980), were employed with both external and self-instruction treatment procedures. In addition to the primary issue of the comparative effectiveness of the two types of instruction in training of acquisition and programming of maintenance, assessment of (a) generalization to an untrained fire emergency situation and (b) transfer of

training to a second simulated in-school setting as well as to the home setting (in the absence of comprehensive programming, which was omitted for the purpose of preventing interference with strict assessment of strategies to promote maintenance) was used in evaluating the present procedures' effectiveness.

Method

Subjects, Setting, and Apparatus

The subjects, 47 black third grade children (28 male, 19 female), ranged in age from 7 years - 9 months to 10 years - 1 month ($\bar{x}$ = 8 years - 8 months). Their IQ scores, as measured by the Otis Lennon, averaged 95.0 and ranged from 69 to 123. Their achievement scores (as measured by the Metropolitan Achievement Test) averaged 3 years - 0 months in reading (range = 1 year - 8 months to 4 years - 3 months) and 2 years - 10 months in math (range = 1 year - 9 months to 4 years - 5 months). All exhibited near-zero levels of performance during the fire emergency prior to training.

Children were trained and tested in simulated "bedrooms" in their public school. Equipment in each room included a bed or cot, a throw rug, a chair, an article of clothing (shirt), an E-Z tilt window mounted on a table, a picture of smoke, a picture of fire, and a blow dryer (to make the door and the air in the crack of the door hot).

Social Validation and Task Analysis

The appropriate methods of responding to the nine fire emergency situations had been established in a previous investigation through (a) contact with fire agencies and officials and perusal of pertinent information, (b) presentation of questionnaires to firefighters, (c) development of a task analysis, and (d) pilot work with children (Jones et al., 1981b). The significance of improvement of children who learned to respond in these ways was validated through presentation of questionnaires to firefighters in the same investigation.

For the present study, four situations were chosen from the nine original situations based on their relevance to children who sleep on the upper floors of the buildings. Three situations--"nothing blocking path," "fire blocking path," and "hot air rushing through crack"-- were trained and assessed, and one--"hot door"--was assessed only. Correct responding to the four situations required performance of 10, 17, 13, and 11 steps, respectively. Correct responses to the first situation ("nothing blocking path") are presented in Table 1. For the remaining situations, confrontation with fire cues (either outside of the bedroom, while opening the bedroom door, or while feeling the bedroom door) alters the responses somewhat. In each, the child must (after encountering the fire cue and returning to the room, if necessary) (a) crawl and get a cloth, rug, or article of clothing; (b) crawl to the bedroom door and push the cloth, rug, or article of clothing beneath the entire door to cover the crack; (c) crawl to an article of clothing or bedding; (e) open the window; and (f) yell and signal for help (wave the article of clothing or bedding). In the second situation ("fire blocking path"), this series of responses occurs after fire is encountered in the hallway outside the bedroom and the child crawls back into the bedroom. In the third ("hot air rushing through crack"), this series of responses follows the discovery that there is hot air rushing through the partially opened bedroom door and the immediate closing of the door. In the final situation ("hot door"), it follows the discovery that the bedroom door is hot.

Insert Table 1 about here

Acquisition Assessment

Prior to and immediately following training, an assessment session was conducted individually in the training room. During this direct behavioral

assessment, the three trained situations were presented to children in random order. For each test situation, the experimenter described the situation and then said, "Show me what you would do." As the child reached certain points in the "house", certain sensory cues (i.e., smoke, hot door, hot air rushing through the crack of the door, and fire) became evident. To determine individual scores, one point was given for each correct response in sequence, the three situation totals were summed for a total score, and the percentage of correct responses was calculated. Immediately following assessment of the trained situations, children were presented with the untrained situation ("hot door"). This situation was scored in the same way as the trained situations. Following the trained and untrained situation assessments, children were presented with a 26-item self-report (yes/no) questionnaire similar to that of Jones et al. (1981b). The percentage of self-report questions answered correctly was calculated. No feedback or reinforcement was given on any of the measures.

Postcheck Assessment

An assessment probe was conducted two weeks, four weeks, two months, three months, four months, and eight months following training. This probe proceeded in the same fashion as acquisition assessment. No feedback or reinforcement was given either after or between assessments with the exception of retraining following the four-month postcheck.

Transfer of Training Assessment

In school. After acquisition assessment, half of the training subjects were randomly selected and tested on the trained situations and untrained situation in a second simulated setting in the school. These assessments were conducted in the same manner as they had been during acquisition assessment. No feedback or reinforcement was provided.

At home. Following a retraining session given subsequent to the four-month postcheck assessment, a total of 21 children (10 external and 11 self-regulation) were available for assessment of the trained situations within their homes.[1] This assessment was carried out in the same fashion as it had been during acquisition assessment.

Following this assessment, the experimenter repeated the testing and gave verbal prompts following errors. Children were given increasingly more specific prompts until they performed responses correctly. The number of prompts given for each response was recorded.

Reliability

A total of 18 graduate and undergraduate students served as observers. Training for situational assessment consisted of modeling, role playing, corrective feedback, social reinforcement, and actual practice over a two-week period. Training for self-report assessment consisted of instructions. Reliability checks were taken during 33% of the total trained and untrained situation assessments and through tapings of 78% of the total self-report assessment sessions. Reliability averaged 94% (range = 76% to 100%) on the situation assessments and 99% (range = 96% to 100%) on the self-report measure.

Training

Procedure. Children were divided randomly into three groups with 16 subjects each: external instruction, self-instruction, and control. Within the two training groups, children were divided into four groups of four subjects each for the purpose of training. Trainers were a graduate student in education with several years of teaching experience and an undergraduate psychology major. Each of the eight groups had the same trainer throughout training. Each of the two trainers had an equal number of external and self-instruction subjects (until one external instruction subject was dropped because of extensive absence).

Both external instruction and self-instruction groups received training that covered the same information and lasted approximately the same length of time (average session length of 37.21 and 40.83 minutes, respectively). All training subjects received the same number of total trials and approximately the same number of opportunities to perform each situation (seven for the "nothing blocking path" situation, five for the "fire blocking path" situation, and four for the "hot air rushing through crack" situation--with differences occurring because all children were not always presented with the same situations during review periods). Children in the control group received only the pre- and posttesting.

Several training components (including modeling, behavioral rehearsal, feedback, and positive reinforcement) as well as maintenance strategies (i.e., fading of reinforcement and isolated followed by simultaneous presentation) were common to both the external and self-instruction treatment packages. The common elements of the procedures will be discussed in detail first, followed by a description of the factors that differentiated the two strategies.

With reference to training, both groups of children were first introduced to the training sessions and presented with the general problem (i.e., to exit a burning house safely). During the first session, children were presented with situation 1 (nothing-blocking-exit). The two subsequent sessions consisted of a review followed by the next situation (fire-blocking path for session 2 and hot-air-rushing-in for session 3). Session 4 consisted of review of situations 1, 2, and 3. Session 5 consisted of further review and a discussion of several points not directly covered by previous instruction (e.g., that you should not get a pet, a toy, or clothing before leaving the house). During session 6, the procedure for acquisition assessment was explained to the children, and children were given a final review, practiced the situations as a team (i.e., two children performing at once), and received

individual remediation (on frequently missed responses). Children who were absent received individual instruction until they reached the point where the group had stopped the previous day. Following the four-month postcheck, children individually received retraining on missed situations from the same trainer they had had during training.

In both groups, training on new situations included both question-and-answer and behavioral rehearsal lessons. Question-and-answer lessons in both groups consisted of questions to which children responded through either showing the correct picture or pantomiming the correct response. Behavioral rehearsal lessons in both groups consisted of four major parts: (a) trainer modeling, (b) subject guided trainer modeling, (c) training, and (d) evaluation. During trainer modeling, subjects were shown the correct responses to the specific situation being trained. During subject guided trainer modeling, subjects as a group were asked to describe verbally the correct responses to the situation.[2] The trainer provided feedback through performing each response that was correctly described. Children were prompted if they hesitated. Training consisted of individual subject performance of the responses to the situation with immediate trainer and peer feedback and praise (positive reinforcement). If the response was incorrect, the trainer verbalized and modeled the correct response until the child performed it correctly one time. The child then proceeded with the remainder of the sequence. Evaluation consisted of individual subject performance of the responses to the situation with delayed feedback and positive reinforcement (i.e., feedback and positive reinforcement occurred at the end of responding unless an error occurred). Children who performed well (made two or less errors) received (or took, depending on their group) a star (positive reinforcement). Immediately following an incorrect response, the trainer provided feedback and modeling. Children were than given a second trial, which was conducted in the same fashion as training except for the elimination of immediate peer praise. For both training and evaluation,

all subjects responded before the group proceeded to the next portion of the lesson.

The review portion of sessions in both groups consisted of both question-and-answer review and behavioral rehearsal review. Question-and-answer review was comprised of questions that covered the major points of the verbal lessons. Behavioral rehearsal review was conducted in the same way as evaluation (step "d" of the training procedure) except that all situations previously learned were presented randomly.

With reference to maintenance, the two previously mentioned techniques--fading of reinforcement and isolated followed by simultaneous presentation of situations--were also carried out in both groups. Fading of reinforcement was employed in both groups to lessen the degree of discriminability between training and nontraining time periods (Kazdin, 1980). This procedure was carried out (a) through fading from immediate reinforcement (after each step in a sequence) to delayed reinforcement (after the entire sequence of responses) and (b) through delivery of tokens (stars) initially following completion of responding to a single situation and later only at the end of the session. Isolated followed by simultaneous presentation of situations was used to provide an opportunity for subjects to learn important discriminations and to increase the resistance to extinction of the correct responses to previously taught situations. This procedure entailed isolated presentation of each situation initially (during training on new situations), followed by simultaneous presentation with all previously learned situations (during reviews).

Differences between the two groups may be noted in all four portions of the behavioral rehearsal lessons. These differences serve to delineate the present definitions of external and self-regulation.

In the external instruction treatment package, trainer modeling included

trainer performance of only motor responses as a tape recording described them. During subject guided trainer modeling, children in this group described only motor responses (e.g., "crawl to the door," "feel the door," etc.). During training, external subjects performed only motor responses. During evaluation, external subjects again performed only motor responses. The trainer placed stars on children's score cards, and the trainer and peers praised children at the end of performance of the task if they made no more than two errors. Thus, monitoring and evaluation of performance were carried out by the trainer, and reinforcement was given by both the trainer and peers.

For the self-instruction treatment package, trainer modeling consisted of training in self-instruction--i.e., self-verbalization, self-monitoring, self-evaluation, and self-reinforcement--as well as fire emergency responding. First, the trainer explained the strategy to be used (i.e., to think before acting). The trainer than expected that children always were to (a) describe what was happening in their bedroom, (b) ask, "What do I do?" before responding, (c) describe each step before performing it (e.g., say, "I crawl to the door" before crawling to the door) and (d) ask, "How did I do?" when they were done responding. Next, the trainer demonstrated the correct verbalizations while showing the children cards depicting the correct responses. The trainer then modeled the correct motor and self-instruction responses. During subject guided trainer modeling, children in this group stated the responses to be used in self-instruction (e.g., "There is just a little smoke...What do I do? I slide to the edge of the bed...I crawl to the door...I feel the bottom of the door...How did I do?...I did a good job.") as the trainer first leafed through all of the cards and then performed the entire sequence of motor responses. During training, self-instruction subjects were required to engage in the self-instructional responses (without the assistance of the cards) as

well as to perform the fire emergency steps motorically. During evaluation in the self-instruction group, children independently monitored their responses, evaluated their performance, and delivered reinforcement through self-verbalizing and self-monitoring as they performed the responses and then self-evaluating and self-reinforcing when they were finished (without the assistance of the cards). That is, during responding, children verbalized for each step what they were going to do and then did it. After completion of the sequence, they asked themselves how well they did, pointed to a "+" or "-", and were permitted to give themselves stars if they made no more than two errors. For example, the child would (a) say, "There is just a little smoke...What do I do?" before leaving the bed; (b) say, "I slide to the edge of the bed" before sliding to the edge of the bed, "I crawl to the door" before crawling to the door, etc.; (c) say, "How did I do?" after completing the motor responses; (d) say how he/she did and point to a "+" or "-"; and (e) take a star if no more than two errors were made. During sessions 1 to 4, self-verbalization was overt. During session 5, children first whispered self-verbalizations and later covertly self-verbalized.

Adherence. To evaluate the degree to which trainers adhered to the procedure, an independent rater observed 11 sessions. A mean of 100% of the rated steps was rating as being performed correctly, indicating that trainers adhered closely to the procedure.

Results

Acquisition Assessment

The three acquisition measures--the trained situations, the untrained situation, and the self-report questionnaire--were analyzed via one way analysis of variance with one between-subject factor (group). Because of the near-zero performance of all groups on the pre-test situations, only posttest data were

included in this analysis. Significant group differences were found on all three measures $F(2,44)=3975.73$, $p < .05$ for the trained situations, $F(2,44)=123.58$, $p < .05$ for the untrained situation, and $F(2,44)=46.90$, $p < .05$ for the self-report measure). Scheffe's test showed these differences to exist between both training groups and the control group but not between the two training groups. Training groups averaged 99% (both groups) on the trained situations, 88% (external instruction) and 92% (self-instruction) on the untrained situation, and 92% (both groups) on the self-report measure. The control group averaged 1% on the trained situations, 2% on the untrained situations, and 67% on the self-report measure. Because of the near-zero level of performance on the part of the control group on the trained and untrained situation assessment during both pre- and posttesting, this group was not included in subsequent analyses.

Postcheck Assessment

Up to four months. A 2 (group) x 6 (assessment session) analysis of variance with repeated measures across assessment session was used to analyze the posttest and the first four months of postcheck assessment. Posttest and postcheck assessment data for the trained situations are presented in Figure 1. For these situations, no significant group differences and no significant interactions were found. However, there was a significant difference as a result of assessment session ($F(5,145)=3.89$, $p < .05$). Scheffe's test indicated that this effect was a result of a difference between posttesting and the four-month postcheck assessment (scores being lower at the four-month postcheck). For the untrained situation, no significant group difference and no significant interactions were found. However, there was a difference approaching significance for assessment session ($F(5,145)=2.06$, $p = .07$). For the self-report measure, no significant group difference existed. However, there was both a significant interaction ($F(5,145)=6.06$, $p < .05$) and a significant difference

for assessment session ($F(5,145)=2.40$, $p < .05$). More specifically, at posttesting and the four-week postcheck the two groups scored similarly on the self-report measure. At the two-week and two-month postcheck assessments, self-instruction subjects performed 1 to 2 percentage points higher. External instruction subjects were 1.5 and 7 points higher at the three-month and four-month postchecks, respectively. Post hoc analysis indicated that the difference for assessment sessions on the self-report measure resulted from significant differences between both posttesting and the two-month postcheck and posttesting and the four-month postcheck (scores being higher at posttesting).

Insert Figure 1 about here

At eight months. An independent t-test was used for comparison between the two groups of the change in scores from posttesting to the eight-month postcheck, and a dependent t-test was used for comparison of the change in scores within groups from posttesting to the eight-month postcheck. For all three measures--the trained situations, the untrained situation, and the self-report test--between group differences were nonsignificant and within-group differences were significant because of a decline from posttesting to the eight-month postcheck ($t(22)=6.77$, $p < .05$ for the trained situations; $t(22)=2.12$, $p < .05$ for the untrained situation; and $t(22=2.92$, $p < .05$ for the self-report measure).

Interaction. An interesting point that becomes apparent upon close examination of Figure 1 is the variation in rate of decline as a function of an interaction between the treatment group (external versus self-instruction) and the assessment period (the period from posttesting to the fourth-month postcheck versus the period from the four- to the eight-month postcheck). A two-way analysis of variance was done to test the significance of this difference.

The analysis supported the observation with a significant interaction ($F(1,38)=7.87$, $p < .05$). The main effect of assessment period was also significant ($F(1,38)=6.63$, $p < .05$--Subjects performed better during the period from posttesting to the four-month postcheck). There was no main effect for group.

Comparisons of the four cells in the analysis--(a) the external instruction subjects' decline from posttesting to the four-month postcheck (4.1%), (b) the external instruction subjects' decline from the four- to the eight-month postcheck (45.0%) (c) the self-instruction subjects' decline from posttesting to the four-month postcheck (14.7%), and (d) the self-instruction subjects' decline from the four- to the eight- month postcheck (13.0%)--indicates that there is a substantial difference between the external subjects' decline from the four- to the eight-month postcheck and the decline in each of the other three cells.

Transfer of Training

A two-way analysis of variance with one between-subject factor (group) and one within-subject factor (setting) was used to analyze transfer of training assessment. Both in-school and in-home transfer of training data showed no significant difference between the two training groups and no significant interaction (as mentioned above, only trained situations were assessed at home). In both cases, there was a significant main effect of setting for the trained responses ($F(1,28)=4.03$, $p = .05$ at school and $F(1,38)=170.86$, $p < .05$ at home). The main effect for setting was not significant for the in-school assessment of the untrained situation. Both groups performed at high levels (i.e., 98% and above on the trained situation measure) in both school settings but performed better in the training setting. Lower scores (i.e., 49% and 50% were obtained at home, but only minimal prompting was necessary to achieve responding on the three situations during the second home testing (overall $\bar{x} = 1.89$ prompts per child per situation, with an average of 2.0, 3.05, and .63 prompts, respectively,

for the "nothing blocking path," "fire blocking path," and "hot air rushing through crack" situations).

Discussion

The present investigation contributed to the knowledge concerning training of emergency responding primarily through examination of acquisition and maintenance of responding. Additional, secondary issues concerned generalization to an untrained fire emergency situation and transfer across settings in the absence of extensive programming in these areas.

With reference to acquisition, behavioral training packages that differed in type of instruction (i.e., external versus self-instruction) were found to be equally effective in training fire emergency responding. Examination of the two packages indicates that techniques common to each, including acquisition strategies such as behavioral rehearsal as well as maintenance strategies such as fading of reinforcement and isolated followed by simultaneous presentation of situations, may have had a significant impact on the equality of acquisition in the two groups.

With reference to maintenance of responding, results revealed (a) a relatively small but noticeable decline in both groups over the first four months of maintenance assessment, (b) a substantial drop in correct responding for both groups at the eight-month postcheck assessment, and (c) a variation in rate of decline as a function of an interaction between treatment group (i.e., external versus self-instruction) and assessment period (i.e., the period from posttesting to the four-month postcheck versus the period from the four- to the eight-month postcheck). Each of these results and its implications will be discussed in detail, followed by a brief summary of the overall maintenance results.

First, the relatively small decline in both groups (5% for external instruction subjects and 14% for self-instruction subjects) over the first four

months of postcheck assessment may be attributed partially to the two maintenance components (i.e., fading of reinforcement and isolated followed by simultaneous presentation of situations) that were common to both groups. Two other factors that should not be overlooked are (a) the presence of overlearning in that virtually all subjects attained a score of 100% on each situation prior to the review lessons for that situation and (b) the frequency of assessment. The success of the present procedures in facilitating maintained responding is suggestive of their utility in contributing to the high levels of maintenance desired in training of low-frequency skills such as fire emergency evacuation. However, the failure of both procedures to result in greater levels of maintenance attests to the need for continued efforts to ascertain and isolate the variables necessary for maintained responding. This issue is particularly crucial in light of the devastating consequences of even a small error in performance of skills necessary for fire emergency responding.

The second finding regarding maintenance, the large decline at the eight-month postcheck, provides an even stronger indication of the need for further research. At this point, external instruction subjects scored 51% correct responses in sequence, whereas self-instruction subjects scored 65% correct responses in sequence. Although the superiority on the part of the active, self-instruction strategy might be taken as an indication of potential for promotion of long-term maintenance, the failure of this strategy to produce significantly greater maintenance than the passive, external instruction strategy suggests the need for further research concerning both strategies prior to the drawing of any definitive conclusions. Such research might give increased attention to underlying developmental and cognitive factors that may affect maintenance of responding (particularly during infrequent assessment and over long periods of time) rather than relying primarily on explanations derived from stimulus

control interpretations of maintenance. In examining developmental and cognitive variables further, it is suggested that strategies to enhance memorial functioning at various developmental levels--particularly training that enhances one's ability to encode and retrieve learned information properly--be considered as possible supplementary components to future treatment packages. For example, such packages might include training in the use of elaborative rehearsal "to enrich and elaborate the memory trace" so as to facilitate encoding and subsequent retrieval of learned information (Craik & Tulving, 1975).

The third and final maintenance result is the variation in rate of decline as a function of an interaction between treatment group and assessment period. That is, the external instruction subjects' mean decline from the four- to the eight-month postcheck was not only greater than both groups' declines from posttesting to the four-month postcheck but was also larger than the self-instruction subjects' mean decline over the same time period (i.e., from the four- to the eight-month postcheck). Another way of viewing this interaction is to portray the rate of decline in the self-instruction group as moderate but steady and that in the external instruction group as initially slight and later substantial.

Although notions concerning the specific factors responsible for this differential decline are only speculative at the present time, discussion of these factors may be useful in formulating hypotheses for future research. Several variables appear to warrant consideration in this respect. During the first time period, both groups received fairly frequent assessment, a factor that may have promoted maintenance. In addition, for self-instruction subjects, there were two other variables that may have facilitated maintenance during this period: (a) the attempt to teach the subjects to control their own behavior rather than to rely on an external agent and (b) the greater liklihood of somewhat more elaborative rehearsal with the more active, self-instruction

package (including self-monitoring, self-evaluation, self-reinforcement, and self-verbalization) than with the more passive, external instruction package. However, despite these advantages, self-instruction scores seemed to decline somewhat more than external instruction scores over the first time period. Thus, it seems that the negative impact of a third factor may have led to a drop in the performance of this group to a point below that of the external instruction group during this period of frequent assessment. For example, the brevity of self-instructional training may have resulted in interference of subject attention to self-instruction with motor behavior (because subjects may not have had sufficient time to learn to perform self-instructional and motor responses simultaneously in an optimally beneficial fashion). Over the second time period, self-instruction subjects' scores continued to decline at the same rate, suggesting that frequency of assessment had little effect on this group and that the remaining factors continued to operate as they had in the previous time period. During this time period, external instruction subjects' scores declined substantially in relation to their decline in the previous time period, possibly due to the lack of frequent assessment. This drop indicates that the facilitative features of self-instruction-subject control of responding and the greater liklihood of more elaborative rehearsal--may have prevented the self-instruction group from experiencing a similarly large decline.

Of course, caution must be exercised in interpreting these results because of a confound between time lapse since the termination of training (i.e., post-testing to four months versus four months to eight months) and interval length between assessments (i.e., two weeks and one month versus four months). Because this confound could not be controlled in the present investigation, the degree to which each of the two assessment period variables (time lapse since termination of training and interval length between assessments) contributed to the

interaction between treatment group and assessment period is unknown. However, the presence of this interaction suggests a need for further examination of the assessment and treatment variables involved.

While the three findings regarding maintenance do not provide a consistent demonstration of superiority on the part of either group, the greater decline on the part of external instruction subjects over the second, more stringent time period (from the four- to the eight-month postcheck) does lend tentative support to the claims regarding the facilitative impact of self-instruction on maintained responding (e.g., Meichenbaum, 1977). However, it is suggested that claims concerning the greater impact of self-instruction on long-term maintenance be tempered by the recognition that the superiority of the self-instruction group was evident only under certain assessment conditions. Superior performance on the part of the self-instruction group did not occur during the period of frequent assessment immediately following training, and the smaller assessment. Keeping this caveat concerning the influence of assessment factors in mind, the active, self-instruction strategy appears to be preferred method for obtaining long-term maintenance--at least until further investigation clarifies the findings of the present study.

Although the present investigation has several limitations,[3] it contributed to the knowledge concerning acquisition, generalization (to other responses), transfer (across settings), and maintenance under "strict" posttreatment conditions (i.e., in the absence of prompting, practice, feedback, and contingencies) while adding to knowledge concerning the application of a primary preventive strategy to the problem of fire safety in the community. In addition, it pointed to the need to examine important conceptual and empirical limitations of current approaches to long-term maintenance. Both training strategies proved to be fairly inexpensive methods of bringing about acquisition, generalization, transfer, and maintenance (at relatively high levels for a four-month period) of

correct emergency responding. However, the self-instruction strategy was suggested as the preferred method of obtaining long-term maintenance, at least until additional strategies for improving retention and retrieval of learned skills in the absence of systematic practice as well as the impact of assessment variables have been further examined. It is hoped that future research addressing treatment and assessment issues will further promote the degree of maintenance of correct fire emergency responding needed to prevent loss of life and physical and emotional suffering resulting from fire emergencies.

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Footnotes

[1]Due to practical constraints (i.e., accessibility to subjects at home), in-home assessment could not be performed at all appropriate points: i.e., at baseline, at posttesting, and at follow-up.

[2]It should be noted that this form of verbalization does not constitute self-verbalization inasmuch as it is not followed by corresponding motor behavior, and, as a result, does not have a self-guiding function.

[3]One limitation was the lack of assessment in the absence of an adult and in the presence of real fire cues because of the emphasis on maintenance of responding rather than on generalizability to actual fire situations. (However, the use of a large number of experimenters helped avoid the problem of any one individual becoming a discriminative stimulus for responding, and the simulated fire cues helped approximate some of the conditions of a real fire.)

A second limitation was the lack of a component analysis of each of the procedures. The absence of a component analysis resulted in an inability to determine the additive contribution of the various components (i.e., fading; isolated followed by simultaneous presentation, external monitoring, evaluation, and reinforcement; and self-verbalization, self-monitoring, self-evaluation, and self-reinforcement) to the observed degree of maintenance. However, it should be noted that the major purpose of the current investigation was to compare the effects of external and self-instruction when employed in addition to the other components rather than to determine the individual contribution of the components.

Table 1

Correct Responses to One of the Four Emergency Fire Situations

Situation 1 (nothing blocking path). There is just a little smoke in the room. The door is cool. There is no hot air rushing through the crack of the door. There is no fire in the child's path as the child attempts to leave the house.

(a) Slides out of bed and onto the floor.

(b) Gets into a crawl position.

(c) Crawls to the door.

(d) Lifts one hand and places it on the door. Stands up and places a hand on the upper part of the door.

(e) Returns to a squat or crawl position.

(f) Opens the door one to two inches, keeping one knee on the floor and bracing the door with one foot and one hand at all times. Places a hand in front of the crack, still bracing the door.

(g) Opens the door further.

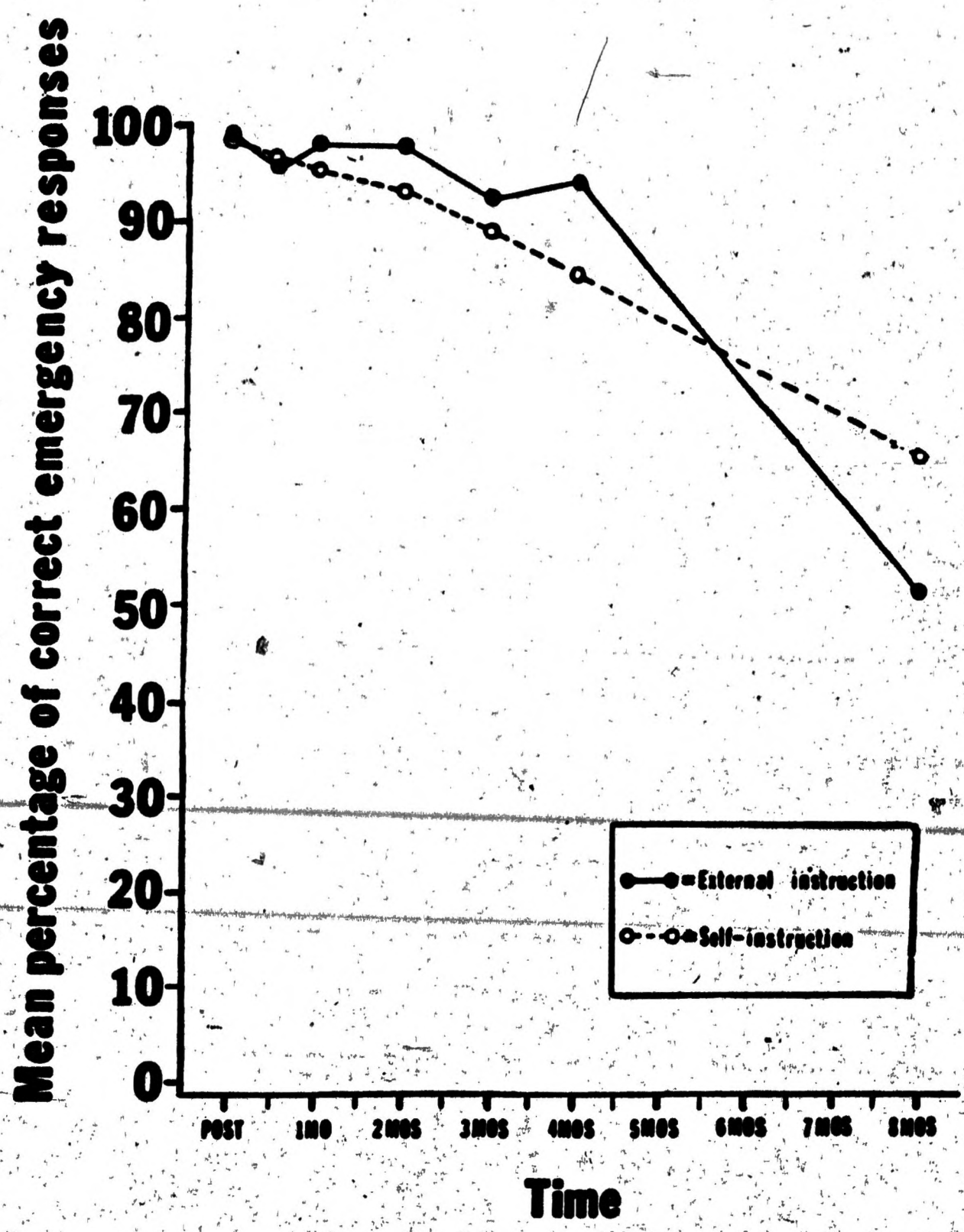
(h) Crawls outside the bedroom door.

(i) Crawls to the outside door.

(j) Walks or crawls out of the door.

Figure Caption

Figure 1: Percentage of correct emergency responses performed in sequence immediately following training (Post) and at each of six post-check assessments (two weeks, four weeks, two months, three months, four months, and eight months following training). Each set of two points represents the mean of the percentage scores of all subjects in the external and self-regulation groups who participated in a given assessment session.


Mean percentage of correct emergency responses
100
90
80
70
60
50
40
30
20
10
0
POST
1MO
2MOS
3MOS
4MOS
5MOS
6MOS
7MOS
8MOS
Time
External instruction
Self-instruction